Issues in Science and Religion: Publications of the European Society for the Study of Science and Theology

Dirk Evers
Michael Fuller
Antje Jackelén
Knut-Willy Sæther *Editors*

Issues in Science and Theology: What is Life?

ESSSAT

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ESSAT

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In memory of Chris Wiltsher

Preface

Every other year, the *European Conference on Science and Theology* (ECST) is organised by ESSSAT, the *European Society for the Study of Science and Theology*. ESSSAT is a scholarly society that promotes the study of the interactions of science and theology, thus creating opportunities for scholars from a wide diversity of backgrounds, geographically and linguistically, and from different disciplines and confessions to engage in conversation and debate. From 24 to 29 April 2012, ESSSAT arranged the Fourteenth *European Conference on Science and Theology* (ECST XIV) in Tartu, Estonia, in collaboration with Tartu University and its department for biosemiotics. Over 100 participants from Europe and beyond were attracted by the conference, and ESSSAT members and other conference participants alike were inspired to present and discuss about 70 papers in the conference's paper sessions.

The theme of the conference was: *What is Life?*, and it was approached from a number of different perspectives, including biology, biosemiotics, ecology, philosophy, technology and theology. Life is far from being indifferent to itself. Organisms *want* to live. They develop concerns, ambitions, emotions, understanding, and even start to think about themselves. How can these phenomena be interpreted within a scientific framework? Is there a path from physics to biology, and has this path something to do with the concept of signs and semiosis? How do these insights relate to philosophical and religious perspectives on the human life-form? These and other questions were addressed by the plenary lectures of the conference, which covered a broad spectrum of disciplines and approaches and which are printed in this volume in revised and edited versions. In addition, the editors chose a selection of short papers presented at the conference and thus composed this volume of *Issues in Science and Religion* (ISR). (Most of the other papers of the conference have been published in Volume 14 of the yearbook of ESSSAT, *Studies in Science and Theology*, which all society members receive and which can be ordered directly from ESSSAT.)

This volume marks a double transition. It is the first volume with ESSSAT's new publisher, Springer, who took over our series from T&T Clark. The editors took this opportunity to rename the series from *Issues in Science and Theology* (IST) to *Issues in Science and Religion* (ISR) and thus to indicate the broad range of approaches towards scientific and religious questions which ESSSAT wants to foster. The editors are looking forward to a fruitful and successful collaboration between ESSSAT and Springer. And with this volume, I as ESSSAT's Vice-President for Publication hand this task over to Michael Fuller from Edinburgh who took great responsibility for this and the preceding volume of the series, and who will be an excellent editor-in-chief for this new Springer book series.

The publication of ESSSAT's yearbooks is always an opportunity to thank organisers and sponsors of the conferences. We express our gratitude to the local organiser Anne Kull (ESSSAT Vice-President for the conference), Roland Karo (registration officer) and Meelis Friedenthal, who designed the conference website and did the layout for all conference material. Other members of the Organising Committee were Antje Jackelén (ESSSAT President), Lotta Knutsson Bråkenhielm (ESSSAT Secretary), Knut-Willy Sæther (Scientific Programme Officer) and Chris Wiltsher (ESSSAT Treasurer). Particular thanks go to Tartu University as the host of the conference.

Without sponsors and partners ESSSAT would not be able to organize conferences like these. Financial support from Estonia came from Rector Alar Karis of the University of Tartu, from The Centre of Excellency in Cultural Theory, Tartu (European Union Regional Development Fund 2008–2015); from Professor Anne Kull, Tartu (as part of the John Templeton Foundation Grant ID#15658 "The Collegium of Science and Religion at the University of Tartu"); and from businessman Väino Põllumäe. We express our deep gratitude to all of them. Thanks also go to the *Udo Keller Foundation – Forum humanum*, Neversdorf (Germany), which supported the ESSSAT prizes.

Rev. Triin Käpp was responsible for the morning prayers and transformed a storage room to an appealing chapel. St John-University Church and its organist and music director Elke Unt hosted the ecumenical service. We express our gratitude to the friendly and helpful staff of the Dorpat Conference Centre in Tartu, the venue of our conference. Dr. Enn Kasak, Ph.D. and., Ursula Haava, Triinu Akkermann, and the crew of the barge "Jõmmu" served as excursions guides. Conrad Krannich and Felix Kalder helped with the editorial work in different stages of the process. Finally we thank the staff from Springer and especially Cristina dos Santos for their cooperation on this volume, now the eighth of the old and the first of the new series.

While we were in the process of editing this volume, and just before our 2014 conference in Assisi, ESSSAT suffered a great loss. Chris Wiltsher, ESSSAT's treasurer and membership secretary, died suddenly and unexpectedly on April 4, 2014. Chris had served the society in these positions since January 2000. But he was one of the very few members to attend all *European Conferences on Science and Theology* since their beginning in 1986. His contributions to the work of the council and the organizing committees for conferences, including the Tartu conference documented in this volume, have been invaluable. His wit, kindness and sense of humour are deeply missed, and in accordance with the unanimous decision of the general assembly of ESSSAT we dedicate this volume to his memory.

Halle (Saale), Germany Dirk Evers
November 2014

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Part I
From Physics to Biology

Chapter 1
From Physics to Semiotics

Stuart Kauffman

Abstract Since Newton we have sought laws that "entail" the evolution of the system. These dreams range from reductionism, dreams of a final entailing theory, upward. In this chapter I hope to show that no laws at all entail the becoming of the biosphere. Ever new, typically unprestatable, biological functions arise, often as Darwinian preadaptations, and once they exist, they do not cause, but ENABLE an often unprestatable set of "opportunities" forming a new "adjacent possible" into which evolution flows, creating yet new adaptations that enable new adjacent possibles in an unprestatable becoming. Because we cannot prestate the variables, we can write no differential equation laws of motion for evolution, so cannot integrate those equations. Thus no laws entail evolution. Since the biosphere is part of the universe, if the above is correct, there can be no final theory that entails all that becomes in the universe. The discussion rests on the legitimacy of "functions" in biology, subsets of the causal consequences of parts of organisms. Physics cannot distinguish between causal consequences. I try to justify "functions", whose unprestatable becoming are parts of the ever changing phase space of evolution, hence no entailing laws. "Functions" are justified in the non-ergodic universe above the level of atoms by Kantian wholes such as collectively autocatalytic sets in protocells that can sense, evaluate, and act in their worlds, yielding teleonomy and biosemiotics. Modernity is based on Newton and Darwin: these ideas may take us beyond Modernity.

Keywords Autocatalytic sets • Biosemiotics • Evolution • Modernity • Reductionism • Teleonomy

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Introduction

My main aim in this chapter is to take us from our deeply received scientific world view and, derived from it, our view of the "real world" in which we live – from the world spawned by Newton and modern physics – to an entirely different, newly vibrant, surprising, unknowable world of becoming, within which the living, evolving world, biological, economic, cultural, co-creates, in an unprestatable mystery, its own possibilities of becoming. We will pass from physics to the edges of semiotics along the way. One issue to ask is this: Why is the subject of semiotics regarded as almost a pseudoscience by so many scientists? I shall argue that this view is deeply wrong, among the other points I seek to make.

I have many points to make and ideas to explore, and hope they will prove relevant and find resonance. If I am right, we are in the world in a way that we do not now clearly recognize. In it we will find a natural magic, in William Gaddis' sense in the Recognitions: "There is no truth beyond magic".

I begin with an amazing statement by early sociologist, Max Weber, who said, roughly, "With Newton we became disenchanted and entered Modernity". Weber was right. In the fifteenth and sixteenth centuries, the white and black magi sought magical knowledge of the world. Kepler was perhaps the last of the white magi, overseeing the transition to modern physics: starting with the five Platonic solids for the orbits of the planets and finding his way to, of all things, ellipses.

The black magi were convinced that by incantations they could stand Nature on her head and wrest their due. Following Newton's triumph founding classical physics came the Enlightenment, the Industrial Revolution, and Modernity. Newton's amazing successes left no room for magic.

Newton

How the Western and now modern world, 350 years later, changed with the inventions of, largely, one mind – Newton's. He invented not only the mathematics, the differential and integral calculus, that give us, as moderns, our way of thinking, from physics upward: he also gave us his famous three laws of motion, and universal gravitation.

Ask Newton: "I have 9 billiard balls rolling on a billiard table. What will happen to them?" Newton might have rightly responded: "Measure the positions and momenta and diameters of all the balls, the boundary conditions of the table, write down my three laws of motion representing the forces between the balls and between the balls and the edges of the table, then integrate my equations to yield the deterministic future trajectories of the balls".

What had Newton done? He had mathematized Aristotle's "efficient cause" in his differential equations giving forces between the entities, the laws of motion.

He had invented a conceptual framework to derive the deterministic trajectory consequences by integration. But integration is deduction is “entailment”; so the laws of motion, in differential form, entail the deterministic trajectories. In this entailment, Newton mathematized in a very general framework Aristotle’s argument that scientific explanation must be deduction: All men are mortal, Socrates is a man, hence Socrates is mortal.

In the early 1800s, Simon Pierre Laplace generalized Newton. Given a massive computing system, for the Laplacian demon, informed of the instantaneous positions and momenta of all the particles in the universe, the entire future and (because Newton’s laws are time reversible) past of the universe is fully predictable and determined.

This statement by Laplace is the birth of “reductionism”, the long held view that there is some “final theory” down there – Stephen Weinberg’s “Dream of a final theory” – that will entail all that becomes in the universe.

We need two additional points.

(a) Poincaré, studying the orbits of three gravitating objects (a topic Newton knew was trouble), was the first to show what is now known as deterministic chaos. Here tiny changes in initial conditions lead to trajectories which diverge from one another exponentially. Since we cannot measure positions and momenta to infinite accuracy, Poincaré showed that we cannot *predict* the behavior of a chaotic deterministic dynamical system. Determinism, contra Laplace, does not imply predictability.
(b) Quantum mechanics overthrew the ontological determinism of Newton, on most interpretations of quantum mechanics. Nevertheless, quantum systems obeying Schrödinger’s equation *deterministically* evolve a *probability distribution* of the ontologically indeterminate probabilities of quantum measurements.

With General Relativity and Quantum Mechanics the twin pillars of twentieth century physics were firmly in place, where they remain. No attempt to unite General Relativity and Quantum Mechanics has been successful after 85 years of trying. Success may or may not come.

Darwin

After Newton, and perhaps as profoundly, Darwin changed our thinking. We all know the central tenets of his theory: heritable variation among a population, competition for resources insufficient for all to survive, hence Natural Selection culling out those variants “less fit” in the current environment. Thus we achieve adaptation, and critically, the *appearance of design* without a designer.

The well known story of the difficulties of Darwin’s theory with “blending inheritance” and its unexpected rescue by Mendelian genetics, even the fact that a copy of Mendel's work lay unopened on Darwin's desk, is well known. Mendelian genetics prevents blending inheritance and paved the way for the mid-twentieth Century "Neo-Darwinian Synthesis".

Monod and "Teleonomy"

The concept of "function", doing, and "purpose" in biology, and with it, a potential "meaning" for signs or symbols, totally absent in physics where only "happenings" occur, has been mooted in standard biology by Jaques Monod. Consider a bacterium swimming up a glucose gradient. It "seems" to be "acting to get food". But, said Monod, this view of the organism is entirely wrongheaded. The cell in its environment is just an evolved molecular machine. Thanks to natural selection, the swimming up the gradient gives the appearance of purpose, of teleology, but this is false. Instead, this behavior is a mere "as if" teleology that Monod called "teleonomy".

In short, for Monod, and for legions of later biologists and philosophers, "doing" is unreal in the universe: there is only the mechanical, selected appearance of "doing".

Indeed, in so arguing, Monod is entirely consistent with physics. As noted, there are no "functions", "doings", or "meanings" in physics. Balls rolling down a hill are merely Newtonian "happenings". So too the happenings in the evolved molecular machine that is the bacterium swimming up the glucose gradient.

Yet we humans think functions and doings are real in our world. If this is so, from whence do functions, doings and meanings arise?

Functions, Meanings, and Doings Are Real in the Universe

I now give, as far as I know, an entirely new set of arguments that, I believe, fully legitimize functions, doings and even meanings as real in the universe, but beyond physics. The discussion has a number of steps.

The Non-ergodic Universe Above the Complexity of the Atom

Has the universe in 13.7 billion years of existence created all the possible fundamental particles and stable atoms? Yes.

Now consider proteins. These are linear sequences of 20 kinds of amino acids that typically fold into some shape and catalyze a reaction or perform some structural or other function. A biological protein can range from perhaps 50 amino acids long to several thousands. A typical length is 300 amino acids long.

Then let's consider all possible proteins of length 200 amino acids. How many are possible? Each position in the 200 has 20 possible choices of amino acids, so there are $20 \times 20 \times 20$ 200 times, or 20 to the 200th power, which is roughly 10 to the 260th power possible proteins of length 200.

Now let's ask if the universe can have created all these proteins since its inception 13.7 billion years ago. There are roughly 10 to the 80th power particles in the known universe. If these were doing nothing, ignoring space-like separation, but making proteins on the shortest time scale in the universe, the Planck time scale of 10 raised to the power of −43 s, it would take 10 raised to the 39th power times the lifetime of our universe to make all possible proteins length 200 just *once*.

In short, in the lifetime of our universe, only a vastly tiny fraction of all possible proteins can have been created. This means profound things. First, the universe is vastly non-ergodic. It is not like a gas at equilibrium in statistical mechanics. With this vast non-ergodicity, when the possibilities are vastly larger than what can actually happen, history enters.

Not only will we not make all possible proteins length 200 or 2,000, we will not make all possible organs, organisms, social systems ... There is an *indefinite* hierarchy of non-ergodicity as the complexity of the objects we consider increases.

Kantian Wholes and the Reality of Functions and "Doings"

The great philosopher, Immanuel Kant, wrote that "In an organized being, the parts exist for and by means of the whole, and the whole exists for and by means of the parts". Kant was at least considering organisms which I will call Kantian wholes.

Functions are clearly definable in a Kantian whole. The function of a part is its causal role in sustaining the existence of the Kantian whole. Other causal consequences are side effects. Note that this definition of function rests powerfully on the fact that Kantian wholes, like a bacterial cell dividing, are complex entities that *only get to exist in the non-ergodic universe above the level of atoms because they are Kantian self-recreating wholes*. It is this combination of self-recreation of a Kantian whole, and therefore its very existence in the non-ergodic universe above the level of atoms that, I claim, fully legitimizes the word "function" of a part of a whole in an organism. Functions are real in the universe.

Now consider the bacterium swimming up the glucose gradient to "get food", Monod's merely teleonomic *as if* "doing". But we can rightly define a behavior that sustains a Kantian whole, say the bacterium existing in the non-ergodic universe, as a "doing". Thus, I claim, "doings" are real in the universe, not merely Monod's teleonomy.

Interestingly, Kant opined that there would never be a Newton of biology. Despite Darwin, a major point of this paper, which will take us beyond physics, is that here Kant was right. There never, indeed, will be a Newton of biology, for, as we will see below, unlike physics and its law-entailed trajectories, the evolution of the biosphere cannot be entailed by laws of motion and their integration. No *laws* entail the evolution of the biosphere, a first and major step beyond physics at the "watershed of life".

Collectively Autocatalytic DNA Sets, RNA Sets or Peptide Sets

Gonen Ashkenasy at the Ben Gurion University in Israel has created in the laboratory a set of nine small proteins, called peptides. Each peptide speeds up, or catalyzes, the formation of the *next* peptide by ligating two fragments of that next peptide into a second copy of itself. This catalysis proceeds around a *cycle* of the nine peptides (Wagner and Ashkenasy 2009).

It is essential that in Ashkenasy's real system, no peptide catalyzes its *own* formation. Rather the set as a whole *collectively catalyzes its own formation*. I shall call this a collectively autocatalytic set, CAS.

These astonishing results prove a number of critical things. First, since the discovery of the famous double helix of DNA, and its Watson-Crick template replication, many workers have been convinced that molecular reproduction *must* rest on something like template replication of DNA, RNA or related molecules. It happens to be true that all attempts to achieve such replication without an enzyme have failed for 50 years. Ashkenasy's results demonstrate that small proteins can collectively reproduce. Peptides and proteins have no axis of symmetry like the DNA double helix. These results say that molecular reproduction may be far easier than we have thought.

I shall only mention briefly that between 1971 and 1993, I invented a theory for the statistically expected emergence of collectively autocatalytic sets in sufficiently diverse "chemical soups" (Kauffman 1971, 1986, 1993). This hypothesis, tested numerically, is now a theorem (Mossel and Steel 2005). If things are so, routes to molecular reproduction in the universe may be abundant.

Collectively autocatalytic DNA sets and RNA sets have also been made (Lam and Joyce 2009; von Kiedrowski 1986).

Collectively Autocatalytic Sets Are the Simplest Cases of Kantian Wholes and the Peptide Parts Have Functions

A collectively autocatalytic set is precisely a Kantian whole, which "gets to exist" in the non-ergodic universe above the level of atoms, precisely because it is a self-reproducing Kantian whole. More, given that whole, the "function" of a given peptide part of the nine peptide set is exactly its role in catalyzing the ligation of two fragments of the next peptide into a second copy of that peptide. The fact that the first peptide may jiggle water in catalyzing this reaction is a causal side effect that is NOT the function of the peptide. Thus, functions are typically a subset of the causal consequences of a part of a Kantian whole.

Task Closure

Collectively autocatalytic sets exhibit a terribly important property. If we consider catalyzing a reaction a "catalytic task", then the set as a *whole* achieves "task closure". All the reactions that must be catalyzed by at least one of Ashkenasy's nine peptides ARE catalyzed by at least one of those peptides. No peptide catalyzes its own formation. The set as a whole catalyzes its own reproduction via a clear *task closure*.

Task Closure in a Dividing Bacterium

Consider a dividing bacterium. It too achieves some only partially known form of *task closure* in part in and via its environmental niche. But the tasks are far wider than mere catalysis. Among these tasks are DNA replication, membrane formation, the formation of chemosmotic pumps and complex cell signaling mechanisms in which a chemically *arbitrary* molecule can bind to part of a trans-membrane protein, and thereby alter the behavior of the intracellular part of that molecule, which in turn unleashes intracellular signalling. Thus this task closure is over a wide set of tasks.

Biosemiosis Enters at this Point

I thank Professor Kalevi Kull of the Tartu University Department of Semiotics for convincing me that at just this point, biosemiotics enters.

As Kull points out, the set of molecules that can bind the outside parts of transmembrane proteins are chemically arbitrary — a point Monod emphasized as well in considering allosteric enzymes. Thus, as Kull (2009, 2010) points out, the set of states of the different molecules outside the cell that can bind to the outside parts of these transmembrane proteins and unleash intracellular signaling and a coordinated cellular response, constitute a *semiotic code* by which the cell navigates its "known" world, "known" – without positing consciousness – via the code and, in general, probably evolved by selection encoding of the world as "seen" by the organism. Change the molecular species binding to the outside of the transmembrane proteins, and the world the cell "knows" changes.

Biosemiosis is real in the universe.

Toward: No Entailing Laws, But Enablement in the Evolution of the Biosphere

I now shift attention to a new and I believe transformative topic. With my colleagues Giuseppe Longo and Maël Montévil, mathematicians at the École Polytechnique, Paris, I wish to argue that *no law* entails the evolution of the biosphere.

If we are right, entailing law, the centerpiece of physics since Newton, ends at the watershed of evolving life. If this claim is right, it is obviously deeply important. More, it raises the issue of how the biosphere, the most complex system we know in the universe, can have arisen beyond entailing law. I will discuss these issues as well. Again, the discussion needs to proceed in several steps.

The Uses of a Screw Driver Cannot Be Listed Algorithmically

Here is the first "strange" step. Can you name all the uses of a screw driver, alone or with other objects or processes? Well, screw in a screw. Open a paint can, wedge open a door, wedge closed a door, scrape putty off a window, stab an assailant, *objet d'art*, tied to a stick to make a fish spear – the spear then rented to "natives" for a 5 % fish catch return so that it becomes a new business.....

I think we all are convinced that the following two statements are true: (i) the *number* of uses of a screw driver is indefinite; (ii) unlike the integers which can be ordered, there is no natural ordering of the uses of a screw driver. The uses are *unordered*. But these two claims entail that there is no "Turing effective procedure" to *list* all the uses of a screw driver alone or with other objects or processes. In short, there is no algorithm to list the uses of a screw driver.

Now consider *one* use of the screw driver, say to open a can of paint. Can you list all the other objects, alone or with other objects or processes that may carry out the "function" of opening a can of paint? Again, the number of ways to achieve this function are indefinite in number, and unorderable, so again, no algorithm can list them all.

Adaptations in an Evolving Cell Cannot Be Prestated

Now consider an evolving bacterium or eukaryotic, say, single-celled organism. In order to adapt in some new environment, all that has to occur is that one or many cellular or molecular "screw drivers" happen to "*find a use*" that enhances the fitness of the evolving cell in that new environment. Then there must be heritable variation for those properties of the cellular screw drivers, and natural selection will select the fitter variants with the new uses of the molecular screw drivers which constitute adaptation. This *is* the arrival of the "fitter".

But no algorithmic *list* of the possible uses of these cellular screw drivers can be had, thus we cannot know, ahead of time, what natural selection *acting at the level of the Kantian whole organism* will reveal as the new uses of the cellular screw drivers acting in part via the niche of the organism, which *succeed better*, and which hence were selected. We cannot, in general, pre-state the adaptive changes that will occur. This is the deep reason evolutionary theory is so weakly predictive.

We Cannot Pre-state the Actual Niche of an Evolving Organism

The task closure of the evolving cell is achieved, in part, via causal or quantum consequences passing through the environment that constitutes the "actual niche" of the evolving organism. But the features of the environmental "niche" that participate with the molecular screw drivers in the evolving cell which will allow a successful task closure, are circularly defined with respect to the organism itself. We only know after the fact of natural selection what aspects of the evolving cell and its screw drivers, and which causal consequences of specific aspects of the actual niche, are successful when selection has acted at the level of the Kantian whole evolving cell population.

Thus, we cannot pre-state the actual niche of an evolving cell by which it achieves task closure in part via that niche.

But these facts have deep meaning. In physics, the phase space of the system is *fixed*, in Newton, Einstein and Schrödinger. This allows for entailing laws. In evolution, each time an adaptation occurs and a molecular or other screw driver finds a new use in a new actual niche, the very phase space of evolution has *changed*, and done so in an unprestatable way. But this means that we can *write no equations of motion for the evolving biosphere*. More, the actual niche can be considered as the boundary conditions on selection. But we cannot pre-state the actual niche. In the case of the billiard balls, Newton gave us the laws of motion, and told us to establish initial and boundary conditions and then to integrate the laws of motion, stated in differential equation form, to get the entailed trajectories. But in biology we cannot write down the laws of motion, and so cannot write them down in differential equation form. Nor, even if we could, can we know the niche boundary conditions, so could not integrate those laws of motion which we do not have anyway. It would be like trying to solve the billiard ball problem on a billiard table whose shape changed forever in unknown ways. We would in that situation have no mathematical model. Here, too, the profound implication is that *no laws entail the evolution of the biosphere*.

If this is correct, we are, as stated above, at the end of reductionism at the watershed of evolving life. Now the machine metaphor, since Descartes, perfected by Newton, leads us to think of organisms, as Monod stated, as molecular *machines*. Let me distinguish diachronic from synchronic science. Diachronic science studies the evolution of life and its "becoming" over time. Synchronic science studies the (presumably) fully reducible aspects of, for example, how a heart, once it has come to exist in the non-ergodic universe, “works”. In these synchronic studies, reductionism presumably works. But in the diachronic becoming of the biosphere, *life is an ongoing, unprestatable, non-algorithmic, non-machine, problem-solving for survival, state of becoming*.

Darwinian Preadaptations and Radical Emergence: The Evolving Biosphere, Without the “Action” of Selection, Creates Its Own Future Possibilities of Becoming

If we asked Darwin what the function of my heart is, he would respond, “To pump your blood”. But my heart makes heart sounds and jiggles water in my pericardial sac. If I asked Darwin why these are not the function of my heart, he would answer that I have a heart because its pumping blood was of selective advantage in my ancestors. In short, he would give a selection account of the causal consequence in virtue of which I have a heart. Note that he is also giving an account of why hearts exist at all as complex entities in the non-ergodic universe above the level of atoms. Hearts are functioning parts, by pumping blood, of humans as reproducing Kantian wholes. Note again that the function of my heart is a subset of its causal consequences, pumping blood, not heart sounds or jiggling water in my pericardial sac.

Darwin had an additional deep idea. A causal consequence of a part of an organism, of no selective significance in a given environment, might come to be of selective significance in a different environment, and so be selected; and, typically, a new function would arise. These are called “Darwinian preadaptation” without meaning foresight on the part of evolution. Stephen Jay Gould renamed them “exaptations”.

I give but one example of thousands of Darwinian preadaptations. Some fish have a swim bladder, a sac partly filled with air and partly with water, whose ratio determines neutral buoyancy in the water column. Paleontologists believe the swim bladder evolved from the lungs of lung fish. Water got into some lungs, now sacs partly filled with air, partly with water, poised to evolve into swim bladders. Let’s assume the paleontologists are right.

I now ask three questions: (1) Did a new function come to exist in the biosphere? Yes, neutral buoyancy in the water column. (2) Did the evolution of the swim bladder alter the future evolution of the biosphere? Yes, new species of fish evolved with swim bladders. They evolved new mutant proteins. And critically, the swim bladder, *once it came to exist*, constituted what I will call a *new adjacent possible empty niche*, for a worm, bacterium or both could evolve to live only in swim bladders. I return to this point in a moment, for magic hides here. (3) Now that you are an expert on Darwinian preadaptations, can you name all possible Darwinian preadaptations just for humans in the next 3 million years? Try it and feel your mind go blank. We all say no. A start to why we cannot is this: How would you name all possible selective environments? How would you know you had listed them all? How would you list all the features of one or many organisms that might serve as the preadaptation? We cannot.

The underlying reason we cannot do this is given above in the discussion about screw drivers, their non-algorithmically listable uses alone or with other objects/process, and the non-algorithmically listable other objects/processes that can accomplish any specific task, like opening a can of paint, that we can use a screw driver to accomplish.

The Adjacent Possible

Consider a flask of 1,000 kinds of small organic molecules. Call these the Actual. Now let these react by a single reaction step. Perhaps new molecular species may be formed. Call these new species the molecular "Adjacent Possible". It is perfectly defined if we specify a minimal stable lifetime of a molecular species. Now let me point at the Adjacent Possible of the evolving biosphere. Once lung fish existed, swim bladders were in the Adjacent Possible of the evolution of the biosphere. But 2 billion years ago, before there were multi-celled organisms, swim bladders were not in the Adjacent Possible of the evolution of the biosphere.

I think we all agree to this. But now consider what we seem to have agreed to: with respect to the evolution of the biosphere by Darwinian preadaptions, *we do not know all the possibilities*.

Now let me contrast our case for evolution with that of flipping a fair coin 10,000 times. Can we calculate the probability of 5,640 heads? Sure, use the binomial theorem. But note that here we know *ahead of time* all the possible outcomes, all heads, all tails, alternative heads and tails, all the 2 to the 10,000 power possible patterns of heads and tails. Given that we know all the possible outcomes, we thereby know the "sample space" of this process, so can construct a probability measure. We do not know what *will* happen, but we know what *can* happen.

But in the case of the evolving biosphere, not only do we not know what *will* happen, we don't even know what *can* happen. There are at least two huge implications of this. (1) We can construct no probability measure for this evolution by any known mathematical means. We do not know the sample space. (2) Reason, the prime human virtue of our Enlightenment, cannot help us in the case of the evolving biosphere, for we do not even know what *can* happen, so we cannot reason about it. The same is true of the evolving econosphere, culture, and history: we often do not know ahead of time the new variables which will become relevant, so we cannot reason about them. Thus real life is not an optimization problem, top down, over a known space of possibilities. It is far more mysterious. How do we navigate, not knowing what can happen? Yet we do.

Without Natural Selection, the Biosphere Enables and Creates Its Own Future Possibilities

Now I introduce Radical Emergence, a kind of natural magic that I find enchanting. Consider the swim bladder once it has evolved. We agreed above, I believe, that a bacterium or worm or both could evolve to live only in that swim bladder, so the swim bladder as a *new adjacent possible empty niche*, once it had evolved, alters the future possible evolution of the biosphere.

Next, did natural selection act on an evolving population of fish to select a well functioning swim bladder? Of course. (I know I am here anthropomorphizing selection, but we all understand what is meant.) But did natural selection "*act*" to create the swim bladder *as a new adjacent possible empty niche? No!* Selection did not "struggle" to create the swim bladder as a new empty adjacent possible niche.

But that means something I find stunning. Without selection acting to do so, evolution is creating its own future possibilities of becoming! It is a kind of natural magic.

And the worm that evolves to live in the swim bladder is a Radical Emergence unlike anything in physics.

Evolution Often Does Not Cause, But Enables Its Future Evolution

The bacterium or worm that evolves to live in the actual niche of the swim bladder, whereby it achieves a task closure selected at the level of the Kantian Whole worm or bacterium, evolves by quantum indeterminate, and ontologically acausal, quantum events. Thus, the swim bladder does not *cause*, but *enables* the evolution of the bacterium, or worm, or both, to live in the swim bladder.

This means that evolving life is not only a web of cause and effect, but of empty niche opportunities, that enable new evolutionary radical emergence. The same is true in the evolving econosphere, cultural life and history. We live in both a web of cause and effect and a web of enabling opportunities that enable new directions of becoming.

Toward a Positive Science for the Evolving Biosphere Beyond Entailing Law

The arguments above support the radical claim that no laws entail the evolution of the biosphere. If they are right, Kant was right. There will be no Newton of biology. Not even Darwin was that Newton, uncovering entailing laws.

But the biosphere is the most complex system we know in the universe, and has grown and flourished, even with small and large avalanches of extinction events, for 3.8 billion years. Indeed, there is a spectacular increase in species diversity over the Phanerozoic.

How are we to think of the biosphere building itself, probably beyond entailing laws?

Organisms are Kantian Wholes, and the building of the biosphere of these past 3.8 billion years seems almost certainly to be related to how Kantian wholes co-create there worlds with one another, including the natural magic of creating, with no selection, new empty adjacent possible niches that alter the future evolution of the biosphere.

There may be a way to start studying this topic, a new quest. Collectively, autocatalytic sets are the simplest models of Kantian Wholes. In very recent work with Wim Hordijk and Michael Steel, computer scientist and mathematician respectively, we are studying what Hordijk and Steel call RAFs, which are collectively autocatalytic sets in which the chemical reactions without catalysis, occur spontaneously at some finite rate, and that rate is much speeded up by catalysis. Fine results by Horkijk and Steel show that RAFs emerge and require only that each catalyst catalyses between 1 and 2 reactions. This is fully reasonable both chemically and biologically (Hordijk and Steel 2004).

Most recently the three of us have examined the substructure of RAFs (Hordijk et al. 2012). There are irreducible RAFs, which, given a Food Set of sustained small molecules, have the property of autocatalysis but if any molecule is removed from the RAF the total system collapses. It is irreducible. Then, given a maximum length of polymers allowed in the model as the chemicals, from monomers to longer polymers, there is a maximal RAF, which increases as the length of the longest allowed polymer (and hence the total diversity of possible polymers allowed) increases.

The most critical issue is this: There are *intermediate* RAFs called "submaximal RAFs", each composed either of two or more irreducible RAFs, or of one or more irreducible RAF and one or more larger "submaximal" RAF, or composed of two or more smaller submaximal RAFs.

Thus we can think mathematically of the complete set of irreducible RAFs, all the diverse submaximal RAFs, and the Maximal RAF. For each we can draw arrows from those smaller RAFs that jointly comprise it. This set of arrows is a partial ordering among all the diverse RAFs possible in the system.

The next important issue is this. If new food molecule species, or larger species, enter the environment, even *transiently*, the total system can grow to create NEW submaximal RAFs that did not exist in the system before. This is critical. It shows that existing Kantian Wholes can create new empty Adjacent Possible niches; and with a chemical fluctuation in which molecular species are transiently present in the environment, the total "ecosystem" can grow in diversity. A model biosphere is building itself!

In this system, the diverse RAFs can "help" one another. For example, a waste molecule of one can be a food molecule of another; or they can hinder one another in complex ways, via inhibition of catalysis, or through the products of one being toxic with respect to another. They form a complex ecology. Further, these RAFs, if housed in compartments that can divide, such as bilipid membrane vesicles called liposomes (Luisi et al. 2004), have been shown recently to be capable of open ended evolution via natural selection, where each of the diverse RAFs act as a "replicator" to be selected; and in that selection, chemical reaction "arcs" that flower from the RAF core act as the phenotype with the core.

Thus, to my delight, we have the start of a theory for the evolution of Kantian Wholes.

But there is a profound limitation to these models. They are in a deep sense algorithmic, and their possible phase spaces can be pre-stated. The reason is simple. The only functions that happen in these RAF systems are molecules undergoing reactions, which are catalyzed by molecules. But the set of possible molecules, up to any maximum length polymer, can be pre-stated. And the set of possible catalytic interactions can be pre-stated, even in models where the actual assignment of which molecule catalyzes which reaction is made at random or via some "match rule" of catalyst and substrate(s) leading to a probability of catalysis.

By contrast, in the discussion above, we talked about the vast Task Closure achieved by an evolving bacterium or eukaryotic cell or organism. These tasks were not limited to catalysis. And as we saw with the discussion of the possible uses of a molecular screwdriver in a cell, those uses are both indefinite in number and not orderable, so no algorithm can list all those uses. Nor can we pre-state how the Kantian whole cell will evolve, where selection acts at the level of the Kantian Whole and culls out altered screwdriver parts with heritable variations that achieve some often new functional Task Closure via the Actual Niche. Thus the real evolutionary process is non-algorithmic, non-machine, non-entailed.

With respect to our initial evolving RAF ecosystems, we do not yet know how to make this evolution non-algorithmic and non-entailed. While we have a start, and a useful one, it is not enough.

Re-enchantment and Creating a New World

I return to Max Weber's astonishing statement: "With Newton we became disenchanted and entered Modernity". Was Weber right? I think so. As noted above, the fifteenth and sixteenth centuries saw the black and white magi, the former seeking occult knowledge to stand nature on her head and wrest their due. With Newton magic lost its magic, and we entered the world view of the deterministic dynamics of Celestial Mechanics. The Theistic God retreated during the Enlightenment to a Deistic God, who set up the universe with Newton's laws and let them unfold. The war between theistic religion and science, let alone science and the arts, was under way. Next came our beloved Enlightenment, "Down with the Clerics, up with science for the perpetual betterment of Man". The Enlightenment was the "Age of Reason". Next came the Industrial Revolution based on science derived from physics and chemistry. Thence we entered Modernity.

We know the goods and ills of our fully lived Enlightenment dreams. We have democracy, we have a higher standard of living, we are better educated, we have better health and longer lives. Yet our democracies are often corrupted by power elites. We are, as Gordon Brown said as Prime Minister of the United Kingdom, "Reduced to price tags" in our increasingly global economy, where we make, sell and buy plastic, purple penguins for the poolside. If we ask why we do this, part of the answer is that we do not know what else to do.

More: we *are* disenchanted. We are, a billion of us, secular realists in a meaningless universe, to quote Stephen Weinberg's famous dictum. We have lost our spirituality.

But our physics based world view, if right for the abiotic universe, seems badly wrong for the living, evolving world, past the watershed of life. We do live in a world of cause and effect, but also unprestatable opportunities that emerge in an unprestatable, ever growing and changing Adjacent Possible that we partially co-create, with and without intent.

It really is true that, with no selection acting to do so, the newly evolved swim bladder is a new adjacent possible empty niche that alters the future possibilities of biological evolution. The worm or bacterium that is enabled to evolve really is radically emergent. It really is true that the Turing machine enabled the main frame computer whose wide sale created the market opportunity for the personal computer, whose wide sale created the market opportunity for word processing and file sharing, whose wide use created a niche for the World Wide Web, whose creation generated an opportunity to sell things on the Web which created content on the Web which created a market opportunity for browsers like Google and Yahoo. Facebook came and the Arab Spring. None could have foreseen this. No-one intended this radically emergent becoming, so similar to the radical emergence in the evolving biosphere. In both cases, with neither selection nor intent, the evolving system creates, typically unprestatably, its own future possibilities.

How Much Magic Do We Want to Be Re-enchanted?

More, the Age of Reason assumed that we could come to *know*, that the world was solvable by reason. But if we often do not know what *can* happen, we cannot reason about it. Reason, the highest virtue of our Enlightenment, is an inadequate guide for living our lives. And top down decision making, as if we knew ahead of time the variables that would become relevant, then "optimized", is often an illusion. We need to rethink how we make and live in our worlds.

Then what if we ask whether current First World civilization best serves our humanity, or do we largely serve it, price tags and all? I think we are lost in Modernity, without a clear vision of what our real life is.

Ralph Waldo Emerson is famous for "Emersonian perfectionism". We are born with a set of virtues, or strengths and should devote our lives to perfecting them. Read *Walden Pond* by Thoreau. But this perfectionism seems static, like a European hotel breakfast room with all the food choices laid out. We have only to choose among our preset virtues and perfect them.

But this is not how real life is. We live a life of ever unfolding, often unprestatable opportunities that we partially create and co-create, with and without intent. I'm thus falling in love with "Living the Well Discovered Life".

Then my own dream for "Beyond Modernity" starts to become our 30 civilizations around the globe, woven gently together to protect the roots of each, yet firmly enough to generate new cultural forms by which we can be human in increasingly diverse, creative ways, each helping himself or herself and the other to live a well discovered life, and ameliorating our deep shadow side.

We need an enlarged vision of ourselves, and of what we can become.

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Stuart Kauffman trained in philosophy and Medicine University at Dartmouth, Oxford and the University of California Medical School, completing his M.D. in 1968. He invented Random Boolean Nets, models of thousands of genes mutually regulating one another. In 1971 came the first paper on the spontaneous emergence of “collectively autocatalytic sets” about the origin of life. His NK fitness landscapes have been widely used. Four books, *Origins of Order*, *At Home in the Universe*, *Investigations* and *Reinventing the Sacred* have been published, and a fifth is forthcoming. Interests range to economics and physics. He was a MacArthur Fellow, holds an Honorary Doctorate, and is a Fellow of the Canadian Royal Society.

Chapter 2
Is Life Essentially Semiosis?

Peter P. Kirschenmann

Abstract Biosemioticians oppose the dominant physico-chemical molecular-biological approach to life. They regard many, if not all, organic processes as semiotic processes, processes involving "signs", "information", "representation" or even "interpretation". I am rather skeptical or critical about their views. Given the growing diversity of their specific views, I can consider only a few of their ideas, some being all-encompassing, others more detailed. I criticize the global idea that "all life is semiosis" and also the view, used to back up this global idea, that the concepts of function and semiosis are coextensive. Among other things, I suggest that such views confuse means and ends. A related and very intriguing idea is that all biological and psychic processes, as teleological processes, have a quasi-semiotic relationship to an "absent content". I argue that explanations should refer to actual, present factors. Another proposal, which is meant to avoid bothersome questions of where there could be interpretation in "biological semiosis", is to regard biological processes like protein synthesis as "manufacturing semiosis". I oppose this view as well as the other biosemiotic views with my own ideas about emergent forms of structural determination and co-determination in biology.

Keywords Absent content • Biological function • Biosemiotics • Code(maker) model • Emergence • Genetic code • Life • Manufacturing semiosis • Protein synthesis • Structural determination and co-determination

Introduction

Part of the spirit of our 2012 conference location, to wit the so-called Copenhagen-Tartu biosemiotic school, invites a philosophical evaluation of the ideas of biosemioticians. We all know the importance of the workings of the genetic code for life, and the importance of all kinds of signaling processes, like those in nervous systems, for many organisms. Biosemioticians regard such and many other organic processes

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as semiotic processes, processes involving “signs” and “symbols”, “information”, “representation” or even “interpretation”. Rather generally, they oppose their views to the dominant physico-chemical approach in molecular biology, which for them involves an “asemiotic conception of life as mere molecular chemistry” (Kull et al. 2009). Given the growing diversity of their specific views, I can consider only a selection of their ideas. I shall present somewhat skeptical considerations regarding both their more detailed and their more far-reaching ideas. And I shall present my own ideas about structural determination and co-determination in biology.

A Confusion of Means with Ends?

For a number of biosemioticians, who frequently have been adopting a philosopher’s role rather than that of a biological specialist, life is “semiosis”, “signification” and “communication”. If this is supposed to be definition of the essence of life, my admittedly *very general* first comment would be: this global definition cannot be satisfactory for the following reasons. Universal characteristics of life rather are self-maintenance, growth, reproduction and – if one wants to add a general evaluative term – thriving as a living being. Important biological coding and signaling processes, just like metabolic processes, are amongst the *ways or means* of realizing such goals. Yet, in that sense, they certainly do not constitute the essence of life.

Biosemioticians might retort that they are not interested in defining the complete essence of life, but in giving an answer to questions of the difference between non-living matter and life. Marcello Barbieri ends one of his biosemiotic statements (Barbieri 2008) by stating “there is a deep truth in the oversimplified statement that ‘life is semiosis’”. All this emphatically indicates the task of giving alleged semiotic processes in biology their proper places and specific, non-simplified, conceptualizations.

Semiosis and Biological Functions

Biosemioticians have elaborated and articulated semiotic ideas in often rather different ways. In view of this diversity, some leading biosemioticians obviously have felt the need to formulate a number of common theses (Kull et al. 2009). One (meant to support the global definition above) is that the concepts of function and semiosis are coextensive. Both are said to be teleological, determined by an “end”, a specific “absent” content.

Surely, functional analyses and explanations, like those of coding or signaling processes, are part and parcel of biological research, even though the question of the right philosophical account of biological function is far from settled (cf. Kirschenmann 2009). A great many functional explanations can be said to specify interdependencies between traits, behavior and environment, appealing regularly to counterfactual reasons. For example, concerning the advantage of a blood circulatory system, one relevant consideration is that mere diffusion of oxygen and carbon dioxide would not work for organisms of the size of vertebrates. A nice further example, regarding behavior, is the explanation of why electric fish swim backwards. Only in doing so, can they successfully scan a prey with their electric sense, which does not provide much focus. Such answers are *explanations of their own kind*, clearly marking biology off from physics and chemistry, clearly different from deductive-nomological or causal explanations in those fields. They are explanatory in that they show how a trait or behavior fits into the structure of functional interdependencies within organisms and of organisms and their environment.

Yet, the two examples are enough to show that functional explanations need not turn on semiotic considerations, even though further details of the function of traits or behavior concerned may, for example, include signaling processes. In short, the concepts of function and semiosis are *not* coextensive. Most functional structures and behavior can hardly be said to "represent" their effects.

The "Absent Content"

The above-mentioned idea of an "absent content" or a "constitutive absence" is a challenging philosophical idea. It is due to Terrence W. Deacon, who has incorporated it in his recent grandiose sketch of the emergence of life and also mind (Deacon 2012). Its overall architectonic idea consists of a hierarchy of dynamical regimes – homeodynamics, including thermodynamics, morphodynamics ("self-organization"), teleodynamics – interacting and building upon each other, with ever more constraints becoming effective.

The most characteristic example of an "absential relationship" on the highest teleodynamical level, for Deacon (2012: 24ff), is purposeful human activity, since its goal is *not* (yet) physically present. In that sense, for him, purpose is intrinsically incomplete, dependent on something extrinsic and absent, the goal. Similarly, information, function, meaning, representation, intention, consciousness, relevance and value exist for him only in semiotic relations to something they are *not*. This also holds for him for the biological counterparts of such notions, counterparts which do not involve conscious or psychological states.

In such terms, Deacon (2012: 42ff) pleads for a fundamental shift in perspective: while a traditional idea has it that life and mind must involve something *more* than mere physics and chemistry, his proposal is that they are *less*, since they always depend on something specifically missing, *not* physically present.

The "absential relation", for Deacon, need not be an orientation towards an end or consequence; it can also be a relation to something abstract, potential or hypothetical. Thus, for example, he considers the Shannon information of a message as being determined by the probabilities of all the possible messages *not* sent (Deacon 2012: 378ff).

Architectonically, Deacon ties "absent contents" to constraints on the behavior of organized dynamical systems, as constraints restrict (or render absent) the degrees of freedom of such systems. Undoubtedly, living organisms abound in constraints of a great diversity of forms. For example, blood vessels constrain the flow of blood, so that it can supply all cells with nutrients and oxygen. Of course, one can, perhaps equivalently, say that blood is prevented from flowing in all the possible ways that it would do without blood vessels: that the actual flow of blood is determined by those absent possibilities.

I would prefer to describe and explain biological matters in positive terms regarding what is present. Also, in the case of human purposeful activity, I could agree that the goal is not yet physically present, but I would hold that it certainly is mentally present in the actor. In sum, Deacon would have to show more clearly how approaching biological and psychic phenomena in terms of "absent contents" has specific explanatory advantages.

Manufacturing Semiosis

Biosemioticians are aware of the difficulties of identifying something like referents or meanings of signs in biology and identifying some agency interpreting such supposed signs. Because of these difficulties Marcello Barbieri (2008) has come up with the proposal of applying, instead of a Peirceian semiotic model, a "codemaker model". His idea is that just as human "codemakers" create signs and meanings with *conventional* coding and the interpretation of relations between them, so ribosomes, for example, take gene sequences ("signs") as sequences of particular codons to *produce* proteins ("meanings"). Thus departing from the requirement of interpretation, the author regards protein synthesis to be a case of "*manufacturing* semiosis".

Now, it certainly is odd to call a *manufacturing* process a "semiotic process". Barbieri (2008: 43) offers a nice argument, supposed to convince us that one indeed can speak of "signs" in protein synthesis:

> The existence of signs can be recognized by the fact that they are 'agent-dependent' entities, because they exist only when an agent (a codemaker) treats them as signs. This makes us realize that in protein synthesis the codons of a messenger RNA are true signs. If the nucleotides were scanned two by two, the codons would be completely different, which proves that they are not objective properties of the RNAs. Codons are codemaker-dependent entities, and have therefore the qualifying feature that defines all signs.

This abstract consideration is all right, as far as it goes: if scanning two by two, instead of three by three, were to be seen as a sort of rather arbitrary human convention. Yet, scanning two by two would not have the function of leading to the production of appropriate proteins, and it would not do so for non-semiotic reasons.

Protein synthesis, after all, is a very complex process, depending also on numerous gene regulations and repair mechanisms. (Knowledge of these, by the way, is being used in combatting viruses.)

Structural Determination

Biosemioticians view their approach as the necessary alternative to a conception of life as mere molecular chemistry. Yet there are other alternatives. In protein synthesis, the structure of DNA and mRNA, given the appropriate gene regulations, determines the structure of the resulting proteins. This *structure determination* is not a plain chemical process: it constitutes an *emergent* level of determination, but not a particularly semiotic one. Since protein synthesis depends on numerous factors in the cell, it might be more appropriate to refer to the contribution of DNA and mRNA as “structural co-determination”. One particular type of structural determination is signal determination (cf. Kirschenmann 1970), which surely is important biologically, and which is also present in technical information transmission and processing.

Biosemioticians are aware of, and argue against, the objection that their proposals are mere metaphorical redescriptions of biochemical processes. No doubt, the discovery of emergent structural determinations through the idea of a “genetic code” or the results of studies of specific biological processes as “signal processes” are great scientific achievements. My impression is that biosemiotics, because of its predominantly redescriptive character, has not been able to match such achievements. For example, viewing a genetic code as a “representation” of the environment, because it helps to bring about adaptive phenotypical traits, to my mind adds nothing to calling them “adaptations”.

