TILLICHIAN TELEODYNAMICS: AN EXAMINATION OF THE MULTIDIMENSIONAL UNITY OF EMERGENT LIFE

by Adam Pryor

Abstract. Emergence theory has generated many significant new questions for dialogue between theology and science. My work will examine the models of one emergence theorist, Terrence Deacon, and consider the constructive potential of Tillich's multidimensional unity of life for responding to the theological ramifications of this account of emergence theory. Such a Tillich-inspired constructive process will rely upon Robert Russell's method of "Creative Mutual Interaction." Building on the interactive quality of Russell's method, I will also begin to offer suggestions for how Tillich's theological themes might influence scientific research programs using Deacon's emergence theory by contributing to the process of defining life. Finally, I will conclude by identifying three facets of continued research that stem from this analysis, focusing primarily on its implications for theological anthropology and what it means to be in the image of God.

Keywords: autocell; Terrence Deacon; emergence; image of God (*imago Dei*); multidimensional unity of life; Robert John Russell; Paul Tillich

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In a lecture to the North American Paul Tillich Society, later published in *Zygon*, Robert Russell outlines many topics of twentieth-century theoretical science that have resonance with Tillichian themes. His hope was to provide the groundwork for more extended treatments of those facets of Tillich's theology that could be potentially fruitful for interdisciplinary dialogue with natural science (Russell 2001, 270). For Tillich, theology is concerned with relating existential questions and theological answers. By thinking of theology in these terms, what he calls the "method of correlation," theology is under a constant state of renewal: needing to be rearticulated in light of the changing questions of each new generation. What Russell helps clarify in this scheme of existential questions and theological answers is how science poses questions of existential significance.

I have found Russell's proposals in this regard to be an interesting and overall convincing point of departure for my own work. Russell suggests correlating features of nonlinear thermodynamics, such as in Prigogine's

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[*Zygon*, vol. 46, no. 4 (December 2011)]
 ISSN 0591-2385

account of developing order-out-of-chaos, to Tillich's notion of continuing creation. However, in the spirit of changing existential questions, I will focus on creating correlation with the work of Terrence Deacon on emergence theory. His work examines the processes of organization that allow order to develop out of chaos. In particular, I will consider his unique model of the "autocell." The autocell is particularly interesting because it points to the place where teleological behavior first seems to be instantiated in the universe and stretches our preconceptions about what separates living and nonliving things.

In what follows, I will use Russell's method of Creative Mutual Interaction (CMI) to correlate Deacon's work on emergence as a Scientific Research Programme (SRP) to Tillich's "multidimensional unity of life" (which is a part of his work on continuing creation) as a Theological Research Programme (TRP) (see Russell 2001, 278–80; 2008, 1–24). After reviewing Tillich's and Deacon's work, respectively, I suggest that Deacon's work will indicate a needed emendation of Tillich's multidimensional unity of life, if it is to fruitfully be in conversation with origins of life theorists. Given this emendation, I will outline how Tillich's multidimensional unity of life might provide philosophical assumptions and analogies that could prove beneficial to trajectories of emergence theory and origins of life research.

Tillich's Multidimensional Unity of Life

Defining "life" as a technical term in any discipline is notoriously difficult, and it is a difficulty that Tillich does not gloss over. Tillich seeks an ontological conception of life, which he defines as the "actuality of being." It is a concept derived from the phenomenological characterization of those existing things that we deem living in a quotidian sense. What he discovers is that living things are those that emphatically include their own negation: living beings are always dying beings (Tillich 1963, 11).

By Tillich's account this approach to defining life has two distinct advantages. First, this ontological definition of life fits very well within the dialectical tension of the essential and existential that characterizes his systematic approach as a whole. As actualized being, life incurs the conditions of estrangement and represents a mixture of essential and existential elements in all its manifestations. Second, "The ontological concept of life liberates the word 'life' from its bondage to the organic realm and elevates it to the level of a basic term that can be used within the theological system only if interpreted in existential terms." (Tillich 1963, 12). Tillich's definition of life makes it a "structural condition" for all being.

Tillich's concept of the multidimensional unity of life is intended to represent the essential quality of life; it is an idealistic precursor to his existential analysis of the ambiguities of actualization. When

describing these essential dimensions of life, Tillich intentionally avoids the hierarchical concept of level (1963, 12–15). In this way, his approach remains distinct from a minimalist interpretation of Aquinas' great chain of being: the protestant principle will not allow such a hierarchically and mutually independent notion as levels when it comes to characterizing life.[1]

Instead of the metaphor of level, Tillich proposes the technical terms dimension, realm, and grade. The problem caused by the mutual independence of levels, namely how to characterize the relationship *between* levels of life, disappears when our vision of the actuality of being is characterized in terms of the metaphor of dimensions. Dimensions (unlike levels) can cross one another without being in conflict; dimensionality is introduced as a metaphor to emphasize the continuity of all life. If conflict exists between dimensions, it is a result of the ambiguity of existential actualization that is inherent to all life processes. Still in need of some taxonomic means of distinguishing the variety of living things, Tillich introduces the term "realm." It is used in a social sense (as in a kingdom) that preserves the discontinuity and uniqueness that the metaphor of levels previously indicated. It represents those strata of living things under the rule of a particular determining dimension.

There is an interplay between the metaphors of dimension and realm unfolding. In any realm, all of the dimensions are present, even if only potential. This interplay leads us directly to Tillich's third concept: gradation. There exists a gradation amidst living things so that those dimensions that characterize higher realms rely upon the actualized dimensions of lower realms (a new dimension does not replace a previous dimension). Further, "in the realm which is characterized by the already actualized dimension particular constellations occur which make possible the actualization of a new dimension" (Tillich 1963, 16). This relationship between dimensions makes a classificatory schema of realms different from levels and allows for an ontological gradation of value amidst living things: where the criterion of such a value judgment is the maximization of actualized dimensions (Roesler 2006, 70–71; Tillich 1963, 15–17).