Conclusion

Quasi-semiotic processes have many biological functions, but are not the essence of life. Rather, diverse forms of structural determination and co-determination, often hierarchically ordered, are characteristic of all forms of life.

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Chapter 3
Life in the Open Air

Bronislaw Szerszynski

Abstract In this paper I reflect on the nature of our relationship with the atmosphere that surrounds us, by exploring the constituent parts of my title and the complex relations between them. I first look at 'life'. How might the meaning of 'what is life?' depend on the context in which it is uttered? What does it mean to choose the boundary between the living and the non-living to interrogate? Are we asking after the current state of life or the very essence of 'life itself'? I then look at the notion of being 'in'. Drawing on Martin Heidegger, Hans Jonas, Cornelius Castoriadis and Jesper Hoffmeyer, I suggest that to say that life is 'in' something is to invoke the constitutive relations between organism and environment. Then I turn to 'air', exploring the variegated meanings that make up the modern concept of 'air' and looking at a number of different ways we might say that 'life is in the air'. The atmosphere can be seen as having its own kind of abiotic life, or life can be seen as carrying the signal of life – but life can also be said to be 'in the air' in a strong sense because of the metabolic relation between the inside and outside of the living body. Finally, I turn to 'the open', exploring the differing uses of this term by Heidegger, Giorgio Agamben and Tim Ingold. I conclude by arguing that the air contains not just the vital signs of life but also the signs of our technological disruption of the atmosphere, and that the reading of these signs can be a moment of responsibility for us.

Keywords Air • Life • Phenomenology • Biosemiotics

In this paper I reflect on the nature of our relationship, as organic beings, with the atmosphere that surrounds us. The approach I take is very simple – deceptively so: I will simply take the constituent parts of my title, one by one, and more or less in order, and explore what they mean. However, we shall see that in so doing we commit ourselves to a rather more interesting task than might have been anticipated. As well as the different terms being more complicated than we might think, we will

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also have to start to inquire how exactly each term relates to the others. As I hope to show, there are complex internal relations between the four terms – relations which have to be confronted if we are to understand the nature of the terms themselves.

Life – in – the open – air. I first look at "life". What are we asking, when we ask "what is life?" How might the meaning of – and hence the answer to – that question depend on the context in which it is uttered? What does it mean to choose the boundary between the living and the non-living to interrogate? By using the word "is" to join "what" and "life", are we asking after the standing, the state or the status of life, or the very essence of "life itself"? Or does life always elude such essentialist inquiries?

I then look at the notion of being "in", arguing that in the case of life especially we have to look at "in-hood" not just *topographically*, in terms of location in mathematical space, but *topologically*. Drawing on Martin Heidegger, Hans Jonas, Cornelius Castoriadis and Jesper Hoffmeyer, I will suggest that to say that life is "in" something is not just to describe a spatial containment, but to invoke the constitutive relations between organism and environment that life brings into being. I will thus suggest that to capture the distinctive way that life can be "in" something is already to start to answer the question "what is life".

Then I turn to "air", exploring the variegated meanings that make up the modern concept of "air" and looking at a number of different ways we might say that "life is in the air". First, the atmosphere can also be seen as having its own kind of abiotic life, as a far-from equilibrium system with dissipative structures, a "concretised" whole with parts that resonate with each other. Following the anthropologist Tim Ingold, weather can also be seen as the life of air, a species of life – a lively mixing of substances, of sky and earth, which makes possible the arising of forms. Second, the air can be seen as carrying the signal of life – the signs that it is made over by and taken up into the self-maintenance of life. Third, reflecting on the predominance of ideas of breathing and breath in words for "life" in Indo-European and other languages, we can see how life is "in the air" in a strong sense because of the centrality of respiration in the metabolic relation between the inside and outside of the living body.

Finally, I turn to "the open". I look at the way that Ingold uses the term "the open" to describe the relations between an organism and its environment: "to inhabit the open", he suggests, "is to be immersed in the fluxes of the medium" (2007a: S34). But I point out that Heidegger and Giorgio Agamben use it in an almost opposite way – for them, "the open" is an event of "disconcealing", or truth, that occurs when the immersion of the organism in its environment is disrupted. I conclude by suggesting that "life in the open air" can be used to summarise our human condition of responsibility towards climate in the Anthropocene epoch. We need to recognise that our immersion in the life of the air is not just *ontic*, an empirical matter, but also *ontological*, in that it has a constitutive relation with what it is to be alive. More, I argue that the air contains not just the vital signs of life but also the signs of our technological disruption of the atmosphere, and that the reading of these signs can be an opening for us, a moment of responsibility.

Life

The question "what is life?", of course, is famously hard to define. There are a number of useful lists of definitions of life, such as the chronological one in the appendix of Marcello Barbieri's *The Organic Codes* (2003: 255ff). But instead of discussing the merits of different definitions, I want to approach the question laterally. As Nietzsche said in the second essay of *The Genealogy of Morals*, "all ideas in which a whole process is promiscuously comprehended elude definition: only that which has no history can be defined" (1913: 53). And the idea of life certainly has a history.

So my question here is not "what is life?", but "what is it to *ask* 'what is life?'?" What are we doing if we ask "what is life?" Let's break this question down further.

What Does the "Is" Do in "What Is Life?"?

The "is" of our question is of course a *copular* use of "to be", in that the word is being used not to express mere existence (that or if "life is"), but to connect a subject (in this case, "life") and a predicate (as yet unspecified). Now, copulas in Romance languages can typically be sorted according to from which of two Latin verbs they derive – *essere*, "to be", or *stare*, "to stand". Those give us our two forms of the Romance copula – permanent "essence", or temporary "state" or "status". So, when we answer that, for example, life is an aperiodic crystal (Schrödinger 1944), or a self-interpreting text (Kull 1998) – we might ask whether we have penetrated through to the *essentia* of life, or only to its current state.

Some copulas are ones of *classification*. So, we might say that life is a thermodynamic phenomenon (Prigogine 1969), or a semiotic phenomenon (Hoffmeyer 1996), and thus place it as a member of a larger class of phenomena. But we might feel that this does not specify what life *is*. Alternatively, we might take the "is" of our question to be a copula of *predication*. And definitions of life do often take the form of a collection of predicates – for example, that life is: capable of self-maintenance, of self-repair, of metabolism, of reproduction, and of evolution. But if we take any of these away, have we life? If the answer is, "maybe", then are we happy to say that life is the property of possessing most or all of these characteristics? Furthermore, are these "essences" or merely "accidents" of life? Might life in time itself come to leave all or most of them behind?

We might try to reduce life to what could be seen as single (if composite) predicate, like Aristotle did with his definition of "man" as a "rational animal" (Aristotle 1956). In effect, this is to use "is" as a copula of *identity*. So we might say that life *is* a chemical system with certain special qualities – such as Stuart Kauffmann's definition involving autocatalysis (1993). But are we saying that it would be impossible to find a form of life that was *not* chemical? Or just that we have not yet found one? Could God – who is presumably not a chemical phenomenon, who cannot reproduce and therefore presumably cannot evolve – be nevertheless said to be alive?

Anyway, does life really have an essence? In *De Anima* Aristotle says that life *is* the essence of animals – that a particular kind of life is what we specify in defining a thing. "That it [i.e., the soul] is so as essence[1] is clear; for essence is the cause of existence for all things,[2] and for living things it is living that is existing,[3] and the cause or first principle of this is the soul" (Aristotle 1968: 18 [ii.4 415b12]; see also Cameron 2000). Such an approach would suggest that it might not be useful to try to come up with a general definition of life, since each kind of living thing lives in its own way.

When We Ask "What Is Life?", What Is the "Other" That We Are Contrasting It with?

By asking "what is life" we are marking and policing the boundary between life and non-life. But what is the contrast that we have in mind? Biology and physics? (Yet living organisms are also physical beings.) The animate versus the inanimate? (Or can there be a kind of life in inanimate things?) Life versus death? (But without life there is no death; death, too, is biological.) Life versus mere survival – bare life (*la nuda vita*), in Giorgio Agamben's (1998) phrase?

If we were instead to ask what is *non*-life, would it be effectively the same question? Anyway, why is it that we do not have a word for non-life that is more than a negation ("*a*biotic", "*in*animate")? The fact that it is the animate rather than the inanimate that is a puzzle tells us a lot about the structures of thought today. Hans Jonas points out that in the ancient and medieval worlds, in which everything seemed to be alive, it was *death* that stood as the primary mystery, confronting humans as an experience which seemed to contradict the very essence of a cosmos which was understood as alive. Jonas suggests that in that period the corpse was "the limit of all understanding", a surd figure which was "not to be accepted at its face-value" – hence the prominence of the cult of the dead in these cultures. By contrast, with the arrival of the materialist, mechanistic monism of post-Renaissance thought, it was not life but *lifelessness* that was taken to be the natural state of things, and not death but *life* that at once invited and eluded explanation. And rather than the corpse, it was the living organism that was taken to be a hoax, a trick, to be unmasked as, after all, really dead (Jonas [1966] 2001: 8–12). Nineteenth-century thought may have moved away from narrow mechanism, and given us the concept of life in the modern sense, but we are still haunted by that difficulty of thinking life (Bishop 2011).

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[1] *Ousia.*

[2] *To aition tou einai.*

[3] *To de zên . . . to einai estin.*

Why Interrogate This Boundary?

Where is the boundary between life and non-life? Is there such a boundary, or does it depend on the "knowledge interest" that grounds our question? The term "knowledge interest" captures from Habermas (1971) insight that all forms of inquiry that can orient human action must be grounded in some kind of human interest, even if these are general, "species interests". Do we want to extend life (such as in medicine)? To contain, control or extinguish it (bio-security)? Do we want to optimise, capitalise and commodify it (the knowledge-based bioeconomy)? Our precise interest in life will shape what we think is a convincing answer to our question. It will also shape whether we think there is only one, a few or many boundaries that are pertinent, and whether the life–non-life one is the most interesting of these. Biologists, chemists and thermodynamicists will of course give different answers to such questions.

What about the boundary between organic and inorganic life? When some writers make this contrast, by "inorganic" they simply mean a life that is biological but is not that of the individual organism. An early example of this kind of distinction would be August Weismann's idea of the immortal germ-plasm, that gives rise to the bodies (*soma*) of individual organisms but is not shaped by them – the precursor of modern genetics, and Richard Dawkins' "selfish gene" (1976). Jonas points out that the germ-soma dualism can be seen as "a strange parody of the Cartesian model of two noncommunicating substances", in that they are the basis of two almost wholly disconnected dramas: on the one hand, the blind, subterranean automatism of germ history; on the other, the upper world of the soma, the organism confronting the world in constant struggle (Jonas [1966] 2001: 52–3).

But the key theorist of inorganic life is surely the arch-philosopher of vitalism, Henri Bergson, who was a great influence on Gilles Deleuze. In *A Thousand Plateaux* (1988: 503), Deleuze and Guattari wrote that "[t]he truly intense and powerful life *remains* anorganic", and that the organism is little more than an expedient for life to oppose and reinvent itself. Yet Bergson's view of organic life was more positive: evolution is creative *because* of the endless conflict between life's cessation in stable forms and its tendency to always break out from them (Ansell Pearson 1999: 43). The evolution of life is like an exploding shell in which the fragments themselves burst into other fragments. In *Creative Evolution* (1921), Bergson describes life as a "tendency" that, through its growth and becoming, creates divergent directions amongst which its "vital impetus" gets divided. This inorganic life can preserve all the different bifurcating tendencies that it generates – unlike organic life, which can only preserve one (Ansell Pearson 1999: 45). However, for Bergson, the organism does not negatively limit life, but is what makes life as invention, creation and duration possible (Ansell Pearson 1999: 62). Just as the destructive power of a bomb is the combination of the explosive force and the resistance of the metal, "[l]ife enters into the 'habits of inert matter'" and from this learns how, little by little, to draw from it animate forms and vital properties (Ansell Pearson 1999: 44–5).

Another way of thinking about life beyond the organism – and even beyond the biotic – comes from the work of the anthropologist Tim Ingold (2007b, 2011). In *Lines*, Ingold develops an ontology in which it is the wandering of lines, rather than stable objects, that are primary. He cites Bergson's argument that we should look at living beings not as stable objects but as "thoroughfares", through which flows the current of life (2007b: 117). In *Being Alive* he presents a concept of life that extends well beyond the narrowly biotic, as the creative becoming of a world continually in formation. In Ingold's vision, life is the generative capacity possessed by zones of flux and interpenetration of substances and media, and it is this that allows forms to arise and maintain themselves (2011: 120).

In

In the last section, I tried to approach "what is life?" not as a question to be answered, but as a space for thought. There is arguably something paradoxical about asking "what is life?", because of the way the question invites us to reflect on the boundary between life and non-life – on the distinctive character that boundaries *have* in the world of life. We can explore this further by looking now at the word "in". If we are going to talk about life being *in* the air or anything else, how are we using that word? In the case of life, I would suggest, we have to look at the in-hood of life not just *topographically*, as it were, in terms of its location in mathematical space, but *topologically*. To say that life is "in" something is not just to describe a simple spatial relationship, but to invoke the constitutive relations between organism and environment that life brings into being.

In *Being and Time* Heidegger presents in-hood (*Inheit*) not as simple spatial containment, but as a primordial ontological relation, a fundamental characteristic of Dasein – the "there-being" of human embodiment (Heidegger [1927] 1962: 79–80). Dasein finds itself already thrown into the world: being-in-the-world is being-alongside (*Sein bei*) the world, not as separate objects might be alongside each other, but as always already involved with each other ([1927] 1962: 81–2).

But that topological understanding of in-hood can be extended to that of the living organism itself. Metabolism is a good way to think this through. As Jonas puts it, the metabolism of the organism is "not a peripheral activity engaged in by a constant core: it is the total mode of continuity (self-continuation) of the subject of life itself", its "constant becoming" (Jonas [1966] 2001: fn 13). Metabolism is not just an activity that takes place *across* the boundary between a living thing and its environment; in some senses it *is* that boundary – or at least shows how the boundary of living things is a different thing to the boundary of a stone or raindrop. As the biosemiotician Jesper Hoffmeyer argued, the step from the prebiotic *membrane* to the organic *interface* represented the emergence of a radically new relationship between inside and outside – and indeed a new way of *being* inside and outside. The cell's closure brings into being both an *Umwelt* and an internal representation of that *Umwelt* (Hoffmeyer 1998, 2000b); inside (firstness) and outside (secondness) are brought into relation (thirdness) (Hoffmeyer 2000a). The living organism thus has a boundary in a way that inanimate objects do not.

Cornelius Castoriadis came to a similar philosophy of the living organism in his later life (Adams 2011). As Suzi Adams summarises, Castoriadis argued that the living being "represents a rupture of inorganic nature, and as such a rupture of and within being itself" (Adams 2011: 185) The living being does not simply respond to and organise a world in which it finds itself. By being for itself, and by creating a functionally closed phenomenological world around itself, it creates its own world and itself in the same continuing gesture. "That is, the world *qua* world first comes into existence at the ontological level of the living being:'life', 'world' and 'meaning' are co-emergent" (Adams 2008: 395).

Air

We have seen that the word "in" repays a lot of thought when thinking about life. Perhaps we can go as far as to say that, to capture the distinctive way that life can be "in" something is itself to capture what life *is*, in the sense of *"essere"*. But what about air?

The modern idea of "atmosphere" pulls together some domains which would once have been seen as very different: **sky** – once seen as a domed lid lifted up over the world (sky, from Old Norse *skiuja*, "cloud" from the Proto-Indo-European base (s)keu-, "to cover"; heaven, from German, *hame*, "cover", or perhaps from *heben*, "heave" as in "that which is heaved, lifted up"; **clouds** – a word which originally meant hills, or rocks, from the pre-Germanic *glū'to –, meaning any agglomeration, as in "clod", "clot"; **meteors** – a word originally used to describe any unusual events observed high up in the sublunary sphere, such as comets, storms, shooting stars or the aurora borealis; **air** – from the Latin āēr, regarded as one of the four basic elements from which the sublunary universe is made; **weather**, and wind, both from the Indo-germanic root *wē to blow[4]; and, relatedly, **breath**, understood, as we shall see, as the essence of life.[5]

Yet the rich set of ontological meanings associated with these various realms, appearances and substances can hardly be said to have survived into the scientific notion of "atmosphere" into which they have been absorbed. Indeed, the notion of "atmosphere" could be said to "kill" the air, stripping it of animacy and meaning, rather as Ivan Illich (1985) suggested happened to water when it was reconceived

[4]Though many words for weather derive from words for time, indicating its phenomenological character as a conditioning medium for human experience.

[5]As etymological sources I have used the online Oxford English Dictionary and the 1913 edition of Webster's Dictionary.

as "H_2O".[6] As I have suggested elsewhere, through scientific instrumentation and standardised practices of measurement and statistical aggregation, weather was in effect turned into a laboratory artefact, was "brought indoors", in an attempt to tame its material and semiotic unruliness (Szerszynski 2010: 21). Within a modern ontology, it seems, the air had to be made inanimate in order to make it intelligible.

But there are other ways in which, ironically, starting from what Jonas described as the "dead" world of modern, mechanistic monism can enable us to see more clearly how air can be seen as alive (Jonas [1966] 2001: 15). In this section I want to explore three ways in which we might say that life is in the air.[7]

The Air Has Its Own Life

Let us start by thinking about the way that the atmosphere has its own kind of inorganic life – its own animacy, its own self-organising properties. Though the atmosphere is famously chaotic (hence the inherent difficulty in predicting the weather more than a few days ahead), it is not without its extensive properties – its shape. Vertically, the atmosphere is broken up into layers (the troposphere, stratosphere, mesosphere, and so on), and the troposphere itself is divided horizontally into various "cells", bands of air that circle the globe laterally. These cells have their own life and function, circulating air and heat. The two Hadley cells either side of the equator, and the two cells near the poles, basically roll over continuously, thereby creating the easterly winds characteristic of the tropics and polar regions. The two mid-latitude Ferrel cells, rolling in the opposite direction between the other cells, generate their own internal, more transient, pressure-structures of cyclones (or lows) and anti-cyclones (or highs), which in turn produce our familiar UK maritime patterns of cloud, rain, storms and sunshine, with most "weather" occurring at the boundaries or "fronts" between air-masses with the same temperature and humidity.

But these atmospheric structures are not stable, equilibrium entities – they do not primarily belong to the domain of what Gilles Deleuze calls the extensive. The atmospheric system is a *metastable* entity, a structure whose extensive shape is a dynamic product of its intensive properties such as temperature, pressure, density or chemical concentration, and thus continually *in formation*. Like an organism, the climate system lives on an energy gradient – in this case, one produced by the sun's differentially slanted rays. The air generates its own order under the thermodynamic "need" to dissipate energy, to degrade the energy gradient between the equator and the poles. But the taking-form of the atmosphere does not happen once and for all,

[6]Though there have been attempts to resurrect the phenomenological dimensions of atmosphere – see for example Böhme (1993).

[7]I could also have discussed the growing understanding of the extent to which the atmosphere – even far above the ground – contains life in an empirical sense; it is not empty of life but a collection of habitats, and of communities of organisms (Womack et al. 2010).

like the cooling of lava into an igneous rock; it happens continuously, as inherent incompatibilities – tensions between different intensive states – are continually resolved through processes of internal resonance and exchange of energy and matter between the different structures of the air (cf. Mackenzie 2002: 50; Simondon 1989). Yet air lives abiotically, in a different way to organic life; whereas the extensive characteristics of biological life are an emergent property of its *chemistry* (Kauffman 1993), the extensive characteristics of the atmosphere are an emergent property largely of its *physics*. Furthermore, using the language of Terrence Deacon (2012), we can say that the continual taking-form of the atmosphere can be described as morphodynamic, but not teleodynamic: even if, out of extraordinarily complex, chaotic interactions at the microscopic level, macroscopic order emerges, yet these are not goal-directed in the same way that biological processes are. The specific taking-form of the atmosphere is guided by its goal of most effectively redistributing heat from the equatorial regions to the poles, but this is only the ghostly prefiguration of a goal. The atmosphere does not quite have that semiotic closure from its environment that would allow us to say that its actions are guided by a representation of that environment.

And yet, in paraphrase of Galileo's famous muttered phrase after his official recantation of the idea that the Earth moves, *"eppur si muove"*, we may yet want to say of the atmosphere *"eppur si vive"*: it still lives. And Ingold gives us another way of thinking about how a certain aliveness is generated by the inherent properties of the air, by the fluxes and flows of the weather. For Ingold, weather is not a bounded phenomenon that happens above the surface of the land. Indeed, the ground, for Ingold, is not a coherent surface that separates earth and sky, but a "zone of admixture and intermingling" (2011: 119), in which "the air and moisture of the sky combine with substances whose source lies in the earth" (2011: 87). It is in the different layers of this zone of intermingling between earth and sky that life takes place. "There could be no life in a world where medium and substance do not mix, or where the earth is locked inside – and the sky locked out" (2011: 120). But this life is not the property of the organisms, but their precondition; "life is not *in* things, rather things are *in* life", in the sense that they are "caught up in a current of continual generation" (2007a: S31). The air itself can thus be said to be a-live, in the sense of being constantly engaged in liveness.

The Air Carries the Signal of Life

A different way to think about the "life in the air" is to ask how the air might carry the signal of life. To what extent is the air, the atmosphere, a biotic phenomenon? When life developed to the point that it could move Earth from a near-equilibrium state to a far-from equilibrium one, around 3 Ga (three billion years ago), the atmosphere became a part of Gaia – was taken up into life, in that it came to carry the signals of life in the same way that our artificial, technological environment, while not alive in the strict sense, is clearly a sign, an index of life.

In the space I have available I can only touch on a number of examples of the way that life is "in" the air in this way. Firstly, the very chemistry of the atmosphere contains the signal of life. This idea is well known from the work of James Lovelock, and now generally accepted – that the chemistry of the Earth *with* life – with high levels of nitrogen (78 %) and oxygen (21 %), and very low carbon dioxide – is starkly different to how it would have been in an Earth *without* life. The temperature and pressure at the bottom of the atmosphere are also both much lower than they would have been on an Earth without life (300 °C and 60 bars respectively – see Lovelock 1988: 9). More recent research suggests that major transitions in the state of the Earth system – for example the large increases in concentration of atmospheric O_2 that occurred in the early Proterozoic aeon (2 Ga) and then again in the Neoproterozoic (0.5 Ga) – seem to have been associated with major transitions in the evolution of life, such as that from prokaryotes to eukaryotes. Although it is as yet unproven, the suggestion is that the causality is from life to the physical Earth system, rather than the other way round (Lenton et al. 2004). Life does not just adapt, but, without conscious intention, changes its environment in a way that is conducive to life.

Secondly, life changes not just the climate but also the weather. For example, Makarieva and Gorshkov (2007) argue that without life, there would be little precipitation in areas far inland. They suggest that the world's major river basins can only have formed through the action of "forest pumps of atmospheric moisture". They show how natural forest ecosystems generate horizontal flows of air and moisture, directing it far inland. These forest pumps "are capable of pumping atmospheric moisture from the ocean in amounts sufficient for the maintenance of optimal soil moisture stores, compensating the river runoff and ensuring maximum ecosystem productivity" (2007: 1029).

And even when the rain has fallen, life's work in shaping the water cycle is not over. Hauhs and Lange (2008) compared two approaches to modelling runoff in water catchments. They first considered a physical paradigm that used mechanistic functions to try to derive runoff patterns from rainfall patterns using algorithms based on causal reasoning and hydrometric and hydrochemical properties. But it was their alternative, interactive paradigm that exhibited features of decision-making, strategy and memory that was able to duplicate the patterns of water runoff that were observed. The ecosystems seemed to remember how water had moved through them in the past, and to adjust the way that they allowed it to return to the ocean. Different watersheds even seemed to follow the same strategies for controlling water runoff (2008: 251). It seems that aliveness, the sign of life, is not only in the air but in the water too; both have been taken up into Gaia.

The Organism Is "in" the Air

But our earlier discussion of the word "in" can also point to another way of thinking about how life is "in" the air. The in-hood of living things, we saw, is somehow constitutive of life – and the relationship with the air. As Goethe put it, we are

"Völker des Luftmeeres" – people of the air-ocean, as dependent on the atmosphere that surrounds us as are fish on the watery ocean that surrounds them(Sullivan 2010: 58).[8]

And it is interesting that most ancient words for life derive from words for movement of the air, whether of wind or breath or both. This is certainly true for Hebrew, Greek and Latin. The main Hebrew "life" words *nephesh* and *ruach* are associated with wind and breath. *Nephesh* was originally "throat", or "neck", then came to mean "to breathe", or "refresh one's self", and then later used to mean life. *Ruach* means breath, especially the breath of life (Gen 6:17), but in the Old Testament it is also used for wind (for example in Genesis 3:8 it refers to the cool breezes that were blowing in the garden when Adam and Eve hid from God) and spirit (such as in Genesis 1:2 where the spirit of God moves on the face of the waters). Similarly, the Greek *psyche*, from *psykhein*, "to blow", derived from the Proto-Indo European root *bhes- "to blow"; while *pneuma* "wind, breath, spirit", from *pnein* "to blow, to breathe", came from the PIE root *pneu-, "to breathe". The Latin *animus* "rational soul, mind, life" and *anima* "living being, passion" are related to the Greek *anemos* "wind" from the PIE root *ane- "to blow, to breathe".[9]

Such etymological relations seem to represent an acknowledgement that breathing, as a metabolic process, does not just join inside to outside, but *makes* the inside inside, and the outside outside – makes the body a body, and the air the air. As Ingold puts it, "[i]nspiration is wind becoming breath, expiration is breath becoming wind" (2007a: S31). Before the air was ever enclosed, there was no open air – and only the living being can enclose the air, making it part of itself, in the way that it does. Only the living being can hold its breath, for to hold one's breath is "to not respire" in a different way than an inanimate object can be said to not respire; holding one's breath takes place and makes sense only in the context of the needful freedom that is metabolism. Respiration is thus a key aspect of the way that living things are "in" the world; our in-hood of the air is not just ontic, but ontological.

The Open

I have looked at different ways in which life could be said to be "in the air". But what about the "*open* air"? Should we interpret the phrase timelessly, as the exhalation of the living body, the outpouring of spirit that returns the air to the world, transformed? Or should we interpret it historically, to refer to what the air, the weather, the sky and all they contain would be if they were to be returned to the outdoors, after their

[8]The notion of the air-ocean stands as a reminder that the concept of "air" in this paper stands in for a wider possible set of "oceans" that might form the "outside" of the living being.

[9]The notable exceptions to the "life = breath rule" seem to be the Hebrew *chay*, Greek *zoe* and *bios*, Latin *vivo,* and the English "quick" (from the Old English *cwic* – which all derive from the PIE root *gwei- or *gwiwo-, "to live, life").

modern incarceration as atmosphere? Ingold uses the term “the open” ontologically, to describe the relations between an organism and its environment, but in a way that also leaves open the possibility that this ontological relation can be disturbed or lost. “[T]o inhabit the open”, he says, is “to be immersed in the incessant movements of wind and weather” (2011: 121). His “open world” is a world of verbs, rather than nouns; in Ingold’s “weather world” there are no insides or outsides, no separate objects, only comings and goings and productive movements. This is a world of bindings rather than boundaries, a world in which there are “formations, swellings, growths, protuberances and occurrences, but not objects” (2011: 117).

Yet Heidegger and Agamben use the notion of “the open” in an almost opposite way – to name not the normal, environmental mode-of-being of the organism, but an event of disconcealing, or truth, that occurs when this immersion of the organism in its environment is *disrupted* (Agamben 2004). Ingold explicitly takes issue with this idea of Heidegger in *Being Alive* (2011: 82–3). Heidegger in his Freiburg lectures in 1929–30 had argued that while the stone has *no* world, the animal has *“poverty in world”*, in that it is captured by the instinctual fit between its environment and its senses. Heidegger had of course read Jakob von Uexküll on the *Umwelt*, the immediate, lived environment, of the organism (von Uexküll 1992). For Heidegger it is only the human – Dasein – that can have a world. And it is in some sense the human capacity to withdraw from our immediate instinctual immersion in our *Umwelt* – itself grounded in the brokenness of our relationship with our sensory environment, our lack of an essence – that allows us to be-in-the-world in the distinctive way that Heidegger calls Dasein (Heidegger 1995).

In my own work I use “the open air” in a way that is closer to Heidegger than to Ingold. The open is not just a matter of our organic being, another name for the in-hood of the living organism. Jonas argued that the origin of life was a great step in the opening up the possibilities of freedom within the cosmos, in that a new form of identity, of being, became possible; instead of matter being the essence and form merely an accident, in this new form of organic being *form* became the essence, and *matter* the accident (Jonas [1966] 2001: 80). Now we might clarify this claim of Jonas: this liberation of form from matter is always already a potentiality of matter, even before organic life makes its appearance. We can see it in a simpler form in any dissipative structure, such as those of the atmosphere.

But the origin of the organism – not just life but the organised, living body, the systemic and semiotic autonomisation of the organism from its environment in what Jonas calls a relation of “needful freedom” – surely represents another step change in being. Organic life is not just bindings, comings and goings, as Ingold says; it is also an act of separation from “the rest of things” (Jonas [1966] 2001: 83). This separation from the outside, which is also, because of our metabolism, a greater dependency on it, is at once the positing of a world and the start of the journey to the open. As Jonas argues, the tension between freedom and necessity inherent in the metabolic relationship of the organism with its environment is the ground of “the self-transcendence of life in having a world, with all its promise of higher and more comprehensive stages” (Jonas [1966] 2001: 84). As Castoriadis similarly puts it, the living being creates a rupture in Being itself, by existing for itself and by creating a world. But as far as we know it is only the human being that *ruptures that rupture* – that breaks the functional closure of self and world, thereby making space for a socio-historic mode of existence in which living beings live by the laws that they have made (Adams 2011: 181–94).

Life in the Open Air: For Us, Here, Now

What should these reflections mean for our relationship to the air? What would it mean to live in the "open air" – not in the sense of immediacy and immersion, but in a way that finds an opening in the human being's distinctive relationship with its *Umwelt*? I would suggest that my title, "life in the open air", can be used to summarise our human condition of responsibility towards climate in the Anthropocene epoch.

First, as I have argued, we need to recognise that our being in the life of the air is not just ontic but also ontological. As living beings, whether in a broad or narrow sense, our being in the air is somehow constitutive of what and how we are. As Peter Sloterdijk argues, conventional thinking about the human being as a subject neglects our radical dependency as living beings on the air that we breathe (Sloterdijk 2011). To imagine that this metabolic dependency is not essential to being a subject, that it is a mere accident that could be transcended, is a mistake. But at the same time we are not *just* living things, immersed in the medium; we can also, for better or ill, separate ourselves from the facticity of our organic existence, and let the air that we breathe presence itself. Therein lies the possibility of both alienation and responsibility.

Second, the air contains not just the vital signs of life but also the signs of technological life, of our disruption of the Earth's systems and cycles. Humans, prosthetically enhanced through technology, have transformed 30–50 % of the land surface of the planet; they use around a quarter of the global biosphere's yearly biomass flow; they utilise more than half of all accessible fresh water; and they fix more nitrogen synthetically than is fixed by all other living things put together (Szerszynski 2012). The Earth system, the argument goes, is entering a new state, one in which a definitive role is being played by human beings and their interventions into natural systems, both unintended and intended. The atmosphere, like the other parts of the Earth's "geophysiology", is thus starting to be "alive" in a new way; to any outside observer, real or imagined, it will carry the signs of a very different kind of life, the long-term viability of which is not yet clear.

Thirdly, the reading of these signs can be an opening for us, a moment of responsibility. Reading in the open is not just the receiving of a message, or an instinctual response to a signal in the environment; it is always a task, that of responding to the opening that reading represents (Bennington 2000: 36). Reflection on the meaning of "life in the open air" can help us to recognise the profound nature of this moment of responsibility, but by necessity it cannot tell us what to do. If we approach weather as an opening, then no decoding of it will tell us when we have "done our bit", when we have "fixed" our relationship with the air. An adequate response to the current situation would not be adequate, a just response not just; "responsibility" here, now, would require something radical, something extraordinary to happen (Szerszynski 2010). This would involve finding a new way of being "in the air", one in which both our animal immersion in it and our human distancing from it were taken up into a more comprehensive relation, the lineaments of which we can only begin to discern.

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Chapter 4
Reflections on Life: Lessons from Evolutionary Biology, with Insights from Sergius Bulgakov

Gayle E. Woloschak

> *Let me try to make crystal clear what is established beyond reasonable doubt, and what needs further study, about evolution. Evolution as a process that has always gone on in the history of the earth can be doubted only by those who are ignorant of the evidence or are resistant to evidence, owing to emotional blocks or to plain bigotry. By contrast, the mechanisms that bring evolution about certainly need study and clarification. There are no alternatives to evolution as history that can withstand critical examination. Yet we are constantly learning new and important facts about evolutionary mechanisms. (Dobzhansky 1973)*

Abstract In this paper, I set out to make several points, as follows: (1) that evolution is the unifying theory within biology and that nothing in biology makes sense without it: (2) that evolution is tightly linked to another biological science, ecology, and that failure to accept evolution often leads to a failure to accept ecological principles; and (3) that many serious scholars who choose not to accept evolution do so because of false ideas that they believe acceptance of evolution will convey about our society and our world – that many scholars who refuse to accept evolution do so on principles of philosophy or sociology allegedly underlying the theory of evolution. To address the first two points, I will focus on the biological sciences and the connections between science and ethics and philosophy; in response to the third issue, I will reflect not on evolution as science, but on the correct understanding of scientific vocabulary, of human "nature", and of the difference between theology and teleology. For the final point I will especially revisit the thoughts of the Orthodox scholar Sergius Bulgakov (1877–1944) which may help inform some concerns of the critics of evolution.

Keywords Bulgakov • Causality • Determinism • Ecology • Evolution

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Evolution as the Unifying Theory of Biology

Biological evolution is defined as descent with modification. This definition includes both small-scale evolution (such as changes in the frequency of a particular gene within a population from one generation to the next) and large-scale evolution (such as the descent of different species from a common ancestor over many generations). Evolution as a biological theory was first proposed by Charles Darwin, a British naturalist who explained that species develop over time and that they developed from a common origin. His two most important works are *On the Origin of the Species* (Darwin 1859) and then *The Descent of Man, and Selection in Relation to Sex* (Darwin 1871). The major tenets proposed by Darwin and accepted by the mainstream scientific community to this day were that there is a common ancestry for all of life on earth; that species develop through variations in form (now known to be result of inheritable mutations); and that natural selection selects variations and drives speciation. At the time, the books were controversial both from a public view and from a religious perspective. The Church of England's establishment reacted against the book at the time, although this view softened into an uneasy acceptance over the ensuing decades. Even the Roman Catholic Church eventually took a pro-evolution perspective through the work of such noted scholars as Teilhard de Chardin and others.

Evolution was originally presented as a scientific theory: a logically self-consistent model describing the behavior of a natural phenomenon originating and supported by observable facts. Like all other scientific theories (such as the theory of gravity, the theory of relativity, etc.), evolutionary theory is formulated, developed, and evaluated according to the scientific method. Often in everyday language, people equate the word "theory" with a "speculation" or a "conjecture." In scientific practice, however, the word theory has a very specific meaning – it is a model of the world (or some portion of it) from which falsifiable hypotheses can be generated and verified (or not) through empirical observation of facts. In this way, the concepts of "theory" and "fact" are not opposed to each other but rather exist in a reciprocal relationship. While it is a fact that an apple falls from a tree, it is the theory of gravity that explains it. The scientific method which is used to test a scientific theory is not radically different from a rational attitude that is used in many aspects of everyday life (Peacocke 2001: 26). The scientific method is characterized by several major features: (1) it uses an objectivity in approach where the goal is to observe events as they are without falsifying them: (2) the results (if produced experimentally) must be reproducible in a broad sense in laboratories anywhere in the world: (3) there is an interplay of inductive reasoning (from specific observation and experiments) and deductive reasoning (reasoning from theories to account for specific experimental results); and (4) the objective of the work is to develop broad laws that become part of humanity's understanding of nature (such as the theory of gravity developed by Isaac Newton). The definition of a scientific theory, which is generally considered to be a paradigm that is proven or assumed to be true, is in marked contrast to a dogma, which is a principle that is proclaimed as true. It is essential to science to fight hard to be open to any changes imposed on it by the utilization of the scientific method.

For that reason, the vocabulary of science is cautious: science has refrained from making dogmatic claims; instead, it relies upon hypotheses, which are assumptions used as the basis for investigation or argument, and which can be tested. Proven hypotheses support and modulate their originating theory.

The textbook definition of evolution describes it in a broad sense as a process of change, but biological evolution itself is much more limited in definition. Futuyma (1997) in his book *Evolutionary Biology* makes the following distinction:

> In the broadest sense, evolution is merely change, and so is all-pervasive; galaxies, languages, and political systems all evolve. Biological evolution [. . .] is change in the properties of populations of organisms that transcend the lifetime of a single individual. The ontogeny of an individual is not considered evolution; individual organisms do not evolve. The changes in populations that are considered evolutionary are those that are inheritable via the genetic material from one generation to the next. Biological evolution may be slight or substantial; it embraces everything from slight changes in the proportion of different alleles within a population (such as those determining blood types) to the successive alteration that led from the earliest protoorganism to snails, bees, giraffes, and dandelions. (Futuyma 1997: 751)

Biological evolution, then, does not act upon individuals but rather on populations (Smith and Szathmáry 1999: 81; Wilson 2002: 9). The fate of individuals can be affected by their traits, but individuals do not undergo biological evolution: changes we undergo in life may perhaps be called “personal evolution”, but not biological evolution. A natural unit enacting biological evolution is the population. A population acts essentially as a collection of genes and genotypes that evolves, and the evolution of the population can be expressed as a change in the frequency of certain genes and genotypes in the population. For example, the prevalence of lighter skinned individuals in dusky climates and darker skinned individuals in sunny climates resulted from a selection of gene combinations balancing D vitamin deficiency and protection against UV light-induced mutations; since neither of these issues is instantly lethal, and they are mutually opposed to each other, selection pressure over many generations lead to the skin color gradient between equatorial Africa and Sweden. It is not the purpose of this work to provide a proof for biological evolution. Despite alleged challenges (Behe 1998) there is an overwhelming body of support for biological evolution in the scientific literature that comes from protein and DNA data, from the fossil and geological records, physiological and functional studies, and much more (see for example, any textbook of biology currently used in universities today).

Biological evolution (throughout the remainder of this text referred to as evolution) is the unifying theory of biology. Results of evolution shape the lives of people in almost every respect of everyday life. Agriculture and medicine have used the principles of evolution for centuries before that word was ever used for the first time. Regardless of their attitude toward education about evolution, the governments of most countries utilize the life sciences, from agriculture to medicine, to support the survival of their citizens – knowledge about evolution is engrained in every aspect of the life sciences. Drug and vaccine testing for humans require prior testing in non-human primates because they are the genetically closest species; while those working with primates receive vaccinations equivalent to those for travelers to distant countries. The evolutionary proximity of species leads to similar physiology and cell biology, similar resistance or susceptibility to infections, and so on.

Recent studies in molecular biology have led to the sequencing of the genomes of (so far) 254 eukaryotes (including humans, chimps, dogs, bony fish, frogs, yeast, fruit flies and others), 378 bacteria (including many that cause human infections like pneumonia and Strep throat) and 158 Archaea bacteria that live in adverse climates like ocean vents (Wikipedia 2012). Universally, each of these sequences has confirmed that the relatedness of two species is shown in the sequences of genes that carry out specific functions. The more related two organisms are from a taxonomic perspective, the more related their genomes are. Mice and rats are more closely related to each other than either is to the dog, humans and chimps are more related to each other than either is to the marmoset, and so forth. This vast wealth of data (most of which is available on publicly accessible websites) provides perhaps the strongest evidence that evolution is the shared history of life on earth.

There is a unity of living creation that is a direct result of the common evolution of all of life on earth within the confines of our environment (Woloschak 2013, 2011: 209). Life on earth all shares the same elements (carbon, nitrogen, trace metals), the same processes (cell division, replication and repair of DNA, transcription of RNA, translation of proteins), even the same genetic code. These shared processes are sufficiently complex to make any two living organisms more similar to each other than to anything non-living in the universe. At the same time, life forms in different parts of earth have access to, and use for survival, different types of nutrients and energy sources, and are exposed to different environmental obstacles. Together, these challenges create selection pressure, which leads to specialization and speciation: features that make for a healthy organism in the equatorial rain forests are inadequate for survival in an oceanic thermal vent. Thus, mankind and every other species share something in common as they evolve into diverse forms. Both the unity and diversity of life have a profound theological significance that is missed if we do not incorporate the theory of biological evolution into our contemplation of Creation. Unity helps humanity to see the relationship of all creatures, and our relationship and separation from the earth itself. All of life shares its simplest ingredients with the earth, and everything more complex with each other. The diversity of creation helps humanity appreciate the need for all creatures, all of life, all niches and environments, to support each other and our planet. With both of these concepts come a profound ecological consciousness and a view of humans as guardians of creation.

The Relationship of Evolution and Ecology

Ecology is a "branch of biology that deals with the distribution, abundance and interactions of living organisms at the level of communities, populations, and ecosystems, as well as at the global scale" (http://www.biology-online.org/dictionary/Ecology, accessed 29 August 2012). The term is derived from the Greek words οίκος, which means household, and λόγος, the word for knowledge or study. The study of the human "household", the earth and its environment, and of how interactions with the environment play a role in the survival and development of living organisms, are the context of ecological study. The environment as an organism encompasses its "external surroundings including all of the biotic and abiotic factors that surround and affect the survival and development of an organism or population" (http://www.biology-online.org/dictionary/Ecology, accessed 29 August 2012). In sharing the same biotype with the rest of its own population and with populations of other species, an organism is a part of a wider biological community. The term "ecology" was first used by Haeckel in 1866 to describe "the comprehensive science of the relationship between the organism and its environment". It is considered to be a highly interdisciplinary field with interactions among areas including geology, geography, biology, population dynamics, statistics, and others. Eugenius Warming (1841–1924) is considered to be the founder of the field of ecology as a separate discipline of biology.

The link between ecology and evolution has long been recognized in academic circles: many universities have a single department of evolution and ecology, and studies in one discipline generally require coursework in the other. These two areas of biology are usually viewed as two different sides of the issue of organism-environment interaction. While evolution studies this interaction from the perspective of the population over time, ecology examines this same interaction from the perspective of the environment over time. There are numerous examples of how environment affects evolution and how organisms affect environment. The following examples "view" humans as a species in its interaction with the environment.

Perhaps one of the simplest examples of the interplay of biological environment and life is evident in the Great Chinese Famine that occurred between 1958 and 1962. In China at the time, there was a poor crop yield in the cooperative farms. The Chinese government blamed sparrows for the famine, alleging that they were eating up the food crops: as a result, an organized and massive destruction of sparrows occurred. In reality, the sparrows had kept the locust population in check and as a result of their near extinction in 1958, the locust population massively increased, destroying the crops at a high rate. This exacerbated the famine and gave rise to a large loss of human life. The ecosystem balance between locusts and sparrows was destroyed by humans who were not interested in the study of ecology, and who were focused on personal beliefs (Dikötter 2010: 333).

An example that illustrates the role of the environment in evolution is the example of sickle cell anemia and its relationship to malaria in humans. The sickle cell disease is caused by a single mutation in both copies of the beta-globin gene, which encodes a protein that transports oxygen in red blood cells. This mutation results in an atypical beta-globin molecule, which distorts the shape of red blood cells into a sickle, or crescent, shape. People who have two copies of the sickle gene die early of complications from sickle cell anemia; however, people with one healthy and one sickle gene have normally-shaped discoid red blood cells. More importantly, however, red blood cells with one half of sickle protein are resistant to malaria, a disease endemic in Africa and areas of the Mediterranean region, which was brought to the southern parts of the USA as well. In these regions, people with two copies of the healthy version of the gene die of malaria, while those with a healthy and a sickle protein do not succumb to malarial disease. In the present day United States, Western Europe and other areas where malaria is no longer found, there is no evolutionary advantage to having a copy of the sickle gene; it is only in areas where malaria is endemic that the sickle cell gene is actually beneficial to its carrier. Thus, the frequency of the sickle gene in non-moving human populations tracks the regions affected by malaria.

These two examples illustrate the interactions between the environment and evolution on human species, and demonstrate how difficult it is to understand one without the other. Rejection of the ideas of evolution, then, can lead to a misunderstanding of the relationship between organisms and their environment. Subsequently, such misunderstanding may contribute to a lax attitude toward environmental concerns: anti-evolution sentiment may develop into anti-environmental attitudes. In general, most serious scholars do not accept a literal understanding of scripture, and therefore should not have a problem with the concept of evolution.

Critiques of Evolution

Many critiques of evolution come from those who are fundamentalist in their views and have, for example, chosen to view the Bible (or other holy writ) as a literal truth. There are also those who have chosen to ignore scientific evidence and reinvent "science" without critical thinking and offer "alternatives to evolution" such as a new discipline they term "intelligent design". I have chosen to largely ignore those critiques mostly because many, including myself, have written and spoken on these topics previously (Woloschak 1996, 2011: 209; Buxhoveden and Woloschak 2011). Instead, I have chosen to address critiques based on arguments that have an appearance of "common sense" and which I have received as comments in response to articles I have written, lectures I have given, or discussions I have had with religious scholars about evolution.

What are these concerns regarding evolution discussed by religious scholars? Some are ideological, some are theological, and some quasi-scientific. I will give examples of each, again noting that this list is not complete but rather is an excerpt from a much larger collection. For example, I choose to ignore critiques of science in general as radical materialism, or those blaming biology for existence of social Darwinism. Both of these two types of arguments are confrontational without an interest in discussion, without which no argument can expect reception. Good examples of the three categories of "common sense" arguments against evolution are:

(a) "Evolution is based on chance, and a belief in chance is contrary to a belief in God."

(b) "Acceptance of evolution leads to our acceptance of human beings as just animals, leading to a lowering of our estimation of ourselves."
(c) "Science finds causes of events in the world. Where does God fit in if God is the Creator and Cause of all?"

I will take these issues one-by-one and attempt to discuss them in more detail.

The (Quasi-Scientific) Question of Chance in Science (and Evolution)

One source of anti-evolution sentiments is the fact that biological evolution depends in part upon "chance", and to some people it is unclear how God could work by "chance". Many want to assume that the process of Creation could not have come about by a chance process but must rather be a process (pre-)determined by God. The concept of chance, however, needs to be considered at several levels. All events that can occur in the world fit into the one of two categories: stochastic or deterministic. The word "stochastic" comes from the Greek word Στόχος ("stochos") referring to an event partially but not fully determined by the previous state of the environment. Such events are the subject of conjecture and randomness, and therefore look as though they are determined by chance. An example of this is the decay of a radioactive isotope. Each radioactive isotope has, as one of its properties, a half-life which defines how long it will take for it to decay. Despite that characteristic of the radioisotope in general, one cannot predict in which precise order the individual atoms of the radioisotope will decay. Thus, radioactive decay is a stochastic process. Opposed to stochastic processes are deterministic processes, which do not involve random phenomena. Processes described deterministically always produce the same output for a given starting condition. An example of a deterministic process is the genetic cause of disease: a person bearing two copies of the sickle gene will develop the sickle cell disease. Deterministic events have great predictive power for humans while stochastic events do not. Occasionally, additional knowledge about the prior conditions of events considered to be occurring by chance makes them predictable, and therefore deterministic. However, based on what is observed in the cosmos and on earth, it seems clear that both deterministic and stochastic events occur naturally in creation.