In Tillich's account, he identifies five realms within the multidimensional unity of life. He is careful, however, to note that these five realms are not final: as the phenomenological analysis of living things yields new dimensional categorizations, this set of realms may expand or contract. In this account, newly actualized dimensions that rule over a particular realm are identified by their modification of the finite structures of being and thinking that make up the fourth-fold of Tillich's ontology.[2] Below, I have included a table (Table 1) of Tillich's five realms, for quick reference, with the appropriate distinguishing dimensions. Each of these dimensional distinctions represents a modification (phenomenologically) of time, space, causality, or substance that characterizes the dimensional predominance for that realm.

Table 1. Tillich's Dimensional Distinctions

Realm	Dimensional distinction
Inorganic	Actualization of substance
Organic	Self-related, self-preserving, self-increasing, and self-continuing *Gestalten*
Psychological	Self-awareness or an individual inner awareness
Spirited	The personal-self
Historical	Purposeful processes, the influence of freedom, production of the new, and significance of unique events

The characterizing dimension of the inorganic realm is fundamentally necessary for the actualization of every other dimension: it is the substantial actualization of a living thing that makes possible "spatial-temporal-causal relations" (Tillich 1963, 19). The inorganic signifies a fundamental phenomenon by which there is something rather than nothing, and its actualization is of fundamental importance to Tillich's rejection of process philosophy (1951, 197; 1963, 25–26 & 297–99). As such, it is the dimension symbolizing God's originating creativity.

The organic realm might also be called the vegetative, and it is characterized by "self-related, self-preserving, self-increasing, and self-continuing Gestalten (living wholes)" (Tillich 1963, 20). The emphasis on the development of self in these dimensions is clear. It seems to echo the formulation that Tillich rehearses in the first facet of his fourfold ontology—where self-centeredness occurs when "the reaction to a stimulus is dependent on a structural whole" (1951, 169). We might summarize by suggesting that the dimensions of the organic realm perpetuate an identifiable self, composed of constellations of inorganic substance, which through the use of spatial-temporal-causal relations interacts with its environment.

The psychological realm might also be called the animalistic. It builds upon the self-referential Gestalten of the organic realm. Those dimensions of the organic interact in such a way as to actualize self-awareness of life or an individual "inner awareness." Tillich identifies the presence of this inner awareness on analogy to the human being. "It seems wiser to restrict the assumption of inner awareness to those realms in which it can be made highly probable, at least in terms of analogy, and emotionally certain in terms of participation—most obviously in higher animals" (Tillich 1963, 20–21). This analogical approach suggests that we might imagine the psychological realm representing a new complexity in the way a self uses spatial-temporal-causal relations, whereby the dimension of self-awareness represents a partial actualization of the ontological polarities. Most notably, Tillich's description of the dialectical relationship between

vitality and intentionality as part of the dynamics-form polarity helps give language to describe the dimensional distinction for this realm (Tillich 1951, 180–81). The vitality and intentionality of the psychological realm is more evident than in the organic realm, but lacks its fullest instantiation as in humankind. The psychological is a deeply transitional realm for Tillich.

The full ramifications of this transitional realm are manifest when we consider the spirited realm. It is here we find the actualization of a personal-self that transcends the constitutive dimension of its psychological realm; it is, in many ways, the full actualization toward which Tillich's analogy that constitutes the psychological realm is pointing. Tillich offers two examples of this action of the centered-self: epistemological and moral acts. In both of these cases, a variety of phenomena of the psychological realm is sorted through, but not by some structure that is additional to the psychological phenomena. Rather, the personal center arises from the psychological phenomena itself; it is the center of the psychological phenomena standing as a unique property that is comprised solely in the enacted totality of the phenomena. This is especially clear in the example of the moral act where "drives, inclinations, desires, more or less compulsory trends, moral experiences, ethical traditions and authorities, relations to other persons, and social conditions" are sorted through by a personal-self that in this act transcends these elements themselves (Tillich 1963, 27–28 & 38–41). Thus, we can summarize the spirited realm as the dimension wherein we discover a personal-self enacting the pole of freedom in the ontological polarity of freedom-destiny. Further, remembering that it is with the finite freedom of the human being that the spirited realm actualizes, we can claim that the spirited realm is the dimensional location of human uniqueness and our being in the image of God.[3]

The historical realm deserves a much fuller treatment than I might offer here, for in many ways it is the most complex of the realms and the dimensional preponderance that characterizes it represents the actualization of the potential. The historical realm is present in the actualization of all the other realms as the dynamics of life (the actualization of being) itself. So also, the actualization of the other realms are themselves historical events within the history of the universe. In this way, the historical realm is actualized in "an anticipatory way" and embraces all of the other dimensions (Tillich 1963, 26 & 297). Note the subtle difference of the realm of history from all other realms on this point. The dimension of the spirited realm, for instance, may be potentially present to the psychological realm, but its dimensionality is not actualized. In the case of the historical realm, its dimensional characteristics of the occurrence of purposeful processes, to be under the influence of freedom, to produce the new, and the enacting of the significance of unique events, are analogically actualized, but remain unfulfilled. It is only in human history, in the history of spirited beings,

that the historical realm is fully actualized; it is only in the spirited life, which can experience ultimacy and meaning, that the historical realm is actualized (Tillich 1963, 302–306).

The description of the realms in Tillich's multidimensional unity of life seems so divided and hierarchical that it is easy to forget his rejection of the metaphor of levels. However, we must remember that the realms only represent a dimensional preponderance and that transition between realms is not sharp. Tillich's recounting of the uniqueness of the "awakening" of historical being in humanity serves as an excellent example of this point. It reminds us just how important his shift to dimensional language is and of the complexity of the relationship that exists between realms as their dimensional constituencies overlap.

> Prehistorical man is that organic being that is predisposed to actualize the dimensions of spirit and history and that in his development drives toward their actualization. There is no identifiable moment when animal self-awareness becomes human spirit and when human spirit enters the historical dimension. The transition from one dimension to the other is hidden, although the result of this transition is obvious when it appears. We do not know when the first spark of historical consciousness dawned in the human race, but we do recognized expressions of this consciousness. We can distinguish historical from prehistorical man though we do not know the moment of transition from one to the other because of the mixture of slow transformation and sudden leap in all evolutionary processes. If evolution proceeded only by leaps, one could identify the result of each leap. If evolution proceeded only by a slow transformation, no radical change could be noticed at all. But evolutionary processes combine both the leap and the slow change, and therefore, although one can distinguish the results, one cannot fix the moments in which they appear. (Tillich 1963, 307)

Deacon's Concept of Emergence and the Autocell

Characterizing emergence theory is notoriously difficult. The term has become an umbrella for a wide variety of projects and research programs spanning many different traditional scientific fields. As Philip Clayton has rightly identified, at first blush emergence theory is not itself a scientific theory, but a meta-level concept seeking to explain iterative causal patterns that appear across many different scientific disciplines (2008, 64–66).

The complexity of emergence theory is amplified when we clearly articulate the philosophical distinction at stake between various emergence theorists. Typically this distinction has been labeled epistemological versus ontological, or weak versus strong emergence. In accounts of weak emergence, the iterative or emergent processes identified describe *properties* of a single ontological reality. No ontologically new things arise from weak emergentist accounts; only a single (usually physico-reductionist) ontological reality exists upon which *descriptive* properties

indicate greater complexity. The causal work of weak emergence occurs at the most fundamental microphysical levels. By contrast, accounts of strong emergence yield an ontologically new causal agent or causal process. It is not just a property that emerges, but an emergent whole with irreducibly new causal power. It is quite easy to slip into a vacillating language about emergence that inadvertently tries to entail both of these incommensurable positions at the same time (Silberstein and McGeever 1999, 182–84). Still, at stake in both positions is an understanding of an ontology in which different levels are recognizable by novel causal production.

Terrence Deacon's work is a form of ontological or strong emergence. Yet even amidst strong emergentists, there are a variety of approaches one can take to explicating the relationship across the novel levels of emergent causal powers. In its broadest conceptions, emergence theory simply refers to the unexpected appearance of something new: the emergence of some novel feature that could not be conclusively predicted to occur given its constituent lower level parts. In such a guise, emergence theory is a prototype of the aphorism "the whole is greater than the sum of its parts."

However, the difficulty of such a broad definition is that the nature of such newness remains ambiguous. How is the emergence of heavy elements similar or dissimilar to the process of the emergence of life, and then further how might it be related to the emergence of consciousness? What is critical for the scientific study of emergence theory is to better explain the relationship between processes that explain how a new property within the universe comes to be. If the process of *how* these novel phenomena emerge cannot be explained, however, then the correlation between phenomena termed emergent is descriptive: a hopeful placeholder in a holistic metaphysical system straining against reductionism.

Terrence Deacon's approach to emergence is able to strongly rebuff the "hopeful placeholder" accusation. He attempts to set out "a technical sense of emergence that explicitly describes a specific class of causal topologies (i.e., self-constituting causal structures)" (Deacon 2006a, 123). Only by better understanding the dynamical interaction that gives rise to an emergent property are we really equipped to begin discussion about the ontological status of the property. Given this approach, we should not be surprised that much of Deacon's work focuses on the emergence of entities and properties at or beneath living forms. In terms of Tillich's multidimensional unity of life, we can say that Deacon's work focuses on the dynamics of the dimensional structures that create the transition from the inorganic to the organic realm.

This emphasis on causal topologies or underlying dynamic interaction is immensely important to understanding Deacon's work. The emergent property or effect is of secondary value; what is critical in explicating emergence theory for Deacon is to identify the underlying organizational

change giving rise to the emergent property. To make a significant change in the quality of this organization is akin to instantiating a new causal law.

To best understand this emphasis on causal topology, it is helpful to think of Deacon as reclaiming a lost insight of one of the earliest emergentists: J.S. Mill. Even before G.H. Lewes coins the term emergence, Mill captures the spirit of emergence theory with his examination of "homopathic" and "heteropathic" effects. Homopathic effects are characteristic of mechanical causes that can be understood in arithmetic terms. According to Mill, a mechanical cause produces a given effect; a number of different mechanical causes will produce an effect that is the sum of the effects of the individual mechanical causes. Specifically, he thought of mechanical causes in terms of the addition of forces in physics. Effects of multiple mechanical causes are still homopathic. Playing on the idea in physics that this additive principle of vectors is called the composition of forces, sometimes Mill uses the term the "composition of causes" to describe the mechanical quality of homopathic effects.

These are different from heteropathic effects that are characteristic of chemical causes. *These causes violate the additive quality of mechanical causes.* One of Mill's examples was that the combination of sodium hydroxide and hydrochloric acid (two agents with mechanical causes detrimental to living things) produce table salt and water (two agents with mechanical causes needed for life). Here, the combination of two detrimental mechanical causes does not just produce double detriment. Instead, we have an emergent effect: what Mill calls a heteropathic effect ([1843] 1965, bk. 3, chap. 6, §1–2).[4]

How is this related to Deacon's development of emergence theory? We have to consider how Mill is developing his understanding of homopathic and heteropathic causal effects: "To whatever degree we might imagine our knowledge of the properties of the several ingredients of a living body to be extended and perfected, it is certain that no mere summing up of the separate actions of those elements will ever amount to the action of the living body itself" ([1843] 1965, bk. 3, chap. 6, §1). The living body is produced as a series of heteropathic causal effects. What we find then is that the heteropathic is not limited to the level of chemical effects, but describes a particular mode of causality that is distinct from the "composition of causes" yielding homopathic effects. Just as Mill makes a case for emergent, heteropathic effects being the product of a fundamental shift in their mode of causality, Deacon's approach to emergence theory is reclaiming this original emphasis on searching out the production of new causal laws. In Deacon's account, these new causal laws are actually fundamental changes in the organization of processes that cause new properties and entities to emerge. I hope that it is already beginning to become clear, as well, that Deacon's approach to emergence theory views the appearance of complex novelty as a red herring. What is curious about emergent phenomena for

Deacon is that they represent an increase in complexity against what we would expect given the second law of thermodynamics in open systems: an increase in entropy. We should be seeing evermore chaos and less order. Remembering that for Deacon emergence refers to a set of causal topologies, the appearance of a novel structure is really better understood as a symbol indicating the potential presence of a constitutive emergent topology. The ordered features of novelty are the structural traces of "regularities in the dynamics of a process," wherein it is the process that is emergent (Deacon 2006a, 118).