While most people think of evolution as occurring predominantly by chance, evolution, like most other physical phenomena, involves both deterministic and stochastic processes. In general, neither process entirely determines how a biological system behaves, and the interplay between deterministic and stochastic processes is complex and not readily understood. Only infrequent glimpses in the interplay between deterministic (for example, inheriting one, two or no sickle hemoglobin genes) and stochastic (for example, the possibility for contracting malaria) aspects of human evolution are afforded in today's science. Some features of evolution are determined in large part by stochastic processes – mutations in genes are often triggered by random enzymatic processes, often triggered by interaction with the environment. On the other hand, other processes, deterministic in nature (such as natural selection), also drive evolution. Both the generation of mutations (stochastic) and natural selection (deterministic) are processes which are essential for evolution: neither process is the only driver of evolution, and both depend upon each other and are multiply interwoven with each other. Without the introduction of “random” mutations which bring material advantage to their carriers, the natural selection process would become effectively random: without natural selection, the mutations would have no survival implications and their accumulation in a population would be random. In general, stochastic processes (which involve predominantly the occurrence of mutations) operate at the level of the individual, while deterministic processes (involving natural selection and thus the accumulation or elimination of mutations) occur at the level of the whole population. Evolution requires both processes, and together their effect is more deterministic then stochastic.

The human body cannot function without an intact immune system. How do our bodies manage to develop a method to fight every possible invading organism that might enter, given that there are trillions of possible foreign bodies that can invade and attack a human being? The immune systems of most higher organisms have a stochastic component that allows for a random generation of mutations and a subsequent positive selection of the “right” mutation to fight the infection within the body. This selection and amplification of the “fighting” immune cell clone occur in every person’s body in response to foreign invaders. The stochastic process is the sparking of mutation, and the deterministic process is the selection of the proper protein that makes the immune system able to give us protection from foreign entities (Woloschak 1986: 581; Woloschak et al. 1986: 645). Thus, our bodies (as well as those of most higher animals) have evolved (deterministically) a stochastic approach to fighting disease; the stochastic nature of the immune system is also a part of creation. If stochastic processes in our body are natural, those that lead to evolution outside our bodies are as well.

The (Ideological) Question of “Animal Baseness”

Another issue that has been raised against evolution is the notion that to accept human evolution would “reduce” us to being “just” animals after all. Linked to this question, I believe, is the question of how to understand the story of Genesis, not so much from the literal story, but more from the concept of a primordial edenic state. The stories within Genesis (as used by all the Abrahamic faiths) point to some perfect state of creation that existed prior to humanity’s fall from grace, at least as defined in the creation myths. What is Eden, if it is not the original state of humans? How can we reconcile the concept of Eden as a perfect state of “original” humans truly in communion with God, to the origin of humans from ape-like common ancestors? Are we to assume that these ape-like common ancestors were actually in communion with God and that when we became human (whatever that actually means) we fell out of communion with Him?

In looking at the problem of humans as animals, I would note that humans are animals. In fact, I would argue that there is some truth to the idea that animals are more true to what they are supposed to be, and thus more perfect, than humans. My dog is a better dog than I am a human being, and I would venture to say that this is true for most non-human species. Certainly, there are individual exceptions to this – there are animals accused of brutal killings – but I believe that most of these events are provoked by unusual circumstances. Humans kill without justification: we torture one another needlessly, and we injure ourselves and others with little, if any, provocation in some instances. I believe this is not what humans are supposed to be: we do not measure up to the standards of our species. This consideration of humans as animals always reminds me of a cartoon I once saw . . . . a human being is doing his night-time reading with a chimpanzee lying next to him, reading *The Origin of the Species,* saying "We're COUSINS? Well that's kind of gross" (http://popperfont.net/2012/05/14/were-cousins-well-thats-kind-of-gross-evolution, accessed 29 August 2012).

Sergius Bulgakov discoursed a lot on this question of Eden and the primordial edenic state, but before that let me introduce him as a religious philosopher and scholar. Sergei Bulgakov was a Russian-born Orthodox priest, and professor of dogmatic theology at the St. Sergius Institute in France. He was born in 1877, was forced to emigrate to Paris, and after a long professorship died in 1944. He wrote several books and articles examining the relationship of humans to nature, published in many languages both during his life and posthumously (Bulgakov 1937, 1972, 1988, 1993, 2002, 2003, 2004; Plekon 2005: 125). Most notably, his book *The Bride of the Lamb* examines the science-theology interface from an Orthodox perspective (Bulgakov 2002). In this book, Bulgakov examines Genesis, not as history per se but rather as a meta-history or even hyper-history: "To assert that the stories [of Genesis] are 'history' in the very same sense as empirical history is to do violence to their direct meaning, to subject them to critical mutilation[. . .]." He, like many more recent scholars, believed that there were deep truths within the Genesis stories.

Bulgakov recognized the issue of "the missing Eden" inherent in the Genesis stories as a stumbling block for contemporary thought, and in his book *The Bride of the Lamb* (Bulgakov 2002) he notes: "One can say that the remembrance of an edenic state and of God's garden is nevertheless preserved in the secret recesses of our self-consciousness, as an obscure anamnesis of another being[. . .]" (Bulgakov 2002). This anamnesis comes from the Greek word meaning "calling to mind" or "not having amnesia", i.e., not forgetting. What Bulgakov is alluding to is that Eden is a state to which we strive in our personal future, and not in our species' past. The Eden referred to is something human beings and all of creation strive for, not something lost in the past. Similarly, in the Liturgy of St. Basil the Great, during the anaphora the priest's prayers call for a remembering of things yet to come, by remembering not only the things past like the crucifixion, the resurrection, and the ascension, but also by remembering (or calling to mind) those things yet to be, such as the second coming. This is discussed below when we discuss causality and time.

Related to this question of human beings as animals and the idea of Eden, Bulgakov states: "[. . .]although man is phylogenetically connected with the animal world by his animal nature, his origin is not merely an evolutionary achievement, but an express and new divine creative act that is *outside* the evolutionary process. It is something *new* in creation" (Bulgakov 2002). The appearance of a godlike spirit in humanity is a mystery that is not understood empirically, and evolution does not attempt to define when or how this spirit first appeared in humans or human-like creatures, nor is it supposed to. According to Bulgakov, continued reflection on the animal nature of human beings can be useful, but in some ways it keeps us from understanding what it is that makes us human.

The (Theological) Question of Causality

The final question of causality is about the relationship of God to cause and science to cause. Evolution takes place in time and requires time. While processes that fall under the domain of chemistry and physics require time, this time is usually at the level of nano- to micro-seconds; however, processes in the fields of biology and astronomy require often large amounts of time. The evolution of life on earth has required billions of years and astronomical distances are calculated based on time – the distance that light travels in 1 year, called light years. While non-evolutionary biology and evolution experiments with very short lived organisms (bacteria, fruit flies) can sometimes generate experiments in real time, astronomy cannot do so. Evolution is a process that occurs only on a long time-scale: it is totally time-dependent, and it cannot be well-handled experimentally because such vast amounts of time are needed (and also because the deterministic effects of each possible mutation and processes of natural selection are not yet fully understood). Therefore, evolution is seen over many generations, and perhaps the only ways that it can be manipulated experimentally is with bacteria or fruit flies that have short generation times.

Much early science was oriented towards understanding God. Mendel, a monk of the Catholic Church, pursued genetics as a way of understanding nature and thereby obtaining a view into God's creation. Galileo peered at the stars to understand the universe in hopes of better understanding the One who created it. These early science perspectives were simple and linked to a "two book" model for understanding science and religion – with the "book of nature" and "the book of scripture" being two different approaches to understanding God and his creation. In this view, God was the source of all causality, and creation was a reflection of God's action in the universe. Modern science has distanced itself from any concept of a Creator, focusing instead on understanding intermediate causes or "sub-causalities". God is not present in this equation, and I would argue that this is a good thing because scientists have often shown themselves to be totally ignorant of God or theology.

I would also point out that the issue of causality is often a driver of human thinking and human pursuits. Tolstoy acknowledged this in *War and Peace* when he wrote: "The human intellect cannot grasp the full range of causes that lie behind any phenomenon. But the need to discover causes is deeply ingrained in the spirit of man" (Tolstoy 2006). This drive to find causes is found in all areas of investigation: in history, where we try to uncover the cause of events in hopes of not repeating mistakes: in psychology, where we hope to find the cause of mental disorders and thereby cure the patient: in medicine, where we hope to find the underlying cause of disease and give the appropriate therapy. The overall goal of science is to provide useful models of reality, and this is driven by the cause-effect relationship.

Scientists look at bacteria and viruses as causes of infectious diseases, psychological trauma as causes of mental disorders, and so on; but scientists do not attribute any aspect of this to God. In fact, while many people have complained that science is wrong because it does not consider God as a cause, there is really no need for God to be the direct cause of small individual events. Science attempts to be objective with the goal of uncovering a pathway or defining a chemical response: this provides a language and approach that is unified among all scientists, and that allows for communication across the globe and even across disciplines. When a biologist in Chicago and a biologist in Japan are talking about a particular response to radiation, they both know what it takes to define that response and whether the appropriate criteria have been met to establish that it is in fact a response to radiation. When journal papers are being peer-reviewed for inclusion in a particular journal, often the comments on the paper will be similar regardless of whether the review is from Germany or Canada. While many feel confused and even angered by the fact that scientists can discuss creation without putting God into the story, these same people do not understand that there is humility in not discussing God. There is a limit to what science can define, and that limit is based on the objective scientific approach of performing hypothesis-driven experimentation. God is not subject to such testing, and therefore if a scientist were to bring God into the discussion that would be based not on scientific experimentation, but rather on his or her personal belief system. Despite some who think that science can be used to prove the existence of God, most scientific scholars do not believe that the scientific method is amenable to such considerations. If scientists were to put God into their scientific results, one wonders what the basis for this would be and what criteria would be used for including some faith-based information and not other. In fact, it could be argued that much of the animosity in the science-religion discussion is based on scientists over-stepping their bounds and delving into faith-based comments. The issues of causality from a scientific perspective and those from a theological perspective become confused. As modern science finds scientific causes and pushes the cause of events (e.g. beginning of cosmos) further and further from God (as described by the "God of the gaps" above), God appears to be smaller, and one wonders whether God is even there.

One early proponent of "God as cause" was Thomas Aquinas who argued that God is the Primary Cause of all things: "There must be found in the nature of things one first immovable Being, a primary cause, necessarily existing, not created; existing the most widely, good, even the best possible; the first ruler through the intellect, the ultimate end of all things, which is God" (Aquinas 1948). This argument of Aquinas' has become a hallmark for the Western Church in defining the relationship of God and Creation with God as the Primary Cause and other causes as being secondary. At first examination, this statement of God as the Primary Cause of all seems well-based in reasoning and understanding, and in fact God could be placed as the Primary Cause of all things with science examining secondary causes. This, however, may lead to erroneous conclusions.

Sergius Bulgakov takes this perspective to task arguing that "The One Who Causes" is not a proper designation for God. He bases this on how we understand the word cause (Bulgakov 2002). When humans cause things to happen, we think about "cause-effect" relationships; for example, turning the key in the car ignition causes it to start, or exposure to the influenza virus causes a person to develop the flu. This is not the proper way to think of God's relationship with the world. Bulgakov argues that the proper description of God's relationship to the world is that of Creator and creation, and that this is not the same as "The One Who Causes". If human creativity is somehow a micro-relation to God's creativity and God's creative activity, then perhaps we can understand God as Creator through considering our creative acts as humans (as opposed to causative facts). A comparison of cause-effect actions with creative actions actually shows that they are quite different. Creativity is often considered to be a mental activity that involves the generation of new ideas or new concepts, although there is great difficulty in defining it and its features. The source of creativity has been attributed to a variety of different processes (social environment, cognitive processes, divine intervention, serendipity, and so on) and it is usually multi-dimensional in nature. Creativity is not something that can be dictated or even defined, nor is it something that can be predicted ("Today I will be creative"). This is very different from a cause-effect relationship, in which the end-result can be easily attributed to a specific action. So, a person can easily say: "I will make a ___" and proceed to do it, if it involves no inspiration; but such is not the case with creation and creative thinking. While a person can indicate that they will design a particular experiment or a particular building at a given time, the inspiration for the creative component to that work cannot be dictated, and may come when least expected (or may never come). Thus, we often hear people claim that their best ideas (creative moments) happen in the shower or when they first wake up in the morning. If one then extrapolates from human experience with creativity, it becomes clear that creativity and cause-effect are very different things. Bulgakov provides a critique of aspects of western theology including arguments against the doctrine of first and second causes. He prefers instead a concept of "co-imagedness" in which the creatures contains the living image of the Creator, and he argues that the world does not have a cause since it was created and God is not the cause of the world but rather is the world's Creator and Provider. In this sense, the world becomes a correlative unity understood by its connection with its Creator rather than an autonomous and unrelated entity. We can also easily understand this stand from our own creative experiences: things we have caused to be made are much less important to us than those we created drawing upon our inspiration, our originality. We are proud of such things, and want to be measured by them: in some way they are us ourselves. This is another meaning to be had from the word originality – when we create and are the origin of a creation, we are truly original. God as Origin of all is infinitely more than a cause. Bulgakov reasons that the proper relationship of the Creator and creation is expressed as an icon:

> In general, the idea of the Creator and creation does not need to be translated into the language of mechanical causality, for it has another category, its proper one, that of co-imagedness, since the creature contains the living image of the Creator and is correlated with Him [. . .]. The world does not have a cause, since it is created; and God is not the cause of the world and not a cause in the world, but its Creator and Provider. God's creative act is not the mechanical causation through Himself of the world's being, but His going out of Himself in creation [. . .] (Bulgakov 2002: 221–222)

This co-imagedness fits well with the Genesis context of humans being made in the image and according to the likeness of God. Humans bear the imprint of their Creator, the icon of God.

Concluding Thoughts: Lessons from Evolution

Based on everything I have noted above, I would now like to summarize some of these lessons from evolution. First of all, evolution tells us that we are related to all life on earth – through our history, our common origins, our shared genetic code, our proteins and pathways. While there is a diversity among life on earth that makes each species (and, indeed, each individual) unique, there is more that unites us than divides us, particularly as we compare phylogenetically closer and closer species.

The second lesson is that a failure to realize evolution as the origin of our species and of life in general leads to significant problems for humanity. Failure to recognise the strong relationship between evolution and environment, and the identification of the environment as an evolutionary force, leads to a failure to understand the proper relationship of creatures and their environment. This attitude can (and already has) led to small and large scale environmental disasters dangerous to the planet, to life on earth and to the survival of the human species.

Finally, a study of at least some of the critiques of evolution reveals that reflection on evolution can promote deeper understanding of the relationship of humans to the Creator and to creation as a whole. A better understanding of human beings as animals, human beings as unique within the animal kingdom, the relationship of the Creator to creation, and much more can be examined theologically and spiritually when discussed in the light of evolution.

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Chapter 5
Life in Terms of Nano-biotechnologies

Thierry Magnin and Fabien Revol

Abstract Classical biology seeks to analyze living systems, their structures, functions and history. What is studied is not life directly, but the living entities through which life expresses itself. And this is in terms of functionalities of the living, which is a perfectly legitimate reduction in a scientific framework, as long as it is a conscious process which does not limit the view on living, and moreover on life, to functionalities. Synthetic biology, combined with nano-biotechnology, uses the discoveries of classical biology for the development of synthetic pieces of living material, and tries to reproduce the essential functions of life. Its goal is also to produce forms of living that nature itself has not yet produced. This vision of life is questionable, not only in philosophy (i.e. in terms of the classical distinction between functionality and experiences), at the epistemological level, but also in science itself, where the influence of experience on the functionalities of life starts to be investigated. For instance, in epigenetic phenomena, gene expression is influenced by the environment and by the behavior of the individuals carrying these genes; and also in brain plasticity, the development of synapses is affected by the practice of brain functions or by the re-education of these functions. These new findings suggest that life is a unity, at least at the physical, psychical and even spiritual levels for the human being. Respect for the living and for life must take into account this unity, which can also become a criterion for evaluating and discerning a "humanizing" use of nano-biotechnologies – for medical applications, for example.

Keywords Nano-biotechnology • Unity • Functionality • Biology-bricks • Emergence • Living • Life • Artificial life • Synthetic biology • Bioethics • Vulnerability

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Introduction

What is life? Many express in their own way how life is the most precious human good, although in daily life most people also know difficult times. But as St. Augustine said about time: “What is time? If no one asks me, I know, but if you ask and I want to explain it, I do not know” (Augustine 1937: 308). It is the same for the concept of life. Today, defining life is indeed a complex task as the viewpoints are many. How are we to define life at a time when humans have the power not only to sequence genomes, including the human genome, but also to manufacture artificial pieces of living material? The scientist, for instance, may define life through the “operations (working) of living organisms”: the organization of living matter, nutrition, reproduction, conservation, evolution. But for the philosopher, the psychologist, the poet, and the theologian, life is firstly about existence. Theologians speak of life as breathing, and as a gift of God. The ethical question is then: what impact do scientific techniques have on our relationship to the living and to life, especially human life?

What Is Life?

The “Technosciences” and the Making of the Living

Today, chemists are able to manufacture nano-materials, nano-particles and also nano-electronic chips or DNA micro arrays, all containing elements produced at the scale of the nanometer, a billionth of a meter. Current and expected applications relate to many fields, from electronics, chemicals, aerospace, automotive industries, food processing and textiles, through biology to medicine and surgery. The use of the term “technoscience” combines in a single word two usually highly distinct notions, the technical and the epistemic. Here the “knowing” of the scientist is achieved through “doing”, and science is lived in terms of production (Bensaude-Vincent 2009). The development of ever more exceptional synthetic performance leads scientific research. Biochemists thus access an indirect reflection on the natural processes of living on the basis of their artificial productions.

Technology not only extends our senses, as is usually claimed. It also allows analysis and imitation of the living; and, moreover, its reorganisation, its self-assembly, and the production of novelty. Through technology, some believe that humans have taken over from evolution! What nature does through huge amounts of time, technology can do too, and it can even be faster and better! Thus, at the level of applications in biology and medicine, the goal is not only to “fix” the sick or disabled, but also to increase the performance of the healthy.

This is the field of synthetic biology that has recently been strengthened by the contributions of nano-technology, including the manufacture of pieces of artificial living material and the hope of achieving artificial life. To this end, we can consider copying the living, thanks to genome sequencing, and then manufacturing it. However, on Thursday, May 20, 2010, the American biologist Craig Venter revealed in the prestigious journal *Science* that he had "created the first living cell with a synthetic genome." It is a "scientifically and philosophically important step" in understanding the mechanisms of life. "It is the creation of the first synthetic living cell, in the sense that it is entirely derived from a synthetic chromosome." And the new bacterium works following the instructions of its new genome. "This approach is indeed a very powerful tool to try to conceive what we expect of biology and we think indeed of a wide range of applications," he says (Gibson et al. 2010: 52–56). Even if Craig Venter has not created a living being from inanimate matter, making the first living cell with a synthetic genome is an important step not only towards the manufacture of artificial living organisms, but also in understanding the mechanisms of living systems.

Nano-bioengineering, then, consists in using or building on mechanisms found in living systems in order to imagine and design nano-devices. We might even make synthetic products that nature itself has not. At the level of applications, the implementation of nano-bioengineering is already effective, especially in medicine. And developing micro- and nano-biological devices based on the modular setting of DNA, lipids and proteins can act in the human body to detect and correct pathologies in their early stages, repairing or regenerating tissues. The coupling of nano-biotechnology with the information and cognitive sciences indicates new possibilities for developing artificial genomes, including also brain implants, nano-chips of DNA, nano-robots and nano-reproductive systems.

We can say that nano-synthetic biology uses living organisms as a reserve of components or "bio-bricks" that can be assembled like a Lego toy. It offers tools for the manufacture of artificial viruses or bacteria, unprecedented living organisms, enzymes, and synthetic biomaterials. Is life equivalent to a Lego kit?

Philosophical Consequences: The Reduction of a Living System to Its Functions

The scientific approach is methodologically reductionist in the sense that it attempts to reduce everything to a system of elementary blocks (the parts). This reductionism is legitimate if it is conscious and acknowledged. This is so when we separate from living systems well-defined functions that we wish to reproduce artificially (like auto-generation, self-healing or reproduction). But life is complex: it is more than the sum of its parts.

The technosciences, then, functionalize the minimal units – the elementary bricks of life – treating them as devices or machines. Neurons are nano-machines (called collectively a brain-machine); cells and molecules are large factories full of nano-machines. For scientists, there is no difference between inert and living matter at the nano-scale: there are only atoms and molecules like chemically synthesized elementary bricks, whose working may be improved and refined. Living systems are built with modules and spare parts; they are not seen as wholes, but as collections of ingenious devices. The temptation to see the human body, as well, as a set of "spare parts" has especially penetrated our collective imagination, as evidenced by the recent debates on biomedicine and bioethics in France (Sicard 2005: 37–42).

Reducing life to its functionalities, combined with other accumulated reductions, is not without meaningful social impact on the way people look at life. We find that life is only accessible to us in the shape of living beings. The sciences describe the operations of life, and biology looks at the living as objects. But life is not observed, it is experienced "in action". The living is also a subject. Already we observe the difference between "having a body" and "being a living body", an experience from which is felt the subjectivity of a human person insofar as he or she is "living".

Life manifests itself within living beings, and it refers to at least two dimensions: biological life and existence. We talk about biological manifestations of life, but also about intellectual and moral life, social life, spiritual life. Biological life only seems to be a form or a standard of living, even if evolutionary science and neuroscience now seek to establish links between different forms of life lived by the same subject.

Responding to scientists who reduce life to chemical mechanisms that characterize the living, the philosopher Michel Henry says, perhaps too emphatically, that "in biology, there is no life, there are only algorithms" (Henry 1996: 57). He defines life from a phenomenological approach, as what has the ability and power to "feel and to prove itself at each point of its being." This "power of feeling" is the experience of being oneself. Such is life, invisible and constant movement of "coming to oneself, growing by oneself".

Historically the question of the natural-artificial link is raised repeatedly, but the context of the technosciences intensifies it. Recognizing that "nature, artifice and culture" are related to each other does not lead us to blur their distinctiveness, but re-qualifies them by one another. As we have said, the development of more exceptional synthetic performances drives scientific research. It is possible to think of other combinations of atoms than those found in nature: they may even be more efficient. The goal is not just repairing, but increasing the potential of nature, since nano-materials offer mastery of living systems, including humans. The artificial can be more perfect than the natural!

In the horizon of possibilities offered by nature to techno-scientists, the determination of the elementary bricks of life is paramount. We illustrated it by the case of a "natural" bacterium, operating with a synthetic and artificial genome, breeding another bacterium. A conviction then emerges: access to the elementary level opens up all possibilities. The dream of the technosciences is to master the elementary level: the most primitive, it might be said, is the most full of possibilities. The idea of nature is not erased, but nature is no longer seen as a raw and inexorable datum, rather as an opportunity to enter the nascent state and the processes by which the elementary may lead to complex devices of exceptional performance (Simondon 2001: 71).

How may such technology be controlled, and what respect should it show for life and for living beings? Far from being neutral, research in the field of the technosciences calls for “ethical vigilance.” This is not a rejection of science, but rather identifying a real human responsibility to assess, identify, and promote what is good for humans, taking into account the impact of these approaches on today’s society.

From the Representation of Life to the Ethics of the Living

Human Responsibility Facing the Limits of the Living

The philosopher Hans Jonas has called for a “responsibility principle”, which can be summarized as follows: “Act so that the effects of your action are compatible with the permanence of a truly human life on earth” (Jonas 1997: 55). The mastery of nature by the technosciences itself needs to be mastered! Given these responsibilities, it seems essential to have spaces and skills for a real democratic debate on nano-biotechnology, especially in its application to human beings. This inquiry focuses first on the goals pursued in the development and use of nano-biotechnology in terms of risk-benefit analysis. Thus, concerning Craig Venter’s discovery, it may be noted (among other things) that on the one hand, there are possibilities for the production of new eco-fuels, of structures capable of purifying water, of capturing carbon dioxide, of producing vaccines: whilst on the other, there are possibilities for the production of biological weapons, military interests, toxic risks and threats to health and biodiversity.

The relationship between natural and artificial raises the usual, formidable, ethical question of limit. How far is it possible to exceed “human limitations”, and at what price? Is this humanizing, or is it an escape from human finitude, a denial of death and of the contingency of man? Jürgen Habermas has explored this issue for a long time, stressing that if interventions modifying genetic traits in humans became customary, we would be in the presence of reifying acts, which affect both our power “to be ourselves” and our relationship to others (Habermas 2002: 65–75). For Habermas, genetic engineering raises the issue of species identity: the understanding that human beings have of themselves, as generic beings, sets the context of its legal and moral representations. Through these debates we see the recurring question of human nature: issues of identity and human dignity are at stake. Seeing the body solely as a modular reprogrammable machine is a dehumanizing reduction. It seems that seeking to free oneself from matter is like overcoming time and death, and imagining a world of illusory physical well-being.

In addition, the temptation to see the human body as “spare parts” has especially penetrated our collective imagination (Sicard 2005: 37–42). A consequence of this vision might be to consider that life is worth living for as long as the defective modules can be fixed. But this means that there are lives that are not worth living, when no repair is possible. What does this view say to us about old age, and its active acceptance, at a time when our society is composed of many elderly people sometimes deemed "unnecessary and costly"?

The View of the Christian Tradition: A Ternary Anthropology and Attention to the Lower

One way of approaching an answer may lie in the ternary anthropology dear to Christianity, derived from St Paul (1 Thess 5: 23) and from St Irenaeus of Lyon in particular. This anthropology can be a basis for ethical judgement concerning the use of nano-biotechnology for humans. This belief is also based on recent scientific discoveries regarding the relationship between biological and psychological phenomena, as in the field of epigenetics (the branch of genetics that studies gene expression and its conditions). For humans, it has been shown that nutrition, physical training, stress management, pleasure, and social network may operate on the mechanisms of epigenesis of the organism. Current studies on brain plasticity show also a close link between features of the living and what is actually lived (Richard 2010). For instance, the organization of our neural networks is modified on the basis of the experiences of the body. Thus, practising or retraining one's brain capacities has an impact on the biology of the brain itself.

Ethical issues raised by technosciences place every human being in the situation of the book of Genesis, in front of the tree of life – of the knowledge of good and evil. "Knowing good and evil" is, in biblical language, experiencing good and evil: that is to say, experiencing all things. But the biblical text tells us: if you want to be free and "choose life", do not seek the immediate satisfaction of your desire for power, rejecting any limitations, or you might lose your life.

If humans succeed one day in "manufacturing" life from inert matter, they could then think of themselves as the originators of such life. The Christian, and therefore the theologian, who believes "in God, in whom we live and move and have our being" (Acts 17: 28) adds that we must avoid confusion between what is a part of the creation of God (who gives existence to every moment), and what is the artificial product of living things. The Bible sheds light on the trap of such a reduction of a living thing to its functions: God does not create life; God creates living beings by the Word that is a creative relationship. Life is God, who gives him/herself. In the New Testament, Christ, who is Life, is the one who came "so that men might have life and have it abundantly" (Jn 10: 10). Life can be considered as the result of a biological process, but we should remember that it is much more; it is gift, history and presence from the beginning.

The technosciences could appear to remove a fragility that continually resurfaces. If they can reduce biological vulnerabilities, which is a significant achievement, they should not hide "the condition of fragility" inherent to human life. For Christians, the vulnerable person is the cornerstone of ethics (D'Ornellas 2010: 11–27). The example of palliative care is particularly meaningful. Faced with the inevitable approach of death, omnipotence is biologically no longer relevant. Here, scientific techniques are as helpful for fighting against physical pain, as against mental and spiritual suffering. Vulnerable persons at the end of their lives are then considered in all their dimensions, physical, mental and spiritual. Faced with the non-omnipotence of organic medicine (which is still very useful, especially for the treatment of pain), another relationship is established between life and death. Human fragility and contingency are not rejected, but rather integrated, allowing a true respect for life in its breadth and mystery.

Conclusion

We must do all we can to improve the life of all mankind, especially using the technosciences. But is this not done, first of all, by respecting humanity in its finitude and wholeness, and not just by focusing on the biological features of the human? An alliance between the biological, the physical, the psychological, the social and the spiritual can help to locate the issues of the use of technosciences and their purpose. This is shown quite convincingly by the case of palliative care.

It also appears that recent studies on epigenetics, a scientific field that studies the moderation of gene expression by external factors, teach us a lesson concerning "life management". Genes are no longer considered to be simply programs of cellular machinery. Their messages can be inhibited, rendered completely silent, or amplified by small molecules interfering with the translation of the genetic code into functional tools of the cell factory: proteins, enzymes, growth factors, hormones. This greatly expands the possible fields of intervention of synthetic biology to rectify, moderate or build from scratch some vital functions. Human factors such as nutrition, exercise, stress management, leisure, social network or family circle, all have an impact on the mechanisms of epigenesis. In fact, these five elements combined together provide a regular dynamic equilibrium of the body, maintaining good health and slowing the aging process. The way we conduct our lives has an effect on genetics: a human is a unity of body-soul-spirit.

It is in this unity/alliance that humans can receive abundant life and live a "fulfillment" that goes beyond all biological manipulations, without discrediting these biological aspects of humanity. To those who think that human beings have taken over Darwinian evolution, Maurice Zundel, a philosopher (and a spiritual person), admirably answers:

> Our lives are immersed in the physical universe. We are cosmic, we come from the plant, we come from the animal, we are outcomes of the immense changes of evolution, and we are a piece, a crumb of the universe. We carry in our unconscious the whole history of the universe; we carry in our unconscious the history of the species, its claims, and its will to endure. There is nothing in us that is from us. We are a prefabricated product, and when we say 'I' and 'me' – said actually by everyone – it is a fraudulent label on our nothingness. (Zundel 2005: 216)

He adds:

> The human being is an animal that is called to born to his humanity [. . .] it has its biological roots in the soil, the humus; it must suck the forces of nature to bring them up to heaven and to love [. . .]. Yet the roots of the human person are not back in its prefabricated me, they are ahead of it. (Zundel 1947: 14)

When the technosciences are perceived from the perspective of this vision for the growth of human beings, then they will find their right place in the service of life. Zundel adds further, in another book: "life reveals to ourselves our capacity for the infinite. That is the secret of our freedom. Our size is nothing, and the very immensity of those physical spaces is a picture of our hunger" (Zundel 1998: 13). When the body, the psychic and the spiritual are well combined, we can really speak of "life wide open!"

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Part II
Concepts of Life in Philosophy, Theology and Ethics

Chapter 6
Life: An Ill-Defined Relationship

Antje Jackelén

Abstract For the most part of the history of humanity, the definition of life has not been an overwhelmingly important issue. Or at least, it was not a controversial issue. It was sufficient to go by a simple rule: you know it when you see it. Questions like whether viruses are alive or why a brain-dead person is pronounced dead, although her heart works, do not have a long trajectory in the history of understanding life. However, progress in science and technology continues to complicate the issue. What does life mean when we talk about synthetic biology, artificial bacteria, prosthetic genomes, bionics and robotics? How can we know what we are looking for when we search for life in the universe, if we do not have a clear definition? How big a problem is this? Until now, all suggested definitions of life have been falsified by counter-examples. Signs like metabolism, growth, reproduction, reaction to external stimuli, adaptation to changes in the environment, some form of communication that leads to some form of coordination – none of these provide an irrefutable definition of life, since these traits can be found in various types of systems, some of which cannot be named life by any other criteria.

Keywords Biology • Eternal life • Evolution • Information • Relationships

What Is Life?

> Life's but a walking shadow, a poor player
> That struts and frets his hour upon the stage
> And then is heard no more
> (Shakespeare. Macbeth, Act V, Scene V, 24–26)

> Life is a self-sustained chemical system capable of undergoing Darwinian evolution.
> (A definition associated with NASA and Gerald F. Joyce)

> I have set before you life and death, blessings and curses. Choose life.
> (Moses according to Deuteronomy 30.19)

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Life is more than food, and the body more than clothing.
(Jesus according to Luke 12.23)

With life, it seems, we are doomed to choose and engage in what we cannot define.[1]

Do We Need a Definition of Life?

Biology is a highly successful science, although its very basis, bios, life, eludes a scientifically valid definition. So maybe we can just go on with life and continue to do science, theology, philosophy, music and poetry without a definition of it!

Nonetheless, the lack of a scientific definition of something as essential as life feels counter-intuitive to what we mean by science. No wonder it is not very often talked about. But this lack of definition is certainly a reminder to the scientistically-minded: science presents itself as not simply contained by exact definitions to the degree that a scientistic worldview will presuppose. "[D]efining 'life' currently poses a dilemma analogous to that faced by those hoping to define 'water' before the existence of molecular theory," as the philosophers Carol E. Cleland and Christopher F. Chyba have put it (2002: 387). Without the molecular theory, there was no chance of getting at H_2O. Will we ever have the relevant theoretical framework when it comes to offering a definition of life? When will we know who or what makes decisions in a cell, and how that happens? (Ernberg 2010: 14). When will we know how life came into being in the first place, and what it looked like? (Ernberg 2010: 73). When will we know for sure what consciousness is? (Ernberg 2010: 149). Why did evolution care to develop mammals? (Ernberg 2010: 173). Why did sexual reproduction come about in the first place? (Ernberg 2010: 92).

The wording of these questions may not sound very scientific. One question anthropomorphizes the cell by speaking of it as acting and making decisions; others attribute intentions to evolution by asking why it cared to produce mammals. Yet all these questions are quoted from a book written by scientists. This indicates how little we are able to discuss life in a purely and exclusively scientific mode. Questions about life easily acquire an existential touch and an anthropomorphic flavor, even if they are meant to deal solely with science. When it comes to life, we are not just disinterested spectators. We are existentially self-interested.

So far, the situation seems sobering. The definition of the most basic notion of biology – bios itself – is unknown, and criteria for what we are looking for are in flux. When in 2010 a microorganism was found that has the ability to thrive

[1] In spite of Schrödinger's influential book (1944) and in spite of Ed Regis (2008).

and reproduce using arsenic, NASA commented: "The definition of life has just expanded. As we pursue our efforts to seek signs of life in the solar system, we have to think more broadly, more diversely and consider life as we do not know it."[2] In other words: when we try to define life, we do not really know what we are looking for. Again, to what extent is this a problem? As philosopher Carol Cleland puts it:

> I don't think that defining 'life' is a very useful activity for scientists to pursue since it is not going to tell us what we really want to know, which is 'what is life.' A scientific theory of life (which is not the same as a definition of life) would be able to answer these questions in a satisfying way.[. . .] Definitions tell us about the meanings of words in our language, as opposed to telling us about the nature of the world. In the case of life, scientists are interested in the nature of life; they are not interested in what the word 'life' happens to mean in our language. What we really need to focus on is coming up with an adequately general theory of living systems, as opposed to a definition of 'life'.[3]

This statement certainly provides a bit of relief for the anxious. Viewed pragmatically, we seem to be fine without a clear-cut definition of life. But since definitions are part of the building blocks of theories, they are not trivial. Whenever something can be mistaken for something else, definitions become important. And with the possibility of finding unknown forms of life in the universe, and with technology merging "organic" and "artificial" life, we will have to make sense of unfamiliar grey areas of life. Definitions then become indispensable – both for scientists' own understanding of what they are doing and for communication with the public.

Biology is, by definition, *the* science of life. And yet, the question of life ranges over so much more than biology. Experience and intuition tell us that, when all scientific answers about life have been given, not much (if anything) will have been said about the burning issues of our own lives and the lives of the communities we belong to. *Bios* in Greek is *vita* in Latin. We are used to think that our *vita* materializes in a *bio*graphy. We invest great efforts in the compilation and presentation of our *curriculum vitae*, in spite of the fact that no CV can "say it all". A CV mostly reflects our *vita activa*. Can it say anything at all about our *vita contemplativa*? Moreover, many of us reach the point where we realize that when our biology goes downhill, our biography goes uphill.

These observations bring me to the question:

[2]Ed Weiler, NASA's associate administrator for the Science Mission Directorate at the agency's Headquarters in Washington, according to http://science.nasa.gov/science-news/science-at-nasa/2010/02dec_monolake/ [Accessed 29 January 2012].

[3]Carol Cleland, philosopher at University of Colorado, Boulder, and NASA's Astrobiology Institute, http://www.nasa.gov/vision/universe/starsgalaxies/life's_working_definition.html [Accessed 30 January 2012].

Do Theologians Have Anything of Worth Saying About the Definition of Life?

a. Diagnosing a Definition Deficit

The standard religious studies encyclopaedia that I grew up with as a theologian has just about half a page on "Life" and 6 ½ pages on "Death".[4] If that is a hint, the answer to the question whether theologians can contribute significantly to the definition of life must tend towards "no". Theologians seem to talk about death more than about life. On the other hand, a similar proportion can be found in the Swedish National Encyclopedia, with a little more than 3 lines on life and more than 11 on death.[5] So things are not as straightforward as they appear.

We know life by our own experience which, of course, is not true about death.[6] Therefore, we tend to list more precise criteria for death than for life. In search of a holistic understanding of life, we often look at definitions of the opposite of life. Or, we go by a conglomerate of signs and decide: this is life. Definitions of life that focus on functions rather than on properties may end up saying that ant hills and viruses are alive, whereas infertile human beings are not (Korzeniewski 2001). Can a wild fire, which feeds, grows and reproduces, be considered a living entity? The borderline between concrete and metaphorical uses of the term life is fluid, underdetermined. For phenomena that are within our usual range of scale, this under-determination is not a problem. We manage to talk intelligibly about the life of a *Drosophila melanogaster* (fruitfly) and the life of an idea in the same sentence.

For better or worse, to some degree we remain stuck with the anthropomorphic lens through which we gaze at the phenomenon of life – even in this essay. Naturally, our general epistemological limitations affect how we understand life. All the instruments we use are selective. We rely on them to supply objective data, and they will do so as long as the measurement is exact, but they do so only within a preselected framework. The brain, our main meaning-making device, is selective, and thus subjective rather than objective. And our brain is living its own life, beyond consciousness. We know very well that this is the case, but we know rather little about what that really means. In search of our understanding of that which is beyond consciousness we rely on intuition more than on objective knowledge. Our definitions cannot get beyond our minds and the languages we use. They can only reveal our current beliefs about life.

Thus far we may conclude that when it comes to life, we have a definition deficit. But we know that we cannot define life without a sense of that there is other than

[4] Åke Hultkrantz "Leben", *RGG* IV: 248–249, and Carl-Martin Edsman et al. "Tod", *RGG* IV: 908–921.

[5] www.ne.se. Art. "liv" and "död" [Accessed 28 January 2012].

[6] Here, I leave aside the issue of Near Death Experiences.

life: "there is no life where there is no 'otherness' " (Tillich 1964: 421)[7] – be that otherness death, God as Creator or eternal life as part of our eschatological hope.

b. Handling a Definition Deficit

Theologians are quite familiar with the situation of definition deficits. Central concepts in theology, like God and eternity, defy clear definitions, and yet there is plenty of research, teaching and experience regarding them. Lack of definition does not prevent us from drawing conclusions that shape private as well as public life.

Most of today's theologians are well-trained in understanding and interpreting concepts *in their context*, which is a result of their schooling in hermeneutics – the practice and theory of interpretation and understanding. Hermeneutics entails both the use of concrete methods and an art, namely the art of constructively handling the suspicion that we might never get everything right (Jackelén 2004: 15–34).

When it comes to life, we are easily overwhelmed by the multiplicity of contexts and frameworks that we can use to describe and understand life. Is life beautiful or not? This brings us to aesthetics. Ask "Is life good or not?" and we are into ethics. "Is life happy or unhappy?" and we have started to discuss the physical and psychological aspects of emotionality. Ask whether life is a goldilocks phenomenon or a dysfunctional happening and you open up a debate on functionality. The question of whether life is best understood on the molecular level or on the systems level alerts us to the significance of scale. Is life just a flicker or a permanent quality of the universe? This opens a huge arena of existential and philosophical themes. In spite of everything we know about evolutionary history, people continue to ask "Is life driven by chance or by purpose?", demonstrating that the idea of teleology is not outmoded. All these questions can lead into the study of religious thought, ritual and experience. In a hermeneutical perspective, theologians can reflect on "life" in all these contexts.

Life as Relation

In the choice between a definition of life and a description of life, in terms of the relationships that surround both the term and the phenomenon "life", I give preference to the latter. I want to understand life as relation. An adequate understanding of life is not limited to an understanding of single elements – as important as that may be – but includes structures, systems and relationships, being and becoming.[8]

[7] Here, the quotation is applied in a different context.

[8] Cf. my hermeneutical approach in (Jackelén 2005: 1–9). In fact, much of what can be said about (the difficulty of) defining time can be said about defining life, too – including a paraphrase of

A religious studies perspective will examine several aspects of life, namely the existence of life, the essence of life and the power of life. To that end, scholars study (for example) creation myths, materials regarding the relationship between body and soul/spirit, as well as rituals. The religious studies perspective is different from the scientific perspective in that it moves between the scales in both time and space in a way that may seem disrespectful to the scientist. Creation myths talk about the whole cosmos, mostly without any reference to the real size of planet earth, solar systems or galaxies, and yet they are occupied with the life of humankind more than anything else. Myths and rituals actualize the cosmic perspective of time and eternity, but relate it to concrete, individual human life spans and to the life and history of specific communities and locations.

The Significance of Scale

The stunning success of biology in the past century is in large part due to its concentration on the molecular level – a scale rather unknown and very new to religious language. The success of religion is in large part due to its providing tools to move across the whole range of scales and even to transcend them – from grains of sand to eternity in just the blinking of an eye. Or, in the famous words of William Blake (1757–1827):

> To see a World in a Grain of Sand
> And a Heaven in a Wild Flower,
> Hold Infinity in the palm of your hand
> And Eternity in an hour.[9]

However, in both areas, voices that require us to work with complementary perspectives are being heard. Microbiologist Carl Woese has remarked that biology as a whole is somewhere between its "reductive molecular past and its holistic future", and is in need of a new guiding vision: "molecular biology could read notes in the score, but it couldn't hear the music" (Woese 2004: 175 f.). In his view, physics and chemistry have entered biology like a Trojan horse and turned it into an engineering discipline. Woese leaves little doubt about his own vision: biology should "break free of reductionist hegemony" and re-integrate itself. The relationship between biology and the physical sciences must be reciprocal instead of hierarchical (Woese 2004: 185). For him, the release of biology "from the intellectual shackles of mechanism, reductionism, and determinism" constitutes a turning point within the discipline: biology resynthesized as the study of evolution

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Augustine's often-quoted remark from the eleventh book of his Confessions: that if no one asks him what time (life) is, he knows, but if he wants to explain it to someone who asks, he does not know.

[9] William Blake. "To See a World…" Fragments from "Auguries of Innocence" http://www.poetryloverspage.com/poets/blake/to_see_world.html [Accessed 29 January 2012].

in complex dynamic-systems terms: “an emphasis on holistic, ‘nonlinear’, emergent biology” (Woese 2004: 179, 185). He is surely not the only biologist, philosopher or theologian to have gone in this direction. Immanent transcendence through emergence has become an attractive concept these days.[10]

In religious studies, there is a call for more precision in the use of terms like life, world, nature, creation, cosmos, and universe. These terms can no longer be used interchangeably when theologians speak about the future of creation and the last things, eschatology.[11] Even ethical reasoning requires distinctions that are new to many scholars: the ethics of biotechnology requires familiarity with scales of life far below those that are subject to common awareness. Ecology requires a more deliberate broadening of attention to living and non-living entities that have tended to fall outside the main focus of religious reflection. A (self-) critical stance toward anthropomorphism and anthropocentrism has become increasingly familiar, whereas notions like geocentrism, biocentrism and speciesism are less reflected on.

Another issue of scale concerns information. The production of data in the biosciences has grown out of proportion with the capacity to handle and assess the ever-growing quantity of data. Even in the area of religion there is access to more data than ever before. Religious texts and artifacts are examined with new methods. Religious movements have become truly global both through migration and through use of the media (Casanova 1994). Religious rituals, concepts and experiences have been tested with new methods, such as brain scans and behavioral studies in the cognitive sciences of religion. In both biology and religious studies, we have a situation that is not only new, but even unprecedented.

What Is Life According to Christian Theology?

Life Is Relationship

Theologically speaking, life is primarily being in relationship. God breathes the breath of life into the nostrils of the human whom God has formed from the dust of the ground, and the human becomes a living being, *nephesch hajja* (Genesis 2.7). God calls on Adam and Adam gives names to all the animals (Genesis 2.20). Adam is to till and keep the garden of creation in harmony with God. That is the initial vision of life in paradise. Life is being in relationship with God and with creation. Consequently, life is about more than biological existence. It is in this sense that Jesus’ statement makes sense: “I came that they may have life, and have it abundantly” (John 10.10b).

[10]Cf. for example Kauffman (2000) and Clayton (2004).

[11]Jürgen Moltmann is but one example of prominent thinkers who tend to confuse these terms in their eschatology (1996).

Falling out of this relationship with God equals death. In the shadow world of Sheol, the world of the dead, no one praises God (Psalm 115.17). “For Sheol cannot thank you, death cannot praise you; those who go down to the Pit cannot hope for your faithfulness. The living, the living, they thank you as I do this day; fathers make known to children your faithfulness” (Isaiah 38.18–19).

Praising God is a sign of life that unites all creation, both animate and inanimate, as Psalm 148 especially makes clear: sun and moon, highest heavens, sea monsters and all kinds of weather, mountains, trees and animals, kings and people, men and women, young and old, all praise the Lord.[12] The wisdom tradition in the Hebrew scriptures conveys a sense of the unity of all living things, for example in Job 12.7–10: “[. . .]ask the animals and they will teach you [. . .] ask the plants of the earth[. . .]”, and in Ecclesiastes 3.19–21: “They all have the same breath [. . .] all are from dust, and all turn to dust again. Who knows whether the human spirit goes upward and the spirit of animals goes downward to the earth?” Even Psalm 104 emphasizes the continuity, the play and interplay of all life – biological and social – in its relationship with God: “These all look to you[. . .]. When you hide your face, they are dismayed[. . .]. When you send forth your spirit they are created; and you renew the face of the ground” (Psalm 104.27–30). The creation of life is not only original creation, but also continuous creation. God blesses, sustains and renews what is there.

The theologian Paul Tillich describes life as a multidimensional unity. Everything created is rooted in the eternal ground of being (God); life is kept together in relation to its eternal destiny. More important than defining life is to understand the structure of our being related to what concerns us ultimately, to use Tillich’s terminology. We understand our being as bounded by non-being, which feeds into our sense of finitude and anxiety. The answer to this condition is not a definition of life but courage, *The Courage to Be*, to quote a famous book title of his. “The courage to be is rooted in the God who appears when God has disappeared in the anxiety of doubt”, as Tillich phrased it (1952: 190). The alternative is rather bleak: if the anxiety that is discovered in the experience of finitude is not met with courage, it will end up in despair, as Kierkegaard has shown in his *Concept of Anxiety* and *The Sickness Unto Death* (1980a, b).

Eternal Life and Relationship

Eternal life is life whose time and quality transcend everyday life. In the Hebrew Bible, God is said to live forever (Deuteronomy 32.40; Daniel 12.7), while humans do not (Job 7.16). It is only in post-exilic times (after 538 BCE), that the thought of a life after this takes shape, as in Daniel 12.2: “Many of those who sleep in the dust of the earth shall awake, some to everlasting life, and some to shame and everlasting

[12] See also Psalms 104 and 150.

contempt."[13] Hope for life eternal is driven by the experience of injustice regarding quality and length of life. All too often the wicked thrive – "I was envious of the arrogant; I saw the prosperity of the wicked" as the godly psalmist realizes (Psalm 73.3), hence the desire for a compensation beyond death. Yet, it was only at the turn of the third to the second century BCE that the idea of a general resurrection of the dead gained influence in Jewish thought.