Deacon envisions three categories of emergent dynamical processes, wherein the two more complicated processes couple two factors: "stochastic amplification logic and reciprocally reinforcing patterns of bias and interaction constraint" (2006a, 125). This is a basic circular causality (or what we might more precisely call nonlinear dynamics), wherein the stochastic amplification iterates throughout an entire system exploring the possibility of an increasing diversity of outcomes—then the system comes to be defined by global biases reinforcing the stochastic amplification, making more probable some smaller set of particular outcomes from the total possible outcomes. Two of Deacon's three categories of dynamical processes manifest this feedback form of recurrent causal topology.[5]

The only order Deacon describes that does *not* fit this reciprocal form is first-order emergent processes. These processes have nonrecurrent causal topologies and produce thermodynamic effects. Typical examples of this "simple" set of emergent properties are surface tension in a liquid or viscosity. Let us follow the case of the surface tension of water: here, it is the shape of water molecules themselves that bias the way many water molecules near each other can interact. The bias limits the "freedom" of the water molecule in such a way that a particular orientation of the molecule is iteratively favored creating a holistic property (surface tension) that, in typical emergentist language, we might say "supervenes" upon the lower level features (Deacon 2006a, 127–30). These first-order processes are nonrecurrent because the amplification of biases is actually canceling out the perturbations of the system and moving it toward greater entropy and uniform distribution.

Second-order emergent processes have simple recurrent causal topologies. These simple recurrent causal topologies produce morphodynamic effects. A typical example of this second-order emergence would be the appearance of hexagonally symmetrical Bénard cells in an evenly heated liquid of uniform depth. In this example, the liquid begins in a state of equilibrium. The even heat on the bottom of the system perturbs this state, so that liquid molecules on the bottom of the system have a decreased density through the continual influx of thermal energy. This lighter liquid on the bottom moves to the top in an effort to convey its heat and return to a state of equilibrium. This movement, given the finite space, presses

the cooler top liquid down to the bottom, which is then heated. Initially, the molecules may simply rise and fall, but with higher and higher thermal energy input into the system, a convection dynamic has to form in order for there not to be a local accumulation of heat. The result is the macroscopic effect known as Bénard cells—whose hexagonal shape is incidental to being geometrically most dense, but necessitated by the rapidity with which the heat must be conveyed (Deacon 2006a, 130–31).

How are second-order emergent processes different from the first-order processes described above? In the first-order processes, the only constraining feature is the shape of the molecule itself. But this bias alone only enacts a standard thermodynamic process that tends toward entropy, insofar as entropy represents the most statistically even disbursement of molecules given the conditions. In the example given for the second-order emergent processes, it is a set of thermodynamic processes that enable the morphodynamic formation of Bénard cells: without the constant input of heat causing perturbation in the system that strives to regain a state of equilibrium, the morphodynamic feature could not form. Here, the convection cycles that create these hexagonal cells are the product of two thermodynamic processes in relationship to one another (the input of heat that causes iterative movement of the molecules and the shape constraint spontaneously formed by the agitated molecules continuously bumping into each other and then forming currents so as best to convey the heat). The second-order emergent process is called simple recurrent because it relies upon the recurrent input of heat (in this example) for the emergent effect to form. In the first-order emergent process, no recurrence is needed for the property to emerge since the shape of the molecule itself provides the constraint for the emergent property.

In the most basic terms, the thermodynamic effect describes the tendency to evenly distribute elements across a system. The morphodynamic effect forms by harnessing the power of two thermodynamic effects and pitting them against each other. This pitting against each other (or biasing) limits the nearly infinite possible states each thermodynamic effect might demonstrate on its own in generating even distribution; instead, the thermodynamic effects pitted against each other yield a very limited number of likely (probabilistic) outcomes. The stability of these likely outcomes synergistically link the two thermodynamic effects as a simple recurrent causal topology yielding a morphodynamic effect.

Third-order emergent processes have hyperrecurrent causal topologies. These topologies produce teleodynamic effects. It is at this stage that we have, at the very least, a proto-biotic entity and its lineage that is subject to evolution by natural selection. Just as the recurrent causal topologies of morphodynamics rely on thermodynamic effects, we find that the hyperrecurrent causal topologies of teleodynamics rely on morphodynamic effects. In fact, teleodynamic processes rely on (at least) two reciprocally

related morphodynamic processes. Deacon's example of an "autocell" is helpful in understanding this most complex emergent topology.

In its most fundamental articulation, the autocell consists of two concepts related to ubiquitous features of life: autocatalysis and containment. Containment, being a bit more straightforward, is that feature of the autocell that separates it from the rest of its world. Without the separation caused by self-assembling containment (the special form of containment at stake here that relies on the local interaction of parts to create an encapsulating boundary), the complex molecular processes needed for life would fall prey to the thermodynamic tendency toward entropy. It is rare though to find enough substrate material in a localized space in order to assemble an entire container. Autocatalysis is a nonequilibrium chemical process where there is a circular arrangement of molecular interaction. Imagine six chemicals A–F, where A and B make C, while D and E make F. Now imagine further that F is a catalyst for the A and B reaction, and that C is a catalyst for the D and E reaction. In this simple hypothetical set, we have the circular arrangement of autocatalysis: where the product of a first reaction is a catalyst for a second reaction and the product of the second reaction is a catalyst for the first reaction. The limitation on the autocatalytic set is that its ever-hastening production is quickly limited by the supply of substrate materials. When the morphodynamic processes of autocatalysis and containment reactions are reciprocally related to one another, there is the potential for an autocell.[6]

Let me explain this in a bit more detail. Imagine one of the molecules produced in the process of autocatalysis has a tendency for self-assembly that leads to containment (assume product F from the example above). The great lack of self-assembly in the potential to form containers is sufficient amount of substrate (meaning there is not enough substance F in a localized space), but in the setting of an autocatalytic cycle, more and more of the self-assembling substrate will be produced, greatly increasing the chance of containment. In forming a container, there is also a likelihood that some group of molecules will be trapped within the container separated from the rest of the environment (to extend our thought experiment imagine the new container encapsulates some of substrate A & D as well as product C). By forming containers, the cycle of autocatalytic reactions are prevented from being exhausted. If the container then breaks open in a new environment rich in substrate molecules for the autocatalytic cycle (in this case, an environment with substrates B & E since the autocell already contains A & D), then more autocells can be formed (Deacon 2006b, 136–49; Deacon and Sherman 2008, 59–76).