The notion of the immortality of the soul surfaced, too. As in Plato, it could be combined with a view of the body as the prison of the soul: eternal life starts when the soul leaves the body, like the butterfly its pupa. The Wisdom of Solomon 3.1 ff. declares: "The souls of the righteous are in the hand of God". This could either mean that resurrection is superfluous, or it could mean that the souls of the righteous are with God, waiting to be reunited with their bodies at the time of the resurrection. In the latter interpretation, the material and immaterial are kept together, which is a concept preserved in the Christian creeds, as they speak of the resurrection of the dead, the body or the flesh (not survival of the soul!). Rather than ignorance of the physical processes of decay, this reflects the attempt to keep together matter and idea, body and soul. This is motivated both by the understanding of nature as creation and by the central theme of Christianity – God becoming human, an event which is not called "inhominisation" (becoming human), but incarnation, literally the *enfleshment* of God, the embodiment of God in Christ.

In the New Testament, the resurrection of the dead is discussed in the light of Jesus' resurrection. It is worth noting that experience of the resurrection of Jesus does not immediately trigger the individualistic interpretation "if he, then also me." Far more important was the fact that God did not allow the shame of Jesus' horrible death to persist. The Resurrection means that God enforced justice, as Luke reports from Peter's Pentecostal sermon (Acts 2.22–36). It takes considerable theological reflection to arrive, as Paul does, at the insight that the Resurrection of Jesus as the beginning of a new order has significance for the death of the individual and that its goal is "that God may be all in all" (1 Corinthians 15.28).

New Testament writers largely look at life and death from a soteriological aspect, from the perspective of salvation through the person and work of Jesus Christ – a highly relational concept indeed. The power of righteousness is manifested in the overcoming of death. In the light of the death and resurrection of Christ, life is more than biological existence: life is dwelling in salvation, in the realm of God, God's *basileia*, through the gift of faith. It is synonymous with freedom from sin and death (Revelation 21.4), and with seeing clearly: "now we see in a mirror, dimly, but then we will see face to face" (1 Corinthians 13.12a). Once again, the significance of relationality jumps out – life culminates in a clear face-to-face relationship, indicating perfect communion in love.

As human-centered as this all sounds, the soteriological perspective is not limited to humans. Paul expresses the hope "that the creation itself will be set free from its bondage to decay and will obtain the freedom of the glory of the children of God"

[13]See also Daniel 12.1–3; 2 Maccabees. 7.9, 11, 14, 29, 36.

(Romans 8.21). From the perspective of soteriology and eschatology, it is much more accurate to speak of the (cosmic) Sabbath as the crown of creation than to put humanity in that position. This is in line with Scripture as well as with evolutionary theory and environmental ethics.

Eternal life is realized relationality: life in God, life in the Eternal One. Tillich calls the Pauline vision of God being all in all "eschatological pan-en-theism", the "in" describing the creative origin, as well as the ontological dependence and the ultimate fulfillment of life in God. According to Tillich, it is "this threefold 'in-ness' of the temporal in the eternal [that] indicates the rhythm both of the Divine Life and of life universal" (1964: 421). This rhythm describes the movement from potentiality to actual existence and fulfillment that goes beyond both potentiality and actuality.[14]

Death Revisited

In the light of biology, a theological transvaluation of death was needed. A move had to be made from understanding death as the wages of sin (Romans 6.23) to an understanding of death as the price for multidimensional life. In the words of biologist Ursula Goodenough: "Sex without death gets you single-celled algae and fungi; sex with a mortal soma gets you the rest of the eukaryotic creatures. Death is the price paid to have trees and clams and birds and grasshoppers, and death is the price to be paid to have human consciousness to be aware of all that shimmering awareness and all that love" (Goodenough 1998: 151).

Arthur Peacocke, one of the most energetic founding fathers of ESSSAT, clearly stated the necessity of the theological transvaluation of the concept of death and the use of the story of the "Fall" (Genesis 3). Evolution can only operate through the death of individuals, hence the wages of sin must be about something other than the principle of biological death (Peacocke 1993: 221 f.). In 2006, dying from cancer, Peacocke reverted to the topic in a short note on natural evil. He wrote:

> I have often attempted to illustrate the ambivalence of this concept[. . .]. The irony is that one of the examples I took was the role of mutations in DNA which are the basic source of evolution, and so of the emergence of human beings – and also of cancer. This is a new challenge to the integrity of my past thinking. I am only enabled to meet this challenge by my root conviction that God is Love as revealed supremely in the life, death and resurrection of Jesus the Christ. (Peacocke 2007: 192 f.)

If Peacocke was right, then in the face of death we are thrown back to the issue of relationship and relationality as the basic feature of life.

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[14] A note on the side: the merger of ontological philosophy and existentialism in Tillich comes with some cognitive challenges. Langdon Gilkey recalls a comment from the audience after one of Tillich's lectures: "I did not understand a word that the professor was saying, but he was talking about me every minute" (Gilkey 2001: 87).

Relationality in Human Life

Relationality is also what makes the brain – the connectivity between the neurons, the discovery of neuroplasticity that came as a great surprise to my generation, the shaping and reshaping of the synapses – all those features of the brain that make comparisons between the computer and the brain appear crude at best and mistaken at worst.

However, all relations are not equal. Let me give an example. Some people today fear that the pressure of information overload that seems to be a mark of the early twenty-first century may be changing the patterns of connectivity in our brains, and thus be leading to a flattening-out of the deep structures of human personality and culture. This thought received popular exposure when playwright Richard Foreman coined the term "pancake-people" for the generation of "digital natives". In a 2005 statement he said:

> I come from a tradition of Western culture in which the ideal (my ideal) was the complex, dense and 'cathedral-like' structure of the highly educated and articulate personality – a man or woman who carried inside themselves a personally constructed and unique version of the entire heritage of the West.[. . .] But today, I see within us all (myself included) the replacement of complex inner density with a new kind of self – evolving under the pressure of information overload and the technology of the 'instantly available'. A new self that needs to contain less and less of an inner repertory of dense cultural inheritance – as we all become 'pancake people' – spread wide and thin as we connect with that vast network of information accessed by the mere touch of a button.[. . .] Sometimes I am seduced [. . .] sometimes I shrink back in horror at a world that seems to have lost the thick and multi-textured density of deeply evolved personality.[15]

The metaphor is powerful: The cathedral-like structure of the cultural self, flattened out into a pancake. The counter image to the pancake-personality is described in the much-loved poem "Romanesque Arches," by 2011 Nobel Laureate in Literature, Swedish poet Tomas Tranströmer:

> Inside the huge Romanesque church the tourists jostled in the half darkness.
> Vault gaped behind vault, no complete view.
> A few candle flames flickered.
> An angel with no face embraced me
> and whispered through my whole body:
> 'Don't be ashamed of being human, be proud!
> Inside you vault opens behind vault endlessly.
> You will never be complete, that's how it's meant to be.'
> Blind with tears
> I was pushed out on the sun-seething piazza
> together with Mr. and Mrs. Jones, Mr. Tanaka, and Signora Sabatini,
> and inside each of them vault opened behind vault endlessly.[16]

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[15] Richard Foreman, "The Pancake People, or, 'The Gods are Pounding My Head' " Edge 050308, http://www.edge.org/3rd_culture/foreman05/foreman05_index.html [Accessed 2 April 2012].

[16] Trans. Robin Fulton http://companionstar.org/library/scores/RomanskaBagar_text.pdf [Accessed 22 April 2012].

In my home town I live next to a twelfth century Romanesque cathedral. The robust yet soft strength and beauty of the rounded vaults, with the significance of every stone in relationship to the cornerstone, and the impression of this vaulted structure on people are visible to me on a daily basis. These are qualities out of reach for a pancake structure, a layer spread wide and thin.

What makes us human is our capacity to relate, within ourselves – mind and body, rationality and emotionality, memories and thoughts – and beyond ourselves, to people and other living beings, to the inanimate world and to the world of transcendence. We evolved to be – in many respects – the most social species of which we know. It seems that our drive to relate is never truly satisfied with the immanent only. We are, as they say, hard-wired to be religious. The more we learn about how the connections in our brains work, the more we seem to return to the old thesis of the *homo religiosus*.

Foreman's cathedral versus pancake scenario is not the end of the story. It looks like a proof of the thesis that relationality is a characteristic of life in general and of human life in particular, that we seem to be able to turn pancakes into cathedrals, so to speak. In an era when information can be considered to be the main raw material, human creativity immediately sets out to build cathedrals out of pancake-like accumulations of data. Offering solutions that analyze information with many dimensions and from many different sources and link them together into a structure where vault opens behind vault, leading to the wisdom of the right decisions, is a business idea that sells well today.[17]

Relationality as Wisdom

One may say that wisdom is the climax of relationality. Theologically, this translates into the understanding of Jesus as Sophia, wisdom (Johnson 1992). Jesus is God's Sophia who introduces otherness into the life of God, without which we would not be able to call God alive (Tillich 1964: 421).

Relationality taken seriously will help to overcome some of the things that have been identified as shortcomings in Western thought, such as the focus on the (disembodied) individual self, and an anthropocentric approach that separates what has been united in creation. Even nature needs to be understood as an image of God (Gilkey 2001: 115 f.; Page 1996: 116–122), thus making the difference between active and passive relationship a difference in degree rather than in quality. Consequently, anthropocentric exclusiveness can be relativized, or rather relationalized.

[17]Cf. the company *Qlikview* that informs potential customers that it can "[p]rovide intuitive access, comprehensive analytics and sophisticated visualization to the data that is trapped in your data warehouse." For more information, see webpage http://www.qlikview.com [Accessed 10 September 2012].

Notwithstanding the problems with such generalized concepts as Western versus Native Science, a glance at the latter can illustrate this point. In his book *Native Science: Natural Laws of Interdependence*, Gregory Cajete emphasizes relationality as a distinguishing mark of the economy of knowledge in indigenous peoples. “They found ways to address [. . .] questions of survival and sustainability in profoundly elegant ways [. . .] they thought of themselves as truly alive and related” (Cajete 2000: 178). The Lakota *mitakuye oyasin* (we are all related) (Cajete 2000: 178) resonates with the South African *ubuntu* (the radical interdependence of all). Both contrast with the Cartesian *cogito ergo sum* by emphasizing “I belong, I participate, therefore I am” (Tutu 2000: 31). With relationship as the basic ontological feature, the border between animate and inanimate gets relativized. Cajete again: “Guided by this metaphysical principle, people understood that all entities of nature – plants, animals, stones, trees, mountains, rivers, lakes, and a host of other living entities – embodied relationships that must be honored” (Cajete 2000: 178). These are all relationships in need of seeking, making, sharing and celebrating. Whereas in Western thought relationality keeps being centered on inter-human relationships, Native science makes the point that nature as such is the subject of interrelatedness, and not the object of it.

Like the French philosopher Maurice Merleau-Ponty, Native science emphasizes the epistemological significance of the body as the source of thinking, sensing, acting, and being, and as the basis of relationship (Cajete 2000: 25). Thus, the body is regarded as the primary site of knowing the world, a knowledge that is gained by participation instead of by objective detachment and psychological disassociation. Rather than viewing consciousness as the source of knowledge, Merleau-Ponty contended that the body and that which it perceives cannot be disentangled from each other. Our living body is not an object for us. It is deeply grounded in nature while at the same time being transformed by culture. It is neither wholly nature nor wholly culture.

Meaning is not a once and for all given, but arises where body and situation meet. Biology and transcendence come together in the body (*la chair*, flesh) (Sjöstrand 2011: 178–214). Even radical phenomenologists like Emmanuel Lévinas and Jean-Luc Marion have insisted that human subjectivity is constituted in relationship – in meeting the face of the other, in being addressed.

If Life Is Sacred, What Constitutes Its Sacredness?

A possible answer would be: its character as gift: the fact that we cannot produce life, just receive it. This will never change as long as individual conscious beings reflect on their own existence. Yet, already the successful practice of IVF and other assisted procreation technologies have changed the flavor of the notion of life as a gift. Further changes are looming.

More than in its character of gift, it seems to me that sacredness of life, if there is such a thing, is rooted in relationality, such as in the relationship between immanence and transcendence and the relationship between the grandeur of life and its imperfection. The latter relationship – between grandeur and imperfection – is one where scientific and theological aspects complement each other.

From the perspective of science we note that on the one hand, we observe high levels of perfection. Through evolution nature "knows" methods that surpass any mathematical processes of optimization of which we know. Biological systems are brilliant architects and engineers, which is the basic idea of bionics (Blüchel 2005). On the other hand, we observe striking levels of dysfunction: the human birth canal is mal-adapted to the size of a baby's head: the human lower back is not made for upright walking. We observe imprecise instruments of measurement, protein that cannot stand quick acceleration and is not as heat-resistant as many bacteria are, and not as cold-resistant as many grains of seed. We observe life that cannot stand starvation, as many mosses can, and that does not grow new extremities in case of loss, as sand lizards do.

Theologically speaking, one can see the encounter between the risen Jesus and the disciple Thomas (John 20.24–29) as paradigmatic in this respect. This is the narrative of perfect life – Christ released from the shackles of death – being recognized as wounded life. It is by his wounds that Thomas finally recognizes Jesus and is able to relate to transcendence, exclaiming: "My Lord and my God!"

It needs the recognition of a wounded God to overcome violence, especially the sort of violence that so often accompanies people's beliefs in what is sacred. Millennia ago, people's beliefs in what is sacred led to the sacrifice of fellow human beings and animals. Centuries ago, beliefs about what is sacred led people into crusades, inquisition and colonialism. Decades ago, and still today, beliefs about sacredness and purity have led people into acts of nationalism, racism, and sexism – all of this accompanied by streams of violence, enforcing mechanisms of victimizing both human and non-human nature. The sacred, and what is taken to be sacred, always has the potential of being very violent – because the more sacred something is, the more ultimate significance comes with it. And the more ultimacy, the less is usually our willingness to compromise, to tolerate otherness, to relate. That is why tongues that preach love so often have been found also to promote hate. The risk of such violence is there, unless one recognizes the wounded life and the wounded God at the center of what is most sacred.

Conclusion

We cannot discuss and handle issues of life apart from our own anthropology. The defining elements of anthropology have shifted throughout time. In the present day, neuro- and nanosciences contribute significantly. Human enhancement technologies will interact with ideas of transhumanism and, hopefully, theological ideas of justice. Growing understanding of how the brain works may have paradoxical consequences: on the one hand a nothing-but-biology attitude, which in its vulgarized shape will make it more difficult to relate to the world of ideas (my neurons made me do it), and on the other hand a focus on the brain that weakens our attention to what it means to be embodied.[18] After all, brain scans may tell us what happens in the brain when we realize that we are hungry, but that is not the same as understanding what hunger is.

Life cannot be understood apart from its quality of being threatened, vulnerable and wounded life.

Life retains a non-reducible quality of gift. In spite of our growing knowledge and potential to interfere with life for various purposes, there remains a dimension that is "not at our disposal". At this point, theologically speaking, the question of life turns into the question of hope.

Understanding Life does not need definitions as much as it needs stories, compelling narratives that can answer our questions regarding what it means to be alive among living beings and non-living things. The Epic of Creation by Evolution told by scientists of various disciplines, by archaeologists, anthropologists, ethnologists, theologians and philosophers, poets and other artists, is an indispensable reservoir of narratives of this kind. This will be worth our exploration in days to come.

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[18]Here, as always, knowing does not take away the sense of enchantment. Science does not necessarily bring about disenchantment. It takes away a belief in magic and superstition, but also re-enchants the enlightened mind. As Antonio Damasio has put it beautifully: "Neither anguish nor the elation that love or art can bring about are devalued by understanding some of the myriad biological processes that make them what they are. Precisely the opposite should be true: our sense of wonder should increase before the intricate mechanisms that make such magic possible" (Damasio 1994: xvi).

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Chapter 7
Emergence, Realism and the Good Life

Mikael Leidenhag

Abstract In this paper I analyze two recent attempts to naturalize meaning and values. Two thinkers, who both argue for a naturalistic conception of "the good life", are considered; Stuart Kauffman and Loyal Rue. The main thesis of this paper is that there is a conflict between naturalism and scientific realism, views which are presupposed by both Rue and Kauffman. I argue that this severely undermines their project of developing a normative naturalism. My conclusion is that they either have to give up a realistic conception of meaning and values, or abandon naturalism in favor of a less restrictive framework.

Keywords Emergence • Values • Meaning • Naturalism • Dualism • Loyal Rue • Stuart Kauffman • Scientific realism • Reductionism • Teleology • Inherentism • Inventionism

Recent thinkers in the science-religion dialogue maintain that the theory or concept of emergence may offer a framework for making sense of meaning in a naturalistic or materialistic universe. The reconciliation of the notion of meaning with naturalism has been described by some as the "really hard problem" in science and philosophy. This is because many have taken naturalism/materialism to imply reductionism and thus a denial of the meaningfulness of reality (Flanagan 2007: 9–36). Indeed, some have interpreted science itself as a threat against the possibility of locating meaning in the universe, and maintain that science actually teaches us that we live in a world devoid of values. This view has led to many societal injuries, one of them being a growing division between the natural sciences and the humanities (Kauffman 2008: 7). One way to solve this problem would be to throw science and naturalism out of the window. However, most would agree that this solution is not very attractive and that it really doesn't solve anything; on the contrary, it would probably only make us more ignorant of our place in the universe. Instead, many suggest that we need to take the naturalistic lessons of science seriously if we are

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successfully going to reconcile the "scientific image" with the "manifest image" of the world (Drees 1996: 9–12). The problem for naturalism, with respect to the issue of meaning and values, has been to define these terms in such a way as not to break the monistic commitment of naturalism. That is to say, to give meaning and values an ontological interpretation that does not imply dualism (i.e. that meaning and values are somehow non-natural or supernatural phenomena). Several naturalists argue that emergence theories could provide effective frameworks for dealing with this dilemma, frameworks which may help us to "tread the golden path between physicalism and dualism!" (Jackelén 2006: 625).

I will describe and analyze two recent attempts to naturalize meaning and values, and what it means to live a good life from the vantage point of naturalism. First, I will describe the theory of emergence and how it differs from its natural rival, reductionism. Second, I will describe two attempts to argue for the positive ontological status of meaning and values based on theories of emergence, represented by Stuart Kauffman and Loyal Rue. Thereafter, I will provide a critical discussion of both these approaches to emergence and the naturalization of values/meaning. My main thesis is that there is a conflict between the naturalistic assumptions of Kauffman and Rue and their realist conception of scientific theories. This, I will argue, severely undermines their attempt to naturalize values and meaning based on theories of emergence.

Emergence Theory: Going Beyond Reductionism

Emergence theory has, in recent years, caused a lot of buzz in the science-religion dialogue. Some have placed a great amount of faith in the ability of emergence to overcome classical dichotomies, such as dualism/monism, facts/values, faith/reason, theism/atheism, and so forth. But, what does emergence theory suggest, and what does it mean to say that reality or some part of reality is emergent? To start with, emergence theory asserts the truth of three propositions:

(1) Reality consists of a hierarchy of higher and lower levels (levels of reality thesis).
(2) Higher level Y has emerged from lower level X (from low to high level thesis).
(3) Higher level Y cannot be reduced to or be replaced by lower level X (irreducibility thesis).

These three propositions seem to constitute the basic elements of emergence theory. They are, one should say, a minimal and necessary part of any emergence theory. However, theories of emergence are typically divided into two forms, one weak and one strong. Proponents of weak emergence not only maintain the three propositions listed above, they also add an epistemological claim to the theory which states that we are epistemologically unable to deduce higher levels from lower levels. David Chalmers, for example, adopts this view when he argues that the human mind is emergent, meaning that we are epistemologically unable to deduce it from physical laws alone. The mind, Chalmers believes, is unexpected relative to the underlying principles that govern biological processes (Chalmers 2006: 253). This should be interpreted as a qualification of the irreducibility thesis which entails the following proposition:

(4) We are epistemologically unable to deduce high-level entities/properties from low-level physical laws (epistemological irreducibility thesis).

The weaker thesis of emergence is believed by some to be insufficient, since our ignorance "should not be taken as a guide to ontology" (Clayton 2004: 25). Proponents of strong emergence add that an emergent phenomenon Y not only has to be irreducible, it must also exhibit causal effectiveness. Thus, it must play some sort of causal role in order to be considered a genuine feature of the universe. When emergence theorists speak of causal effectiveness it usually involves the notion of downward causation. By downward causation they mean to suggest that a higher-level entity or emergent phenomenon Y manifests genuinely causal powers, so that Y affects its constituents, or that the whole causally affects its parts (Niño El-Hani and Emmeche 2000: 242; Clayton 2004: 49). Downward causation, thus, provides justification for the belief in ontological emergence. Thus, strong emergence theorists supplement emergence theory with another proposition:

(5) Higher level phenomena Y can exert causal efficacy on their constituents.

These are some of the central tenets of both weak and strong forms of emergence, where the former seem to include propositions (1)–(4) while strong emergence entails the truth of (1)–(5).

Many thinkers take the reality of emergence to imply the collapse of reductionism. At last we can move beyond a worldview guilty of producing several of the false dichotomies that have been prevalent in theology and philosophy. Suddenly we seem to encounter a naturalistic world not unfriendly to values and meaning. On the contrary, several naturalists maintain that emergence theory rather invites an interpretation of the universe as value-laden and infused with meaning. I will now look at the first attempt, by Stuart Kauffman, to naturalize values and meaning on the basis of emergence theories.

Meaning, Values and Agency

Several naturalists, including Stuart Kauffman, maintain that meaning and values are somehow embedded in the natural order. The scientific story about the world is not just a story about brute facts, it is also a story about how values came to be via natural processes. Moreover, this story narrates how we as humans have been cognitively equipped to apprehend meaning and values. The epic of evolution, far from being only a story about how matter arose from matter, shows why we should expect nature to support the emergence of values. Kauffman maintains that several scientific discoveries should lead us to reject reductionism and embrace a value-friendly interpretation of reality provided by emergence theory. He seems to provide four arguments for this view: (1) The biosphere is non-reducible with respect to physics, (2) Teleological language cannot be replaced by physical language and is therefore irreducible, (3) we can properly attribute agency to molecular organisms and (4) the fact of agency brings values into reality.

Kauffman maintains that the biosphere is irreducible and that biology cannot be replaced by physics. The physicist cannot, according to Kauffman, deduce the evolution of the biosphere. Thus, we cannot say ahead of time what kind of organisms, properties or functionalities will arise during the course of evolution (ibid.: 37). The biosphere, but also human culture, is essentially unpredictable and creative (Kauffman 2007: 911). We cannot pre-state all possible Darwinian pre-adaptations for the species alive today. There are frankly too many variables to take into account when trying to, for example, simulate the outcome of the evolutionary process and what kind of organisms it is most likely to produce. As Kauffman puts it: "The becoming of the biosphere is partially beyond sufficient natural law" (Kauffman 2008: 10). This means that Darwinian selection cannot be reduced to any lower-level explanations (Kauffman and Clayton 2006: 511). But, not only is the biosphere emergent with respect to low-level physics, specific happenings in the biosphere can also alter the "molecular makeup" of the biosphere as a whole. For instance, if a specific biological organism were to go extinct, then that scenario would affect the course of evolution since the specific proteins, genes, molecules etc. that were particular to that organism would no longer be present in the biosphere (ibid.: 516). The extinction of one species could have an immense effect on its biological surrounding. Thus, it seems that we have a case for downward causation whereby higher-level entity Y (a biological organism) can causally affect its lower-level constituents (the molecular makeup of the biosphere as a whole).

When we talk about human action it usually involves notions such as reasons, motives and purposes etc. These notions are teleological in nature. Some argue that we can replace these notions with, for example, a causal account of what has occurred in the brain. Kauffman, however, believes this to be highly problematic since scientists are unable to "pick out from this full account the relevant aspects of these events, that is, the subset of events that constitute [. . .]" the action of a specific subject (Kauffman 2008: 76). Thus, eliminative reductionism, that is the attempt to replace teleological language with physical language, fails. We should therefore conclude that teleological language is irreducible, and actually beyond reductionism.

The irreducibility of teleological language and the viability of teleological explanations carry important implications for how we can make sense of agency in a natural world, according to Kauffman. We are now justified in attributing agency to biological organisms, and not just to humans. On his view, it is even possible to detect agency at the molecular level. Kauffman takes a bacterium as an example of an autonomous agent (Kauffman and Clayton 2006: 505). When a bacterium is swimming up a glucose gradient, a biologist would normally say that it does so "to get food". In that sense it acts on its own behalf and it knows what it must to do in order to survive and flourish. Kauffman, therefore, suggests the following minimum definition of agency: (a) agent X must be able to reproduce, (b) X should perform at least one work cycle, (c) we must be able to individuate X from all other living organisms. When a bacterium starts its work cycle it does so for a purpose and the food that it aims to get has value for the bacterium. Once this is concept is granted, it seems that values become an emergent and irreducible part of reality. Furthermore, if a successful account of minimal agency has been formulated it seems that "ought" enters the universe; a bacterium "ought" to swim up the glucose gradient in order to get food and thus survive. "Out of agency come value and meaning", as Kauffman puts it (Kauffman 2007: 909). This is how Kauffman suggests that values and meaning are emergent properties of nature and thus non-reducible to the level of physics. From the behavior of molecular agents we are able to provide a minimal definition of agency and thus to give an account of the ontological status of values.

On Kauffman's view we can, given the reality of values, create a new vision of the world with a global ethic that respects all of life and the planet. Emergence theory provides the basis for an ethical framework that recognizes the simple truth that "We are of the world, it is not of us" (ibid. 2008: 276). Thus, equipped with a scientific view of emergence which has taken us beyond reductionism, a naturalistic conception of what it means to live a good life begins to take shape.

Teleology and Values as Inherent in Nature

Loyal Rue's views on meaning, values and emergence are quite similar to those of Kauffman. He argues, like Kauffman, that we can extract values and meaning from the behavior of certain biological organisms. Loyal Rue maintains that it is possible to understand the meaning of human existence and what it means to live a good life by identifying the purpose and meaning of the evolutionary process. Thus, by pinpointing the telos of evolution we are also able to find out the ultimate telos of human existence.

He believes that we have three options when trying to explicate the ontological status of teleology, meaning and values. The first option is to adopt inventionism, according to which telos or purpose only exists in "individual minds or in the collective meanings of a groups" (Rue 2011: 42). There is, strictly speaking, no meaning to life beyond the subjective imaginations of individuals and their communities (ibid. 2007: 833). Telos thus arises through imaginary constructs in social discourse. The second option would be to claim inherentism for telos, values and purposes; the idea that they exist independently, in an extra-mental world. Thus, the natural world is inherently infused with purpose and meaning. The third option, which is a denial of options one and two, maintains that meaning is neither to be located in an extra-mental world nor in the minds of people. Rather, meaning is reducible since all that ultimately exists are quarks and the properties of those quarks. Thus, teleology cannot be counted as a genuine phenomenon within the universe; teleology is an illusion. Rue favors inherentism and finds neither inventionism nor reductionism satisfactory, although they both have some truth to them and must not be completely dismissed.

How then can we detect meaning and purpose in the universe? Rue argues that we can understand what a living thing is, and what its purpose may be, by seeing how it carries on. The "epic of evolution", the story about the creation of matter from energy, clearly shows that "what really counts in the game of life" is to "endure and reproduce" so that we may achieve our "biological teloi" (Rue 2005: 21, 26, 57). For all species, what ultimately matters is living (Rue 2000: 100). Consequently, by achieving reproductive fitness one is living a good and meaningful life. Living is the ultimate fulfillment of life and the continuation of life is therefore the ultimate and objective value for all life forms (ibid. 2000: 106). To carry on in our pursuit of reproductive fitness is the ultimate purpose, or grand telos of life (ibid. 2005: 74). Two intermediate goals are important to achieve if this is going to be possible; personal wholeness and social coherence. The latter referring to the creation of conditions such that the construction of coherent and cooperative groups is made possible. By creating these conditions we will maximize the odds of us achieving reproductive fitness, which consequently will enable us to live a good life. Meaning, on Rue's perspective, is thus objective and "inherent in the objective world by virtue of the various telê found embodied in the heritable traits of living organisms" (Rue 2011: 85). Given that biological behaviors have emerged from the pointless and purposeless matter of the cosmos we can properly say that teleology is an emergent property of nature (ibid.: 78–79). This, according to Rue, supports strong emergence rather than weak emergence (ibid.: 49).

Scientific Realism in Kauffman's and Rue's Theories of Emergence

I am going to argue that the practice of science is on Kauffman's and Rue's perspectives realistically conceived. More specifically they seem to adopt scientific realism with respect to scientific discourse in general, and emergence theory in particular. I will suggest that scientific realism involves three different theses: (1) Ontologically, the scientific realist maintains that the world has a definite and mind-independent structure and that scientists are investigating a real world (Psillos 1999: xix; Drees 1996: 131). This however does not mean that the scientific realist overlooks the fact that human beings intervene in the world, and that we and our activities, whether physical or mental, are part of this world (Haack 2003: 123). (2) Semantically, scientific realists hold that scientific theories are literal and truth-conditioned descriptions of their intended domain. Scientific theories are intended as literal descriptions of physical reality, which implies that they are capable of being true or false (Psillos 1999: xix; Trigg 1993: 96). (3) Epistemologically speaking a scientific theory is considered successful if it is approximately true, and acceptance of a scientific theory therefore involves the belief in its truthfulness (McGrath 2002: 32; van Fraassen 1980: 80). This is, I believe, a good enough characterization of the central features of scientific realism.

In virtue of accepting a strong form of emergence both Kauffman and Rue seem to be committed to scientific realism. They both seem to assume that the aim of science is to describe a mind-independent reality full of causal events and different entities (Kauffman 2008: 4–5; Rue 2005: 16). Furthermore, they both maintain the positive ontological status of emergent entities/properties, which, they argue, exert causal influence on this reality (Kauffman and Clayton 2006: 515–516; Rue 2011: 52). Moreover, the objective world is on their view hierarchically structured from simpler levels and organisms to more complex levels of organization. Hence it seems unprovocative to say that Kauffman and Rue adopt the ontological thesis of scientific realism.

The second thesis of scientific realism flows quite naturally from the ontological thesis, on Rue's and Kauffman's view. They both seem to presuppose a semantic view of scientific theories in their critique of strong forms of reductionism, which they have criticized for not being able to capture the complexity of reality. This semantic view far transcends the nothing but conception of the world. Instead they have proposed strong emergence which, as Rue puts it, embodies a "thesis about reality" (Rue 2011: 53, Rue's emphasis). According to Kauffman and Rue, reductionism and emergence are intended to be literal descriptions of reality, where the latter has been viewed as more successful than the former. Consequently, they also adopt epistemological realism with respect to scientific discourse. Reductionism, Kauffman and Rue argue, is no longer believed to be a tenable thesis about the world and its structure given new discoveries made in the empirical sciences. Reductionism should be rejected, since it has not been able to deliver true accounts of the world. Emergence theories, today, seem more likely to be true; hence we should accept them.

It seems quite clear that Kauffman and Rue are scientific realists, given their view of the nature of the world and of the function of scientific theories. We are now ready to move on and examine the issue of naturalism and scientific realism and their potential incompatibility. If a case can be made that there is a conflict between naturalism and the theses of scientific realism, then it seems that Kauffman's and Rue's project of extracting a normative conception of "the good life" based on emergence theory will be severely undermined.

The Conflict Between Naturalism and Scientific Realism

As described above, Stuart Kauffman and Loyal Rue presuppose scientific realism (SCR). I have taken SCR to consist of three theses: ontological realism (OR), semantic realism (SR) and epistemological realism (ER). In this section I want to highlight a potential conflict between SCR and the naturalistic assumptions of Rue's and Kauffman's views. But before this can be done we have to clarify what kind of naturalism is being presupposed by Kauffman and Rue.

The ontology of naturalism is defined by Rue in the following way: "All we have in the real world is matter and its properties", and all natural facts can be construed in terms of "the organization of matter" (Rue 2005: 14, 2011: 52). Thus, the naturalistic story about the world is a story about how matter emerged with different properties that brought "a staggering variety of complex patterns" into existence (ibid. 2000: 49). Kauffman's stance on the ontology of naturalism is less clear, but he denies the notion of a Creator God and he claims that whatever exists must be at least compatible with the laws of physics (Kauffman 2007: 903, 905). Thus, he seems to deny the notion of non-natural causes in the universe. Furthermore, his conception of emergence theory and endorsement of strong emergence suggests that all the organisms, entities, and properties present today have emerged from something physical, although many organisms/entities/properties are irreducible with respect to physics. Hence, everything that exists is natural, even though everything cannot be explicated in terms of physical language. I suggest that we construe the ontology of naturalism in terms of four propositions:

(ON^1) If X exists, X is either something material or a property of matter.
(ON^2) X has emerged through the organization and re-organization of matter.
(ON^3) If X exists, X must be compatible with the laws of physics; thus there are no non-natural causes in the universe.
(ON^4) The truth of ON^1, ON^2, and ON^3 does not entail that X can be reduced to physics.

These four propositions seem to capture the essence of the naturalistic ontology presupposed by Kauffman and Rue.

Epistemically they seem, given their commitment to epistemic realism, to maintain the reliability of our belief-forming processes. Epistemic naturalism, i.e., the conjunction of epistemic realism and ontological naturalism, entails the following proposition:

(EN) Our belief-producing faculties are reliable, and belief X about the world is either something material or a property of matter.

And, semantically, a naturalist would (given ontological naturalism, semantic realism and epistemic naturalism) maintain that:

(SN) We can give a correct (though maybe not a complete) naturalistic account of the world, and propositions about the world must refer to some object or aspect of physical reality.

With definitions of scientific realism and naturalism in place, let's turn to the question of whether there is some kind of incompatibility between them. It seems to me that there is, and I will give three arguments to support this claim: (1) Scientific realism involves several normative concepts that do not seem to square with naturalism, (2) Ontological and epistemological naturalism conflict with epistemic realism, and (3) naturalism implies an anti-realist conception of scientific practices.

Involved in scientific realism are several normative notions such as justifiability and rational acceptability (Putnam 1983: 229). One can be justified or unjustified in adopting a scientific theory. These notions are usually deontologically conceived, such that if S's belief in scientific theory X is unjustified or unacceptable, S ought to refrain from that belief (Stenmark 1994: 31). S has a duty to adopt as many true beliefs as possible, while minimizing the number of false beliefs adopted. According to the naturalistic position that Kauffman and Rue seem to have adopted all facts must be natural. Whatever objects, properties or facts we are talking about, they must be natural, such that they could be revealed by science (at least in principle) (Price 2011: 188). However, how are we to ground such notions as justifiability and rational acceptability in nature? What kind of natural facts corresponds to normative concepts such as these? This problem is, of course, related to the topic of naturalized epistemology; and I want to make a couple of remarks about why I think that a fully naturalized epistemology is untenable.

First, in evolutionary or reliability theories/models of rationality, some kind of metaphysics is always presupposed. Both Kauffman and Rue presuppose realism, meaning that we discover truths about a mind-independent reality. That is, natural facts are not made up or constructed: they are out there waiting to be discovered by conscious creatures. Moreover, the kind of scientific realism presupposed by them involves deontological notions like justifiability and rational acceptability. But how can we derive such notions from nature? They do not seem to be empirically given. What kind of empirical test could show that we ought to refrain from false beliefs in order to be qualified as rational creatures? Normative concepts such as these are metaphysical presuppositions that we bring to the table of inquiry, and normative facts such as justifiability and rational acceptability cannot be construed as natural facts since they lack any reference in the natural order. To develop a normative epistemology based on naturalism seems difficult, given that many epistemic concepts seem to transcend nature.

Moreover, it seems that Kauffman's and Rue's metaphysical presumption of realism cannot be grounded in nature. How could one explicate the following proposition in natural terms: "we must adopt scientific realism with respect to scientific theories"? How, for example, could one discover the truth of scientific realism through empirical investigations? It does not seem to be possible. Scientific realism seems more like a metaphysical presupposition than a derivable truth. Thus, the naturalistic assertion that all facts must be natural seems to conflict with scientific realism, since the truth or correctness of scientific realism itself cannot be naturalized. That is, we have no naturalistic reason for adopting a realist interpretation of scientific theories.

Let's turn to my second claim that ontological naturalism (ON) and epistemological naturalism (EN) conflict with epistemic realism (ER). ER implies the possibility of acquiring knowledge. Assumed in this view is that a subject S is cognitively equipped such that S can differentiate truths from falsehoods. But according to ON (especially ON^1 and ON^2) and EN all beliefs are material or at least properties of something material. Beliefs would in this sense be physical, material or natural states, or maybe neural events. However, physical/material/natural states cannot be true or false; "they just happen" (Polkinghorne 2007: 110). It would be meaningless to attribute notions of truth and falsehood to physical or material states, just like it would be strange to attribute true and false beliefs to computer software. We can no longer, according to naturalism, have true beliefs, which means that ON and EN are in conflict with the claims of ER. Naturalists, such as Kauffman and Rue, are committed, given the monistic ontology of naturalism, to a view of mental states as physical, or as properties of something physical. To say that mental states are anything other than physical, or a property of something physical, is not an option for the honest naturalist.

My third claim, that naturalism implies an anti-realist interpretation of scientific discourse and practice, follows naturally from my first and second claims, that (a) scientific realism involves concepts that do not seem to fit a naturalistic framework, and (b) that ontological and epistemological naturalism undermines epistemic realism. Now, given (a) and (b) it seems quite hard for the naturalist to avoid scientific anti-realism. Scientific theories would from this perspective only be inventions or constructions that we come to adopt due to their pragmatic or instrumental values. They are not truth tracking, even though they may happen to be true sometimes. However, the naturalist might object that one could, from an evolutionary perspective, construe the value of scientific theories in terms of them helping us to survive in the game of life. The problem is that this view of scientific theories seems to contradict scientific realism, the view that the theories of science are truth-tracking. The naturalist could object, however, that the survivability of a certain belief is not necessarily opposed to it being true: on the contrary, if it helps us to survive it will likely be true, since true beliefs promote survival better than false beliefs. Thus, it could be argued that a naturalistic and evolutionary account is fully compatible with scientific realism. However, I do not think that this view is necessarily correct, because it seems perfectly possible to imagine a world in which conscious creatures have mostly false beliefs, even though these beliefs enable them to survive. There is no necessary relationship between belief X being able to promote survival and it being true.

To conclude, I think that a naturalistic view of science amounts to some kind of evolutionary instrumentalism and thus an anti-realist interpretation of the practice of science and scientific theories. Given a naturalistic perspective, it seems that the task of science is not to discover truths about a mind-independent world; on the contrary, the idea of a mind-independent world is difficult to justify through naturalism, since it cannot be construed as a natural fact.

Consequences for Kauffman's and Rue's Normative Naturalism

I have so far argued that Kauffman and Rue adopt strong emergence, which they argue supports the positive ontological status of values and meaning. When values and meaning enter reality we have everything that we need in order to formulate an adequate conception of what it means to live a good life. Furthermore, I have suggested that they adopt a realist conception of science, a conception that follows naturally from their view of emergent phenomena/properties. A realistic view of science, however, seems to be incompatible with the kind of naturalism presupposed by Kauffman and Rue. This carries some negative consequences for their attempt to naturalize meaning and values. They can no longer be realists about meaning and values, which means that their attempt to formulate a normative naturalism should be considered unsuccessful. How can Kauffman and Rue construe their view differently so as to make it more plausible? They have essentially two options to consider. The first option would be to adopt instrumentalism with respect to meaning and values. Values are not "out there": rather, they help us in our pursuit of some pragmatic goal. To use Rue's term, we would hold inventionism to be true in matters of values, telos, and meaning. So if, for example, values do exist, they do so in the minds of people, not in a mind-independent reality.

If the first option is to abandon realism about emergent properties, then the second option is probably to abandon naturalism and to adopt a metaphysical framework compatible with the belief in the positive ontological status of emergent phenomena. What kind of framework are we talking about? Well, if naturalism has been found unable to provide an account of "the good life", then we are probably in need of a framework less restrictive than naturalism; a framework that can expand the number of available ontological categories. One such framework would be dualism. A dualist would be quite comfortable in saying that reality is constituted by both physical and non-physical things, and that not all entities must be material, physical or "natural" (I take natural to mean part of natural or physical reality). Thus, the dualist finds it much easier to talk about the reality of meaning and values and to provide an account of what it means to live a good life. Dualism is, of course, a controversial position in philosophy nowadays, and I do not have the space to explicate or defend it here; but it seems that dualism could square better with scientific realism compared to naturalism. Maybe dualism is not so bad after all?

Conclusion

In this paper two recent attempts to naturalize meaning and values through the concept or theory of emergence have been presented and analyzed, one represented by Stuart Kauffman and the other by Loyal Rue. The main thesis of this paper has been that there seems to be a conflict between the naturalistic presuppositions of their project and their commitment to a realist understanding of science and scientific theories. It has been argued that the kind of naturalism that they seem to presuppose conflicts with scientific realism for at least three different reasons. Scientific realism seems to involve several normative concepts such as justifiability and rational acceptability, which both are difficult to integrate into a naturalistic framework. The second reason is that the ontology and epistemology of naturalism conflict with epistemic realism, in the sense that, on naturalism, our beliefs could not be true or false. The third reason follows naturally from the first two which says that naturalism, because of its ontology and epistemology, implies an anti-realist interpretation of science. Thus, we seem to have several positive reasons to consider Kauffman's and Rue's attempt to naturalize meaning and values through emergence to be unsuccessful. Consequently one should conclude that naturalism does not offer an adequate framework for dealing with questions concerning the good life.

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Chapter 8
Dust of the Ground and Breath of Life (Gen 2:7): The Notion of 'life' in Ancient Israel and Emergence Theory

Klaus Nürnberger

Abstract This essay explores the way emergence theory could render the intuitive notions concerning human life found in ancient Israelite literature more precise and persuasive. In ancient Israel, life was granted by God to a lump of structured earthly material (Gen 2:7). The 'living soul' denoted the living being as a whole, which collapses when life is withdrawn by God (Gen 3:19). Life did not, therefore, represent an independent ontological reality, but a *process* triggered at the beginning, sustained while it lasted, and terminated at the end. Platonic dualism, in contrast, posited a pre-existent and post-existent soul that was incarnate or entrapped in the earthly body, but which could, in principle, subsist outside the body or without a body. In terms of emergence theory, Platonic dualism has become untenable. Emergence theory is able to update the more realistic Israelite concept of life as a *process* involving structured matter, and subject to the constraints of time, space and energy. A number of Israelite anthropological concepts are then juxtaposed with their modern scientific counterparts. This exercise does not ignore the difference between the scientific view of reality from within immanent reality and the believer's view of the same reality from a transcendent perspective.

Keywords Emergence • Israelite anthropology • Platonic dualism • Life • Death • Soul • Flesh • Spirit • Heart • Word • Person • Free will • Theological relevance

Introduction

In biblical times, the 'Word of God' expressed the creative and redemptive response of God to changing human predicaments and depravities. As such it was packaged in the worldview assumptions prevalent at the time it was pronounced. As these

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assumptions changed, the divine message changed as well, thus involving the 'Word of God' in an evolutionary process (The research underlying these assumptions can be found in Nürnberger 2002).

To become part of this dynamic we must do for our times what the biblical authors did for theirs. Although the Israelite set of assumptions is pre-scientific, it is based on interpreted experience, rather than metaphysical speculation. As such it is more amenable to being updated, enriched and empowered by modern science than a doctrinal theology based on Hellenistic metaphysics.

This observation is not meant to sidestep the fact that science looks at reality from an immanent perspective, while faith looks at the same reality from a transcendent perspective. It only means that biblical worldview assumptions can be reconceptualised in terms of contemporary insights, thus updating, enriching and empowering the biblical message for our times.

Following the approach of 'experiential realism', rather than Hellenistic metaphysics, in this essay.[1] I intend to juxtapose the concepts of 'life', 'death', and a number of typical anthropological notions found in the literature of ancient Israel, with modern emergence theory.

Emergence Theory

The scientific theory of emergence says that cosmic evolution produced different levels of complexity and volatility (for the theory of emergence, see Clayton 2006: 1–64; Peacocke 2007: 12–16; Ellis 2008; Kauffman 2008: 1–43). A crude enumeration would include fields, waves, particles, atoms, molecules, amino acids, cells, organisms, nervous systems and brains, symbolic systems such as language, structured and oriented consciousness, collective consciousness, social structures and processes.

Each higher level is based on the entire hierarchy of lower levels and could not exist or function without the latter. However, it represents a different kind of reality with its own characteristics and regularities, because wholes are based on networks of relationships and interaction and are, therefore, something more than, and something different from, the sum total of their components.

There is both upward and downward causation right throughout the system. Higher levels are partially determined by lower levels, which are again impacted by higher levels. Downward causation can only happen within the constraints set by lower levels of emergence.

For the concept of human life, relevant levels are the biological organism, the brain, consciousness, and social processes. The brain has three functional levels, the

[1] My concept of 'experiential realism' is similar to that of 'critical realism' (Peacocke) or 'model-dependent realism' (Hawking and Mlodinov), but more inclusive of various kinds of human experience. For details, see Nürnberger (2011: 72ff).

reptile brain (seat of survival instincts), the limbic system (seat of emotions) and the prefrontal cortex (seat of rationality). Structures in the reptile brain are genetically engrained and cannot easily be changed. But they can be subdued, sublimated and controlled by the prefrontal cortex. The same is true for the limbic system. Yet survival instincts and emotional sensitivities are critically important for human life. They should not be repressed, but kept under control.

'Spirit' is structured and oriented consciousness, based on synaptic networks that emerge and evolve in response to genetic inputs and incoming information. Such systems can be switched on and off by certain triggers, which explains the toggle between the subconscious and the conscious. Encoded in symbolic systems, they can be transferred from person to person. The constant flow of communication between individuals throughout the social system constitutes and determines collective consciousness.

Due to the need of the body for homeostasis at the neural level, any imbalance triggers chemical and electrical reactions that are experienced as unpleasant and that require corrective responses. That is also true for any 'cognitive dissonance' caused by incompatibilities between an existing system of meaning and new information, or the challenges posed by alternative systems of meaning.

In such cases the brain will try to adapt its current structure to accommodate incoming information, prune and transform incoming information to make it fit, or reject it. The criteria are determined by the structure of the existing system of meaning. The outcome depends on how deeply entrenched the latter is in the synaptic systems of the brain.

Structured and oriented consciousness (spirit) is located at the personal level of emergence. For the purposes of this essay I define a person as an entity endowed with intentionality, agency, communicative competence and the capacity to form dynamic and meaningful relationships with other such entities.

Platonic Thought

For millennia theology was geared more to a Hellenistic metaphysics than to the approach of ancient Israel.[2] As an attempt to contextualise the biblical message

[2]The 'Protestant Orthodoxy' of the seventeenth century, for example, defined God as "infinite, spiritual, most perfect essence" (Schmid 1875: 112). Note what is excluded: finite, material, imperfect, and (historical) existence. From this axiom God's 'attributes' or characteristics were deduced – and that by retaining all perfections and subtracting all imperfections found in ordinary experience (Schmid 1875: 117ff). The source of the argument is not the Bible, but Greek metaphysics. Verses that seem to fit the different contentions are added from all over the Bible, irrespective of their contexts. It is not often understood that this theology is the common ancestor of Pietist, revivalist, evangelical and fundamentalist interpretations of the Christian faith. But it also provides the basic framework (the 'symbolic universe') within which most of contemporary Systematic Theology operates.

in terms of the Hellenistic worldview, this was legitimate. Paul said that he had to "become all things to all people" (1 Cor 9:19–23). However, static ontological assumptions managed to entrench themselves in the foundations of theology and stifled the dynamic response of the message to the flux of history.

Platonism expressed the contrast between what is and what ought to be in terms of idealised abstractions from actually experienced reality. It moved from the flux of time to eternity, from location in space to universality, from power plays to harmony, from existence to essence, from concrete entities to underlying ideas. Spirit was 'real': matter was 'unreal'. Spirit was the authentic, matter the inauthentic, if not evil, aspect of the world. God was a name for the highest ideal – the good, the true and the beautiful – thus for ultimate and unadulterated perfection.

We cannot do without abstraction. However, there is a difference between a deductive approach that begins with assumptions and draws out a string of inferences, and an inductive approach that begins with observations and then discerns regularities, similarities, and relationships between observed entities.

Granted, Plato's anthropology was much more complex. It was also refined by Aristotle. For the purposes of this essay, however, it is sufficient to highlight the view, also found in many other ancient anthropologies, that an immortal soul was 'enfleshed' or imprisoned in a mortal body, only to be released upon the death of the latter. The body was the seat of temptation and evil. In this life, it had to be subdued, disciplined, chastised – and finally left to decay. A motivationally effective vision is transformed into the longing for a hereafter without conflict, responsibility, or duty. All this clashes with ancient Israelite thought.

Taken literally, the dualistic approach is also at variance with modern scientific insights. In terms of emergence theory, there can be no soul or spirit that could subsist and function without the biological infrastructure of the body. Moreover, reality is an evolutionary process that has never been perfect, it is not perfect, and it cannot ever become perfect. Even ideas and ideals are in constant evolutionary flux. In fact, perfection cannot even be imagined.

Greek and Israelite Thought

Hellenistic thought has embedded itself deeply into the Christian symbolic universe and cannot easily be dislodged. However, the Hellenistic approach is no longer persuasive in our times. Applied consistently, it leads to an ontological stasis in which nothing moves. The definition of God as 'unmoved Mover' is a contradiction in terms.

As such it is at variance with Israelite thought geared to actually experienced reality. For Greek philosophy, God was the logical construct of a perfect being presiding over the world of eternal ideas, rather than the vibrant concept of the personal Source of experienced reality found in the Old Testament. In contrast with Hellenism, the Israelite worldview followed the incessant flux of history with its unending conflicts and tensions between what has become and what ought to become. The preferred medium of Greek philosophy was the abstract concept: the preferred medium of Israelite thought was the narrative.

Whether in the past, the present or the future, time was specific – the significant time – the time of sowing and harvesting, the time of marriage and funeral; the time of war and peace; the time of festival and ritual (Preuss 1991: 251). Space too was specific – the significant space – the created cosmos, where chaos was kept at bay and life could flourish; the Promised Land as the space of Israel; the temple as the space of the presence of Yahweh. Power was equally specific – significant power – the empowerment of particular people by Yahweh, the Source of all power.[3]

Because God's presence constituted the precondition for anything to exist or happen, the issue was never the existence of God; the issue was always God's empowering presence or debilitating absence (Janowski 2004: Preface). 'Life' was a process driven by a divine dynamic, a process that had a beginning, duration, and an end. Earthly reality was in constant flux. Creation was not complete or perfect, but in need of redemption, transformation and empowerment. God was the dynamic, ever active Source and Destiny of reality that challenged and sought to transform an unacceptable status quo.

The Concept of Life in Ancient Israel

Since the emergence of Deuteronomic theology, the overarching presupposition of ancient Israelite thought has been the covenant relationship between Yahweh, the God of Israel, and Israel, Yahweh's chosen people. Yet the God of Israel is understood as the transcendent Source and Destiny of reality as a whole. As the Source of life, Yahweh is beyond the constraints of earthly life – energy, time and space. But very little is said about God 'as such'. The focus lies on God's relationships with human beings.

God represents the fullness of life, from whom all life is derived, who sustains all life, and to whom all life returns (Deissler 2006: 48ff). The concept of life in ancient Israel, whether animal or human, has two decisive aspects: the composition of a biological construct and its uncanny operation. That reality is composed of matter is self-evident. But life is a mysterious and empowering gift of God. Genesis 2:7 says that God formed the human being from the soil of the field like a potter and then breathed the breath of life into 'his' nostrils. Thus the human being became 'a living creature' (Brueggemann 2002: 47).

This life *can* be taken away at any time and *will* eventually be taken away by God. Then the biological construct collapses back into the 'soil' from which it was

[3] Seen in this light, the different aspects found in the Priestly creation narrative (Genesis 1) present an enumeration of basic parameters of experienced reality, rather than a temporal sequence; the Sabbath was an affirmation of the completeness and goodness of the created cosmos (Janowski 2004: 240).

taken (Genesis 3:19). This happens to every living being. Life is a process that has a beginning, duration, and an end. It cannot be thought of in terms of a timeless ontology. God was at the beginning and God will be at the end (Deissler 2006: 136f).

The Old Testament discerns an intimate connection between the gift of life to humans and to animals. Though subordinate to humans (Gen 1:28ff), and not to take the place of the human partner (Gen 2:18ff), they were created and blessed on the same day (Gen 1:24ff). According to Ex 20:8–11 they were to enjoy the rest of the Sabbath. Though there was a clear distinction between (useful) domestic and (dangerous) wild animals, the Israelites treasured the immense riches of animal life (Janowski 1999: 10ff).

Expressed in scientific terms, the formed 'soil of the field' is constituted by energy conglomerations organised in a staggered hierarchy of emergences. At some evolutionary stage autocatalytic processes kick in. They produce trillions of complex systems that function in perfect coordination. That the outcome should be a living creature can rightfully be considered a miraculous and mysterious gift of God.

The scientific equivalent to the 'divine breath of life' thus consists of organisation and information systems that constitute the living organism. This intricately organised conglomeration of systems is highly vulnerable. The failure of one critical function can lead to the collapse of the entire system. Then it is all over and the organism disintegrates. That is the scientific equivalent to the Israelite notion of the withdrawal of the gift of life by God.

Let me illustrate this with a recent experience. A much loved Siamese cat, healthy silk, all muscles are totally relaxed, and the eyes seem to look at me in their sparkling blue. Everything that made up this organism seems to be as present and intact as a minute before. But life has gone. It seems as if all systems that pass information through the body have been switched off. Immediately the order of the body's chemistry begins to disintegrate. A few hours later the cadaver is stiff and smelly. In terms of Genesis 3, God has withdrawn the gift of life from the lump of clay.

The Concept of Death in Ancient Israel

Israelite-Jewish traditions (from Genesis 2 to Sirach 41) are remarkably realistic about the inevitability and finality of death. Death was "both an undeniable and undenied reality" (Brueggemann 2002: 47). You were granted a limited and precious period in which the gift of life enabled you to enjoy a living relationship with Yahweh as part of your clan, tribe or nation. You got a chance to make your contribution. When you died, your progeny continued to take the baton forward, while your bones were gathered to those of your fathers (Judg 2:10). The death of an elderly person was taken as normal: it is only an evil, premature death that caused consternation, a death caused by disease, accident, war, or murder (Jüngel 1973: 84ff).

The deceased were dead. They had no ontological reality. Ancestors never functioned as mediators between God and God's people. Any oracle or appeal to the deceased was strictly forbidden: Yahweh alone was to be worshiped and approached in case of calamities. Abraham, Isaac and Jacob were the initial recipients of Yahweh's promises, thus as a historical seal of Yahweh's commitment to Israel, but they never played a cultic role as such (Nürnberger 2007: 57ff). Nor were the ancestors considered particularly holy. In fact, the national catastrophes of 721 BC and 587 BC were blamed upon their apostasy and disobedience, giving them a bad name (Judg 2:6–23; 2 Chron 29:6ff; 34:21ff; Neh 9:16ff; Jer 16:19; Ez 20:4ff; Am 2:4).

The concept of *sheol* was not the same as the later notion of hell as a place of post-mortem punishment. It was the mythological 'sphere' where you no longer see the light and cannot praise God (Is. 26:14; Ps. 88:10ff; Ps. 6:5f; Job 14). In fact, you no longer exist. "The place of the dead is simply a place of nonbeing that stretches limitlessly into the future ..." (Brueggemann 2002: 48). Why Israel did not extend the power of Yahweh over the 'realm' of death (Preuss 1991: 301) is a wrong question. There was really no such realm.

If life was a gift of Yahweh, taken from God's own abundance of life, death could be no more than the absence of life. It had no ontological reality, no mythical power, no divine function. The idea that death constituted a power *sui generis*, or even that it was an enemy that had to be vanquished (1 Cor 15:16), emerged much later.

Death also functioned frequently as a metaphor for extreme adversity, danger and distress (Murphy 2001: 141–148). God can pull somebody in wretched circumstances or mortal danger 'out of the pit'. This metaphorical use often led exegetes influenced by Christian assumptions to postulate an implicit notion of life after death in ancient Israel. That is hardly appropriate.

However, when biblical authors eventually ventured to make statements about life beyond death, they were motivated by a burning concern for divine righteousness and human authenticity. As a post-exilic innovation, the idea of a resurrection of the dead to face judgement arrived late on the scene. Within the biblical Canon, it appears for the first time in Daniel 12:2, which is usually dated between 168 and 164 BC. It always remained controversial in Judaism. Ecclesiastes (or Jesus Sirach), probably written in about 180 BC, is still in line with the ancient Israelite tradition (17:1–32 and 41:1–42:8). Death is a decree of God and we had better live with it. Wisdom of Solomon (1:12–3:19), on the other hand, argues that 'righteousness is immortal' and those who deny resurrection do this only to get a free ticket for iniquity – hardly a persuasive charge against Sirach. Being responsible for their thoughts, words and deeds, humans would not get away with unrighteousness, nor be deprived of the blessings of righteousness. For the Giver of life, death could present no insurmountable problem. Apocalyptic literature integrated this reassurance concerning the righteousness of Yahweh in a cosmic drama that depicted the reconstitution of reality as whole.

Utilising the apocalyptic worldview, the New Testament proclaimed the death of an inauthentic being and the resurrection of an authentic being. The latter was deemed a holistic bodily life, albeit of a different kind (1 Cor 15:35–49). It was part of a reconstructed heaven and earth based on righteousness, which included the whole of the natural world (Romans 8:18–25; 2 Peter 3:13). Today we can respect apocalyptic expectations as symbolic expressions of what *ought* to happen, given the assumption of a God of power and love, rather than scientific predictions of what was *going to* happen. This can be seen from the deliberately unrealistic imagery used in apocalyptic literature. The 'new Jerusalem' in Revelation 21, for instance, descends from heaven as a perfect cube with sides longer than the distance from Johannesburg to Cape Town, made of pure gold, but transparent like glass. There is not the slightest attempt to make the 'new heaven and earth' sound plausible. Understood in this way, these texts do not contradict scientific insights about the probable future of the cosmos.

The Israelite faith was also remarkably realistic about the relation between 'body and soul'. 'Flesh' was the whole human being estranged or set apart from God, rather than the material component of life. 'Spirit' was the whole human being empowered by God, rather than a bodiless soul. This observation is critically important for the meaning of these terms in Paul's letters, which is so often wrongly interpreted in Platonic terms. Seen in this light, Israelite thought on life and death does not clash with the theory of emergence, or with the scientific understanding of biological life and death for that matter. It is simply more rudimentary and intuitive.

Yet the ancient Israelites experienced human life as complex and multidimensional. This can be gleaned from a variety of Hebrew concepts associated with human life. These concepts can only be understood as aspects of the living human being as a whole, as it experiences itself and others, rather than components that could be contemplated apart from each other. Let us consider a few of the more important.

Nephesh: The *Needy* Human Being

For the following see Wolff (1974: 25–48). The concept *nephesh* is usually translated as 'soul'. This translation is inappropriate. At the most basic level, *nephesh* is the *throat* (the organ used for feeding the body) or the *trachea* (the organ used to breathe). Yahweh is praised for satisfying the hungry, thirsty, languishing, or 'breathless' organism. From the outset it is clear that *nephesh* is not a 'soul' that could be considered apart from the body.

From here a number of related meanings are deduced. They extend to the whole range of sensations connected with dependence, vulnerability and suffering: fear, fright, weakness, defencelessness, exhaustion, worry, anger, love, hatred, sorrow, impatience, but also satisfaction, joy, jubilation. Scientifically speaking we are here in the area of neural and chemical processes that lead to homeostasis, without which a healthy and pleasant life is not possible.

In its widest sense the concept *nephesh* denotes life itself (whether that of animals or humans) in contrast with a corpse or cadaver. Human beings do not **possess** *nephesh*, but they **are** *nephesh*, that is, living creatures. That is why *nephesh* can also be translated as 'person', why a number of people can be counted as so many ‘souls’, and why you can speak to yourself as ‘my soul’. However, ‘soul’ never means “an indestructible core of existence that could be contrasted with bodily life and could also exist without the latter” (Wolff 1974: 40; Brueggemann 2002: 47).

Basar: The *Frail* Human Being

For the following see Wolff (1974: 49–56). The basic meaning of *basar* is ‘flesh’ or ‘meat’, for instance the meat of the sacrificial animal, or parts of the human body. From there the meaning can extend to the human body as a whole; then to blood relations; the clan, fellow human beings and even humanity as such. ‘Flesh’ should not be feared (Ps 56:4), and one’s life should not be entrusted to mortals (Ps 146:3).

As a description of the decrepit existence of the creature, flesh is contrasted with the divine Creator. It does not last; it is not dependable, powerful, or self-sufficient. It blossoms for a short while, then withers and decays (Ps 90:5; Is 51:12). Being frail, it is susceptible to the temptation of drifting out of the sphere within which a wholesome life in fellowship with the life-giving God is possible. Yet, again, ‘flesh’ is not something different from the person, but the living person itself.

Ruah: The *Empowered* Human Being

The same is true for the next concept to be discussed (For the following see Wolff 1974: 57–67; Fabry in 2004: 365–402). *Ruah* is usually translated as ‘spirit’, but again this translation is hardly appropriate. At the most basic level, *ruah* means wind or storm. It refers to an “invasive power at work in the world, deeply linked to YHWH’s will and purpose, capable of disrupting and transforming earthly reality” (Brueggemann 2002: 200). Applied to the human being, it is breath, understood as life-giving energy. It comes from God and returns to God at the point of death (In Gen 2:7 the word *neshama* is used, an older term that has roughly the same meaning as *ruah*). When it returns to God, a previously living being returns to the earth from which it was taken (Eccl 12:7).

As a metaphor, *ruah* is applied more often to God than to humans, denoting the *power* of the life-giving God, in contrast to the ‘flesh’ (*basar*), which is characterised by creaturely infirmity. However, the divine *ruah* is normally not contemplated on its own, but rather as divine power *empowering* the human being (Tengstroem in 2004: 386ff). Special allocations of divine power include the authorisation and empowerment of great judges, leaders, prophets, and even artists (Ex 31:3; 35:31). It is noteworthy that *ruah* always refers to a dynamic power in space and time; therefore the term hardly occurs in legal documents.

Although *ruah* is associated with divine power, the Israelites did not exclude negative aspects of this ‘empowerment’. An example is the evil spirit that caught hold of King Saul. Such a spirit is sometimes called a ‘spirit *from* Yahweh’, in contrast with the 'spirit *of* Yahweh' (1 Sam 16:14). *Ruah* can also denote human anger or aggressiveness. Israel could simply not contemplate any part of reality that was not brought about by Yahweh, the ultimate Source and Destiny of reality as a whole.

As an anthropological term, *ruah* roughly fits the level of structured and oriented consciousness in emergence theory – the combination of emotional strength situated in the limbic system with the orientation and determination emanating from the prefrontal cortex. Its negative version can be compared with the egotistic survival instincts that break out of their reptile confines and assert themselves against the control of the prefrontal cortex.

Leb (lebab): The *Rational* Human Being

(For the following see Wolff 1974: 68–95). *Leb* is usually translated as 'heart'. Again the translation is misleading. *Leb* has nothing to do with either the biological organ that pumps blood through the arteries and veins of our bodies, or the emotional sensitivities that we associate with the concept of the 'heart'.

As a metaphor for something 'deep inside', *leb* can be applied to anything hidden and inaccessible, such as the 'heart of the sea'. Applied to the human being, however, it is the hidden seat of human motivations. Only God knows 'the heart', that is, what it is that informs and directs the behaviour of a person. In this sense, *leb* represents the responsible human person as such.

In the great majority of cases *leb* denotes the faculties that we associate with the 'head' rather than the heart – insight, rationality, knowledge, thought, attention, interest, and memory. The 'heart' hears, observes, and understands God's will. But the concept also covers motivation, orientation and will-power. Significantly, the concept is hardly ever applied to animals, never to idols, and not very frequently to Yahweh. It is a typically anthropological term.

Again the negative is included. The Israelites observed the reality of a 'hardened heart'. As in the case of *ruah*, what happened in the heart had to be attributed to God (the Source of reality) and to humans at the same time. Yahweh hardened the heart of Pharaoh (or Israel for that matter), with the result that Pharaoh (or Israel) hardened his heart.

Although the Hebrew usage is much more diffuse and can extend to any dimension of human life – identity, vitality, emotion, cognition, understanding, memory, will, morality – the concept of *leb* links up most easily with the concept of 'spirit' understood as structured and oriented consciousness in emergence theory. It represents synaptic networks that are formed by descent, early childhood socialisation, ongoing experience, and the continuing flow of information.

On the other hand, failure cannot be excluded. The prefrontal cortex is not omnipotent. The survival instincts located in the reptile brain and the emotions located in the limbic system can break loose and overpower rational judgement. The mind can also be structured in a great variety of ways, some beneficial, others detrimental.

Bewailing the disobedience and waywardness of Israel, prophets speak of the need for Yahweh to create something more dependable in humans – a 'new heart' (Jer 24:7; Ez 11:19). This would mean that fearful, wavering, uncertain persons and communities would be oriented, motivated, and strengthened to pursue a more wholesome direction in spite of obstacles and painful consequences.

In biblical terms such a reorientation and empowerment happens through the 'spirit' working through the 'word of God'. In scientific terms it happens through communication via symbolically encoded information systems. According to neurology, the content of the mind can indeed be decisively moulded, strengthened and entrenched by rituals, liturgies and the reiteration of messages. These reiterations reinforce systems of synaptic switches in the brain.

Dabar: The Creative Word

A critically important anthropological concept in ancient Israel is the 'word' (*dabar*). According to Genesis 1, God created the different aspects of the universe by means of a series of 'imperial decrees'. This reveals that the concept of the 'word of God' is not restricted to the communication of some meaning or other. It is the power through which God brings about new realities. It is not a descriptive word, but a 'performative' word. *Dabar* is an act, an event, even a new fact as the outcome of divine action. It is the power that drives the historical process forward. This also true for the word Yahweh speaks through the words of his prophets (Jer 1:9–10).

Statements about the creative power of God's Word have to be seen against the background of the Israelite assumption that human words too are performative. "Words have power, for weal or woe" (Murphy 2001: 67). My own words can destroy me (Sirach 22:27; Eccl 10:12). They can also reveal who I am, a wise person or a fool. As the story of the blessing of Jacob shows, the power of a pronounced blessing or curse constitutes realities that have far-reaching consequences – just as the 'sensitivity to initial conditions' in chaos theory can lead to exponentially escalating processes that defy all predictability.

These observations fall into the fields of various human sciences. It would be interesting to compare these tacit assumptions with modern linguistic analysis, communication theory and information theory. How does the creative Word compare with the encoded information that drives self-replicating molecules, the differentiating directives of genes, communication through language as a symbolic system, significant patterns of behaviour, rituals and gestures, the difference between descriptive statements and performative pronouncements, or with modern reader-response theories? We cannot go into further detail in this essay.

Is God a Person?

In ancient Israelite thought, the 'Word of God' is not some irrational force or other: it is always intensely personal (Preuss 1991: 222–225). To think of God as an impersonal mechanism, an abstract 'creativity', or a blind fate, is inconceivable in ancient Israelite terms.[4] God is always known as the great 'You' (Preuss 1991: 274). As mentioned above, a person can be defined as an entity endowed with intentionality, agency, communicative competence and the capacity to enter into relationships with others.

Scientists may have difficulties with that. The world process does not seem to be the result of anything remotely connected with personal intentionality and agency. Against the background of the theory of emergence, however, this betrays a truncated view of reality. Humans are part of reality, thus one manifestation of the creative power of God. In theological terms we can say that God becomes a person for humans, because humans are persons. An impersonal notion of God would be a deficient notion of God because it omitted a level of emergence that is pivotal for faith and theology.

On the other hand, as the Source of reality at all levels of emergence, God must be much more than a person, just as humans are much more than persons. A tsunami is not caused by a deliberate decision of God, but by tectonic shifts in the crust of the earth that follow natural laws – which are also of God! This insight is of critical importance for a solution of the problem of theodicy. In this sense emergence theory can correct the biblical over-personalization of the concept of God as well as the concept of the human being.

Switch Theory and Spiritual Empowerment

Let us pursue the personhood of God a bit further. Persons are endowed with intentionality and agency. They have will-power. The ancient Israelites took the existence of a divine will and a human will for granted. Yet they were mystified by the profound ambiguity of the phenomenon. Theodicy questioned the power and benevolence of God; the pervasiveness of human sin questioned the capacity of the human will to attain authentic lives in fellowship with God.

A kind of divine determinism – rooted in the Israelite faith in God as Source and Destiny of reality – seemed to question the power and reliability of God's benevolence towards humanity in general and Israel in particular. If nothing could

[4]The theologian Gordon Kaufman (2004: 53ff) and the biologist Stuart Kauffman (2008: 281ff) defined God in immanentist terms as 'creativity'. This is an anthropomorphic metaphor, a noun abstracted from the verb 'to create', which demands a personal subject. Gravity does not create, evolution does not create, computers do not create. So the metaphor does not yield its intended result, namely to define God in impersonal terms.

happen without God's creative activity, and if God was committed to the well-being of God's creatures, why did God not prevent sin? Why did God not overcome sin, rather than getting upset about it? The mythological depiction of the fall in Genesis 3 stated the fact of sin in the form of a narrative, but provided no satisfactory explanation. That was the first problem.

The second problem was the observation that certain actions and events have consequences that seem to follow almost automatically. A single act could determine the fate of a nation. Nowhere in the Scriptures is it claimed that God ever went back into history to repair something that went wrong there. What had happened could never be undone. The only hope one could have is that God would take the current situation as the point of departure for a way into a more wholesome future. This shows how deeply the Israelite faith was based on the interpretation of actually experienced reality. In the Old Testament the linearity of time was simply taken for granted. The notion of the reversibility of time, found in modern physics, is a mathematical construct that has no experiential basis and no bearing on real life. That a particular time has a particular significance, as mentioned above, does not militate against the linearity of time. Specific times are embedded in the overall flow of time.

From a modern point of view, the first question is whether the freedom of the will, whether divine or human, is an illusion. Recent scientific developments are beginning to overcome scientific scepticism concerning the possibility of the freedom of the will. The theory of emergence questions physical and biological reductionism. Bottom-up causation and top-down causation operate throughout the system. The concept of sensitivity to initial conditions in chaos theory, the theory that life is situated critically 'on the edge' between order and chaos, complexity theory, probability theory, indeterminacy and probability at the quantum level, and other developments, all question the assumption that causal networks are always and necessarily closed.

It would seem, therefore, that there are situations in the cosmic system that are underdetermined, if not undetermined. The phenomenon of underdetermination is something different from the assumption of the contingency of all of reality, including causal sequences, as proposed by Wolfhart Pannenberg and others. The former is a scientific finding, the latter a metaphysical postulate based on the assumption of a transcendent Source of reality. This is not a prerequisite for God to act, because God acts through all of reality, but it does create the space for humans to act. It is not necessary for believers and theologians to enter into the intricacies of scientific theories to appreciate their theological repercussions. One only needs to understand that at any given time in any given situation the future opens up a substantial, but always limited, spectrum of options and possibilities.

In what follows I present a simple model that is accessible enough for anybody to understand. I call it 'switch theory'. Using a metaphor from the railways, a 'switch' of rails can send the train into either of two directions. The greater the number of subsequent switches, the greater the range of possibilities. In the same way, and always within certain limits, the motivated and dedicated human mind can effect changes in the direction of a process through external means. That is what agency is all about.

The current situation at any given point in time is the consequence of past developments. Let us call it **factuality**. Because the past cannot be undone, the current situation is fixed. I am now sitting in front of my computer here in Pretoria and cannot be in Tokyo at the same time. However, the parameters set by the past always open up a range of possible futures. If I have the inclination and the financial resources, I may be able to go to Tokyo. Let us call this range **potentiality**. The transition from what has become to what is about to become at any given point in time can be called **actuality**.

If an undisturbed process is left to itself it will take the path of least resistance. That is the direction that encounters the least disturbance and obstacles emanating from new forces that impact the situation. The relative strength of intervening forces create a continuum from the 'adjacent possible', to the 'proximate possible', the 'remote possible' and eventually the 'impossible'.

Human intentionality, translated into agency, is capable of switching the direction of the process, but always only to the extent that it can exert a greater amount of power than the forces that withstand such a switch. The more balanced the forces impacting the situation, the greater the 'sensitivity to initial conditions', the easier it is to change the direction of the process. I cannot just walk through a wall on the strength of my muscle power, but I can force my way through the wall with a bull dozer. So it is a staggered and ultimately constrained kind of freedom.

A number of theologically significant implications seem to follow. First, humans are not necessarily capable of discerning the full range of options available, their respective probabilities and their possible consequences. Every decision involves risks. No option is unambiguous. None is without trade-offs and costs. But believers may prayerfully request God to open their eyes to discern as much of an impenetrable causal network as possible, to make them highly conscious of possible consequences, and to refrain from rash decisions.

Second, the most obvious alternatives do not necessarily represent the most desirable or profitable options available for the entire life world of the believer. Believers may request God to purify their purposes and goals so that they remain, as far as possible, in line with God's vision of comprehensive optimal well-being.

Third, once a decision has been taken, albeit with 'fear and trembling', nothing will come of it without single-mindedness, determination and perseverance. The will to succeed and the boldness to enlist resources and energies found in the environment is a prime prerequisite of success. History is replete with examples where individuals and groups refused to be deterred and eventually brought about remarkable achievements. This is precisely where the Israelites saw the empowering presence of the Spirit of God at play.

Fourth, there is no way one can escape the consequences of a decision, whether positive or negative. Because reality is ambiguous by definition (in the final instance because of the dialectic between entropy and gravity), there is no benefit without cost, no good without evil, no righteousness without guilt. The choice is never between good and evil, but always between the greater and the lesser good, or the greater and the lesser evil.

Finally, not everything is possible. For the ancient Israelites it was clear that God was the ultimate Source of both good and evil (Janowski 2004: Preface). Yet they harkened back to the redemptive promises and actions of the past: Abraham, Isaac and Jacob: exodus and conquest: covenant and law: the institution of the monarchy and the priesthood.

It is here that the conflict between God's (experienced) creative power and God's (proclaimed) benevolent intentionality arose. Believers appealed to God against God. They clung tenaciously to the divine promise in the face of all experiences to the contrary. The Psalms are replete with examples. But believers are also bold enough to act in the direction of God's vision of comprehensive well-being, often in defiance of the circumstances and in spite of the consequences.

This is a stance that does not clash with modern scientific insight. Gravity and entropy, natural good and natural evil, are programmed into the cosmic system. In situations of high sensitivity to initial conditions the direction and outcome of a process are unpredictable. Where there is freedom, there is the potential to go in wrong directions. There are genetic, biological, psychological and social forces and pressures that need to be enlisted or resisted. This is where divine vision and divine empowerment come into play. They provide directions and motivations – and these can 'move mountains'.

There is nothing 'supernatural' about these phenomena, as if God might suspend or override the regularities God has embedded in God's creation as we know it. Creation is in itself a giant and unbelievably complex miracle. Within its processes there are possibilities that we can never dream of. God can utilise the creation God constructed to bring about novel and unexpected outcomes. But there are built-in limitations and regularities without which the cosmic process could not function. For us the main consideration is that God wants to involve us in God's creative and redemptive action in the world.

Conclusion

The Israelite approach to life is based on experienced reality interpreted in relation to Yahweh, the transcendent Source and Destiny of reality as such and as a whole, rather than metaphysical speculations. These ancient authors had no inkling of modern scientific insight. They utilised metaphor, poetry, parable and myth to proclaim the creative and redemptive intentionality of God, the Source and Destiny of reality. But their feet were firmly on the ground of interpreted experience. This is a remarkable feature that makes the Israelite faith more amenable to being upgraded, enriched and empowered by the experiential realism of modern science than doctrinal formulations couched in Hellenistic patterns of thought.

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Chapter 9
The Openness of Life: Personhood and Faith: An Infinitizer Approach

W. Richard Bowen

Abstract Dialogue in science and theology between those of faith and of no-faith is most likely to be productive if both discussants are infinitizers, leading their lives with imagination in ways that are essentially exploratory rather than definitively explanatory. Consideration of personhood may be a fruitful dialogue topic, for key aspects of being a person pose real difficulties for science, and faith can add richness to descriptions of personal life. Some basic experiences of self and personhood are considered and some further thought-provoking aspects of personhood are described. Some of the limitations of scientific approaches to personhood focused on consciousness studies are outlined. The entanglement of subjectivity and objectivity in science and other activities is noted. Ways in which faith can enrich our experiences of personhood are described. Finally, approaches that can promote constructive dialogue between infinitizers of faith and no-faith concerning experiences of God are considered.

Keywords Apophatic • Onsciousness • Faith • *Hypostasis* • Infinitizer • Person • Self • Staniloae • Subjective • Totalizer

Introduction: Totalizers and Infinitizers

Approaches to understanding in science and theology are often characterised in terms of divides such as secular/religious, unbeliever/believer or atheist/theist. However, constructive insights and dialogue may be better promoted by first considering a distinction that transcends these divides: totalizers and infinitizers (Levinas 1961/1969; Wild 1969: 17; Bowen 2012: 24). Totalizers seek control of understanding by focusing on closed orders of knowledge. They include reductionist materialist atheists and theistic fundamentalists or literalists. Infinitizers seek creative advance in their lives through use of the imagination in ways that are essentially exploratory rather than definitively explanatory.

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The different approaches of totalizers and infinitizers are apparent in many matters of concern to science and theology. For example, in considering the important matter of the nature of persons, totalizing explanations may place an emphasis on the individual as an autonomous centre of consciousness. Successive models of such consciousness have been based on the latest (at that time) technology and science, such as clocks, telephone exchanges, computers, programs or quantum mechanics (Squires 2005: 586). However, though our nature has a rational element, there is a much richer sense to our personhood. For example, a basic insight arising from patristic theology is that we are persons because we live in open relationship with other persons, because we live in community, an insight that is also reflected in the Islamic Shakçânya and in the African term Ubuntu, "a person is a person through other persons". Moreover, there is an openness to personhood; we cannot say what another person is, only who he or she is. An infinitizer approach to personhood will seek to be sensitive to such openness.

In considering faith, totalizing explanations may emphasise a search for a supernatural entity (or entities) considered as a "scientific hypothesis like any other" (Dawkins 2006: 50), or consider belief in such entities to be a delusion arising from the tendency of the human mind to detect agency on the basis of inadequate information (Barrett 2004). However, in an infinitizer approach, faith may rather be considered as "an imagination which opens itself" within a way of life that is expressed in worship, prayer, a listening to sacred texts, a practical concern for neighbour and the building of community (Bowen 2012). That is, an infinitizer approach to faith may prioritise shared, lived experience, participation, rather than epistemological propositions. Awareness of God may arise in the flux of interpretation and action of the community's life, there being an openness to God, who cannot be defined, which should be reflected in the openness of our response.

The present paper will consider aspects of infinitizer approaches to personhood and faith. An important goal is to explore possibilities for constructive dialogue between those scientists without faith and people of faith who are genuinely infinitizers. First, some basic experiences of self and personhood will be considered. Secondly, some further thought-provoking aspects of personhood will be described. Thirdly, some of the limitations of scientific approaches to personhood focused on consciousness studies will be outlined. Fourthly, the entanglement of subjectivity and objectivity in science and other activities will be noted. Fifthly, ways in which faith can enrich our experiences of personhood will be described. Finally, approaches that can promote constructive dialogue between infinitizers of faith and no-faith concerning experiences of God will be considered.

Basic Experiences of Self and Personhood

Ideas of self and personhood are potentially fruitful ways of promoting constructive dialogue between infinitizers of differing fundamental views as such ideas pose a great challenge to science whilst also being important to conceptions of faith. Our ideas of self and personhood include features such as spatio-temporal continuity of body, memory and the experience of a continuity of consciousness. This has led to the postulation of "at least a formal notion of self", at the minimum a "point of view" that can also help give an account of rationality, free choice, decision making, reasons for action, responsibility and planning for the future (Searle 2004: 204). However, selfhood and personhood also have a subjective character that is very important to all of us: there is definitely something it feels like to be a person. Furthermore, others treat our feelings as real. As will be described in more detail later, there would appear to be a real conceptual difficulty in developing an objective scientific approach to such subjective experience, for the more detached the explanation the further it moves from the first-person experience (Nagel 1974).

We all have direct experiences of being a self or a person, and recognise that others are selves or persons. However, we imply rather than objectively demonstrate the nature of our selfhood or personhood. Key features of the way in which we make such implications have been described by Ricoeur (1990/1992), including: (i) self-reflection – consideration of our curious possibility of saying "It's me here!" and of our ability to initiate actions; (ii) the experience of personal continuity and change with time – there is a narrative dimension to our lives, of which we have a degree of authorship, and a tension between sameness and difference in our identity through time; (iii) awareness of others and their testimony – others can also say "It's me here!", we can learn about them by observing and listening, and they can tell us about how we appear to them.

We also recognise that our knowledge of other persons is of a different character to our knowledge of inanimate objects. An insightful account of the differences between the type of knowledge of things that includes scientific knowledge and our knowledge of other persons has been given by Buber (1923/2004). He describes a world of I-It, an essential world of objectivity, work and knowledge, in which scientists could be seen as carrying out their essential tasks. This he contrasts with the world of I-Thou, of subjectivity characterised by meeting, that is of mutual relationship. With regard to the description of human identity he makes a corresponding distinction between individuality, which appears through differentiation from other individualities, and a person, who makes his appearance by entering into relation with other persons. Buber writes from a Jewish perspective, but the basic importance of such relationship finds expression in many cultures. Thus, working from an Islamic perspective, Lahbabi uses the word Shakçânya (from the Arabic shakç, person) to represent "personalism", writing "La personne est, en fait, une réalité autonome, mais dans une interdépendance: un moi communitaire" (Lahbabi 1964: 23).[1] In Hinduism, there is a fundamental Sanskrit expression So Hum, "You are, therefore I am" (Kumar 2002). Furthermore, many African languages contain expressions corresponding to the Bantu (a sub-Saharan language group)

[1]"A person is, in fact, an autonomous reality, but within an interdependence: *a communitarian self.*"

concept of Ubuntu, “a person is a person through other persons”. Desmond Tutu has incorporated Ubuntu into a Christian theology (Battle 2009: 28–70).

Thus, our experiences of personhood include a physical body, a range of mental activities including self-awareness and relationship with others. A further important aspect is the way in which our personhood depends on our relationship with the place(s) where we live. This is implied in Buber’s evocative description of the possibility of an I-Thou relationship with a tree rather than an I-It understanding of its structure and biology (Buber 1923/2004: 14). Relationships of this type with nature can transform our lives. A corresponding idea has been expressed by the term ecological self, which indicates how the nature of a favoured place may determine the details of one’s life (Naess 1987/2008: 82). The ecological self may also involve a more general sense of relationship with the natural world.

Further Experiences of Personhood

A description of the basic, everyday subjective experience of personhood that we all have is a challenging undertaking, and may pose great conceptual difficulties for science. However, being a person may also have further features that seem to be beyond simple physical explanation. These include the “mutuality of subjectivity”, a sense of “presence in absence” and a feeling of “the private absolute”.

Our interactions with other persons entail a sense of encounter beyond the type of knowledge we have of inanimate objects. That is, when we are interacting with other persons we may be aware that they have a presence which is apparently beyond our knowledge of them through sense perceptions, a presence which inanimate objects do not have. Moreover, it has been noted that “every time a person is truly aware of someone else, this feeling does not belong to that one person only but is also experienced by the consciousness of the other” (Staniloae 1980: 31). That is, subjectivity is not necessarily the experience of one person only, there may be a mutuality of subjectivity.

Furthermore, we may have a sense of a person’s presence even in his or her absence. A familiar type of experience is used by Sartre (1943/2003: 33–35) to illustrate such presence-in-absence. He describes arriving late to meet his friend Pierre at their customary café. On arrival he becomes aware of the usual features of the café, its patrons, its tables, its smoky atmosphere, its various sounds. However, Pierre is not there. His expectation of meeting Pierre “has caused the absence of Pierre to happen as a real event concerning this café [. . .] Pierre absent haunts this café” (1943/2003: 34). Of course, others are not in the café, “Wellington is not in this café, Paul Valéry is no longer here”, but these others are absent only in a formal sense. Neither is Pierre’s absence like the absence of a familiar inanimate object. Thus, a person in relationship can in a sense transcend physical boundaries, that is, a person may be able to transcend the limitations of the “hereness” of existence in the world (Yannaras 1987/2007: 115).

There is also a sense in which creative works allow us to experience the personal nature of those of whom we have had no physically proximate experience. It has been suggested, “When we hear a piece of music by Mozart, we find ourselves in the ‘space’ of non-dimensional proximity to the person of Mozart” (Yannaras 1987/2007: 115). We may have a similar experience if we contemplate paintings by, say, van Gogh or Matisse: the artist is present in his absence. Such presence-in-absence may even be experienced in creative academic work, such as the philosophy of Ricoeur, the theology of Rowan Williams, maybe even in the imaginative work of scientists, engineers and mathematicians.

A further enigmatic experience of personal existence has been termed “the private absolute” (Yannaras 1993/2004: 156–162). In our physical personal existence we are just one of billions of other persons, each with a life limited to a few years that is confined to a small number of places. Yet this limited and fragmentary life can also give us a sense of the universal, of in some way relating to those billions of others and of transcending our physical confinement in time and place. Yannaras (1993/2004: 161) describes this as “a real awareness of existential freedom from nature’s arithmetical, temporal and spatial limitations – it is a metaphysical experience”. It is worth noting that the possibility and intensity of such a transcendental experience is greatly enhanced by modern engineering and science, for without modern communication technologies and astronomy we would not be aware of those billions of others or of the extent of the physical universe.

The philosopher Bryan Magee (2011), who does not subscribe to a religious faith but who may be described as a reflective infinitizer, has written in his eighties of how the nearness of death has given him an increasing distance from the empirical world: “And as I approach death it is as if I receive tiny, inarticulable glimpses, the barest possible intimations, of the empirical world as a whole. The overriding impression is of its limitedness” (2011: 32). He describes his experiences of great art, especially music and theatre, as speaking to him “from a realm that is not the empirical” (2011: 35), and notes that occasionally he has related experiences regarding ethics. However, he writes that “anyone with a genuine sense of the extraordinariness of existence will find the explanations put on offer by the mainstream institutions of the various religions pitifully inadequate”, and he has harsh words for religious “fancy-dress-party antics” (2011: 36). Nevertheless, he has great respect for the integrity of mystical traditions, noting that in all religious cultures they stress that the nature of the transcendent cannot be communicated. Furthermore, their experiences seem to have little connection with the particularities of specific religions: “This suggests that mystics of all kinds are describing similar experiences, and that these are largely independent of the doctrines of one, or indeed of any, religion” (2011: 37). He notes particularly how their common experiences involve liberation from enclosed individuality.

Science, Consciousness and Persons

Despite the richness of our subjective experiences of being persons, science has tended to focus particularly on certain discrete, objective aspects, such as the assumed physical origin of the consciousness of individuals. The most recent approaches have been focused on neurobiology. The most widely used procedures have aimed to follow the pattern: (i) find neural correlates of consciousness (NCC) using advanced physical techniques – a much-used technique is functional magnetic resonance imaging (fMRI), which detects changes in blood flow in the brain; (ii) evaluate whether such a correlation is causal; (iii) propose a theory that describes the nature of the correlation. There have been great efforts along these lines giving rise to much interesting data. However, the overall progress in the elucidation of consciousness has not been very great (Searle 2011). Also, interpretation of such studies requires extreme care. For example, there have been studies concerned with free will that may be interpreted as indicating that the brain "decides" some time before a person is subjectively aware of any decision (Libet 2002). However, the validity of both experimental methods and interpretation in such studies require very careful consideration: it may even be, for example, that the subject is reporting not the timing of an initial decision to act but rather the timing of the sensory consequences (feedback) arising from the ensuing action (Robinson 2012).

The NCC approach to consciousness entails measurements on conscious beings. A second approach aims to understand how consciousness arises by considering analogies between complex physical systems, living systems and cognitive systems (Haag et al. 2011). In particular, it is noted how all of these systems may involve dynamic, self-organised processes that naturally develop constraints. Such an approach may adopt very broad definitions of the meaning of "self", such as a "minimal self" indicating only (chemical) responsiveness to an environment, a bodily self in which conscious experience may occur, and a cognitive self in which meaning arises. Though such approaches give rise to interesting insights they do not give clear explanations of how self-consciousness and meaning arise. The stumbling block is that even when a model of the complex chemistry of neural activity is proposed it in no way approaches an explanation of our subjective awareness of consciousness and meaning (Thompson 2011; McGinn 2012).

Such scientific approaches have been subject to philosophical criticism so strong as to merit the use of the description "neurononsense". A key philosophical qualm is that to explain consciousness as being a feature of the brain, or part of the brain, is an example of the mereological fallacy, the attribution of the property of a whole to one of its parts. In these approaches the core of a person is being sought in another entity that does not have "the inconvenient reality of a smile and a face" (Scruton 2011: 349). In the terminology of the present paper there seem to be two incommensurable languages: a totalizer account of chemistry and brains, and an infinitizer account of persons and their acts.

The Entanglement of Subjectivity and Objectivity

Another way of viewing this incommensurability of descriptions is to note that, "Strictly speaking, at present there is no scientific evidence even for the existence of consciousness" (Wallace 2000: 3). That is, as science is concerned with objectively measurable properties of the world, and as consciousness consists of qualitative subjective awareness, consciousness lies, strictly speaking, outside the realm of science. Furthermore, if science is seen as being committed to materialism, then it is difficult to consider consciousness as anything more than an epiphenomenon of the material world. However, such a view poses grave problems for science, for science itself depends on the consciousness and other personal attributes of its practitioners. If such attributes are to be regarded as apparitions then it would seem that the claimed objectivity of science must be similarly questioned.

A mid-twentieth century account of the significance of subject and object in theology made the following observation: "the modern world has arrived at a distinction between subjective and objective thinking, which in its popular version at least tends to identify truth with objectivity and error with subjectivity" (Brown 1955: 13). It would seem that our contemporary scientific totalizers have adopted this distinction by seeking to value only objective views of the world. As already noted, if taken strictly this could result in the collapse of science itself.

An infinitizer, on the contrary, will acknowledge the value of the subjective experiences that are the building blocks of science. Such an infinitizer will also acknowledge the role of subjective judgements in the assessment of the acceptability of both observations and theory. These include evaluations such as coherence, plausibility, reasonableness, simplicity and, even, beauty (Putnam 2002: 31, 2004: 69). The application of these criteria is complex and depends on the subjective assessments of skilled practitioners. Thus, it is not possible to achieve successful explanation by algorithmic means alone. A good scientific explanation has a higher subjective input than is often acknowledged.

More generally an infinitizer will recognise that all human endeavours may involve subjects and objects, subjectivity and objectivity, but that an appropriate balance must always be sought between the hypothetical limits of pure subject and pure object, and between pure subjectivity and pure objectivity. For example, in some physical sciences there may be a relatively clear distinction between subject and object and a prioritisation of objectivity. In contrast, interpersonal relationships will prioritise subjects and subjectivity. In these and other examples, inappropriate prioritisation of subject or object, subjectivity or objectivity, will result in a distortion of the endeavour.

Totalizers may seek to reduce consciousness to chemistry or persons to brain activity. However, infinitizers will value the importance of our subjective interaction with the world and hence move beyond a view of ourselves as dispassionate observers of the world to a recognition of ourselves as bodily participants in the world. As bodily participants we can have knowledge of occurrences beyond those of our senses. Consider a forceful example: "If I see someone writhing in pain with evident cause, I do not think: all the same, his feelings are hidden from me" (Wittgenstein 1953/2009: 235). In such a case, the person is not some component hidden in the body, but some experience of the person is revealed by his body. More generally, it is our bodies that allow us to encounter each other and the world: we are participants rather than isolated observers.

The Enrichment of Personhood by Faith

Experiences of the mutuality of subjectivity, of the presence-in-absence of those we have known and of non-dimensional proximity to those we have not known suggest aspects of personhood beyond physical presence. Experiences of the private absolute and glimpses of a transcendent realm beyond the empirical world, for example in music and art, are also a common feature of our humanity. Error or illusion may potentially, of course, distort all of these types of experience. However, to deny their very existence would be to ignore a vast quantity of evidence: only the most rigorously reductive totalizers would be likely to attempt to do so, and such an attempt would lead them to deny a large part of their identity.

Furthermore, infinitizers may also gain insight from considering the contribution that faith can make to enrich our personhood. For example, it has been noted that the fourth-century Cappadocian Fathers "gave to the world the most precious concept it possesses: the concept of the person, as an ontological concept in the ultimate sense" (Zizioulas 2006: 166). This concept of the person, "as ultimate and primordial ontologically as anything can be", emerged during the development of the doctrine of the Trinity, so that it is "sanctified in its use in connection with the very being of God and of Christ" (Zizioulas 2006: 126, 9). Whatever one's view of God and Christ, this may be understood as a high evaluation. The key terminological innovation of the Cappadocians was the identification of the Greek term hypostasis with the person to express fundamental nature or substance (Zizioulas 1985: 36).

Patristic theology developed very precise teaching on divine persons, but no comparably elaborated doctrine of human persons. The latter has been an important theme for modern Orthodox theologians, such as Zizioulas. He regards the doctrine of the Trinity as providing for our understanding of human beings a model of apophaticism: we cannot say what another person is, only who he or she is. Zizioulas (1985: 50–65) also makes a distinction between a person's biological hypostasis and a person's ecclesial hypostasis (also termed sacramental or eucharistic hypostasis). The biological hypostasis is of necessity given at birth and carries the danger of individualism (egocentricity), and hence hindering an affirmation of relationship, freedom and creativity. The ecclesial hypostasis is considered to be given at baptism, by a new birth "from above" (John 3: 3), and is based on a relationship with God (rather than biological necessity) that develops through participation in the life of the church. Within this perspective, the constitution of the person is thus changed, and though the biological level remains it is in a sense transcended.

This contribution of faith thus adds an additional richness to personhood. From a secular perspective we live as persons in community with each other. From the viewpoint of faith we have the possibility of living in communion with each other and with God, a communion sustained by worship. This potentially transforming nature of faith for our common experience of being persons is an aspect that has been neglected in the dialogue concerning faith and science. Faith has been too often seen by totalizers of both faith and no-faith as being concerned with a "will that submits": we should rather take an infinitizer view of faith as reflecting "an imagination that opens itself" (Ricoeur 1981: 117).

Knowledge of God

These various features indicate that personhood may have some authentic ontological basis. Furthermore, these features give a hint about an approach to discussing God. Buber (1923/2004: 61) has written that "Every particular Thou is a glimpse through to the eternal Thou". Zizioulas (2006: 225) has suggested that those who take presence-in-absence seriously "are not as far as they may think from an implicit assumption of God". Additionally, consideration of the views of infinitizers such as Magee indicates that constructive dialogue between infinitizers of faith and no-faith may benefit from theological approaches that give due regard to the mystical.