By reciprocally linking the simple recurrent causal structures of morphodynamics, the autocell models the hyperrecurrent causal structure of third-order emergence processes: a causal structure that can recur despite temporal distance between instantiations. The autocell builds on

the morphodynamic continuities of autocatalysis and self-containment to synergistically link these two self-organizing dynamics. By linking them, the substrate and energetic limitations are removed (i.e., the autocell remaining intact until a new substrate-rich environment is present so that neither morphodynamic process exhausts itself).

There is a "memory" for the autocell to a reference state because of the interdependence of the morphodynamic processes: in the new substrate-rich environment, the morphodynamic processes will persist in their interdependence and thereby allow for the teleodynamic entity to persist with a newly emergent identity. "Only a third-order emergent process has such an intrinsic identity" (Deacon 2006a, 138–39). This entity with its intrinsic identity is ontologically emergent because it instantiates a rudimentary, teleological power. However, it is important to remember that the emergence of *teleodynamics* as a process of organization does not entail, in principle, a particular metaphysical position with regard to *teleology* itself. Teleodynamics instantiates an entity with teleological power, but the properties of teleology as a metaphysical condition remain quite open.

Further, it is this intrinsic identity of teleodynamic processes that warrants the inclusion of Deacon's work on emergence theory within that group of approaches that seeks to explicate the emergence of life in terms of complex systems dynamics (Weber 2009, 350 ff.). Deacon goes further than most in this field by formulating a new taxonomy of general biology based on principles to be drawn from the autocell model and teleodynamic emergence. He proposes that the functional affinity between autocells (as an example of teleodynamic phenomena) and life, insofar as both self-repair and self-propagate, suggest a functional classification he calls *Autea*. However, there is a distinct difference between autocells and life as well. Autocell reproduction relies upon stereochemical effects, while organisms traditionally considered alive rely on template-based, coded reproduction (a genetic medium separated from phenotypic variation). Thus, Deacon suggests distinguishing between *Semeota* as those *Autea* that use molecular coding for reproduction and *Morphota* as those *Autea* that are constrained to molecular morphology for reproduction (2006b, 146–47). As Bruce Weber rightly notes, the implications of such a taxonomy are that "life did not arise as an event that transformed dead matter, but rather as a process of emergence from rich chemical dynamical systems" (2009, 352).

The Origin of Life: Revisioning the Multidimensional Unity ~ SRP→TRP

I hope at this point that the overview of Tillich's theology and Deacon's theory are whetting the appetite for constructive interaction between science and theology, but before jumping into this fecund interdisciplinary space we need to examine at the outset a potential problem for the

interaction we seek. Tillich is explicit about the ontological nature of the concept of life that he is employing; a concept based on the "generic" or phenomenological account of life we experience in relation to the world. Within such an ontological framework, it is absolutely correct that he applies his definition of life to the inorganic realm, but such a broad use of the term undercuts the very purpose of scientific investigation into the distinction between living and nonliving systems in emergence theory. Crucial to Deacon's account is the explication of dynamical systems that inform this distinction between Tillich's inorganic and organic realms.

The challenge of when to apply the term "living" to an entity so as to allow for interaction between Tillich and Deacon on this point can be accounted for without doing violence to the intention of Tillich's account of the multidimensional unity of life. The flexibility and openness, which his account demonstrates in establishing the dimensions of this multidimensional unity, indicates a certain ease by which we might shift the emphases in his construction of realms (Tillich 1963, 17). As such, I would propose two emendations to Tillich's account of the multidimensional unity of life that would make it more amenable to emergence theory, complexity theory, and current origins of life research.

The first emendation is necessary to allow for interdisciplinary dialogue between Tillich's theological formulation of the multidimensional unity of life and the work of scientists on the origin of life (a track three interaction in Russell's CMI; a scientific theory acting as indirect data for the philosophical assumptions of theology). The second emendation will build on this first change and use Deacon's account of emergent dynamics as a phenomenological instantiation of a most basic dynamical process by which we can symbolically reformulate the dimensions and realms that emerge subsequent to the inorganic realm (a track five interaction in Russell's CMI; a scientific theory acting heuristically in theological models).

Thus, first, the inorganic realm ought to be bracketed off from the other realms of the multidimensional unity of life. If the inorganic is termed alive, there is a fundamental tension with origins of life theorists that cannot be overcome. I would suggest thinking of the inorganic realm as the ground of living things: the substantial and spatial quality necessary for all life.

Tillich alludes to this quality of the inorganic, when he notes that space is the dominant category of the inorganic realm. Within this realm, spatial existence consists in having a unique place amidst all other things in the beside-each-other-ness that is the trans-spatial "space-creating ground of space" (Tillich 1963, 314). The substance of the inorganic realm is that of transitory identity fashioned by arbitrary divisions: the underlying unity of a process of becoming that allows it to be conceived of as a lasting thing (Tillich 1963, 322).

What is most important in both of these instances is that the inorganic realm becomes the most basic, simple instantiation of the transcending

unity of the ontological categories: a unity that must be assumed but cannot be known except through one of the dimensions. Tillich notes that this structure indicates an intrinsic point of self-transcendence for each category that necessitates and justifies their symbolic use (especially in religious language) (1963, 314–15). Given that this is the case, what I am proposing is to interpret the inorganic realm as a kind of originary-symbol for the ontological categories, whereby the inorganic realm consists of a primal dimension without which no life could exist and no sense of categorical unity could be established.

As such, we might think of living things being in relation to the ground of the inorganic in a way analogous to Tillich's double relation between finite being and being-itself that yields the double character of being-itself as creative and abysmal.

> Being-itself is beyond finitude and infinity; otherwise it would be conditioned by something other than itself, and the real power of being would lie beyond both it and that which conditioned it. Being-itself infinitely transcends every finite being. There is no proportion or gradation between the finite and the infinite. There is an absolute break, an infinite 'jump.' On the other hand, everything finite participates in being-itself and in its infinity. Otherwise it would not have the power of being. It would be swallowed by nonbeing, or it never would have emerged out of nonbeing. This double relation of all being to being-itself gives being-itself a double characteristic. In calling it creative, we point to the fact that everything participates in the infinite power of being. In calling it abysmal, we point to the fact that everything participates in the power of being in a finite way, that all beings are infinitely transcended by their creative ground. (Tillich 1951, 237)

Playing on this analogy, we might think of the inorganic realm as the creative source in which all living things participate, but also the abysmal deep by which living beings participate in the inorganic realm in a way that is, existentially speaking, significantly finite. Simply compare the "lifespan" of a rock to that of any living thing; the rock can exist for millenniums with little to no change compared to the fleeting lifespan of the living thing.

This abysmal quality of the inorganic realm can be clarified by Deacon's theory, so that it is more than a commonsense intuition about the smallness of our place in the universe. Instead, the radical finitude of living things in comparison to the inorganic realm is a product of the tenuousness of the dynamical reciprocity that instantiates living things. I believe this has the additional benefit of making clearer the original dialectical tension between life and death that phenomenologically informed Tillich's ontological definition of life (as compared to 1963, 11).

Now, second, if we grant that the inorganic is a realm bracketed from the rest of the living realms, a realm that answers the question of why something and not nothing and therein is conceived as the ground for living things but not properly a part of living things themselves, then it is incumbent upon us to explain how life emerges from this ground. If

this is the case, we have reason to reconsider the work of origins of life theorists in explicating the boundaries and relations between realms and ontological categories in Tillich's work. Bearing in mind that life is not then held hostage to the organic realm, given Deacon's Autea classificatory system, we can begin to further reimagine Tillich's multidimensional unity of life in terms of what it would mean for life to emerge from its ground of the inorganic realm.

Given the dynamics-based formulation of Deacon's work, we might offer that life begins to arise with the introduction of teleodynamic processes within the universe. These processes rely on the reciprocal relationship of morphodynamic processes and represent a hyperrecurrent iterative dynamic. In Tillich's terms, this introduction of a life-like entity comprised of dynamical processes could be characterized as the emergent complexity of the analogical actualization of the historical realm. The historical realm, and its predominantly temporal categorization (Tillich 1963, 314 & 319), is no longer a realm just like other realms. With the introduction of a temporal structure that is more than the basically disconnected after-each-other-ness of Tillich's own reconstruction of the temporal category in the inorganic realm (1963, 316), the historical and its dimensions become driving forces for the actualization of living things. I believe this formulation respects the pride of place, which Tillich himself gives to this final realm.

Historical time, for Tillich, expresses a distinct characteristic of the after-each-other-ness that is the trans-temporal quality of the category of time itself: irreversibility. In no actualizing dimension does time run backward, it always moves forward toward the new. In historical time, this tendency toward newness takes on the quality of "running toward fulfillment" (Tillich 1963, 319). What the realm of history provides is a "telotic" direction to temporal processes, whose ultimate symbolic expression is that of eternal life. Given the reformulated understanding of the inorganic realm, the historical realm and its dimensions provide the ontological language for actualizing life: providing the inner aim of *telos*.[7]

This notion of *telos* is also found, and used with great descriptive force, in Deacon's account of emergent dynamics. The self-organizing features of emergent dynamics represent a peculiarity, for Deacon, because they seem to violate the progressive tendency toward entropy. Indeed, much of his work with emergence theory is intended to give efficient causal explanation for dynamical interactions that yield properties that exhibit final cause: a cause explained by its end—that for the sake of which something is done. As Deacon playfully terms it, his emergence theory seeks a *telos ex machina* (2006a, 113–17). Resultantly, given Deacon's account of how telotic phenomena appear with the emergence of life-like dynamics in so simple a structure as the autocell, I suggest we might reimagine Tillich's multidimensional unity of life with the historical realm

as the force of newness and purpose by which we can characterize realms of increasing dimensional complexity. The anticipatory actualization of the historical dimensions in each of the preceding realms can be analogous to the telotic structure that emerges from Deacon's dynamical interactions. Each dimension preponderant for a given realm can be thought of as a more and more complex telotic phenomena that emergently actualizes from the potentiality of previously actualized dimensions: a force of newness characterized by the persistence of the unique constellation of dimensions that characterizes the transition between realms.

The Dynamics of Constraint: Revisioning the Understanding of Absence ~ TRP→SRP

What I find most exciting about the relationship we might establish between Deacon and Tillich's work is the truly interactional quality of the two theories. What I mean is that I believe Tillich's work (as amended) might offer some new directions to investigations that employ Deacon's emergence paradigm.

First, what should be very clear is that Tillich's language of dimensions and realms can give clear, descriptive force to Deacon's dynamical approach (this represents track seven in Russell's CMI; a theological concept influencing a scientific model). Moreover, Tillich's approach has the advantage (over other potential theological models) of being intentionally fluid. Tillich eschews the "level" schema and argues for the fluidity with which different dimensions might be layered upon each other and avoids mutual interference between dimensions. This accords well with the reciprocally interacting dynamical logic of Deacon's emergence account. We might think of this point of interaction analogically: in the same way that Tillich eschews levels for their hierarchy and mutual independence from one another, Deacon eschews concepts of emergence that place primary emphasis on the emergent structures themselves instead of the interacting dynamics because of the discontinuity it creates. Both thinkers need a vision of reality that emphasizes continuity over discontinuity (Compare Tillich 1963, 15; Deacon 2006a, 118).