A succinct account of an approach to knowledge of God that seems especially well suited as a basis for developing such dialogue in this context has been provided by Staniloae (1978/1994: 95–124), who writes from the Romanian Orthodox tradition. Unlike some other Orthodox writers, he recognises that rational knowledge, both affirmation and negation, can contribute to knowledge of God. This recognition will be valuable in any dialogue seeking to relate faith and science. However, he emphasises the importance of the apophatic experience of God as a mystical presence, "an experience of a reality that transcends all possibility of definition" (1978/1994: 99). This knowledge from experience has recourse to terms of affirmation and negation in expressing itself. Yet, for Staniloae, "Every understanding that touches upon God must have a certain fragility and transparence" (1978/1994: 105); it is something that stimulates us to question and seek further. Such knowledge requires an acknowledgement of one's own insufficiency and an attitude of ascesis, for example prayer as "a means of making the soul sensitive to the presence of God" (1978/1994: 119). This apophatic understanding is not irrational but rather suprarational. Staniloae regards such apophatic experience as having person as its ultimate basis, and one of his favoured descriptions of God is "supreme Personal reality" (1978/1994: 14). In this context he describes two kinds of apophaticism: (i) "the apophaticism of what is experienced but cannot be defined", (ii) "the apophaticism of that which cannot even be experienced" (1978/1994: 103). Thus, Staniloae's primary approach to God is not through epistemological propositions but through lived experience, through participation. Descriptions of

God such as “supreme Personal reality”, expressed with an acknowledgement of the fragility of any such knowledge, give a sense of continuity with our common human experiences.

Such a sense of continuity provides a promising starting point for dialogue about God, but it needs sensitive development if it is to help bridge the gap of incomprehension between faith and no-faith. For example, an infinitizer who recognises the value of subjective experience may acknowledge a curious feature of conscious states: that they only exist if a subject experiences them, that they only exist from a first-person point of view. This property has been termed “ontological subjectivity” (Searle 2004: 94). Mystical, apophatic experiences of God of the type described by Staniloae are subjective, being experienced from a first-person point of view. So, at this point an infinitizer of no-faith might accept the reality of the subjective experience of God but enquire as to whether such experience was of a reality that only exists from a first-person point of view. This might be expressed in terms of a question regarding the extent to which subjective religious experience creates its own objects.

In developing an answer to such a question, it is pertinent to recall the entanglement of subjectivity and objectivity even in science. Indeed, the objective aspects of science arise from a multitude of subjective experiences. Our experience of human persons follows a similar pattern, for though in each interpersonal relationship we prioritise subjective interaction, knowledge of the great multiplicity of such relationships indicates an objective aspect of personhood. Staniloae (1978/1994: 268) expresses a similar approach to knowledge of God: “he is an objective subjectivity, or a subjective objectivity. He transcends the distinction between subjectivity and objectivity”. Here Staniloae is again linking the ineffable nature of the transcendent with common human experience.

Buber’s observation that “Every particular Thou is a glimpse through to the eternal Thou”, which was noted previously, also relates our experiences of human persons and experiences of God. Also from a Jewish perspective, Emmanuel Levinas has written, “There can be no ‘knowledge’ of God separated from the relationship with men[. . .]. Without the signification they draw from ethics, theological concepts remain empty and formal frameworks” (Levinas 1961/1969: 78–79). Both Buber and Levinas sense in their encounter with others something that transcends the persons themselves. Furthermore, a central theme of Levinas’s philosophy is that experience of ethics precedes ontological knowledge. Analogously, in a Christian context, Dussel proposes that ethics is the fundamental basis of theology (Dussel 1986/1988: 239). This is a particularly insightful proposal, for it is surely in a Christian context that the closeness of personhood and God become most clear. This is most explicitly expressed in ethical terms in Matthew’s Gospel: “Lord, when was it that we saw you hungry and gave you food, or thirsty and gave you something to drink? And when was it that we saw you a stranger and welcomed you, or naked and gave you clothing? And when was it that we saw you sick or in prison and visited you? And the king will answer them, ‘Truly I tell you, just as you did it to one of the least of these who are members of my family, you did it to me’ ” (Matthew 25: 37–40).

Concluding Aspiration

An infinitizer approach offers a rich description of personhood that leads to important links between the common experiences of all and faith. Such openness to the richness of life can be accompanied by openness to the richness of faith:

> Our words and thoughts of God are both cataphatic and apophatic, that is, they say something and yet at the same time they suggest the ineffable. If we remain enclosed within our formulae they become our idols; if we reject any and every formula we drown in the undefined chaos of that ocean. (Staniloae 1980: 73)

An approach to a description of the relationship of science and faith through considerations of personhood may be particularly appropriate for a Christian, Trinitarian view of God. Such an approach leads inevitably to ethics, another topic for which totalizing scientific views can provide only a meagre account. So perhaps one day we may be brave enough to consider a promising but somewhat neglected starting point for constructive, infinitizer dialogue between Christian faith and science: the significance of the torture and execution of an innocent man.

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Chapter 10
Respect for Life in the Age of Science

Alfred Kracher

Abstract The Scientific Revolution of the sixteenth and seventeenth century replaced a holistic view of nature with one that became increasingly reductionist. This has made it difficult to find a rational basis for apprehending the objects of moral reasoning, like humans or other organisms in general, as more than the sum of their elementary parts. But the previous world view, here labeled substantialism, cannot be recreated against the evidence of modern science. Substantialism has been replaced by atomism and its ontological consequences. Splitting the world into atomistic science and substantialist philosophy can only be attained by an intolerable ontological relativism. Trying to derive moral principles from a forced amalgamation of the two world views is self-defeating and can have destructive consequences. Theory change in science can suggest patterns whereby solutions that we want to retain can be reconstructed "from the ground up" with a new ontology. However, we should not expect to reconstruct a static theory of moral certitudes in a world that is dynamic and evolutionary.

Keywords Substantialism • Atomism • Ontology • Morality • Common sense • Genetic diversity

Introduction

We all know that there is a moral difference between kicking a rock and kicking a dog. Yet if animals, including humans, are really just "machines programmed by their genes," we are led to wonder whether there is any difference in reality that

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The basic ideas contained in this paper were presented at the 14th European Conference on Science and Theology 2012 in Tartu, Estonia, under the title "On flogging dead horses and kicking live dogs." I am grateful for a lively discussion that helped to improve the current version.

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would correspond to this ethical intuition. We intuitively take organisms to be more than the sum of their parts, and not only in our moral judgements. The general reductionist program of science has made the effort of coherently anchoring this kind of holism in "hard" reality much more difficult than has often been supposed. Although a more holistic view of life existed prior to the Scientific Revolution, I argue here that the ontological implications of modern science preclude a return to this philosophy. This means that our view of life is irrevocably different from that of Greek and Medieval scholars, and that we must come to terms with the ethical problems that result from this different view.

The problem that results, roughly speaking, from the contemporary reductionist mindset is not a lack of ethical theories. It is how such theories can be compelling if there is no agreement about the ontological nature of the living objects of these theories (other humans, animals, nature as a whole). Examples will follow later. I do not propose a new holistic perspective here; in fact I believe that to be impossible at this point in history. But neither am I claiming that without a complete holistic "system," such as was supposed to exist in Medieval Aristotelianism, we are without orientation, or that in our age as a result of reductionism "anything goes" when it comes to morality. My purpose rather is to argue that a spurious holism is worse than none and that unacceptable moral consequences are bound to follow when the results of modern science are grafted onto philosophical concepts that are incompatible with it. To set the stage I will initially have to cover some very familiar history which continues to affect moral problems about life in contemporary society.

Ontologies Past and Present

The historical process that has brought us to this point goes back to Antiquity and can be cast in terms of two incompatible ontologies which I will dub substantialism and atomism. These labels need some explanation, since they are meant here to describe continuous historical threads that run through philosophical (and later scientific) positions that have themselves undergone considerable change over time. The explanations that follow look at these threads not from a historical viewpoint, but from a twenty-first century perspective in retrospect, and summarize our current understanding.

Substantialism

This was the prevailing view from the time of Plato and Aristotle to the end of the Middle Ages. It holds that any object has a peculiar nature of being that makes it what it is. I use substantialism for this view, because I want to separate the issue from modern debates about essentialism in various branches of philosophy. The use of substantialism seems appropriate, because the historical demise of this ontology centered on the term substantial form that was thought to be the expression of a thing's essence.

Substantialism is characteristically holistic, and it is mostly inspired by considering living organisms. In its Aristotelian version, two aspects are of particular interest to the present discussion. First, things exist by virtue of their substantial form, since there cannot be matter without form. A thing ceases to exist when its substantial form does. Second, things by virtue of their substantial form can have a final cause or goal (telos). An acorn can grow into an oak tree because this is its telos. It does not grow into a geranium, because that telos is not inherent in its substantial form. If acorn and oak are different things, then such a concept is clearly needed to explain why one form, that of the oak, always follows that of the acorn.

The invariable substantial form of a thing cannot be seen directly, because individuals vary. Thus every instance of a form comes with the accidents, the outwardly variable features, of a particular individual. Nonetheless we could imagine some perfect expression of the thing, an ideal that each individual more or less approaches.

Atomism

This is the claim that the properties of a thing are determined by its constituent particles which themselves do not share in any of the characteristic properties of the whole thing (van Melsen 1952; Pullman 1998). Atoms were originally conceived as eternal, and it is primarily their mutual relationship that gives rise to the properties of the object constituted by them. Opinions among early proponents of atomism varied as to whether atoms had any properties at all except perhaps different sizes.

Conceived in the fifth or sixth century BCE, both Plato and Aristotle soundly rejected the concept, and the Directorium Inquisitorum by the Dominican Nicholas Eymerich (around 1300) contains a condemnation of it (Lappe 1908: 29). Atomism remained the view of only a small minority until the seventeenth century, at least in Western scholarship (van Melsen 1952; Lindberg 1992; Principe 2011).

Its major drawback would seem to be the difficulty in dealing with exactly the kinds of phenomena that Aristotle's teleology so elegantly explains. In spite of the materialism underlying atomism it would seem to require some non-material formative principle to explain how the atoms arrange themselves in order to create oak trees. Moreover, proponents of atomism until well into the scientific age had no more hope to be able to prove the existence of atoms than Aristotelians could prove the existence of substantial form. Both concepts were, to use modern terminology, inferred on the basis of speculation about the properties of matter.

The Building Blocks of Matter in Modern Science

Our current understanding of the physical world is of course quite different from either concept as it looked at its inception in Antiquity. Nonetheless we now know that matter is composed of atoms, and this is not mere equivocation. The characteristic properties of things are indeed determined by elementary components which survive the particular object they constitute.

Atoms as we understand them today are not exactly "eternal": except for hydrogen and helium they have mostly been synthesized in some star. Neither are they strictly "uncuttable" (atomos), as the etymology might imply. Their properties are more complex than the ones ascribed to them by historical atomists, but this is hardly surprising given the overall complexity of the physical world. Even so the number of distinct atoms occurring in nature, about 300 if isotopes are counted separately, is quite small compared to the diversity of objects made up from them. To study the implications in more detail let us consider two examples, one inorganic and one biological.

The properties of simple objects like a piece of metal are a straightforward consequence of its atoms plus their particular arrangement and interaction. The latter is typically controlled by how the material is treated, e.g., fast or slow cooling, mechanical deformation, etc. For simple cases simulations are available that lead from pure theory at the atomic level to the actual behavior of a work piece, giving us some confidence that our understanding of atomic properties has some robust relationship to reality.

Organisms are of course much more complex than a simple alloy. But here too the typical properties are controlled by elementary constituents that are unlike the whole organism. What determines the potential of the acorn to grow into an oak tree is its DNA, which for our purpose can be thought of as the "atom of life" (Conway Morris 2003: 27). And as in the case of atoms this constituent survives the individual organism, although it is not strictly a material component that survives, but rather the information encoded by DNA that plays the role of the "eternal" particle of the atomists.

In both cases there are other factors that determine the particular individual properties, like the thermal history of the alloy or the climate and soil where our oak tree grows. The interplay of elementary constituents and these outside factors does indeed give rise to variability that can be called "accidental." But this is only a superficial analogy to substantialism. In all the ontologically relevant aspects, like the survival of the elementary constituents and their determinative role in overall properties, our current picture of reality sides with atomism and precludes any kind of Aristotelian substantialism as a reasonable picture of reality.

The following sections discuss how this conclusion emerged historically, and what consequences it has for the moral assessment of living things. At the end the discussion will return to the important issue of reductionism versus holism.

From Substantialism to Atomism

Although the important events in the history of modern atomism begin with the Scientific Revolution, our current trouble in accepting its ontological consequences stem mostly from Medieval philosophy, which in turn based its view of nature on Greek antecedents. Medieval Scholasticism mostly considered issues of natural science as definitively settled by Aristotle, whose writings began to be widely debated in the West in the thirteenth century. What new insights were added by Muslim or Western scholars were mainly considered merely commentaries or clarifying improvements. On the other hand, the interpretations drawn from natural science for the purpose of moral arguments also owed much to the Neoplatonism of earlier centuries. But this only matters for a later part of this discussion, since both philosophies were likewise substantialist and anti-atomist.

Medieval Prelude: Nicholas of Autrecourt

In spite of the dominance of Aristotelianism in the Middle Ages, the original Democritean atomism never entirely vanished even in the heyday of Scholasticism. Among the rare Medieval atomists Nicholas of Autrecourt (c. 1298–1369) is the primary representative of the dissenting minority (Weinberg 1948/1969; Thijssen 2009). Not much of his writing has survived, because in 1347 he was condemned to burn at least some of his works. What is known, however, is Autrecourt's Ockhamist critique of causality and his rejection of the substance-accident ontology. According to Autrecourt things are eternal based on a principle that looks, from a modern viewpoint, like a forerunner of the conservation of matter. Although retaining the terminology of substance and accidents, in Autrecourt's philosophy they have lost their Aristotelian meaning and become more or less nominalist concepts.

Other philosophers of the Scholastic period have criticized the Aristotelian version of the substance-accidents structure of reality, but Autrecourt is of interest to us because he made atomism a centerpiece of his critique. In the case of other philosophers it is not always clear whether they discuss atoms or the concept of natural minima (elachista). These were thought of as the smallest fragments of a thing that preserve the substantial form of the whole (van Melsen 1952), obviously a very different concept from atoms.

The Scientific Revolution

What had been a critique of Aristotelianism by isolated individuals in the fourteenth century became a decisive assault with the Scientific Revolution. Appreciating the changes of the period requires much more background information than can be given here. The history relevant to science from Antiquity until the fifteenth century is covered by David Lindberg (1992). For the Scientific Revolution itself the short introduction by Lawrence Principe (2011) is valuable, particularly because his research interest is the transition from alchemy to chemistry which plays a central role in the resurgence of atomism.

There were many reasons why Medieval Aristotelianism fell into general disrepute in the sixteenth century, but the resurgence of atomism in particular was connected with a new interest in simple chemical reactions. A typical reaction might be the conversion of a metal into its oxide, which can then undergo another reaction that gives the original metal as its product. This is much easier to explain if some "principle" of the metal survives in the oxide (then known as calx) rather than in terms of destruction and generation of Aristotelian substances. Unlike the case of the acorn, reversible chemical reactions do not seem to have a telos and indicate underlying continuity rather than generation and corruption.

Not everyone thought of the surviving principle in atomic terms. Under the influence of Newton, who rejected appeal to invisible entities of any kind in scientific explanation, atomism lost popularity in the early eighteenth century (Principe 2011) until the late nineteenth century (Lindley 2001). But even those chemists who preferred chemical "propensities" or "affinities" (McCann 1978) over atomist explanations no longer thought of these concepts in substantialist terms. In modern terms these chemical properties can, of course, also be explained and quantified by atomic properties, such as ionization potential, electronegativity, etc.

Ancient atomism had thought of atoms as moving randomly, and this was a major reason that substantialist alternatives had been more attractive in explaining life. Even with added notions like chemical affinities this problem persisted, and for some time life was explained in terms of vitalism, which postulated a special life force. During the century from Charles Darwin's Origin of Species to the discovery of the role of DNA the focus of biological interest broadened in two directions: first, from separate identical individuals to populations and the diversity within them; and second, to the microscopic units of inheritance and their change over time (Mayr 1982: 535–570).

Atoms and DNA

The debate over whether atoms and molecules should be treated as real elementary components of matter or simply as a convenient way of keeping track of physical phenomena and chemical reactions lasted until around 1900 (Lindley 2001). Since the early twentieth century a fundamental framework for understanding atoms, molecules, and their interactions has been developed that promises to provide a basis for explaining the behavior of all inanimate matter. Given the direct visualization of individual atoms by the recent techniques of scanning tunneling microscopy and atom probe tomography it takes a determined, radical anti-realist to deny the reality of atoms in the twenty-first century.

With regard to organisms, the discovery of the molecular mechanism of inheritance has led to a similar universal acceptance of the role of DNA. We may not yet understand all the processes that led to the origin of life and its evolution, but even if many details still need to be worked out, we are mostly confident that the explanation will be in terms of fundamental elementary units of matter and information. The success of applying our knowledge of biochemistry and physiology to actual problems in genetics leaves little doubt that we should accept this instance of "atomism" (in the wider sense noted before) as part of physical reality. This is of course crucial to the fundamental change that our view of life has undergone since the end of the Middle Ages.

Philosophical Implications

Retreat from Reality

Two things need to be noted about the consequences that this fundamental change had on philosophy. Once principles about particular kinds of matter, metals and calces for example, can be formulated without recourse to a substantialist ontology, the terms of the latter no longer have their Aristotelian meaning. The substance-accident structure of reality was supposed to explain all change whatsoever, and the existence of plausible atomist alternatives undermines the entire structure. As van Melsen notes, "[C]ontrary to the critique of the fourteenth century, [. . .] philosophic atomism criticized the very essence of Aristotelian philosophy rather than oppos[ing] specific details" (van Melsen 1952: 58).

Connected with this transition was the separation of philosophy and science into different domains of scholarship, which increasingly came to be studied by different scholars in separation. Whereas during the Middle Ages questions about nature were addressed in "natural philosophy," following the Scientific Revolution a specialization gradually emerged that separated scholars interested primarily in nature (later known as scientists) from professional philosophers. Galileo had been "court mathematician and philosopher" to the Grand Dukes of Tuscany, his successor Evangelista Torricelli only "court mathematician" (Redondi 1987). This separation parallels the rise of atomism in interesting ways, gradually increasing from the sixteenth to the nineteenth century. At about the same time that atoms became generally regarded as real, there was also no longer any doubt in anyone's mind that philosophy and natural science were two quite different kinds of inquiry. In fact, the very word "scientist" was invented in the 1830s and quickly replaced "natural philosopher." A consequence of these parallel developments was that substantialism gradually came to refer to an alternate reality that was incompatible with the reality of science.

By the twentieth century the retreat of substances and accidents into unobservability had become complete. True, substances had always been invisible and their existence inferred rather than observed, but it was inferred from observable properties of the natural world, like the growth of oak trees from acorns. In today's scientific world, when we know how DNA controls this process, there is no useful work left to be done by substantialism in our understanding of nature.

The Crucial Difference: Populations Versus Substance

We can appreciate the difference of world views by considering David Lindberg's (1992: 283) explanation of substantial and accidental form: "[. . .]the family dog may be short-haired or long-haired, lean or fat, friendly or ferocious, housebroken or not, and yet it retains the characteristics (supplied by its substantial form) that enable us to identify it unmistakably as a dog." Although the family dog is a bit of a caricature, this example shows us at once why this ontology is unusable in a modern context. The amazing variety of dogs does not fit well with a single characteristic form.

It is DNA that causes a dog to be a dog. But it is the very same DNA that also causes its hairiness, size and most of the other baffling variety among dogs besides (Ratliff 2012). On the other hand, the ferocity or its absence is only partially the result of genetic disposition: mostly it is caused by training. Even more so is his preference for the neighbor's tree over the owner's carpet. Thus our knowledge of nature and nurture classifies the attributes of Fido in fundamentally different ways from Aristotelian ontology. And we have good reasons, based on analytical and experimental evidence, for doing so. To the extent that we can speak about "dog-ness" at all, it is a taxonomic attribution, a piece of nominalism rather than something found in nature.

Implications for Morality

Evolution is only possible due to genetic variation, and diversity is an inherent property of each and every biological species. Whether we consider this important or not with regard to dogs, it changes our thinking about humans in important ways. In scientific terms, that is, from the point of view that used to be natural philosophy, our human nature qua human is determined by DNA. And yet we hear almost every day about police cases where DNA, the same DNA that is responsible for making us homo sapiens, is nonetheless so different from person to person that it can point to a particular individual.

By contrast, any substantialist ontology tends toward uniformity, a kind of single ideal which is common to all members of a species. The theologian Candida Moss illustrates the problem by citing a pictorial representation, the images of saints in procession in the sixth century mosaic at San Apollinare Nuovo in Ravenna (Moss 2011). The striking uniformity of the "heavenly Stepford wives" (Moss' appellation) is a clear expression of the idea that as humans we conform to one, and only one, ideal form. In fact, even their depiction as females is a concession to common sense and the necessity of architectonic symmetry (the male saints are on the opposite wall). If we were to take it seriously that all souls are the same, and that only "indisposed" matter caused a female (see below), as saints in heaven they should either have no gender at all (if gender as such is thought of as "accident") or be masculine.

To put it bluntly, from today's point of view any theory relying on substantial form in its original meaning is incompatible with science, and any theory compatible with science is no longer a theory of substantial form in any recognizable sense. Genetic variation is not a contingent feature of accidental attributes, but a necessary property of biological populations. This change in our understanding of what humans naturally are has consequences for morality. In themselves these would require a much more extended discussion than can be offered here. But it is at least possible to outline how we might go about defining these consequences. Before doing this, two methodological questions need to be addressed: first, whether we can use theory change in science as a useful model for the transition from substantialist to science-informed ontology; and second, whether it is useful, or even possible, to retain some elements of substantialism for the sake of salvaging holism.

Theory Change in Science

The comprehensive change in world view represented by the Scientific Revolution of the sixteenth and seventeenth century is a different phenomenon from theory change in particular areas of science (Principe 2011; see also Lindberg 1992: 359–368), and one needs to be appropriately cautious about comparisons. Nonetheless I believe that there are instructive methodological parallels with the evolution of specific scientific fields, where the supersession of one theory by another happens with some regularity.

Theory change in science is a very well studied phenomenon. Here we are less interested in epistemological issues but in the historical question of whether any elements of obsolete theories survive, and if so in what form and for what purpose. We can then ask the question whether something similar might happen in the replacement of substantialism with atomism. Different episodes of theory change have many common features, but there are also aspects peculiar to each event that are relevant to this question.

Examples

1. In the eighteenth century the notion that combustion was the loss of a substance, known as phlogiston, was replaced by that of a chemical reaction in which an

element, later called oxygen, was added to the combusting substance. Despite some initial reluctance, the old theory disappeared without a trace within a short time (McCann 1978). This happened, although conceptually phlogiston and the newly discovered element, oxygen, were perfect mirror images of each other. All chemical reactions could have been explained equally well by the old theory as long as one was willing to ascribe negative mass and volume to phlogiston. It would even be possible to quantify reactions simply by reversing the sign of oxygen's thermodynamic functions. But it would be pointless to use such a strange hypothetical construct when there was a "real" element available that could do the job.

2. The closely related case of the theory of heat, which was also originally thought of as a substance (called caloric) turned out different. When the caloric theory was replaced by the now familiar kinetic theory of heat (Lindley 2001; Mahon 2003) the terminology of "heat flow" survived, and even the mathematical formalism for heat conduction is analogous to mass transport by diffusion.
3. The example of plate tectonics in geology (Hallam 1973) raises a different point. Whereas a determined anti-realist could quibble about atoms and heat flow, continents are "real" by anyone's standard, and they either move or stay put in the real world. But long before plate tectonics became the accepted view in the 1950 there existed theories of mountain-forming that predicted the occurrence of mineral deposits with reasonable success, in spite of their quite erroneous assumption that continents had always been in the same place. Thus wrong theories can have useful consequences, although replacing them with better ones leads to both practical improvement and insight into why the previous theory sometimes worked in spite of being wrong.
4. Most famously, general relativity has shown Newton's absolute space and time to be fundamentally wrong, but in spite of this most of our technical advances and everyday work are made on the basis on Newtonian physics. That in modern terms this has to be treated as a (usually very close) approximation rather than a fundamental law of nature matters only in a limited number of cases. What is important for the present discussion is that we can define exactly at what point Newtonian equations no longer give us the correct answers. At that point the problem has to be reconstructed from the ground up, so to speak, in relativistic terms. This example not only shows that sometimes wrong theories can still be usefully applied, but more importantly it illustrates the constraints under which it is safe to do so: the conditions under which the old theory breaks down have to be known in advance before valid conclusions can be drawn.

What these examples have in common is that theory change in science requires a reconstruction of the conclusions or predictions of an old theory in terms of the new. This makes it possible to say why wrong assumptions (e.g., about the stability of continents) can lead to factually correct deductions. And it sometimes allows us to establish critical boundaries within which an old theory serves as useful simplification. With these examples in mind we are now in a position to evaluate whether it is reasonable and worthwhile to adapt concepts from Aristotelian philosophy in order to balance scientific reductionism with a more holistic world view.

Options

Since the Scientific Revolution did not immediately solve the problem of explaining the teleology of life, not everyone was willing to give up on Scholastic philosophy and its substantialist ontology. Trying to "repair" existing theories is of course a commonplace and rational response in the face of anomaly (Kuhn 1970). Since the Catholic Church had explained its doctrines in the framework of Scholastic Aristotelianism, many of the scholars engaged in this effort were Catholic apologists, predominantly Jesuits (Principe 2011; Redondi 1987).

During the seventeenth century this was still a respectable and successful way of investigating nature. But as more and more natural phenomena could be explained in other ways than by the traditional substance-accident ontology, defenders of the latter had to choose between either modifying these concepts out of any resemblance to Aristotle's meaning or losing their conceptual foothold in the reality that was described with increasing confidence by the advancement of science.

The Relativist Option

One can continue to simply assume that morality can proceed from a substantialist picture of human nature. Since this is in contradiction to our scientific explanations of nature, this is only possible in a framework of ontological relativism. Unlike scientists, for whom objects consist of elementary particles and human diversity is grounded in DNA, determined Aristotelians could continue to see the world in terms of substances and accidents. What I call ontological relativism here is similar to what Maria Baghramian (2004) calls conceptual relativism.[1] The ontological relativism considered here is somewhat more radical, not so much because of its theoretical aspects, but because of its practical moral consequences. Moral principles relying on an unchangeable, essential human nature do not always come to the same conclusions as principles that take current biology into account. As

[1]This is type 5g relativism in Susan Haack's somewhat tongue-in-cheek identikit of relativisms (Haack 1998: 149), "ontology relative to community." Alternatively it could be type 5b (relative to conceptual scheme), if atomism and substantialism are thought of as alternative conceptual schemes.

I have argued before (Kracher 2010: 154), if "reality" means different things to different people, then there must a fortiori be different rules for how to live in it. Even if the rules use the same language, they refer to a different reality and are therefore different rules.

For our starting point, which was a quest for holism, this is bad news. If we can only have holism at the price of ontological relativism, and furthermore ontological relativism entails moral relativism, we have failed. The reason for wanting holism was in the first place a better basis for ethical treatment of living things, and moral relativism hardly promises a solid foundation. The fact that our scientific explanations of nature are not only "atomist" in the wider sense, but also clearly more successful than their Aristotelian predecessors, raises the question whether it is even rational to base our conduct on the latter rather than the former.

Back to the Future (Repackaging Terminology)

One may of course continue the effort of appropriating some of the elements of the Aristotelian view and make them compatible with the contemporary scientific world view. A contemporary example of this is the effort to revive the concept of substantial form by Terence Nichols (1996) as part of his appeal for returning to a notion of sacredness of nature (Nichols 2003). His paper centers on substantial form as found in Thomas Aquinas, and he proposes to adapt the Thomistic version of the concept to modern science.

Although science is generally analytical and reductionist, this has never been simply a one way street, and Nichols justly summarizes a range of developments that tend to counteract the reductionist trend: quantum entanglement, emergentism, holistic medicine and psychology, etc. These developments are certainly important signs that holism is needed in a range of scientific fields. I also agree with Nichols that philosophically it would be desirable to come to a unified perspective of what at present are mostly local and unconnected holistic trends. When it comes to the question, however, whether Aquinas' substantial form can provide the unifying principle, Nichols realizes that significant problems arise which have to be overcome.

Among the items that, in Nichols' view, need to be further developed or modified in Aquinas' concept of substantial form are the following. (1) The importance of relationality and the need to incorporate this modern insight into the substance concept. (2) Scholastics did not agree whether an organism was a single substance, or whether its parts were also substances. Nichols suggests a solution to this problem through the concept of "nested holons." This, however, is a significant modern modification that may affect other tenets of Thomistic ontology, and that re-opens the question of which level of integration is responsible for our being what we are. (3) Our knowledge that in sexual species a new individual arises through DNA from both parents is radically different from the conception of form (sperm) being imposed on matter (ovum). Which is related to (4) the view of Aquinas that although the same form is common to all members of a species, material deficiencies lead to females and genetic defects, whereas the "proper" expression of the underlying substantial form is male.

Repairing all these deficiencies of Scholastic substantialism would indeed be a formidable task, and it would affect many other parts of Aquinas' system in ways that are currently not clear. One obvious major sticking point (but not the only one) is the asymmetry between male and female. Aquinas follows the familiar pattern that feminists characterize as "equality of the soul, inferiority of the [female] person" (Midgley and Hughes 1983). At first one would think that this can be easily repaired by positing separate but equal expressions of a single substantial form. But the necessary change is much more radical, for several reasons. First, Aristotle had linked the difference between male and female directly to the principle of formative activity (male) and passive matter (female), not as simply a metaphor, but as an ontological distinction (Midgley and Hughes 1983: 40).

Second, the resulting view of inheritance reveals a built-in flaw. The view of sperm carrying form and imposing it on the inert matter of the ovum is not just an accidental mistake as happens in science all the time. True, matter and form could not be separately observed, but their relationship was inferred by speculation, and uncharacteristically for Aristotle against evidence. That the traits of an individual are inherited to roughly equal degrees from both parents had been known to animal breeders for millennia, besides being a common sense observation about humans. Aristotle was in some ways amazingly observant (Lindberg 1992: 62–67; Mayr 1982: 87–91), but for once social prejudice won out over both common sense and the evidence from nature. This error was propagated virtually unchanged during Scholasticism and even into the Modern Age. The consequences are still being felt today (Midgley and Hughes 1983: 39–46), which by itself is enough reason to view any "recovery of Thomistic thought" (Nichols 1996: 303) with great skepticism.

In the end the required adaptations make Nichols' use of "substantial form" mere equivocation with the Scholastic concept. Neither this nor the relativistic use comes anywhere close to the substantialist concepts as both Aristotle and Aristotelian Scholasticism intended them. Using merely the same words will not bring holism back, as desirable as that may be. But as the next section argues, even without it our understanding of life is not deprived of morality.

The Moral Compass

Common Sense

On an intuitive level we are all vitalists. Nobody who encounters a motionless animal asks, "are the chemical reactions going on in front of me compatible with metabolism or with decomposition?" instead of "is it alive or dead?" René Descartes in the seventeenth century claimed that animals are “nothing but” automata, and Julien de la Mettrie in the 18th included even humans. All the same I rather doubt that either would have approved of people who treated their dogs or each other accordingly.

This tells us that even in the absence of a theoretical holistic conception we are not entirely lost at sea without a moral compass. We have common sense notions about the beings affected by our conduct, and these intuitions are the basis for initial judgements on how to treat them. True, common sense breaks down completely when it comes to quantum mechanics or cosmology, but most moral problems have little to do with wave functions or distant galaxies. Even for mundane problems common sense is far from infallible, but at least we should be suspicious of theories whose answers are too radically opposed to it. When it follows from one’s theory of personhood that one should let a woman die rather than removing an embryo that does not have any chance of surviving anyhow, one ought to throw away the theory rather than a human life.

Aristotle was already aware of this and disagreed with Plato that moral principles could be derived from axioms in the way of geometric demonstrations (Jonsen and Toulmin 1988: 23–42). He believed that ethics did not rely on certain knowledge (episteme) but involved experience and wisdom. His word for it, phronesis, is variously translated as prudence (since Latin translators render it as prudentia) or wisdom, but I include it here as part of common sense. The paradigmatic area for phronesis is medicine. Just like medical practice relies on general knowledge, but its application depends on the circumstances of a particular case, so ethics has general principles that guide, but do not necessarily determine, the proper action in a given situation. In light of what we know today about human nature this view of ethics has again become very important. Here I cannot do justice to all the implications, but rely on Jonsen and Toulmin (1988) for the general principle.

Critical common sense is not the same as following the first intuition that comes to mind, but means being aware that such initial judgements are sometimes biased, and correcting for this. In concrete situations common sense is just as necessary in evaluating moral problems as academically developed principles. The reason the Aristotelian world view was so appealing to the later Middle Ages was in part that it began with common sense notions about the world, not just in matters of science (Lindberg 1992: 47–68) but of morality as well (Jonsen and Toulmin 1988). To some extent our own common sense also bears the marks of having evolved in a culture whose morality was guided by Medieval metaphysics. But now our problems are precisely in those areas where this ontological foundation is no longer viable because it is flatly contradicted by science. Wisdom of the past is an important component, but today’s problems need the common sense shaped by how the world of today presents itself to us.

Moral Principles and the Three Blind Men

There is a story of three (or more) blind men who fail to achieve a holistic apprehension of an elephant. That is because their subject is very large. Give them a dog, and agreement would be much easier. If we are all blind to some degree because we do not "see" the objects of moral conduct as organic wholes, it is the area of very large problems where lack of holistic eyesight is a real handicap.

The ethical problems raised by twentieth and twenty-first century advances in medicine and biotechnology are of such elephantine proportions. Since these come from scientific fields like molecular biology, whose ontological basis was expressly denied by Aristotelian natural philosophy, it should perhaps not surprise us if categories from Medieval Aristotelianism do not provide an adequate basis for moral judgements in these problematic areas.

It is nonetheless possible to address these contemporary ethical problems rationally, as an example quoted by Jonsen and Toulmin (1988: 16–19) shows: When the US Congress convened a national commission to evaluate biomedical ethics,[2] its 11 expert members, who had very diverse backgrounds, could reasonably agree on moral solutions to most individual cases. At the same time, individual members were sharply divided about the principles on which each of them based his or her judgements. Their judgements about particular situations were evidently based on Aristotelian phronesis, which converged on similar or even identical solutions. Beyond that the commission members only held some very general ideals in common (Jonsen and Toulmin 1988: 356) that resemble Aristotle's virtues: justice, compassion, common good, etc. These serve as the stable "horizon of human conduct" (Kracher 2010: 164) against which individual cases are judged. Of course, the success of 11 hand-picked experts for solving moral problems does not imply that stated general principles are superfluous. It would still be desirable to have more than merely general intuitions for moral treatment of fellow humans, in biomedical as well as any other contexts. But as desirable as it might be to have a robust holistic metaphysic of living things, we cannot produce a new one overnight, nor go back to a philosophy that is fundamentally incompatible with science.

Consequences and Conclusions

Today's challenge is not to produce a holistic metaphysical system overnight, as if that were even possible, it is to clarify how we have to approach the problem. The substantialist categories of earlier ages have turned out to be wrong, and trying to revive the labels originally attached to them becomes mere equivocation, which

[2]The National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research, created by an Act of Congress in 1974 and active 1975–78 (Jonsen and Toulmin 1988: 16).

can only lead to confusion. Studying the moral arguments of Greek and Medieval philosophy is important, but the ability to draw useful conclusions from this is hampered rather than helped by efforts to distort Aristotelianism into a quasi-modern shape. It is more important to use it as a foil for the development of new concepts.

Contemporary arguments about the ethical treatment of humans have to take into account that genetic diversity is equally as intrinsic to human nature as membership in a universal humanity. The example of theory change in science suggests that such a deep change in our understanding of human nature requires us to reconstruct the consequences of the superseded view. What needs to be reconstructed is this: at least since the Nicomachean Ethics, every consideration of how to treat humans justly has tried to balance the inalienable claims of human-ness with the diversity of individual human needs and talents. Aristotle had no trouble, in spite of his substantialist ontology, in recognizing that humans are not interchangeable, and that different people may want or need different things. Nonetheless, throughout Antiquity and the Middle Ages substantialist ontology promised a stable background against which to negotiate the boundary between unchangeable nature and incidental individuality.

This is no longer true. The confidence with which substantialism had seemed to afford a distinction between harmless idiosyncrasy and morally relevant disorder has turned out to be spurious. Of course facts, such as genetic diversity, do not by themselves provide moral direction. Mary Midgley has argued in Freedom and Heredity that diversity is the basis for individual freedom (Midgley 1981, chapter 2), but to realize the latter requires a moral choice: to accord everyone "the same basic right to fair treatment, whatever our capacities" (40–41, original emphasis). Given the same fact of genetic diversity someone else might choose racism and eugenics. This might be a disappointing conclusion, until we realize that the Middle Ages were not notably immune against using their substantialist view of human nature in justifying morally reprehensible treatment of fellow humans. Factual knowledge rarely prevents bad moral choices, but it does help much in improving good ones. Once we know about the range of diversity, we can avoid accidentally thwarting natural inclinations and talents that previously were, for insufficient reasons, deemed to be unnatural. And this can lead to a better life for everyone.

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Part III
The Hermeneutics of Life

Chapter 11
Life and Consciousness: Is There a Biological Foundation for Consciousness?

Maria-Magdalena Weker

Abstract Numerous scientists from various fields discuss the definition of the concept of life and the concept of consciousness. The interesting thing is that their definitions of life do not refer to the issue of consciousness. Therefore, it would be interesting to analyze consciousness with regard to life. We will attempt to find out if consciousness can exist without life. It seems, however, that the answer to this question will require a redefinition of consciousness. The main part of this paper will focus on the issue of interactions between consciousness and life. The starting point of the deliberations will be the analysis of disorders of consciousness. We will analyze selected research on brain injuries, or neurological conditions which have an impact on consciousness, and selected clinical cases of disorders in consciousness. The study of the interdependence of consciousness and life may give an answer to the question asked in the title of this paper concerning the biological foundations of consciousness. Perhaps it will also be possible to find out whether the definition of life should be extended by including an aspect of consciousness as its constitutive feature.

Keywords Consciousness • Life • Properties of life • Consciousness disorders • Brain • Brain disorders • Proto-consciousness • Telo-consciousness

How Are We to Understand Consciousness?

There are numerous concepts of consciousness used in the medical, psychological, biological, philosophical and religious sciences. In the medical sciences, consciousness is defined as "a physiological state of the central nervous system determined by the appropriate activity of cerebral cortex and reticular formation, characterised by maintaining orientation to place, time and circumstances" (http://sjp.pwn.pl/[...]/swiadomosc 1989). Consciousness is also understood as the highest level of

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awareness. The psychological sciences treat consciousness as the ability to realize one's own behaviour, or as the highest level of human mental development allowing reflection on reality. In clinical psychology, a conscious state is a state of being conscious, awake, receptive to stimuli and having an ability to experience sensations and emotions. In philosophy, the notion of consciousness is treated as a primary notion, whose meaning becomes clear in usage. In epistemology, consciousness is defined as a feeling of experiencing something, the presence of something or something taking place (http://portalwiedzy.onet.pl/66417,haslo.html 2012). As regards the neurocognitive sciences, studies are conducted to define consciousness by means of neurophysiological correlates which differentiate situations when we are aware of stimuli from situations when we are not aware of them. To this end, analyses are conducted of bioelectric and biomagnetic activity of the brain related to updating, in the given moment of time, certain memory traces, the associations they evoked, and the condition of sensory and motor areas of the brain (http://www.kognitywistyka.net/[...]/swiadomosc.html 2012).

The diversity and abundance of contemporary concepts of consciousness requires structuring. Christof Koch distinguishes six approaches to defining consciousness (Koch 2008: 18–25). According to the first, consciousness is related to the immaterial soul, and as such it appears in Platonism, in religious concepts and in the writings of Karl Popper and John Eccles. The second approach claims that consciousness cannot be understood by scientific means. Therefore, human beings are unable to comprehend consciousness due to its excessive complexity. Such a notion of consciousness occurs in the theories of Nagel and McGin. The third group of views covers theories arguing that consciousness is illusory. This is a position characteristic of the behaviorist tradition, as expressed in the concepts of Dennett. A fourth group is formed by those who claim that consciousness requires fundamentally new scientific laws. New laws will allow us to gain new knowledge. The advocates of this approach include Penrose and Chalmers. The fifth group consists of theories according to which consciousness is related to behaviour. The enactive approach is supported by, inter alia, Merleau-Ponty and Gibson. The last group includes theories claiming that consciousness is an emergent property of certain biological systems, that is, it emerges from neuronal features of the brain. This approach is followed by, for example, Christof Koch in neurobiology (Koch 2008: 25–33).

The diversity and abundance of contemporary concepts of consciousness requires structuring. Karen Gloy defined four main groups of answers to the question: what is consciousness? The first group covers notions where consciousness is treated as any kind of sensitivity, consisting in, inter alia, reaction to a stimulus, taking into account each feeling which allows us to experience properties. This notion of consciousness is the most general, and is attributed to the most primitive organic forms. It distinguishes organic from non-organic entities. A characteristic feature of such concepts is treating the ability to feel as the most general, necessary and indispensable condition for consciousness. The second group of concepts of consciousness, as described by Gloy, covers definitions of consciousness as a specific type of reaction in the normal state of being awake. It seems that this definition is used in medicine, where consciousness is correlated with the state of psychophysical activity. Another group of answers includes concepts defining consciousness as an ability to distinguish, analyse and synthesize, compare, combine and memorize complex data. This approach can be found in the concepts of Leibniz, for example, who believed that consciousness was only possible when memory existed (Tatarkiewicz 1993: 76–82). For consciousness to occur, higher-order spiritual acts are necessary, such as judgement, drawing conclusions, desire, and wanting. These acts are required along with an ability to distinguish properties in time and space, to delimit and differentiate them. Such a definition of consciousness is found in the last group of concepts, where consciousness is the pursuit of higher spiritual activity and rationality. This group covers approaches in which consciousness, defined as "animal rationale", is attributed only to people (Gloy 2009: 21–22).

It seems that the division of the theories of consciousness proposed by Gloy can be further simplified to form two main groups. The first group includes the notions of consciousness which give the most prominent place to reactivity. Consciousness is then perceived as a reaction generated by living systems to various stimuli. The second group covers theories in which the greatest importance is attributed to "processing", i.e. analysis, transformation and structuring of obtained information. In order to simplify the discussion further, I will call the first type of consciousness proto-consciousness and the second telo-consciousness. Proto-consciousness seems to be prior to telo-consciousness, and to form its basis.

How Are We to Understand Life?

Numerous scientists from various fields have discussed the definition of the concept of life. Reductionists believe that life is a system or set of elements able to evolve in the biological sense. Artificial life researchers use another definition. They see life as a property of dynamic, self-organizing structures, capable of reproducing themselves and evolving. According to information theory, a living being is a system controlled by information and processing information. Life is the temporary ability (characteristic) of the system to use and transfer the semantic information contained therein. According to yet another approach, life is a feature of some physical systems (so-called organisms) where life processes take place. The most common biological definition of life is a set of life processes, that is, functionally highly organized physical transformations and chemical reactions, taking place in highly morphologically organized and relatively isolated physical systems, which always contain, as far as is currently known, nucleic acids and proteins. These are so-called organisms. They consist of one or many cells and participate in specific biological phenomena (Jura and Krzanowska 2000: 244; Chmurzyński 1997: 65; Legocki 2009: 123).

Due to the difficulty of defining life as it is, attempts are being made to define it by means of its specific, characteristic properties. Tibor Gánti listed eight properties of life, that is, a set of conditions a system should meet in order to be considered a living organism (Gánti 1986: 75–83). Gánti divided these properties into necessary and potential criteria. The necessary criteria include the following properties of a system: it is an individual unit separate from the external world, it has metabolism, it is inherently stable (that is, it is characterised by homeostasis), it has a subsystem to store and process information which is useful for the whole system and, finally, processes in the living system are regulated. The potential criteria include properties which are not necessary if we are to regard a system as living, but which are necessary for the processes of life on a larger scale. They are as follows: a living system must be capable of growth and reproduction, its replication must involve change (a prerequisite for evolution) and the system must be mortal. Necessary properties define a living system as an autonomous structure, while potential properties correspond to the reductionist definition of life, that is, they concern the process of living.

Life and Consciousness

Discussion of the connections between life and consciousness may be concerned with several areas. In this paper I will discuss the link between "life" as defined by the "eight properties" above, and the two types of consciousness, proto-consciousness and telo-consciousness, that I have distinguished.

Life and Proto-consciousness

If consciousness is understood as any type of activity, including reactivity, then it seems that it can be found in the simplest organisms whose reactivity to (any) stimuli can be established or observed. Contemporary microbiological studies show that unicellular microorganisms may exhibit some reactivity (for example, euglena react to light). Research in molecular biology reveals that some cellular systems also have a sort of reactivity, but do not meet the criteria for being "a living system". Therefore, we should consider whether the definition of consciousness as any kind of sensitivity is well-grounded. It seems that consciousness in its basic meaning requires taking into account the reactivity of the system in which it is implemented.

Therefore, it is worth discussing whether the property of a living system described by Tibor Gánti as "having a subsystem storing and processing information which is useful for the whole system" (Gánti 1986: 76) is a way to define proto-consciousness. According to such a definition, consciousness would be the ability to select, collect and use information which is useful for the given system. The information can be collected from the outside or the inside of the system. Proto-consciousness allows an organism to use information in a way useful for the system. It is an inherent property of living systems, since such processes as homeostasis or metabolism are based on reacting to signals concerning the internal or external situation of the living system. Therefore, it may be stated that proto-consciousness is an immanent property of each living system. The lack of an ability to react and process information makes the functioning of a living system impossible. Life by nature entails the exchange of information relating to both the system itself and its relationship with the environment. For example, homeostasis or metabolism is a process requiring a reaction to specific signals from the inside or the surroundings of the system. It seems that discussing life without taking into account proto-consciousness leads to a far-fetched reduction and in consequence to false conclusions.

The possibility of redefining the set of properties characteristic of a living system should thus be considered. In the proposed modified version, essential properties of a living system include: separation from the external world, metabolism, internal stability and homeostasis, proto-consciousness including a subsystem for storing and processing information in a way useful for the system, and allowing the regulation of the internal processes of the system.

Life and Telo-consciousness

The second group of concepts of consciousness requires a different look at the functioning of a living system. Defining telo-consciousness as an ability to differentiate, analyse and synthesize, compare, combine and memorize complex data points to a group or a type of organisms having such consciousness. What is more, it not only defines the group of organisms, but also specifies conditions in which consciousness understood in this way can be found. The processes of comparing, analysing and memorizing require an efficient and specific operation of a data processing system. They also require extended abilities to carry out those processes. On the one hand, a material basis for the implementation of these processes is required. On the other hand, a system for storing and processing the data obtained must exist. It seems that the systems should also be equipped with certain rules governing the data processing, including their editing, selection, use, and so on. Therefore it may be stated that telo-consciousness requires taking into account the implementing and operational areas, as well as the related rules (Weker 2009: 91–101).

Since we do not currently know, or do not have access to, a set of rules relating to the functioning of consciousness, it is worth looking at the functioning of telo-consciousness in relation to the foundation on which it is implemented. In the case of artificial intelligence, this foundation might be the silicon environment. However, since it is difficult to talk about artificial consciousness, I will confine the discussion to the biological foundation for mental processes, which seems to be the brain. The distortions of telo-consciousness understood as an ability to carry out complex analyses are clearly visible in cases of brain injuries and the resulting cognitive distortions, which have been described.

When analysing cognitive distortions, we may distinguish three types of distortions to telo-consciousness. The first group contains distortions related to the loss of consciousness. The second group includes distortions in the functioning of consciousness in the state of being conscious. In the third group, I include untypical cases.