Perhaps even more interesting, however, is the second interactional potential between these two thinkers (this will be a track six interaction in Russell's CMI; theology providing a philosophical assumption for scientific investigation): the use of the ontological elements as an alternative schema to Deacon's reliance on absence as a metaphysical category. For Deacon, it is a constitutive absence that leaves space for the emergence of a more complex structure. The reciprocal interaction of dynamical processes represents a limiting of the potential states of a single dynamic. Without this limiting of possibilities or the constitutive absence of all possible system states, more complex structures could not emerge. "Here we are confronted with

a different sense of causality, in the form of an 'affordance': a specifically constrained range of possibilities, a potential that is created by virtue of something missing" (Deacon 2006a, 120).

In searching for ontological language to describe the constraining dynamical properties of emergence theory, Deacon turns to the *Tao Te Ching*. Tillich, however, provides an alternative set of ontological formulations with his polar elements that might be more directly applicable. The fundamentals of this interaction are nascent within our modified account of Tillich's multidimensional unity of life. Just as he describes the change in one discernible realm to another in terms of a shift in the way we account for the ontological categories in each realm, we can extrapolate that these shifts in the phenomenological description correspond to changes in the mode of interaction between the polarities of the ontological elements.

This is important to understand. In the case of the shift from the inorganic to the organic realm, for instance, the self-relating, self-preserving, self-increasing, and self-continuing *Gestalten* indicate a level of environmental participation in time, space, causality, and substance instantiated by a continuous unity of interdependent ontological elements that overcomes the exclusivity that characterizes the inorganic realm. The belongingness-of-being that constitutes the second element of each ontological polarity is made viable in this transition between realms (Tillich 1951, 165). Consider Tillich's example of the tree on this point:

> The space of a tree is not the space of an aggregate of unconnected inorganic parts but the space of a unity of interdependent elements. The roots and the leaves have an exclusive space only in so far as they are also determined by the dimension of the inorganic; but under the predominance of the organic, they participate in each other, and what happens in the roots also happens in the leaves, and conversely. The distance between roots and leaves does not have the quality of exclusiveness. In the same way the exclusive after-each-other-ness of temporality is broken by the participation of the stages of growth within each other; in the present now, the past and the future are effective. And only here do the modes of time become actual and qualify reality. In the young tree, the old tree is included as "not yet," and conversely, the young tree is included in the old as "no longer." The immanence of all the stages of growth in every stage of the growth of a living being overcomes temporal exclusiveness. As the space of all parts of a tree is the whole tree, so the time of all moments of a process of growth is the whole process. (Tillich 1963, 316)

What Tillich gives us is a way of thinking about the multidimensional unity of life in terms of the transformation of the mode in which the ontological categories are actualized that is a deepening of the interrelationship of the poles of individualization and participation as one of the ontological elements. Dynamics and form or freedom and destiny could be used in such a description equally as well.[8] What is most important is that Tillich's language of dimensions and realms (which

already fits so well with the process of dynamical systems that characterizes Deacon's view of emergence) has built into it an ontological dynamic of reciprocally constraining elements that constitute the basic structure of being. Deacon's concern for particular absences creating the possibility for emergent complexity is exactly akin to Tillich's self-constraining polarities.

Particularly, Tillich's notions of freedom-destiny and dynamics-form provide philosophically dense notions that might be analogically helpful for Deacon's concept of freedom. For instance, we might say that the morphodynamic processes that reciprocally form a teleodynamic entity find their destiny in the teleodynamic entity: the emergent teleodynamic entity becomes the limiting destiny of the freedom of the morphodynamic process.

As a correlative point, one of the greatest challenges in Deacon's scientific program to Christian theological thinking is to try and imagine what place might still exist for God within it, besides being a deistic unmoved-mover that instantiates substance. If absence is the ontological motive power of the dynamical reciprocity of emergence, it is difficult to see how a theistic god is left a place in explicating increasingly complex structures. However, if the emergent dynamics are better described in terms of the constraining ontology of Tillich's polarities, then a ground of being theology such as Tillich's would be quite consonant and amenable. That is to say, a close reading of Tillich's work on God's sustaining and directing creativity might continue to provide a way of describing God's action in the world as the ground of the polar elements themselves that serve as the ontological expression of Decaon's emergent logic of constraint.

The Problem We Are: Imagining an Emergent *Imago Dei*

I want to conclude with two upshots of the preceding interactional account of emergence theory and the multidimensional unity of life. The first will be an important conclusion for efforts at theological anthropology. The second will be a summary of two future directions along which an interdisciplinary account of Tillich's and Deacon's work might continue.

The *imago Dei*, and accounts of theological anthropology generally, have come to be immensely important in recent theological history (especially in interaction with science). There now seem to be a proliferating number of typologies that account for approaches to the *imago Dei*; I prefer one that is threefold: the image can be substantially, relationally, or functionally conceived (as in Herzfeld 2002). The substantial refers to an image of God that consists in some property or facet of the individual: usually our rational or symbolic capacity. The relational posits that the image of God exists in interpersonal encounter or the encounter between God and human beings. Finally, the functional indicates that the image is a reflection of the call and responsibility of human beings to be stewards of God's creation. Nearly all

theologians employ one or more of these arguments in conceiving of what it means for human beings to be in the image of God.

One of the challenges of theological anthropology today is to imagine a way around the hegemony of the substantialist approach to Christian anthropology. Even if a relational or functional approach to the *imago Dei* can be articulated, they seem foundationally reliant upon some substantial interpretation (it is hard to imagine a functionalist or relational account of being in the image of God that does not include a basic account of the uniqueness of our rational capacity). Of course one can, and we might even affirm that Tillich does, argue that the substantial interpretations of the *imago Dei* represent a concern for necessary but not sufficient conditions that describe what it means to be in the image of God. Still, this approach leaves a great degree of primacy to those articulations of the image of God that are rooted in descriptions of human capacities. However, I think this interactionist account of Tillich's and Deacon's work offers us a better way of working around the hegemony of the substantialist interpretation of the *imago Dei*.