The disorders of telo-consciousness, combined with the distortions of awareness, include such states as the total loss of reactivity, consciousness and all homeostatic functions, which usually leads to death. They may also include a coma and a persistent vegetative state. These are neurological states in which it is extremely difficult to establish by external or introspective study whether telo-consciousness is functioning.

Studies conducted in recent years (Owen et al. 2006: 1402) give a chance for detecting telo-consciousness in a person in a vegetative state. The study was performed 5 months after a trauma (car accident). Before the study, a woman was not responsive to stimuli and had retained her sleeping-waking cycle. According to the diagnostic team, she met the criteria of a vegetative state. During the study, brain activity was registered after such commands as “Imagine you are playing tennis”, “Imagine you are walking through the rooms in your house”. The brain activity corresponded not only to a passive (aural) reaction to words, but was complemented with activity of motor areas, which according to the authors may prove that the patient understood commands and consciously performed them by making specific moves. The analysis of the level of metabolism in the cerebral cortex of persons in vegetative states using the PET method (Laureys et al. 2004: 537–546) reveals a variable activity of individual brain areas, which may demonstrate a fragmentary telo-consciousness.

The second group of telo-consciousness’ distortions includes the states in which telo-consciousness seems to be distorted but a human being remains conscious. Analysed subjects can automatically perform certain commands, not knowing what they are doing and that they can do it (such persons function as zombies). This group also covers the states where the subject seems to know what is happening and reacts to it, but his reactions are not within the spectrum of telo-consciousness’ reactions. For example, in amnesic patients the damage to telo-consciousness results from an inability to acquire new memory traces and to use old ones. This may cause a feeling of one’s own identity being unspecified (“I am somebody, but I do not know who I am”). A similar identity disorder occurs in patients with transient global amnesia. A dysfunction within the Brock’s and/or Wernicke’s area results in distortions of thought expression or comprehension. Various types of distortions affecting the drawing of logical conclusions, mathematical thinking, and so on may occur, which also disturb the functioning of telo-consciousness.

Apart from pure types of damage, mixed damage may also occur: that is, damage affecting the functioning of telo-consciousness to a varying extent. Such disorders may be classified as the third group. They include anosognosia (inability to recognize one’s own illness). Similar cases involve patients who are unable to complete “their own image” through having a part of their body (e.g. left leg) paralysed (Damasio 2011: 250). Hemispatial neglect is also connected with disorders of telo-consciousness. In yet another disorder, called “blindsight”, blind persons demonstrate some movement ability for which visual perception is necessary. Their brain can see and can translate this ability into behaviour, but in the telo-consciousness of those people there is nothing that could prove their conscious, visual perception of reality. The research has shown that persons with blindsight can distinguish basic properties of an image, such as simple shapes, layouts and direction of lines, movement or colour, although in a retrospective study they firmly claimed that they have no visual perception.

The functioning of telo-consciousness was also established in studies on the possibilities of cognitive functioning without an efficient basis for implementation (that is, the brain). Medical literature describes many cases of people who, as a result of traumas, injuries and accidents, lost a major part of cerebral cortex, but this did not cause any dramatic change in their cognitive and intellectual functioning. In 1980 a British neurologist, John Lorber, described in "Developmental Medicine and Child Neurology" cases of children without a cerebral cortex whose development was correct and who were functioning as if mentally fit (Smith 1984: 230; Distelmaier et al. 2007: 756–760). The "Human Consciousness Project" focuses on near-death experience and thus covers mainly persons who have experienced clinical death (http://www.nourfoundation.com 2012). The results of those studies seem to negate the necessity of always analysing telo-consciousness with regard to the foundation on which it is implemented.

Conclusion

Summing up the discussion on the connection between consciousness and life, the following issues must be emphasized. If we understand consciousness as a kind of reactivity ("proto-consciousness"), it seems that it has a fundamental connection with life. Proto-consciousness can be understood as an ability to store, collect and use information that is useful for the given system/object. It seems that so understood consciousness is an inherent property of any system which can be described as a living system. The properties of proto-consciousness include an ability to collect, process and use information so that it is useful for the given system. With regard to telo-consciousness, we can talk about expanded and directed properties of proto-consciousness. Telo-consciousness may be understood as an ability to differentiate, analyse and synthesize, compare, combine and memorize complex data. The difference between those two types of consciousness lies in the saturation of consciousness with an "egotistic" element. As in the case of proto-consciousness, the properties of telo-consciousness are related to collecting, processing and using information, but the reference point is a broadly understood "identity", in other words "me", to which the given consciousness is related. This egotistic orientation of telo-consciousness makes its analysis very difficult, since it depends on the foundation on which it is implemented. Its study in isolation from the body or the brain cannot bring about the expected results.

It seems that recognizing consciousness as an inherent property of life which, depending on the degree of egotistic orientation, turns into telo-consciousness, will allow us to understand the mystery of consciousness.

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Chapter 12
"To Research Living Beings, One Has to Participate in Life": Viktor von Weizsäcker's Legacy

Andreas Losch

Abstract Viktor von Weizsäcker was a German medical doctor and philosopher, well known throughout Europe, but hardly recognised in Anglo-American culture. He focussed on the crucial epistemological question of how one can conduct research on living beings. This article's title is a key quote from his magnum opus "Der Gestaltkreis", which works out a theory of the unity of perception and motion. According to Viktor von Weizsäcker, one cannot separate the two, meaning that we locate ourselves in a fundamental union with the living world, which has lasting influence on our capacity for perception. This idea does not seem too different from Ian Barbour's ideas about critical realism, exploring a "consciousness of ourselves as arising out of rapport, interconnection and participation in processes reaching beyond ourselves." Both authors, Viktor von Weizsäcker and Ian Barbour, still have a lasting influence on the dialogue between religion and science, each in their respective cultures – a further reason to compare their core ideas. This essay also presents Viktor von Weizsäcker's life and thought, and assesses the theological impact of von Weizsäcker's thought. Following his philosophy, it becomes clear that the miracle of creation is the condition of the possibility of any perception.

Keywords Life • Viktor von Weizsäcker • Gestaltkreis • Epistemology • Critical realism

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His Life

As Viktor von Weizsäcker's writings – in contrast to his nephew Carl Friedrich's – are not translated into English,[1] it appears necessary first to give some biographical details about him (following the wordings of the concise biographical sketch provided by Hartwig Wiedebach (2009: 360f)).[2] Viktor Weizsäcker was born in 1886 in Stuttgart, the son of Karl Weizsäcker who was then prime minister of one of the German states ("Länder") in Bismarck's Germany. In 1904 he began studies in medicine at Tübingen University, which he continued in Freiburg and in Berlin, where he also studied philosophy and history. He finished with the state examination in medicine at Heidelberg University and a dissertation on the question of the velocity of blood circulation in cases of anaemia (in Freiburg again). After 7 years as an assistant under Ludolf von Krehl in Heidelberg – interrupted by research work with Johannes von Kries, with whom he had previously studied in Freiburg, and with the later Nobel laureate Archibald Vivian Hill in Cambridge – he did his habilitation post-doctorate in internal medicine during WW I in 1917, with a thesis on the energetics of the cardiac muscle. In 1920 he became head of the Department of Neurology founded by Wilhelm Erb in the Clinic for Internal Medicine in Heidelberg. In 1941 he was appointed, as successor of Otfried Foerster, to the most prestigious chair in Neurology in Germany, at the University in Breslau. In 1945 the Heidelberg Medical School established a chair in General Clinical Medicine especially for him. At his new chair in Heidelberg, his disciple Alexander Mitscherlich founded the first department for "psychosomatic" medicine at a German university (Benzenhöfer 2007: 184ff). In 1952, ill with Parkinson's, von Weizsäcker requested early retirement.

After befriending Franz Rosenzweig in 1906, Weizsäcker had a lifelong and very intense interest and involvement with philosophy and theology, in addition to his training as a medical doctor and researcher. His studies under Wilhelm Windelband and Jonas Cohn, and encounters with Martin Buber, Hans Ehrenberg, Romano Guardini, Eugen Rosenstock and Max Scheler, among others, contributed significantly to the establishment of medical anthropology as Weizsäcker conceived it. His first explicitly programmatic publications on this subject were his "Stücke einer medizinischen Anthropologie". They appeared in 1926 and 1928 in the journal Die Kreatur, on which he served as co-editor, with Martin Buber and Joseph Wittig (von Weizsäcker 1926/27a, b). Regarding the topic of this paper, most important is his opus magnum Der Gestaltkreis (the circle of Gestalt), which was published in 1940 and has been reprinted regularly up to the present day. Especially relevant to

[1]Nevertheless, some translated fragments are available in the reader Friedman (1964: 404–410); also, there is secondary literature on Viktor von Weizsäcker available in English, see the online bibliography on http://viktor-von-weizsaecker-gesellschaft.de/sekundaerbib.php?id=38, accessed 7 June 2012.

[2]For the sake of readability, I refrain from marking my few alterations to Wiedebach's account. For a full (German) biography see Benzenhöfer (2007).

the development of von Weizsäcker's thought in this book was his earlier article on the Gestaltkreis in the journal Pflügers Archiv (von Weizsäcker 1933), which made use of some experiments of Paul Vogel, documented in the same journal (Vogel 1931).

Weizsäcker developed an early interest in Freudian psychoanalysis, which was decisive for a psychological and physical-organic understanding of human disease and the state of "being ill". He also observed with great interest the epistemological crisis in modern physics, and contemporary existentialism. With these ideas as a framework, even what is researched and taught from a purely natural-scientific and physiological perspective falls, in Weizsäcker's approach, under the revealing light of an engaged encounter with the living, breathing human being. Weizsäcker died in 1957 in Heidelberg.

His Thought

"To research living beings, one has to participate in life" was Viktor von Weizsäcker's core principle (in German: "Um Lebendes zu erforschen, muß man sich am Leben beteiligen."). It opens his main book Der Gestaltkreis, and is repeated within the volume (von Weizsäcker 1940/1996: v and 168). In the preface of the book, von Weizsäcker explains this phrase with the observation that any life-science begins – with the awakening of questioning – already in the midst of life, not at life's beginnings. I would interpret this statement as meaning that, in biological research, we are involved with the object of research, as we are alive ourselves, and cannot examine it from a God's eye perspective.

The focus and intention of his thinking is therefore the introduction of the ever-present subject into biology (von Weizsäcker 1940/1996: v). How he came upon this idea is at the same time a long and a short story: a short mystical moment of union he once had during wartime was his motivation, and a careful development of experimental settings and observations (which will be presented in the following) allowed him to prove his conviction.

Unity of Perception and Motion

To explain his basic idea, von Weizsäcker gives an example from a doctor's practice: when a sick person mourns, his or her hand would be "as though paralyzed". We can often recognize that he or she does not differentiate between a sensitive and a motor dysfunction (as the doctor does); only our analysis reveals for him or for her, as for us, whether the first or the second guess is right. One should therefore not distinguish too sharply between a sensitive and a motor function (von Weizsäcker 1933: 630). This is the basic theme of the Gestaltkreis: a theory of the unity of perception (sensitivity) and motion. Yet what is meant by these terms?

Von Weizsäcker considers the motion of living beings, not the motion of any – maybe just imagined – body, within the spatiotemporal system. This makes a difference. When realizing that something lives, we acknowledge – especially in animals – its motion. It is the spontaneity, the self-motion, which we notice; this means that we assume a living thing to be a subject, a being acting through itself and in relation to itself (von Weizsäcker 1940/1996: 1), without outward influences. However, the existence of such outward influences may not be denied. Especially interesting for von Weizsäcker is the coincidence of outward forces with the self-motion of living beings, as visually happens when people walk upright, for instance. If walking upright happens on an ascending or descending surface, we observe a change of shapes with the continuous change of the angle of inclination of the road. Although it is true that the walk always consists in alternate bending and stretching of the large joints of the legs, on ascending terrain the extensors are causing the stretching of the joints, while on descending terrain the extensors are slowing down the bending and enable it through their prolongation (von Weizsäcker 1940/1996: 3).

Following von Weizsäcker, we have observed the motions of organisms under certain circumstances. What happens if we perform motions ourselves and then observe the appearance of the motion in perception? It does not make a difference whether the apparent motion is observed at the level of the environment or of the organism – as it did not cause us trouble before that the motion was influenced by an outward force as well as by an organic muscular force. "It is the synergism of both that interests us" (von Weizsäcker 1940/1996: 5). Viktor von Weizsäcker is referring here to his earlier experiments regarding vertigo. I will hence give a brief account of these experiments, as described in the journal article mentioned above (von Weizsäcker 1933).

Vertigo Experiments

The central device of these experiments is the optical rotating wheel: a paperboard cylinder of 1 m diameter, whose inside is furnished with alternating white and black stripes of 15 cm breadth each. The cylinder is covered with some black cloth on top; its inside can be illuminated by a lamp mounted in the axis of the wheel. The wheel is powered by an electronic drive; its speed is variable to a high degree and can be recorded electronically (Vogel 1931: 511). The experiment with this wheel then went as follows. The test persons stood in this rotating wheel with their eyes open. There were two test series: the first was as described above, whilst in the second a sign was installed close to the passing stripes, on which the test persons were supposed to fix their gaze (Vogel 1931: 520). The result of the second experiment, with the observed sign, is that the following illusion appears: "At a certain speed the test person – focussing on an observed sign – receives the impression that the rotating wheel stands still and the sign (and eventually themselves, too) rotate(s) in the opposite direction. The appearance of this illusion is connected with a stop or a

Table 12.1 Von Weizsäcker's *optical rotating wheel*-experiment

Normal state	Critical speed
Wheel turns, observed sign rests	Wheel seems to rest, observed sign seems to move
Limbs unconsciously move with the wheel	Limbs do not move any more or move opposite to the direction of the wheel

change in direction of unconscious limb movements, which happened in direction of the wheel's rotation before" (von Weizsäcker 1933: 635) (Table 12.1).

How are we to interpret what is happening here? According to a more traditional interpretation, following Johannes von Kries' scheme (depicted in von Weizsäcker 1933: 639), the motion of the rotating wheel acts as a stimulus upon the retina of the eye. In this account, the excitement stimulated in this way causes two further events: (1) certain motor reactions or jerks, and (2) the perception of the rotation with respect to the rest of the wheel; furthermore, (3) certain events are happening in the central nervous (motor) devices, which influence the kind and the direction of (1) and (2).

Von Weizsäcker, however, views what is happening differently. When presenting his view, he shifts the example to a small ball held by three fingers of one hand. According to his interpretation, the peripheral organ, consisting of (1) centripetal nerves (e.g. sensor nerves leading towards the central nervous system) and (2) centrifugal nerves (e.g. motor nerves coming from the central nervous system), in this case three fingers of the hand, is viewed here as a "sensomotor" unity, opposed to the object (the ball) and to the central organ. Von Weizsäcker draws a circular sketch of this account, and points out that there is no beginning nor end to the action (which would otherwise start with a stimulus and end with a perception or with a motion), and that one can hence imagine the action taking place in a circle, where the object is included in this circle (1933: 639). Von Weizsäcker reminds us that there are not only centripetal and centrifugal nerves, but "hands, fingers, eyes and ears" (1933: 640).

To elaborate this account further, he introduces the concept of "coherence". Every change in the Gestaltkreis gives rise to an antagonism, and is connected to the appearance of a force. For example, a stimulus in this circular scheme is not be perceived positively as a new impulse but negatively as the abolition of coherence. Therefore there is no longer any need to explain the movement of an eye following an object, or the hands and shanks of a rider in harmony with the movements of the horse, because these appearances are simply an expression of the coherence of the Gestaltkreis (von Weizsäcker 1933: 641). Von Weizsäcker continues: "the investigation reveals that we are related to the environment and to its objects, as if glued to it" (1940/1996: 8).

Now, is it really possible to perceive perception and motion as one act? To prove this thesis, one would have to find a dynamic relation between the function of perception and the function of motion of the organism (von Weizsäcker 1933: 644). The proof is there in the experiment of the optical rotating wheel, which demonstrates the alteration of perception of a moving wheel into a pseudo-rest of this wheel, whilst perceiving a pseudo-motion of an observed sign and the simultaneous change of objective but unconscious body motions into body stasis. If one compares the whole action before and after this alteration, one recognizes that, first, in an experiment without an observed sign, movements accompany the disrupting stimulus, while the rotation of the wheel is perceived. In a second experiment with an observed sign, the movements accompanying the rotation stop, and the test person perceives a pseudo-motion of the fixation sign (and eventually of their own body) together with a perception of the wheel as stationary. As a result, the same force appears on one occasion as an unconscious motor motion, and on another occasion as a sensor pseudo-motion. Therefore one can indeed portray each sort of motion as a replacement or an equivalent of the other (von Weizsäcker 1933: 645).

Me and My Environment

Von Weizsäcker discerns between me (M) as organic-individual totality and the environment (E) as representation of the world connected to me (with exception of myself). (ME) then expresses the full and undisturbed coherence of M and E.[3] In the experiment with the rotating wheel, M represents the eyes following the animated visual impressions, with the head and torso equally following this movement. My environment E is given as the rotating screen, as this room, or as my terrestrial, solar or cosmic environment.

The borderline between M and E is fuzzy, though, as I can perceive myself, too. When observing my arm, a piece of M turns into a piece of E; as the second rotating wheel experiment shows, a piece of E can similarly turn into a piece of M, when I perceive myself as rotating instead of perceiving the objective rotation of my environment. The fuzziness of this borderline means that the question of where my bodily and mental processes begin and where my environment ends cannot be answered by appearances, but must be judged by the dynamic of events in the Gestaltkreis (von Weizsäcker 1933: 655f).

Here, von Weizsäcker's experience of union should be mentioned. In his autobiography, von Weizsäcker recalls an inspirational moment that he experienced in 1915, during WW I: "a moment, in which the original togetherness of subject and object was revealed to me as a thinking body. While quietly watching an ammunition pocket hanging there I am the ammunition pocket and it is me" (1964: 68). One should remember the context of war, when evaluating this insight.

[3] In the German original text, the letters chosen by von Weizsäcker as symbols are *I* for "Ich" and *U* for "Umwelt". There is nevertheless the intriguing result that in English their translations make up the word "*ME*" which nicely symbolises the new definition of "me" as glued to the environment.

In the journal article, von Weizsäcker continues with the observation that the fuzziness of the borderline between M and E can also be interpreted as a representation of various vital activities. For an individual who eats, sleeps, plays, procreates, fights, the borderline between he or she, and his or her environment, is situated differently each for each activity. He or she is not always the same, and his or her environment is not always the same, when he or she changes his or her activity (von Weizsäcker 1933: 656).

Philosophical Conclusion

The methodological distinction between the Gestaltkreis and other accounts lies in the introduction of one's own person into the experiment. When the muscle motion, which the test person unconsciously performs, and his or her impression of a rotating screen are related to each other, the epistemological categories of objective and subjective intermingle (von Weizsäcker 1933: 659). Von Weizsäcker continues his autobiographical account of his experience of unity in a similar sense: "The sensual presence of an outward object of the actual perception knows nothing about a separation between subject and object. The epistemological question, how the subject can get a grasp of the object, how the object can enter the subject, – this question is obviously meaningless, if the described state of sensual experience is the more original one and also, before any analysis, the most real one. [. . .] Now, when we suppose the original experience of oneness of the subject and of the object to be primary, then the task of epistemology is not to explain how the subject is related to the object, but how the separation of the subject and of the object comes into being" (von Weizsäcker 1964: 68).

Comparison with Barbour's Critical Realism

I do not have the space here to present critical realism anew, but I want at least to recall some basic statements of it.[4] Barbour's critical realism is related to an interpretation of modern physics (quantum theory) (Barbour 1966: 303f), but basically consists of a philosophical idea connected to the interpretation of Whitehead (Barbour 1966: 206). In his Issues in Science and Religion, Barbour writes of critical realism that it "must acknowledge both the creativity of man's mind, and the existence of patterns in events that are not created by man's mind. Critical realism acknowledges the indirectness of reference and the realistic intent of language as used in the scientific community" (Barbour 1966: 172). A core principle of Barbour's critical realism is a "consciousness of ourselves as arising out of

[4]For a detailed examination and presentation of critical realism see Losch (2009).

rapport, interconnection and participation in processes reaching beyond ourselves" (Barbour 1966: 171).[5] This seems quite similar to Viktor von Weizsäcker's idea of coherence and his notion of a fundamental relation between me and my environment (ME), and this is my motivation to pursue this comparison here. However, Barbour still used a Cartesian scheme of thought, when he elaborates that in critical realism, the contribution of the subject is never completely separable from the process of scientific enquiry, although prominence is given to the object (Barbour 1966: 171). Viktor von Weizsäcker appears to be more successful in overcoming the separation of subject and object.[6]

However, when it comes to modern physics, Viktor von Weizsäcker does not seem to keep pace with all of the newest developments of his time.[7] At first, Viktor von Weizsäcker recognized newer physics as an ally, or partner (as does critical realism): according to him, it is not at all astonishing that the world started to listen, as physics began to introduce indeterminism, too (von Weizsäcker 1940/1996: 151). Despite his knowledge of these newer developments in physics, von Weizsäcker however operates with a classical understanding of physics and confronts it with his understanding of biology, as can be seen by the following: "Physics presupposes that in research an independent world as object of perception is opposed to the perceiving-me. In contrast to that, in Biology we have to learn that we find ourselves back in a dependence whose ground cannot become object itself" (von Weizsäcker 1940/1996: 168). "In physics, perception is affected by the object; it follows the object. The biologist nevertheless settles in his object and experiences his or her own life through it. To research living beings, one has to participate in life. Physics is only objective: the biologist is also subjective. The object of the biologist is an object inhabited by a subject" (von Weizsäcker 1940/1996: 168f). One can see that the introduction of the subject is the decisive and distinctive feature between von Weizsäcker's understanding of biology and between his understanding of physics and of every science built according to the ideal of physics. However, modern quantum physics allows for the introduction of the subject, too,[8] and therefore I assume it to be possible to extend von Weizsäcker's insights regarding research into living beings into every aspect of research and knowing. There is no knowledge without participation: no God's eye view on the world is possible.

Like Barbour (1997: 108), von Weizsäcker also acknowledges the place of judgement in science, and the theory-ladenness of scientific facts. Nevertheless, his insights, and hence his conclusions, are far more radical: "It could therefore be the case that human beings together with nature make appear what appears; because every observation is already a judgement and every theory a sort of observation. In this case, the appearance would not result from (the observable) event, but would

[5] For the source of this quote see Losch (2009: 90).

[6] Frank Vogelsang has explored the fuzzy area between subject and object further (Vogelsang 2011).

[7] His nephew Carl Friedrich commented that Viktor was unfortunately not successful in finding a physical talking to (Carl Friedrich von Weizsäcker 2002: 424).

[8] "No clear separation of subject and object is possible" (Barbour 1966: 285).

present already a prelude to theory, and theory could be understood as an appearance better observed. The task of science then would not be to explain appearances, but to create reality in a connection of humankind and nature. This alliance would not only account for perception, but also for reality" (von Weizsäcker 1940/1996: 149).

Von Weizsäcker's insight on the nature of biological research leads us to reconsider the nature of every kind of knowing, which begins in the midst of life, performed by a subject, glued to its environment (ME).

From here, it makes sense to me to postulate an epistemological unity of subject and object which can only be expressed by a term unifying the epistemological rivals of subject-orientated constructivism and object-orientated realism. The idea was to call it "constructive-critical realism". I sketched out elsewhere in detail what is meant by this term (Losch 2005, 2010). Here, I want to elaborate on this idea in such a way as to reconcile these epistemologically rival positions within one term. This is surely a necessary logical step if we are to oppose the persistence of the subject/object-distinction. Who makes the predominant contribution to the generation of knowledge – subject or object – can be considered a difficult question given the entanglement of both.[9] Therefore, I would regard subject and object as two intersecting poles in the generation of knowledge. From this point of view, the emphasis on subject (constructivism) or object (realism) would depend on the field of research. In the humanities, reality is already symbolically (subjectively, so to speak) structured, and there the constructive role of the subject gets most of the attention. In the natural sciences, however, the object of research should prevail. As a subjective contribution is also unavoidable, it has to be regarded critically.

That is the idea of constructive-critical realism. One may ask: Why was "constructive(−critical) realism" chosen as a stance and not "realist constructivism"? My sympathy lies with realism, because – as has been observed (Hübner 1995: 95) – the realist stance preserves better the interconnectedness and entanglement of subject and object. This is a commonality of critical realism and of von Weizsäcker's approach, as I have analyzed it.

Theological Conclusion

Finally, I want to address the theological meaning of Viktor von Weizsäcker's findings. I believe it lies at the very fundamental level of the recognition of the world as God's creation. Viktor von Weizsäcker himself once admitted that he had an "ineradicable passion for theology",[10] and in his lecture on the foundations of

[9]I have to admit my struggle in finding an adequate linguistic expression of the idea, which may result from the subject-predicate-object structure of language itself. Frank Vogelsang has recently pointed out that facing such a dilemma, a reflexive form of speech would be desirable: see Vogelsang (2011: 168f).

[10]Unpublished document, quoted in Link (2003: 227).

natural philosophy he starts with the Biblical account of creation (von Weizsäcker 1954). No wonder that in the introduction of the Gestaltkreis, he also hints at a theological dimension. In a very modern fashion, he distinguishes his position from vitalism, and writes: "If we want to become believers, we have to decide to become believers totally and not only partially [. . .], and we therefore have to say: everything and every event exists and happens only through the miracle of creation, and there is no borderline, beyond which something only happens naturally and without the creator" (von Weizsäcker 1940/1996: 22f). The resulting approach to the world is of course crucially different from that of modern science, with its inbuilt methodological atheism.

The protestant theologian Christian Link summarises our situation as such: "The experience of the world as creation got lost in the scientific age" (1974: 77). I follow him in perceiving it as an act of honesty to acknowledge this result of the modern enlightenment, and not to avoid it apologetically. The only way out of this dilemma is to overcome the Cartesian subject/object distinction, which lies at the heart of the method of modern science. Here is where Viktor von Weizsäcker's ideas come in. His concept of the entanglement of the subject and its environment in the Gestaltkreis (ME) offers just such a clue. Unlike in Descartes' conception, "me" becomes again a part of nature, and hence it is possible to conclude with von Weizsäcker that "human beings together with nature make appear what appears" (von Weizsäcker 1940/1996: 149). The rules of this interplay are the laws of nature: its results are determined only as possibilities, not as necessities. So, "there is no complete determinism" (Link 2003: 230) in nature. If this is so, the miracle of creation is the condition of the possibility of any perception. This is the tremendously important theological conclusion of Viktor von Weizsäcker's findings in the dialogue between theology and science.

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Chapter 13
Signs, Science, and Religion: A Biosemiotic Mediation

Gerald Ostdiek

A sign is something which stands for another thing to a mind.
(Peirce et al. 1998: 82)

Abstract Following on the pragmatic notion of belief as propensity to action, this essay argues that science, philosophy, and religion form a Peircian triad. As with all such triads, no single part 'has' ontological status – each is a process that exists only as a function of the other parts. And so, *Religion* represents the 'reading' that generates a mental map; *Philosophy*, checking such a 'map' against itself for functionality, consistency of signage, etc.; and *Science*, checking it against some actual situation. Thus, *religion* (or, *religare*) is ubiquitous to life as it represents the core binding (Jamesian Pure Experience, and Peircian Thirdness become Firstness) that is the consequent of semiotic interaction (an interpretant consequential to an organism 'minding' its environment). As Santayana argued, this 'animal faith' defines life; it includes but is not limited to, self-knowing life. Yet also, as per C. I. Lewis's inversion of idealism, structures of knowing consist of (and bear upon the world) a priori behavior and consequent need. And so, our methods 'mind' their business – often better than we do. They pull behind them a train of institutions, 'jointly held stock' replete with historically contrived symbolisms and other such tools of self-generative function, and 'act' in *their* 'perceived' interest, rather than that of their practitioners. The rub is that in order to either *know* or *be* all this must proceed on its terms, not ours. The upshot is that religion can be done ill or well, but cannot simply be abandoned. For even in the rare instances that result in self-knowing beings, *religion* (as heterarchically binding function within semiosis) is distinct from the objects we call 'religions'. Moreover, every religion that ever existed (function and object alike) is prone to dysfunction. Whether limited to a single living thing or widely practiced and culturally ensconced, the binding of interpretation into being is more likely to result in a more successful interpreter when bound by philosophy and science. This becomes particularly significant when

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the process of religion is abstracted, set apart from its biological function and instituted within human society. In praxis, this analysis of psychogenetic semiosis demands that we 'read again' (*relegere*) the creative morality of Alan Watts.

Keywords Biosemiotic analysis • Peircian triad • Whiggish science • Animal faith • Creative morality

Introduction

It is too often argued that knowledge is whiggish; that *religion* represents a primitive attempt to grasp the mechanisms of interaction that define what-is, and that its presence in human society is a throwback to primitive thinking; that *philosophy* is this same attempt, slightly refined and with a few accomplishments but still basically incompetent and 'properly' abandoned; and that *science alone* graces the heights of human knowing. However, the real need is to abandon whiggishness. To do this, we must reject the neo-platonic emphasis that whiggishness largely (enveloped and) supplanted *as well as* the concept of a 'war' between science and religion. Indeed, this or that scientific or religious claim *can* and often *must* be abandoned; history is filled with those that *have* been abandoned. However we cannot merely ditch religion on the roadside of human progress simply because it is not science, for religion has a natural function that is as much a part of science and philosophy as they are of each other.

Pragmatism and Nature's *a Priori*

To ask "what is life" is to beg the question "what is a beginning", for which there is no answer. 'Nets of causation' (Green 1869–79) operate with a kind of transcendence *into being* (as opposed to the traditional view of transcendence *beyond* it) and certain interplays of object/events do 'leap the scales of being' to become the 'cosmic weather' that Chauncey Wright proposed as a kind of proto-biosemiotics (Ostdiek 2010). Humanity is of the same order as all living things, he argued, and like all living things we have our particular 'knack'. Ours is at pseudo-teleology, which is (in part) the deliberated (though rarely conscious) origination of novel metaphysical niches. What distinguishes us is our ability to make stuff up – and to *continue* making stuff up – even as we act on its 'truth'.

As with all animal natures, ours has strengthened primarily through generations of selection. Those of us who make up stuff that 'works' – that *adequately* (readably and applicably) 'maps' actual circumstances – have tended to live and reproduce. The mechanisms of this are necessarily semiotic. But while all living things *sign*, so far as we can discern only humanity grasps signs *as signs*. The rest tend to rush with their attention to their circumstance and fail to notice the manipulative power to be found in 'standing' for something else – which is necessarily standing for something *more*. Every new beginning, then, is an act of differentiation that is an act of valuation, i.e., it is a claim on being, "taking a stand", which *makes* a beginning.

Our beginning is the reading of Darwin by a small group of young men on the eve of the American Civil War. For all the classical Pragmatists, *The Origin of Species* offered hope – hope that there may be more to the world than the wreck of history or the ruin of lost Eden. As young men of military age, they faced a brutality inspired in no small part by lofty ideals (not the least of which involved Darwin's favorite political cause, the end of race-based slavery). In this context, *Origin* offered hope that Laplace had been in error and the future "unwritten", such that decisions would have consequence. Moreover, *Origin* meant that consequence itself is "real" and can therefore be harnessed by sign-wielding animals so as to seek amelioration within the struggle that is life. Likewise, Darwin also meant that Comte is as mistaken as Kant and Spencer simply absurd, that ideals and imperatives and both innate and revealed knowledge are all as fantastical as medieval werebeasts, and that the secular eschatology of whiggishness is a childish fantasy. In contrast to all this, the classical pragmatists argued that need and function necessarily self-compound, which leaves both open to future action.

Pragmatism can be read as holding "science" as the *only* method of knowing competent to function with net beneficial consequence. And indeed, nearly all the classical pragmatists fancied themselves empiricists, positivists, and nominalists. Yet Pragmatism originated only as a turn towards ontology, and a staunch acceptance that universals too have consequence. Indeed, universals have their own needs, which set up their own heritage of interaction, in which "success" means *more*, not *higher*, existence. Following the tangled bank of Darwin's biology (as opposed to, e.g., Haeckel's towering tree of life), pragmatic argumentation focuses on workaday interactions, which crisscross and bind together multiple scales of lived experience, to become history by surviving (for a time) as objects imbued by their existence with specifiable limitations – which are also specifiable potential for future interaction, which carry the possibility of future object and potential.

Members of our species manipulate this realm by a pseudo-teleological use of signs; this "knack" has made us a most powerful animal. But we too, our notional selves, *need*. As living things we can do no other. For good or ill, all our *minding* feeds our mind – thereby reshaping our selves. In this, the pragmatic a priori is simpler than C. I. Lewis' derivation (Lewis 1923). Unmediated potential exists only as a heritage of past need filled by that which nourishes what already is. The biologically-expressed metaphysics of minding is merely another scale of this same phenomenon.

What Life? How Semiotic? Why Religion?

The Pragmatic approach to science and religion is one of semiotic heterarchy where *life* exists as coherent structures in which extension depends on continued incorporation of extant phenomena as well as excorporation of defunct phenomena both physically, and also as a consequent of success at "minding", or of one thing "standing" for another (Ostdiek 2010: 2). Biological structures depend on coherently structured metaphysics in the form of organized interpretive experience; living things live by "minding" their environment so as to go on living, and this takes on its own consequentiality (Ostdiek 2012). Consciousness is not stuff but it does "evolve", and self-consciousness is a simple complex of adaptive ephemera (James 1912: 3).

Metaphysical structures also experience need, and remain grounded in a heritage of previous interaction become object. Thus, it is not *merely* a metaphor to speak of a "living" church, idea or nation, be it Aldo Leopold's Mountain, the American Dream, etc.; for each of these are wholenesses which emerge from some heritage struggling for success, shaped by *their* search for what they needs must successfully incorporate so as to continue existing. To speak of such things as "alive" *is* metaphorical (they have no physically coherent being and thus cannot be considered living things), but it is not absurd. This is in keeping with all the classical Pragmatists, and expressed in various ways throughout the entire canon. For example, "*any kind of relation experienced must be accounted as 'real' as anything else in the system*" (James 1912: 24).

Much of this comes from Chauncey Wright's proto-biosemiotics: that is,

> [The] use or command of a sign which is implied in language, and essentially consists in the power of turning back the attention from a suggested fact or idea to the suggesting ones, with reference to their use, in place of the naturally passive following and subserviency of the mind to the orders of first impressions and associations. By inverting the proportions which the latter bear to the forces of internal impressions, or to the powers of imagination in animals, we should have a fundamentally new order of mental actions . . . . (Wright 2000: 110)

If our epistemological efforts end in receptivity (e.g. "revealed" knowledge), we will have done nothing more than all other living things (Ostdiek 2010: 53). If we end with what we need (or merely *think* we need) rather than the "fruit" of that need (wholly consequent within our "greater" being, which is the world of which we are mere fragment), then we will have rejected what is so uniquely human, and lazed away our lives perched on the uncomfortable point of some presumed ideal. These are both best described as failures of religion – failure to rebind one's self within existence by re-reading what signs we see.

As Wright argued, the generation of a hypothesis is both the function and the sensation of sentience – it is necessary for and co-extensive with life. By contrast, the postulation of a hypothetical ideal functions well as "true" a priori only if one is able to treat one's *own* ideal as no more than the hypothetical postulation of a possible ideal.

Mankind has refined the semiotic capacity to "mind" the world *propositionally*. This results from our moving beyond the dual (one to one) relationship, which is a construct of that rushing of attention towards the thing signified, and a focused *maintenance* of the sign – as a sign – as it binds the effect of that specific sign into the being of its interpreter. All this requires that we focus on that something that "stands for" the relationship itself, and thereby generate the potential for greater minding awareness of general and/or universal properties. Although semiotic behavior is ubiquitous to all life, it is rarely (even among humans) grasped as a tool. More importantly, as with all semiotic behavior, this is evolutionary; i.e., success and failure will both build on themselves. And in life, excorporation is as vital as incorporation such that we must, more or less deliberately, let go of our dysfunctional *mindings* – however precious they may be to our notional selves. Ongoing success in binding ourselves into being may well depend on forgoing the narcissistic pleasures of Neoplatonic notions of individuality as well as those of a so-called “after-life”, just as it has already forced us to reject the notion of the unique creation of mankind.

All this places Dewey’s “Reconstruction” as the primary element of lived experience. It would seem that when such reconstruction occurs “naturally” (without premeditation), it has a “built in” (evolved) bias towards success. However, this bias commonly fails us on our artificially-mediated level of human abstraction where “unreconstructed” behavior results in a perversion of Santayana’s animal faith: our inability to doubt an immediate “natural” semiosis is unnaturally crossed with an inability to doubt symbolic artifice. This can be seen in all kinds of fundamentalisms, but it is opposed by a conscious turn to biosemiotics, which proposes a radical continuity (synechism) of sign behavior and living things, as with that heterarchical binding of possibility, struggle, and habit, which is the center of Charles Peirce’s ontology.

Peircian Triads

Peirce found multiple definitions (a quick look can discover at least 88 (Marty 1997)) and functions (capable of periodic arrangement (Romanini 2011)) of *sign*. But always signs work in threes, and threes of threes; and, at least for Peirce, *sign* is synonymous with *being*. For example, consider Peirce’s ontological categories: Firstness is ungraspable potential, the fleeting possible of exact situations. That which ‘stands’ as a real possibility necessarily enters Secondness, which is brute effort, struggle, and strife. Secondness is Darwin’s jungle where potential is put to the crucible of (inter-, intra- and trans-) action, where the not-possible-here-and-now perishes (along with the merely unlucky). What survives this necessarily enters Thirdness as object, a thing in hand, stuff or idea. Every known thing, all representation, all “having stood” is Thirdness, but knowing is always a return to Firstness, a “reading again”. Moreover, *every thing* that exists is a Thirdness that *only* continues via a return to Firstness, through re-engaging whatever potential is entailed within that thing and its situation – extended so far as its relevance pertains.

In all this, Peirce depends on a synechistic heterarchy, and yet not every trinity is tied to the above mentioned cenopythagorean mold. While there is no causal link (in the Newtonian sense) from the ontologic to the semiotic, the two sets intertwine: Firstness, Secondness and Thirdness do not exactly match icon, index and symbol, but function is bound across both sets.

And so I feel justified in offering Religion, Philosophy, and Science as a third inter-twinned triad, and placing it alongside the ontologic and semiotic as its own "level" of being. This requires that I reject ("excorporate") a host of notions, including the Whiggishness of Comte, and both Social and Neo- Darwinism. In their place I see a trinity of trinities in the structure of physics (Firstness, Secondness, Thirdness – so far these categories are ubiquitous to all things, thereby including living things), biosemiotics (limited to living things, it replaces Peirce's pansemiotics but makes use of his system of icon, index, and symbol), and psychics (or bioepistemic processes). And this last third of three thirds is the function of empirically self-rendering a psychic map. It is the autopoietic "filling it in" that happens whenever any living thing "knows" anything. As with all such triads, each is a function of the other – and there is no "higher" or "lower". So where life exists, *religion* (or proto-religion) is that semiotic "reading" and "binding" function upon which all living things depend. This entails a proto-philosophy – some way of "checking" the "mental" objects upon which living things (even amoebas) act. Action also informs a proto-science which "tests" the relation of those objects to an actual situation in the world. This generally happens *within the struggle for life* – and rarely as self-aware abstraction. *Sans* absolute failure (death), this process necessarily re-informs and reifies life, making its continuation possible.

In the realm of the human, our knack at making stuff up functions through abstracting the bio-epistemic trinity to generate "living" artifice. These are methods that stand apart from our own interests (Ostdiek 2012). For these Frankensteins (the near infinite variation of all three aspects) to function well, they must "speak" well for themselves and operate in their own interest. This has the effect of strapping a jet engine directly to a donkey cart: it has long overshot our control – it is semiosis *sans* biological response. But it also carries "into orbit" kenotic effect; and this is what distinguishes human knowing from that of other animals. For that knack serves us well *only* in combination with a *practiced focus away from the needs of our own selves*, and *on* the a priori needs of our abstractions! The specific use of religion (or science or philosophy) as scaffolding for the ego turns our knack against itself, regardless of whether that ego is towering or crumbling – i.e. whether the need for scaffolding is in reaction to love of self or fear of other. This can result in harsh consequences, including a furthering of dysfunctional minding and a normalizing of wantonly destructive behavior. This largely defines much of what passes as religious; however, technically speaking it is quite irreligious, as it represents a refusal to re-bind one's self within the actual world.

The entirety of the disputed etymology of the word *religion* can be used to defend religion as a secular function within a Peircian triad. Cicero tells us that *religion* is derived from *relegere*: "read again" or "go back through again" in the sense of careful study. Meanwhile, Lactantius tells us that it is drawn from *religare*: "bind fast" or "stoutly tie together again" in the sense of social obligation. Augustine agrees, before adding that it might also have drawn from "to choose again." While etymology provides no entailment and frequently speaks only of accidents of history, it can, at least occasionally, offer some insight. By taking these descriptive etymological claims as a single whole, it would seem that religion is (and functions as) that intersubjective binding that is the consequent of "reading" what signs are distinguished within the societal (in the largest sense of the word) constraints (obligations as well as opportunities) that are the shape and shaping of life. As with all living things, mankind is a consequence of his interpretations, and thereby "reads" himself into being. We do not "control" interpretation, nor are we "determined" by it, but interpretation (the *making* sense of experience, or "mapping out" of a future possibility, that is common to man and amoeba) carries an obligation that cannot be avoided except by death or psychosis. As for *choice*? It exists only when, and to the extent that, signs are read as signs, and not confused with their objects. That this applies to metaphysical claims goes without saying.

Conclusion: The Pragmatic Practice of Religion

How does an amoeba practice religion? – Exactly as a man does, with his deeds. Religion is not necessarily, as Whitehead famously argued, "what one does with his solitariness" (Whitehead 1960: 16), but what one does with his oneness: how one makes, manages and maintains it – as obliged by the actual relationships of physics and chemistry, history and circumstance, and the synechism of it all. Pragmatically speaking, the practice of religion is a consequence of ongoing transcendence *into* being. It is action so as to go on acting; it is about how best to be so as to go on being. Yet this is only one side of the old saw: how do you get to Carnegie hall? Practice, Practice, Practice: for practice gets you nowhere if you learn nothing from it. Such is another Whiteheadian dictum: "mere repetition is the baffling of opportunity" (Whitehead 1958: 23).

In nature, repetition is just how it's done: one returns to the waterhole – parasite, alligator or no. However, we human animals carry a naturally evolved potential to intend novelty by systematically eliminating dysfunctional notions *by means of methodological artifice*. We can test the safety of the waterhole at no risk to life or limb. That we have also developed socially heritable systems of refusing to make use of this ability, honored this refusing with names like "duty", "faith" or "principle", and allowed unreckoning to ground our talk of virtue, goodness *and actuality "itself"*, speaks poorly for the future of our unusual adaptation. As I see it, much of what has come to be called "religious" is, in practice, irreligious. It is a refusal of renewal and a rejection of *what-actually-is*. All too often *to be religious* means *to refuse to question or allow questions of one's own tribal and/or personal abstractions so as to maintain some preferential notion of self – consequences be damned, alligator or no.*

By contrast, Darwin clearly "believed" the natural selection hypothesis, but acted to decrease *its* probability of error in the world, rather than to deflect his own. He acted with kenosis, and let the theory "find its own way". When an amoeba "smells" sugar and drives itself up the glucose gradient, it is responding to what signs it discerns; it *believes* that food is ahead, and (unless fooled by some artificial sweetener) guided by its belief, it feeds. These actions, like those of Darwin, are "justified" by the construction of a future past out of what is possible within present moments of action. Unlike the amoeba, Darwin objectified his symbolically real conceptions of the world by mediating its consequences through an abstracted methodology (by which biological proto-science becomes human science). Darwin allowed both theory and method to "take a stand" on their own behalf. By contrast, the amoeba just swims, and should the "revelation" of sugar turn out false it simply dies. In this conception, Darwin *did* religion better than all his amoeba-like detractors combined.

As Pragmatism is merely "a new name for an old way of thinking," so too this trinity of Science, Philosophy, and Religion is a mere reframing of a familiar picture. We too seek to "show that Ought, that Duty, is one thing with Science, with Beauty, and with Joy" (Emerson 1941: 46). It is by constraint and obligation that a living thing transcends into being and takes on aspects of beauty and joy. To identify the upshot, I turn to Alan Watts and Creative Morality (Watts 1951: 119–133): while conduct motivated by the extension of the artificial construct "I" is not necessarily "determined" in a strict sense of the word (no living thing is), it is far less likely to "leap the scales" and result in the transcendence into being of novelty, unique oneness, a person, a (relatively) whole and sane psychology, a you or I.

This essay turns on the pragmatic reading of Darwin, and ends by using James to point to Watts, whose review of religion weighs heavily in my own figuring of this Neo-Peircian triad. Future research into the philosophical competence of this proposed bio-epistemic triad will, above all else, involve scientific competence to discuss subjectivity – a feat which may turn on the success of biosemiotic theory. But such competence demands a re-discovery of the ongoing emergence of awareness of and within both self and other-self (most commonly thought of as *not-self*). In all this, Watts brings us back to the stream of consciousness, the wisdom of the body, and function within the varieties of religious experience – especially as each of these "asserts itself" on science as secular, opportunistic constraint. Specifically, *The Wisdom of Insecurity* can be read as a call for a renewal of secular competence in religious action, competence in "standing" one thing for another as a sign of something else that can also serve as a sign of something that is both more and more actual. Perhaps we can begin here.

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Chapter 14
Persons Knowing Life: Theological Possibilities in Michael Polanyi's Philosophy

Vincent M. Smiles

Abstract Michael Polanyi was a scientist and philosopher. His post-modern philosophy attempted to restore to modern society faculties of knowing and understanding which centuries of scientism have stripped away. I argue that Polanyi's philosophy embodies concepts of personhood, knowledge and life which provide rich possibilities for theological reflection, and for the science-theology dialogue. First, as opposed to the "objectivism" deriving from the rise of science, Polanyi insists that the fact of personhood must be the starting point for a proper understanding of reality, and this suggests an understanding of reality in which mind precedes matter. Second, knowledge is a process by which the multi-levelled character of reality invites human inquiry, drawing us forward into more abstract and intangible depths: "deepest reality is possessed by higher things that are least tangible." Third, life is not definable in terms of physics and chemistry: higher ordering principles come into play both in life's beginnings and in its development. Evolution has to take into account the "finalistic principles" to which the fact of personhood attests. Cumulatively, Polanyi's philosophy suggests that reality is far more personal and meaningful than moderns usually recognize, and that our relation to it should be far more I-Thou than I-It.

Keywords Polanyi • Personhood • Knowledge • Life • Biology • Reality • Emergence • Science • Scientism • Centre • Theology

Michael Polanyi (1891–1976) was a scientist turned philosopher. He was horrified by the perversion of scientific knowledge in Soviet Russia and Nazi Germany, and feared that materialist thinking was becoming prevalent throughout industrialized societies (Polanyi 1946: 7–9, 78). Having spent the first part of his life, therefore, studying and teaching chemistry, he turned increasingly in its second half to philosophy. He inveighed against the view that life is reducible to the definitions of physics and chemistry, and believed that the prevailing notion of science alone

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as the source of genuine knowledge lay at the root of much of the malaise in the Western world (see, for example, Polanyi 1958: 139–142, 1965: 12–13).

The entire enterprise of what Polanyi regarded as his most important work is dedicated to showing how the structure of science, and of human knowing in general, coheres naturally with philosophy and theology. He argues persuasively that, just as there is “a continuous ascent from our less personal knowing of inanimate matter to our convivial knowing of living beings”, so also there is a continuum “from our knowing the laws of nature to our knowing the person of God” (Polanyi 1961: 244). Polanyi was not attempting to prove the existence of God; indeed, he regarded “divinity and the possibility of knowing God” as “outside” of his argument (ibid.: 246). But he did regard human knowing, and the natural sciences of which he was so enamoured, as having a transcendent, and indeed a “metaphysical” reach (Polanyi 1964a).