What we find in Deacon's account of teleodynamics that yields a basic protobiotic entity is a rudimentary emergence of memory or information processing. It is the emergence of an entity with "historical moments" that serve as reference points for future states of the entity that yield a quality of memory and interpretation (an interpretation of relationship of the entity to the environment). This allows for what Deacon calls the "self-similarity maintenance" of teleodynamics (Deacon 2006a, 137 ff.). If the substantialist approach to the *imago Dei* is conceived in terms of our unique rational capacity, which in contemporary time has been increasingly specified in terms of human symbolic capacity, Deacon's work on the emergence of life must cause us (at the very least) to be far more specific about what symbolic capacity means (i.e., it must be far more than just the capacity to form representational relationships) or abandon the substantial approach all together. As Deacon quite clearly states, "So life, even in its simplest forms, can't be fully understood apart from either history or representational relationships" (2006a, 139). If this basic semiotic structure is a characteristic of life, and that same capacity is used to delineate the distinction in kind of human beings from the rest of creation, then it seems that we are left with a devastating categorical error—substituting a vast difference in degree of semiotic complexity for a distinction in kind.

If instead we were to extrapolate up from the work that Deacon has done at the level of the emergence of life, to the emergence of the kind of rational capacity that has often been associated with what constitutes the image of God, we would need to say that the emergent feature is actually the trace of a regularity in a dynamics of mutually interconditioning processes. That is to say, the substantial quality operates as a shorthand for a more fundamental set of relational dynamics.

If Deacon's logic of emergence can be found to provide a promising theoretical structure for articulating the emergence of greater complexity, then our account of theological anthropology and what it means to be in the image of God ought to also reflect this phenomenological change of our encounter with the world. We would need an account of the *imago Dei* that would be consonant with such a dynamics-based approach. This is important in the context of this paper for two reasons. (1) Tillich's multidimensional unity of life, as a description of changes in the ontological categories and polarities, provides us with a template for such a theological articulation. (2) Substantialist accounts of the *imago Dei* would need to give way to a more fundamental category of analysis: interconditioning dynamics.

More Interaction? The Teloi of a Deacon and Tillich CMI Program

Given the interaction we have articulated between Deacon's work on emergence theory and Tillich's multidimensional unity of life, I would offer two further avenues of research that this program suggests but are beyond the scope of this work. First, we should consider the second aspect of Russell's original proposal. There is much work that could be done in a constructive theological vein concerning theodicy and the process of actualization. The whole emergent logic that Deacon commends to us continues to be reliant upon increasing entropy: a process with significant eschatological ramifications.

Second, if Deacon's emergence theory has a wider applicability than only its roots in the emergence of life, that is to say if it explains a dynamical law of reciprocity that we could expect to see iteratively enacted with increasing dimensions of complexity, we might look for examples of dynamical interaction to explicate the increasingly complex dimensions of Tillich's multidimensional unity. Deacon's future work on the emergence of consciousness from sentience and the dynamical logic that underlies such a structure could provide a test case to see if Deacon's work can be consistently applied across the dimensions that unify Tillich's conception of reality.

NOTES

A version of this essay was presented at a symposium on "Tillich and New Directions in Theology and Science" during the annual meeting of the American Academy of Religion, Atlanta, GA, USA, October 30–November 1, 2010.

1. Tillich makes a more nuanced case against the conception of levels than I briefly mention here. At the heart of his critique is his concern for the inadequacy of expressing the relationship between levels when this metaphor is used to characterize distinctions in life. Apropos to our purpose (as a way to foreshadow the relevance of Tillich to emergence theory) is his example concerning the problem of relating the "levels" of the organic and the inorganic. When characterized in terms of levels, the tension between the levels leads to reductionism or vitalism: it

"leads to the recurrent problem of whether biological processes can be fully understood through the application of methods used in mathematical physics or whether a teleological principle must be used to explain the inner-directedness of organic growth" (Tillich 1963, 14).

2. A detailed account of Tillich's fourfold ontology and the categories of being and knowing take us beyond the scope of this project. One must consult a separate section of the *Systematic Theology* for an analysis of this material (1951, 161–81).

3. I assume in this statement some background on Tillich's notion of the *imago Dei* in order to assert that the doctrine is best understood as the personal-self enacting freedom (see 1951, 258ff; 1957, 31–33). Even where we might argue that Tillich identifies the *imago Dei* in a more traditional way with the substantial quality of rationality, rationality is chosen because it is the "structure of freedom" (1951, 259).

4. The language of a "chemical cause" is clearly not germane to natural science today. We have to remember, however, that electrons were not even discovered until 1897, over 50 years after the first edition of Mill's work and over a decade after he died (McLaughlin 1992, 55).

5. I should note that Deacon shies away from drawing this connection to feedback systems too tightly because of the hugely stochastic features of his model (2006a, 125).

6. It may be less than obvious why we can call autocatalysis and containment reactions morphodynamic processes. In both cases, a form of self-organization is recirculated and amplified that biases the potential future states of the system *and* allows us to identify the morphodynamic features that distinguish the system itself. For instance, in the case of autocatalysis, the microconfigurational properties of the molecular components will favor particular allosteric reactions that will greatly influence the whole collection of components. With the continuous introduction of energy and raw materials to keep the cycle of autocatalytic reactions going (much like the need for the continuous input of heat for creation of Bénard cells), an autopoietic system is generated (Deacon 2006a, 135–36; Kauffman 2002, 23–48).

7. Tillich calls this "quasi-historical." As such, my reading of the historical realm is diverging a bit from Tillich's own. I am suggesting that this introduction of *telos* is legitimately historical as an analogical or anticipatory actualization of the historical realm that drives all expressions of the temporal category to ultimate fulfillment (see Tillich 1963, 306).

8. As, for example, when Tillich describes the growth and development of an individual in terms of dynamics-form (1951, 181).

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