This “metaphysical reach” becomes clear in Polanyi’s view of “*persons knowing life*.” Each of these terms is crucial within Polanyi’s philosophy. His view not only refutes the materialist views of life deriving from scientism, it also suggests a view, consistent with philosophical idealism, which places mind before matter. Idealism was not Polanyi’s starting point, which rather had to do with critical realism (e.g. Polanyi 1946: 21–41; Mitchell 2006: 82–85). Nevertheless, his ultimate vision, based on his epistemology, has everything to do with idealism in the sense of a view of reality as “founded [. . .] on some form of purposive consciousness” (Ward 2010: 183). One of his interpreters speaks of Polanyi’s sense of “a pre-existing reality” (Scott 1985: 192). In Polanyi’s terms, life can be seen as ultimately a product of mind, in that “living mechanisms” depend for their nature and purpose on “operational principles” that are extraneous, and prior, to the laws of physics and chemistry. The latter detail the *conditions* of a machine’s or of life’s operations, but they are “blind both to [their] success and [their] failure,” which can be evaluated only in terms of ordering principles of which physics and chemistry know nothing (Polanyi 1958: 330).

This paper will primarily describe Michael Polanyi’s philosophy of “persons knowing life,” and will more briefly suggest some of the possibilities which theology might see there. In his vision, life cannot be known without deep consideration of *persons* and the character of their *knowing*. There is no scientific description of life which is not at the same time a personal knowing of life. Living things, says Polanyi, do not conform to any “single highly generalized assumption,” and so the standards a biologist uses to appraise them are necessarily approximations to a norm that has been established by biologists themselves (Polanyi 1958: 348–354, here 349). This means that “biology is life reflecting on itself” (ibid.: 347), and if we examine the evolution and structure of such knowing, we discover the multi-leveled character of reality and life. At every point in Polanyi’s philosophy of *personhood, knowledge* and *life,* there are hints, as I hope to show, of the transcendent and the possibility of knowing God.

Science and Personhood

In the opening of his final chapter in *Personal Knowledge*, Polanyi provides an important statement of what his work aims to accomplish. He begins by saying that he is not providing "any definite theory concerning the nature of things": metaphysics is not his primary concern. His purpose, he says, is "to re-equip [people] with the faculties which centuries of critical thought [scientism] have taught them to distrust" (Polanyi 1958: 381). The "faculties" he has in mind comprise personal elements of knowing which, since the seventeenth century and the rise of science, numerous thinkers, both implicitly and explicitly, pushed aside as though they were obstacles to real knowledge. The Enlightenment imagined that what Polanyi calls "objectivism" was the path to reliable knowledge, and eschewed the foundational roles of faith, commitment, intellectual passion and tradition (Polanyi 1946: 42–62, 1958: 132–202). Such objectivism, Polanyi shows, skews our understanding both of what science really is, and – even more ominously – of personhood. In the presence of pure objectivism, which separates faith from reason and disavows reverence for human greatness, "law is no more than what the courts will decide, art but an emollient of nerves, morality but a convention, tradition but an inertia, God but a psychological necessity. Then man dominates a world in which he himself does not exist. For with his obligations he has lost his voice and his hope, and been left behind meaningless to himself" (Polanyi 1958: 380).

"The modern mind," observes Polanyi, "distrusts intangible things and looks behind them for tangible matters on which it relies for understanding the world." In this materialist understanding, humanity is "but a chance collocation of atoms, without purpose or meaning", definable simply in terms of physics and chemistry (Polanyi 1965: 12). A vivid example of this is the denial or trivializing of mind and free will, which Polanyi encountered in the mid-twentieth century, and which is still with us today (e.g. Dennett 1991; Harris 2010: 102–106).[1] The modern mind views humans as machines, and things like kidney machines, not to mention mind-altering drugs, demonstrate the point. Polanyi takes that description, and agrees that indeed the human person is a mechanism, but he then shows how, precisely *as* a mechanism, a person (or any living thing) is a hierarchy, comprising numerous levels of reality. A simple mechanism, like a watch, illustrates the point. It functions by operational principles that have nothing to do with physics and chemistry. These principles were imposed on the parts of the watch by a watchmaker, and so hard science "cannot

[1] There are also, of course, protests from scientists (with no religious interests) against such denials: e.g. Donald 2001: 1–45, and Tallis 2011. From a more philosophical (including theological) angle, see e.g. Haught 2006, and Ward 2010. Polanyi's own rejection of "the programme of behaviorism" (e.g. 1965: 15–16) was scathing.

reveal the practical principles embodied in a machine, any more than the physical chemical testing of a printed page can tell the content of its text"(Polanyi 1965: 14).[2]

Physics and chemistry provide the *conditions* for the watch's functioning, but if you pulverize the watch with a hammer, it is only the higher operational principles which are disturbed, not the physics or chemistry of the parts. That is why physics and chemistry may account for a watch's failure, but they can never account for its success. And what is true of watches is all the more true of "the machine-like functions of living beings." The analogy of the watch's two levels of operation illustrates "a hierarchy in which the distinction between things essentially higher and essentially lower" becomes clear (Polanyi 1965: 14). The distance between the *physico-chemical composition* of a page on which is written the 23 psalm and the *meaning of the words* on that page is precisely the distance between seeing a person as so much physics and chemistry (*merely* a machine) and seeing that person *as a person*, who lives by realities far beyond those described by the hard sciences.

Scientific reductionism, as a method, is good and necessary, but when the method becomes an ontology that reduces life to *nothing but* physics and chemistry, then it becomes destructive in its denial of further levels of reality. Throughout his writings, Polanyi insisted on a multi-levelled, hierarchic, view of reality, in which the principles operative at the higher level govern the boundary conditions left indeterminate at the lower level. The process by which the higher level comes into existence is an "emergence" – a well-known concept in physics[3] – and what it attests to is that there is a dynamism in reality that is most evident in, but is not confined to, living things (Polanyi 1966: 29–52, here 45).

The discovery of emergence, and thus of the hierarchic, multi-levelled character of nature and persons, precludes the hard reductionism which wants to describe living things simply in terms of physics and chemistry. It also opens up space for asking questions that are of prime concern for philosophy and theology. One such question might be framed as follows: If the physico-chemical properties of human beings are clues to the nature of the universe – as indeed they are – then what about the higher level properties that have emerged with the rise of intelligence, consciousness and moral responsibility? Are they not also clues to the nature of reality? What of the "intellectual passions" (Polanyi 1958: 132–202), such as

[2]At the ESSSAT Tartu 2012 conference, some respondents to my presentation were concerned that the watch analogy sounded reminiscent of William Paley's attempt (*Natural Theology*, 1802) to prove the existence of God by likening the obviously designed intricacies of a watch to the amazing design of living things. Polanyi's point is utterly different, and has nothing in common with Paley. Polanyi only wishes to show that machines (both mechanical and organic) are not reducible to the laws of physics and chemistry but operate by principles that control the boundary conditions left open by inanimate physical matter (more on this below). His point is established simply by observation and logic; it neither depends on nor aims at a theological perspective.

[3]A fascinating study of emergence is provided by Morowitz (2002). Emergence accounts for "novelties [in nature] that follow from the system rules but cannot be predicted from properties of the components that make up the system" (13). His book describes 28 examples of emergence, from the big bang to *homo sapiens*.

appreciation for elegance and beauty and the desire for ultimate truth? What do they tell us about the universe from which they have emerged? For Polanyi, they are intimations of mind, and even "a clue to God" (Polanyi 1958: 324). These properties, of course, defy definition, and may forever do so, and yet – like other clues that draw discovery forward – they are essential to all human inquiry. This brings us to the key concept, for Polanyi, of the *Tacit Dimension* (Polanyi 1966) and tacit knowing.

Personal Knowledge

To understand Polanyi's emphasis on knowledge as *personal*, we need to recall what he finds disastrous in modernity: that is, scientific materialism's view that reality can be reduced to particles in motion. This mechanical view of the universe that began with Galileo and Newton (Polanyi 1965: 12) led in the nineteenth century to the famous assertion of Pierre Laplace (1749–1827) that if a great mind could know both the laws and the motions of particles of matter, then it could calculate all events of both the past and the future.[4] The main problem others have seen in Laplace's assertion is that, if true, it would call into question the reality of free will. Polanyi, however, points out that such a worry overlooks "the more massive fact that a Laplacean atomic topography would tell us virtually nothing that is of interest to us," not even, for instance, "the definite temperature" of some region of the universe. Only "the action of our sentient self, responding to the atoms impinging upon our senses, can supply" any truly meaningful information (Polanyi 1965: 13). Laplace makes no provision for the knowing mind, which for Polanyi is the key to everything. An epistemology that ignores how the "sentient self" reaches out to discover deeper levels of reality misses the most important discoveries of all.

Reality, for Polanyi, is that which continuously reveals itself in new and surprising ways (Polanyi 1966: 32, 1969: 133). Reality comprises numerous levels from the inanimate to the animate, from the first glimmers of amoebic interpretation[5] and striving to animal consciousness and human responsibility. "We have thus," he says, "a sequence of rising levels, each higher one controlling the boundaries of the one below it and embodying thereby the joint meaning of the particulars situated on the lower level" (Polanyi 1965: 15). These numerous levels of reality find an echo in the multileveled character of human discovery and knowledge. His concept of tacit knowing enables us to see this. Tacit knowing refers to the fact – gleaned from Gestalt psychology – that "we can know more than we can tell" (Polanyi 1966: 4). His parade illustration of this is the way we recognize a face. If asked to describe how we do so, we cannot say. But we can see how it happens in the case of the

[4] Polanyi mentions and laments this claim numerous times in his writings: e.g. 1958: 139–142, and 1965: 13–15.

[5] I mention "amoebic *interpretation*" here with reference to Southgate 2012 (Tartu conference paper), which argues that "interpretation, precisely understood, is a fundamental property of life."

police sketch artist who places before the observer various possible noses, chins, eyebrows and so on, and thereby enables us to reconstruct a face we have seen but cannot describe. What this shows is that when we look at something, we attend *from* its particulars (e.g. the details of a face) *to* the thing itself. Depending on what we are looking at, we may not be consciously aware of the particulars, but we are nevertheless guided by them to know the thing in its wholeness.

Recognizing a face or distinguishing, say, a hotel from a government building, or a teenager from an old person, is something we do in an instant; but the same process is taking place when we are faced with far greater mysteries and challenges of knowing, like a doctor diagnosing illness or a philosopher contemplating knowledge (Polanyi 1966: 4–12; Mitchell 2006: 70–79). As we attend from the particulars of what we seek to know, "it is their *meaning* to which our attention is directed" (Polanyi 1966: 12). Knowing is about integration, bringing the parts together to make the whole.[6] Tacit knowing, in other words, attests to the mind's never-ending urge to reach out beyond the immediate material substance of reality to its more intangible, abstract levels. For him it was axiomatic that "deepest reality is possessed by higher things that are least tangible" (Polanyi 1965: 15).

Polanyi liked to refer to the *Meno* in which Plato puzzled over a paradox: "To search for the solution of a problem is an absurdity; for either you know what you are looking for, and then there is no problem; or you do not know what you are looking for, and then you cannot expect to find anything" (Polanyi 1966: 22). Polanyi's solution to the paradox was the process of tacit knowing, by which "the particulars" of the world invite our inquiry. People have an instinct, an "intimation of something hidden, which [they] may yet discover," and so "gradually penetrate to things that are increasingly real" (Polanyi 1966: 22–23, 1969: 168). At every stage in their evolution, humans have faced "something hidden," and have broken through to further levels of reality, and further understandings of themselves and their universe. From a theological perspective, this is the capacity that enables the contemplation of mystery and response to the invitations of God.

This uniquely human capacity to "penetrate to things that are increasingly real" indicates a further important insight of Polanyi's philosophy, and one that is not without significance for theology. Tacit knowing relies on an integration of particulars, but ultimately it is not the particulars – whether of a face or of a scientific problem – which are the aim of our endeavor. Rather, our ultimate aim is the meaning of the whole, and the more profound the problem, the deeper we are drawn into the depths of reality. Polanyi was fond of pointing out "the greater depth of a person and a problem, as compared with the lesser profundity of a cobblestone" (Polanyi 1964b: 4, see also 1966: 32–33). To quote him at more length:

> Persons and problems are felt to be more profound, because we expect them to reveal themselves more richly and unexpectedly in the future. Since I have attributed the capacity

[6] For a neurological description of this phenomenon, known as "binding," see Donald 2001: 178–184. Polanyi, of course, is including the perception and contemplation of the "tacit dimension," in other words, a transcendent dimension which is not in Donald's purview.

> of things to reveal themselves inexhaustibly in the future to the fact that they are an aspect of reality, I shall say that minds and persons possess a deeper reality than a cobblestone, even though cobblestones are more tangible. And since the significance of a thing is more important than its tangibility, I shall say that minds and problems are more real than cobblestones. (Polanyi 1964b: 4–5)

Understanding in this rich sense of attaining meaning, so that "we can both know and experience the higher intangible levels of existence" (Polanyi 1965: 18), is itself a higher comprehensive entity. But it is precisely this "cognitive faculty [that is] cast aside by a positivistic theory of knowledge, which refuses to acknowledge the existence of comprehensive entities as distinct from their particulars" (Polanyi 1961: 239). In such a reductionist conception of reality, particles in motion are real enough, but humans as comprehensive and comprehending realities are absent (Polanyi 1958: 142, 380).

Polanyi's epistemology not only rescues humans from the deadening effects of scientism, it also simultaneously opens up before us the world of transcendence. As Drusilla Scott notes, what Polanyi accomplishes is ultimately a matter of "common sense." To repeat, Polanyi's philosophy restores to the western world "capacities which centuries of critical thought have taught them to distrust" (Polanyi 1958: 381). In doing so, it restores depth to reality, since one level of reality leads on naturally to inquiry about another. "Voice production," for example, "leaves largely open the combination of sounds into words [. . .] a vocabulary leaves largely open the combination of words to form sentences, which is controlled by grammar; and so the sequence goes on" (Polanyi 1965: 15). Higher and more complex levels lead to purpose and meaning, taking the mind into contemplation of higher reality where it is possible to consider the dynamic purposes hidden in creation and in the Creator. This brings us to Polanyi's critique of the modern understanding of evolution.

Persons Knowing Life

Polanyi was very impatient with the notion that "Neo-Darwinism" can explain the rise of human consciousness. Neo-Darwinism "regards evolution as the sum total of successive accidental hereditary changes which have offered reproductive advantage to their bearers." In this theory, "the 'force of natural selection' is supposed to have brought forth the successive forms of life that have eventually produced [human beings]" (Polanyi 1958: 382–383). He was impatient with this theory, of course, because it reduces life to the vagaries of physics and chemistry and therefore precludes "any clear conception of living beings" (ibid.: 383). Physics and chemistry cannot account for any level of being above the inanimate; they are utterly blind to the higher operational principles that control the boundary conditions they leave open. Valuable though these disciplines are – Polanyi spent the first half of his life studying and teaching chemistry – they cannot account for higher levels of being. Polanyi insisted on a description of life and evolution which begins at the other end, so to speak – from the fact of persons with a capacity to seek knowledge.

Living things are the most complex entities we know, and “knowing life”[7] is necessarily “contemplative, rather than analytical.” This is because “[f]acts about living things are more highly personal than the facts of the inanimate world” (Polanyi 1958: 353, 347). The more complex the animal we seek to know, the greater the distance between “our comprehension and the specification of our comprehension” (ibid.: 347). This is true both with respect to the living things which biology seeks to understand, and – more importantly – with respect to the biologist who is seeking the understanding. Further, the higher we ascend the evolutionary ladder, the more we encounter animals (like biologists) having “active centres,” “centres of decision” (ibid.: 402–404) that strive and sometimes fail. In other words, we can make discoveries and know ourselves both as evolved, biological beings and, at the same time, as passionate, committed knowers of complex abstractions; but the higher we ascend this scale of knowing, the less we are able to account for our ability to know, and the more we have to account for the striving, purposive center that is human consciousness.

Once biology rises, as it must, to the level of “a biology of [humanity] immersed in thought”, then it must also acknowledge the human “capacity for continually discovering [. . .] a deeper understanding of reality” (ibid.: 374). Polanyi has in mind here what he calls elsewhere “a society of explorers,” in which, by virtue of tradition, purposeful inquiry and passionate commitment to truth, human culture attains to a point where it knows itself to be called to, and responsible for, “a firmament of truth and goodness” (ibid.: 380).[8] This is the pinnacle of life’s achievement.[9]

The closest Polanyi comes to providing a definition of life is the following:

> I shall regard living beings as instances of morphological types and of operational principles subordinated to a centre of individuality and shall affirm at the same time that no types, no operational principles and no individualities can ever be defined in terms of physics and chemistry. (ibid.: 383)

The highest development of living beings is found in “human personhood,” in which the phenomenon of “a centre of individuality” reaches its highest complexity. Such personhood can only be accounted for by “the assumption of finalistic principles of evolution” (ibid.: 402). Polanyi takes it as common sense that life and mind emerging from inanimate matter represent progress, a progress that has taken place by virtue of the higher ordering principles which enabled life to emerge from inanimate matter to higher and higher states of being. But where do these “higher ordering principles” come from? Do they emerge with random genetic mutations? This is impossible, he says, since

[7]This is the title of Chap. 12 of *Personal Knowledge*.

[8]For Polanyi’s full discussion of “A Society of Explorers,” see 1966: 55–92.

[9]Wilson (1998) argues that all disciplines are ultimately reducible to laws definable by biology, and thus he subsumes even religion and ethics under biology. The contrast with Polanyi, who sees the insights of biology as inevitably leading to the transcendent level of philosophy and theology, could not be more dramatic.

> the ordering principle which originated life is the potentiality of a stable open system; while the inanimate matter on which life feeds is merely a condition which sustains life, and the accidental configuration of matter from which life had started had merely released the operations of life. (Polanyi 1958: 383–384)

Neither life, then, nor *ipso facto* evolution, can be attributed to the random machinations of physics and chemistry. Given the fact of personhood and "the decisive fact that biotic achievements are those of an active centre" (ibid.: 402), Polanyi insists that "this active component" must have been present "down to the lowest levels" of life and of the inanimate substrate from which life emerged. Emergence, to repeat, has a dynamism to it. Life has to do with a "centre" which enables the "opportunities and strivings" of "biological fields". It emerges, in fact, from the mysteries of "a cosmic field", which over billions of years has been evoking "a myriad centres that have taken the risks of living and believing" (ibid.: 404–405). For their part, humans are the striving centres, whose powers of tacit knowing both reflect, and strive to understand, the very processes which gave them existence.

Conclusion: Thoughts for Theology

Polanyi's purpose is to illustrate that personhood is essential for knowledge in its fullness. In both its negative and positive aspects, his philosophy has profound implications for every area of human knowing, and especially for the relationship between theology and science. His theory of knowing is anything but an ivory tower abstraction; it is founded on a profound understanding of science. He is able, therefore, to show how flawed is the modern understanding of biological evolution. At the same time, he is able to show how emergence, of which human evolution is the most dramatic example, brings us to contemplation of our transcendent purpose, perhaps even to "knowing the person of God." In other words, he does not merely *relate* science to philosophy and theology, he shows that they are essentially the same enterprise. They are all gathered in the one endeavour of human knowing.

Theology, therefore, must not consider science an intrusive, threatening methodology. Different though they are in method, theology and science derive from the same source and have the same ultimate purpose. Indeed, from a theological perspective, science derives as much from God as does theology. I am aware of how such an idea might seem to fly in the face of the traditional view that revelation supplies what human reason alone cannot attain. And, to be sure, with respect to doctrines like trinity, incarnation and redemption, we can look only to the privileged revelations of Christian experience – the same being true, *mutatis mutandis*, for any other religion. Nevertheless, what Polanyi's epistemology demonstrates is that humans are endemically capable of transcendence. Their natural inquiries proceed *naturally* to the supernatural. Far from being a diminishing of the supernatural, this suggests that divine presence suffuses every moment and aspect of human searching – it does not diminish, but only reinforces the view of *Immanuel*, "God with us".

I have already mentioned the suggestion, arising from Polanyi's philosophy, that quintessential human qualities (what Polanyi calls the "intellectual passions") must be, no less than our physical make-up, clues to the nature of the reality from which we have emerged. This is a theme for the contemplation of both science and theology. To this we can add Polanyi's insight that reality is not just objective facts: much less is reality reducible to materiality, to "cobblestones." Reality, rather, is that which continually invites our inquiry and manifests itself constantly in new and surprising ways. As emergence and evolution show, there is an inner dynamism to reality which suffuses all things and brings them into relationship. Polanyi was fond of Teilhard's concepts of noogenesis, the emergence of mind, and of noosphere, by which together humans achieve personhood (Polanyi 1958: 388–389). All of this can speak to theology of ongoing divine creation, and could even further inform a theology of revelation.[10]

Also worthy of emphasis is Polanyi's "common sense" insight that ordering principles guide and give structure to the more basic levels of human existence. Physics and chemistry can account for failure in physical beings, but they can never account for their success. It goes along with this that life is an emergent, *metaphysical* entity that cannot be defined in terms of physics and chemistry. Polanyi achieves a massive liberation here not only for theology, but also for biologists who are dissatisfied with, or even just suspicious of, the notion that living things, including humans, are no more than "gene machines". "Darwinism has diverted attention for a century", says Polanyi, "from the descent of [humanity] by investigating the *conditions* of evolution and overlooking its *action*" (Polanyi 1958: 390). For theology, Polanyi provides new possible ways of speaking of the "action" of God in creation.

Finally, Polanyi's science-based philosophy is fully consistent with the idealist notion that mind precedes matter, and indeed that matter is best understood in terms of the loving spirit and creative mind of God – as Mariano Artigas would say, "The Mind of the Universe" (Artigas 2000). This is why reality, though ultimately mysterious, seems constantly to invite human inquiry, and even appears to have a natural correspondence with human minds as they reach out to discern the ground of their being. As St. Augustine says, "You, O God, have made us for yourself, and restless is our heart until it rests in you". In this regard, Polanyi's philosophy not only suggests the reality of God, but also leads to intimations of God's character as creating through emergence, as being dynamically present in life and evolution, and as increasingly evoking intelligence, responsibility, thanksgiving and worship.

[10]Dulles (1992), of course, has already made some use of Polanyi's insights in his understanding of revelation. There is a great deal more, however, that might be said.

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Chapter 15
Life Beyond Critical Realism: Developing van Huyssteen's Transversal Approach to the Science/Theology Dialogue

Pat Bennett

Abstract Despite its steady growth as an academic field, certain tensions relating to the nature and ultimate purpose of science-theology engagement remain, and with them the thorny question of whether and how theology can contribute to scientific thinking. This paper argues that a development of J. Wentzel van Huyssteen's transversal space dialogical model provides a possible way of addressing this issue. After outlining the model's philosophical roots and key dynamics, I propose an extension involving the generation of additional "transversal" dialogical outputs. These aim to actively knit together disparate material brought into the transversal space via a trajectory which lies not downwards *into* but outwards *beyond* the contributing disciplines. The resulting arguments or models are thus neither scientific nor theological in their formulation and expression but, just as with the dialogue from which they originate, exist and are supported in the shared rational space between the disciplines. Hence they too are answerable not to the *domain-specific* epistemic standards of the contributing disciplines, but to those which inhere *in postfoundational rationality itself*. I suggest that this development is both a natural extension of the model's basic dynamics, and demanded by the imperatives of the epistemic quest which it serves. Moreover it provides one possible way in which theological insights can make an equal contribution to the science-religion dialogue.

Keywords Van Huyssteen • Postfoundational rationality • Transversal space dialogue • Transversal outcomes • Haack • Crossword analogy

Any creative engagement, whether between individuals, artistic modes or disciplinary discourses, is governed by an implicit threefold metric of encounter, exchange and expression: Where, and around what nexus is interaction to be situated? In what manner is it to be facilitated and regulated? Finally, in what

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form are any resulting progeny to be “bodied forth”, and for what purpose? The choices and manoeuvres of the three are, moreover, woven together in a web of mutual influence and effect; and underpinning both the parts and the whole is the critical question of *“why?”*. Arguably the science-religion field, despite becoming a recognised and stable academic discipline (Clayton 2008: 1) and spawning innumerable books, papers and conferences, has not been entirely successful in either addressing the underlying question or negotiating aspects of the associated dynamic: certain tensions remain deeply embedded at the heart of the engagement, and with them important issues about the nature of the enterprise itself. Alongside these are legitimate questions as to the wider impact of the science/theology exchange, both generally and on its contributing disciplines. Drees' sombre assessment that: “consensus on issues of importance seems far away, the impact on theology and on religious communities is limited and the academic credibility of ‘religion and science’ remains marginal” (Drees 2010: 2) makes for uncomfortable reading, but is by no means unsupported (e.g. Knight 2001: 1–3; Polkinghorne 2008: xi–xiii; Smedes 2007: 596–597). Moreover while equality of contribution (e.g. Newberg 2010: 54), mutual enrichment (e.g. Murray 2011: 123), and the provision of answers to scientific meta-questions (e.g. Polkinghorne 1991: 75) are routinely claimed for the dialogue, they remain debatable. One need neither dispute that theology contributes to hermeneutics generally nor have the dialogical, epistemological, historical or anthropological naiveties identified by Jackelén (2008: 289–291) to legitimately question whether and how theology has contributed either to scientific understandings of the world or to scientific approaches to understanding the world – except for those who have concomitant religious and scientific commitments.

An implicit recognition of these assorted tensions within the field is evidenced by ongoing attempts to reframe the meeting ground (Hefner et al. 2010: 419–522), develop new methodological strategies (Gregersen and van Huyssteen 1998) and restate the basic nature and purpose of the debates (Drees 2010). It is the management of the “exchange” element of the dynamic which is the focus here, and in particular the alternative strategy developed and deployed by J Wentzel van Huyssteen (1998, 1999, 2006). This, with its emphasis on rationality as a practical skill shared across different domains of enquiry, and its associated dynamic of transversality, offers a combination of disciplinary rootedness, intellectual robustness and cognitive fluidity which is admirably suited to the challenges of science/theology interaction. Hitherto the dialogical mainstay of this has been to invoke a shared critical realism as a basis for sufficient disciplinary similarity to legitimate dialogue, despite the widely different subject matter. However both the elements of this philosophical stance present specific difficulties for theology (Bennett 2012: 175–188) and thus taking it as a basis for epistemological and cognitive parity has not been without significant problems. Whilst there may indeed be similarities in strategy, there are also significant and complex differences in epistemological focus, experiential sources and heuristic structures which cannot be so easily overlooked. Thus despite the claim of parity, there is still de facto a marked asymmetry to the dialogical and constraining relationship between the two disciplines. However van Huyssteen's refiguring of rationality brings in its train both a significant shift in the centre of gravity with respect to epistemological parity, and a reconception of the epistemic task. It thus offers new possibilities for negotiating some of these difficulties. The associated transversal space model set out and used to such rich effect in his 2004 Gifford Lectures (van Huyssteen 2006) also enables a somewhat different type of dialogical engagement between the disciplines. Moreover it carries within itself the seeds for a further development which opens up a very different way of integrating the insights of theology with those of science. Thus it also provides one possibility for addressing the questions of asymmetry and the role of any theological contribution alluded to above.

For van Huyssteen the prime locus of the postmodern challenge is to rationality *itself* (van Huyssteen 1999: 3). Hence his response has been to attempt to recover its rich resources without at the same time falling prey to the problems associated with postmodernism. Thus whilst conceding elements of postmodern critiques against foundationalism and accepting the necessity of abandoning modernist notions of rationality rooted in it, he also rejects the relativist forms of non-foundationalism and contextualism urged by postmodernity. Instead, in conversation with a variety of pragmatist philosophers he has plotted a course between "modernist metanarrativist overstatements of universality and objectivity" on the one side and "the extremes of postmodernist over emphasis on contextuality and personal judgement" on the other (van Huyssteen 2006: 12). The end result is an articulation of rationality not as an abstract concept, but as a complex embodied set of cognitive evaluative skills developed and conserved through evolutionary processes (van Huyssteen 2006: 92) and operating over all domains of experience. Hence the associated key epistemic values of intelligibility and optimal understanding, and the crucial epistemic skills of discernment and responsible judgement, are respectively realised and learned through the performance of everyday problem-solving activities. Moreover, since rationality resides "in the domain of our social, communal and institutional practices" (van Huyssteen 1999: 136), it cannot be confined to or exhausted by any particular discipline, research tradition or reasoning strategy. It is therefore not the exclusive preserve of a scientific approach to exploring the world.

Rationality thus construed is seen instead as a skill set enabling us "to gather and bind together the pattern of our interpreted experience through rhetoric, articulation and discernment" (van Huyssteen 2006: 18). In essence these skills allow us to range over and above the different constellations of thought and action which make up our situated experiences and to identify areas of consensus and dissensus between them, discerning where establishing connection might enable modification or transformation to occur, and where incommensurability precludes the possibility of any useful interaction (cf. Schrag 1994: 66–70). Van Huyssteen identifies this ability to distinguish and then assess the viability and potential productivity of these different connections as the first step in the operation of transversal rationality in specific interdisciplinary conversations (van Huyssteen 1999: 137).

Moreover, although recognising and acknowledging that we cannot think or act except through experiential understanding and engagement with our respective traditions (van Huyssteen 1999: 179–233), his formulation also provides the necessary mechanism for transcension through its central dynamic of articulation and critique: although part of the praxis of postfoundational rationality involves the *giving* of interpretation-laden accounts, it also contains within itself the resources and tools for *evaluating* these. For van Huyssteen this conjunction is not only key, but also another example of successfully negotiating a way between the respective errors of modernity and postmodernity: in the case of the former its glossing over of narrative, and in the latter its blindness, through an over-enchantment with narrative, to the "inescapable moment of evaluative criticism" (van Huyssteen 1999: 182). In contrast, the postfoundational rationality which he proposes allows a constructive appropriation of the return to locality and context demanded by post-modern understandings, while also supporting a process of critical judgement sitting over and above these. Thus whilst allowing us to remain connected in important ways with our formative traditions, postfoundational rationality also contains the absolute imperative to step outside of and stand in critical relation to them. More importantly it also furnishes the evaluative skills and tools with which to do this, thereby enabling us to reach out beyond our own immediate contexts in plausible forms of intersubjective, cross-contextual and cross-disciplinary conversation (van Huyssteen 2006: 10).

For van Huyssteen, developing a postfoundationalist perspective also involves reclaiming the epistemic quest from both the constraints of a foundationalism which is seen as no longer tenable, and the isolating disjunctions of a relativism which threaten to consign it to being nothing more than a local, contextualised conceit. Instead he reformulates it in terms of the pursuit, via increasing clarity and intelligibility, of the optimal understanding of an issue in any given situation (van Huyssteen 2006: 11). In this quest, post-foundational rationality provides the necessary judgemental tools not just for problem-solving, but also for the evaluative discrimination necessary for making progressive choices. Consequently the epistemic skills of rational judgement and theory choice are seen as forming part of a fallibilist process of progressive problem solving (van Huyssteen 1999: 12). The importance of this pursuit of clarity and understanding is indicated by the high value language of "epistemic responsibility" which van Huyssteen attaches to it, and his designation of it as "possibly the most important epistemic goal that shapes the way we interact with others, ourselves and our worlds on a daily basis" (van Huyssteen 2006: 11).

Under the postfoundational rubric, commonality between science and theology thus becomes located not in critical realism, but in the problem solving activities which sit at the heart of each discipline, and in the fact that both appropriate the same shared tools of rationality for these, albeit within very different reasoning strategies. Consequently epistemological and cognitive parity inheres not in an appeal to some universal guaranteed epistemology, but in the possession and employment of the skills and tools common to human rationality. This essentially moves the dynamic of connection between the two discourses from the *specific methodological* to the *shared rational.* Each discipline is therefore also answerable to the same epistemic standards – ones which are not domain-specific, but which are integral to the nature of postfoundational rationality itself: progress towards optimum intelligibility; the execution of responsible epistemic judgement for which suitable accounts can be articulated; an acknowledgement of the role of experiential accountability; and finally a willingness both to adopt a critical stance towards that which is rationally compelling, and to open it up to critical evaluation outside of its disciplinary home. This offers the possibility of a somewhat different approach to dialogue which van Huyssteen utilises through the development of a dialogical model predicated on the tenets of a postfoundational reading of rationality.

In terms of its actual dynamics, this model has two main features: first, a transversal reasoning by which dialogue is facilitated; and second, the delineation of what van Huyssteen terms "transversal spaces" in which such dialogue can be located. The former is essentially coterminous with the performative dynamics at the heart of postfoundational rationality and thus involves the same gathering and binding skills already described. In interdisciplinary exchanges these enable us to work, under the direction of the associated dynamics of epistemic responsibility, in and across the intersections of very different disciplinary discourses as they come together in dialogue in search of "a wide reflective equilibrium" (van Huyssteen 2006: 31). An essential element of this process is the ability to retain a sense of being connected to our disciplinary commitments and beliefs while consciously moving beyond their constraints. Whilst one may bring personal convictions deemed to be rationally compelling to cross contextual discussions, at the same time postfoundational rationality also means that one is rationally compelled to open these convictions to critical evaluation as a part of such dialogue (van Huyssteen 1999: 202).

The second key element of the model is a specific and novel conception for the locus within which the complex, many levelled connections and exchanges facilitated by transversal reasoning occur. Although van Huyssteen does not provide much in the way of detailed development, this is an integral part of, and a key element in, the model's rich potential. The essential and unique feature here is that this dialogical locus is situated not within the confines of any one contributing discipline, but in what he labels "transversal spaces" sitting between them at their "porous boundaries" (van Huyssteen 2006: 9, 43). These are not a disciplinary construct but instead are *shared rational spaces* located at specific points of intersection between disciplines – for example common interests or research foci. As such I believe that they can appropriately be conceived as liminal spaces with all the openness of outcome possibilities that this implies. Since they do not "belong" to any of the participating disciplines, they are neither regulated by them nor constrained by any of their particular features *vis-à-vis* epistemological strategies or warranting, answering instead to those of postfoundational rationality. In fact it is the very nature of a dialogue predicated on its tenets which generates them. It is also what sustains them as places where the different disciplinary voices can operate with a freedom from the assorted constraints which characterise other models. Both their shape and structure, and the freedom they confer, is a direct consequence of the shift in the ground of connection already outlined and the related translation of epistemic standards to those which inhere in rationality itself rather than in any particular methodological approach. The net result of this is that the voices contributing to dialogue need no longer be seen as in contradiction or competitive; neither need they be suspected of being predatory in a reductive or assimilatory way.

Transversal spaces are thus dynamic places of interaction, based on the shared tools of rational enquiry and coming into transient existence as part of a cross-disciplinary engagement on a specified topic. The freedom they entail allows for mutual influence and critique – the exchange of ideas and insights, models and reasoning strategies, in a non-assimilative, multidirectional manner. This effectively transforms boundary transgression from a subversive undertaking (Greenberg 1990: 1) into a potent driver in the quest for optimal understanding of a given issue. Thus the transversal space model, simply as it stands, already offers a promising way of negotiating some of the residual dialogical tensions previously noted. Nevertheless, as his repeated reiterations make clear, van Huyssteen also regards the outcomes of any such engagement to be essentially *inter*disciplinary (van Huyssteen 2006: 35, 159, 273, 307, 323). That is to say, its output trajectories are always downwards back into the contributing disciplines to enlarge, clarify or challenge their respective understandings of the area under exploration (van Huyssteen 2006: 264). But even in his own Gifford project, there is still an inescapable asymmetry in the terminology with which the different outcomes for science and theology are articulated: van Huyssteen sees its "most important interdisciplinary result" as the powerful revisioning of the theological notion of the *imago Dei* in the light of the scientific contribution; at the same time, he remains virtually silent on what the theological input has contributed to scientific perspectives (and here his use of the designation "sympathetic scientist" is also telling) on human uniqueness (van Huyssteen 2006: 322–323). Thus the questions of theology's contribution to the dialogue still linger. However I believe that the model can also generate additional outputs of a very different kind, and in so doing address this vexed problem of dialogical asymmetry. The extension I wish to propose, and which I have employed in my own doctoral thesis to interface data from theology, immunology and cognitive neuroscience, is essentially a very simple one. I would argue moreover that it is both in harmony with the intrinsic nature of the model itself and of the postfoundational rationality which undergirds it, and a natural consequence of the imperatives that these entail. It is also in keeping with the liminal nature of transversal spaces that, as "realms of pure possibility", they can give rise to novel configurations of ideas and relations of the kind proposed here (cf. Turner 1967: 97).

In light of the dynamics outlined for both postfoundational rationality and transversal dialogue, a good case can be made that under appropriate circumstances, van Huyssteen's model can also support the possibility of an additional and different type of outcome arising from the transversal space dialogue, to sit alongside any specific interdisciplinary ones. The trajectory envisaged for these outputs is not back into the participating disciplines themselves but instead would lie between and beyond them in a way not dissimilar to the spaces themselves. As such they would, like the dialogue which engenders them, exist and be supported in the shared rational space between the contributing disciplines; and thus they too would neither belong to, nor be fully constrained by these. Clearly any such arguments and models would be neither strictly "scientific" nor "theological" in their formulation and expression. Instead, drawing on and knitting together disparate material brought into the transversal space by the contributing disciplines, they could appropriately be designated as "transversal". Similarly, just as with the transversal dialogue, they would not be answerable to the domain-specific epistemic standards of the contributing disciplines, but to those which inhere in postfoundational rationality itself, as set out above. What I wish to suggest therefore is that under the existing parameters of the model it is also possible, using the tools of rationality which it already employs, to sometimes bring together perspectives or data from different disciplines to build *composite* arguments and models which are coherent, stable and do not involve any improper appropriation or blending of material. I see this as a logical development of the model, standing in direct continuation with the dynamic operations of both transverse rationality and the transversal space interactions themselves. As such it thus receives both sanction and support from the model's two central elements.

With respect to the first of these – as discussed above, a postfoundational understanding of rationality sees it as a set of practical skills whose hallmark is a certain cognitive fluidity. These enable us to identify, explore, and bind together different elements and patterns in our assorted experiences. In interdisciplinary exchanges these same skills enable us to work, under the direction of the associated dynamics of epistemic responsibility, in and across the intersections of very different disciplinary discourses as they come together in dialogue. This allows the identification of places of actual and potential connection, and attention to the possibilities inherent in these for increasing understanding of the topic under consideration. However this self-same cognitive fluidity can also be employed at a more *meta* level to also range over and above *these* different developments in the transversal space dialogue; likewise the same practical skills of transversal rationality can be used to evaluate, take up and connect elements from different discourses which are held in the transversal space as part of the interdisciplinary dialogue. In effect, then, this is simply the same dynamics and skills being engaged in connection with a different constellation of thought and action – that which belongs to the "situated experience" of a specific transversal space dialogue. It thus represents a natural extension to van Huyssteen's "first movement of transversal rationality" i.e. that of identifying and evaluating viable and productive connectional possibilities in specific interdisciplinary conversation. It is also completely in keeping with the anticipative nature of this rational articulation through which it identifies and marks out new possibilities for both discourse and praxis (cf.van Huyssteen 1999: 137–138).

The development of transversal outcomes can also be seen as being driven by another integral element of van Huyssteen's refiguring, viz. the pursuit of the epistemic quest. In the postfoundational perspective, this is conceived in terms of optimal understanding, realigning progress in this regard with improved problem solving ability, rather than with correlation to "absolute truth". Such a reconfiguration furnishes both imperative and warrant to use the skills of rationality to pursue different possibilities for achieving these goals. Moreover it means that any resulting transversal argument or model can be evaluated by these same standards of optimised understanding and improved problem solving, rather than by specific epistemic standards such as those, for example, which attach to the scientific method. Thus the development of transversal outputs simply represents an extension of the cognitive skills of postfoundational rationality which already undergird and facilitate van Huyssteen's dialogical model.

The second key element offering validation and support for suggesting such an extension is the actual mechanics of the model itself, particularly as these act as critical filtering mechanisms. First, the nature of the transversal space model is such that any dialogical ground is already fairly specifically delimited. This pre-selection of closely intersecting interests, even if dissensus is the predominant voice, increases the likelihood of discovering elements from different disciplines which might be connected to yield transversal outputs. Moreover, as already noted, the identification of just such possible areas of fruitful connection is a key skill of transversal rationality. This dynamic and its associated skills could also arguably be extended to facilitate pre-identification of those conversations in which the development of a transversal output might conceivably be either an appropriate course to actively pursue or a likely spontaneous outcome. In this instance, one possible scenario might be where a question has been raised in one or more of the contributing disciplines which cannot be completely answered from within *any* of them.

Secondly the application to all contributing material – both prior to and during the course of transversal conversation – of the required epistemic standards of postfoundational rationality also acts as an additional filter. One of the model's criteria is that contributory positions need to demonstrate that any material intended for transversal dialogue is suitably accountable to the standards of postfoundational rationality and thus displays the features of responsible judgement and a fallibilist approach. These standards also preclude the offering of privileged protection to any dialogical partner, demanding that all convictions must be open to critical evaluation as a part of such dialogue. Thus at various levels of the dialogical process, there is a winnowing of data, theories, and models through the mechanisms associated with epistemic responsibility. This allows various elements which might be incorporated into a planned transversal output to be evaluated against the standards of rational and epistemic accountability inherent in the model. This in turn gives a confidence that for any selected element, a suitably robust account of its defensibility in these respects can be articulated. The notion of defensibility leads finally to the important question of whether, given their hybrid nature, the proposed outcomes are themselves warrantable. Here, once again the twin dynamics of postfoundational rationality and of the model itself hold the key through the nature of the evidential support for beliefs and claims which these enable.

In developing a postfoundational account of the connections between experience and how we justify the beliefs arising from this, van Huyssteen draws on Susan Haack's foundherentism (van Huyssteen 1999: 222–230). Haack works through a carefully and closely argued sequence involving the differentiation between the state and the content of belief, evidential and non-evidential components within the causal nexus of these, the strength of justification, and the role of the passage of time. From this she builds a case that the justification of our beliefs is never unidirectional, but always involves relations of mutual support between them. However, this relationship does not merely describe a perpetual circular trajectory, but is genuinely interlocking (Haack 2009: 117–139). Here her argument is developed through the use of a helpful crossword puzzle analogy (Haack 2009: 126ff). In essence crossword clues become analogues of the subject's experiential evidence, and already completed entries analogues of his/her reasons. The reasonableness of any crossword entry depends on a number of things: how well it fits with both the clue and any other already completed intersecting entries; how reasonable those other entries are, independent of the entry in question; and how much of the overall crossword is completed. Similarly, how justified someone is in believing *that p* depends on how supportive their evidence is, how secure any reasons are independent of the belief itself, and how much of the relevant evidence their own particular moiety includes. Hence the good reasons for the beliefs we hold are always justified by a mixture of experience and other beliefs. In other words the *explicandum* is always couched in terms of "A is more/less justified in believing *that p* depending on [. . .]" (Haack 2009: 58).

The same crossword analogy can be used both to support the development of transversal models and arguments generally, and as a way of assessing the relative coherence and strength of any specific one. Here it is important to state something about the nature of the transversal developments proposed. What is envisaged is not the uncritical transfer of theological convictions into science to function as "data" within its systems, neither is it a reverse flow which places theological agendas under the direction of science. Indeed van Huyssteen has rightly cautioned against both such manoeuvres within transversal space dialogues (van Huyssteen 2006: 323–324). On the contrary, what is critical here is that the different contributions are in no way envisaged as operating in a "god-of-the-gaps" type manner. Hence this is not a case of theological perspectives plugging holes in the scientific data, or vice versa. Instead different disciplinary perspectives interlock to provide the sort of "pervasive relations of mutual support" for a thesis which Haack (2009: 57) describes. In this way it is envisaged that arguments and models may be built in response to particular questions, even in the absence of direct definitive evidence from within a particular discipline, on the basis of mutually supportive, albeit radically different, types of evidence.

A brief example from my doctoral thesis can illustrate the process. One of the central chapters considers whether relationality can be designated as an emergent phenomenon. However assorted methodological issues preclude the possibility of establishing this from within the perspective of a single discipline and so a composite argument is developed from a particular transversal space exchange. In this, each of the project's three disciplinary voices provide evidence, at levels from the cellular to that of conscious embodied experience, for the existence or operation of a different key feature of emergent phenomena. Thus experimental data from cognitive neuroscience and immunology give input on the presence of system complexity and the possibility of top-down influence respectively, whilst theological reflection based on the work of von Balthasar supplies key insights on the role of restraint in the development of relationality. Together the three very different perspectives interlock to provide the kind of mutual support for claiming the position which Haack describes.

It is here, then, that the applicability of her crossword analogy becomes clear. The plausibility of any entry depends on various things: how well it fits with both its clue and any intersecting entries: how plausible these latter are *independent* of the entry in question; and on how much of the overall crossword is completed. Similarly, the relative strength of a claim depends on how supportive the evidence actually is, how secure this evidence is independent of the claim in question, and how much of the relevant evidence it includes (Haack 2007: 24). In other words the key features required in building a convincing case are supportiveness, independent security and comprehensiveness, where supportiveness is not categorical but a matter of degree (Haack 2007: 66). Translating this to the context of the proposed transversal arguments and models: different contributions to a specific transversal space dialogue (which thus potentially come from different disciplines) can be seen as standing for the different entries in the puzzle and as offering support for other possible entries to be added, even if the clues leading to these are not always completely clear.

Assessment of the evidence supporting each of these individual entries comes from the operation of the tools and dynamics already described, at both disciplinary and transversal level. The degree of confidence with which each such entry can be made is likely to be variable, and thus whereas some answers may be "inked in" with a fair degree of certainty, other elements of the model being built may remain rather more provisional "pencilled" entries, subject to revision at a future date as more data are accrued or ideas develop further. This however is completely in keeping with the dynamics of epistemic responsibility entailed by postfoundational rationality. Indeed Haack herself uses the picture of a giant crossword with many entries blank, some completed in indelible ink, others in regular ink, still others pencilled in and repeatedly rubbed out, to describe how the growth and integration of the body of scientific knowledge itself proceeds (Haack 2007: 93–94). Over and above this method of evaluating the strength of any proposed construction, transversal models can also be judged on the same criterion as those which Laudan proposes with respect to scientific progress generally: the degree of conceptual clarification enabled, and the balance achieved between resolving/generating empirical and conceptual problems (Laudan 1977: 119–120, 1996: 77, 87). Such indicators of the coherence and usefulness of any particular argument or model thus generated are also completely in keeping with the conceptualisation of epistemic accountability expounded by van Huyssteen.

In conclusion, then, the proposed development of van Huyssteen's model is not only a natural extension of its normal workings, but also one demanded by the imperatives of the epistemic quest which it serves. Furthermore, the skills employed in the identification and construction of the proposed transversal outcomes are those which are already at work driving the dynamics of the model as it currently operates. As regards its potential contribution to the further development of the dialogue between science and theology, it opens up the possibility of establishing a different fulcrum from that on which much interaction currently turns (i.e. that of causal mechanisms and an emphasis on *theos*) and whose end-product often seems to be various species of apologetics (cf. Drees 2010: 12–37). Instead it offers a mechanism for generating and facilitating non-reductive conversations, particularly with the neurosciences, in which theology's wealth of rationally developed insights on *anthrōpos* can make a full and equal contribution to expanding knowledge and understanding of humanness. In an era where information production is outstripping and swamping knowledge use at both individual and institutional level (Frodeman and Mitcham 2007: 507), such conversations form a key part of a much larger and vital project for reconceptualising how we can integrate increasingly sub-specialised disciplinary outputs to construct the complex knowledge envisaged by Morin (2008) and vitally necessary to life in an ever more fragmented world.

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