AUTOPOIESIS: LESS THAN SELF-CONSTITUTION, MORE THAN SELF-ORGANIZATION
REPLY TO GILKEY, MCCLELLAND AND DELTETE, AND BRUN

by Niels Henrik Gregersen

Abstract. Replying to the variegated responses by theologian Langdon Gilkey, philosophers Richard McClelland and Robert Deltete, and biologist Rudolf B. Brun, I emphasize three elements of my theological use of autopoietic theory: (1) Autopoietic systems are less than self-constitutive, since they do not create themselves from scratch, but more than self-organizing, since they are capable of producing new elements inside the local system. Correspondingly, the theological importance of autopoietic theory is not found within the doctrine of a creation out of nothing but within the doctrine of nonuniform continuous creation. (2) Locating the concept of autopoiesis within third-generation systems theory, I underline the pluriform character of type-different systems; the possibility of giving a full causal account from the purview of any privileged single systems (including physics) is thus denied. (3) I distinguish between two complementary roles of theology in the dialogue between science and religion: whereas theology1 offers a participatory second-order description of the internal meaning of particular traditions of faith, theology2 provides a third-order inquiry into the external coherence between religious and nonreligious worlds of meaning. Theology2, however, always presupposes the internal descriptions of theology1. On this basis, my use of autopoietic theory is related to the theologies of creation and providence of Paul Tillich and Langdon Gilkey; likewise, I discuss various theological strategies for relating a theology of creation to standard interpretations of evolution.

Keywords: autopoiesis; Christian doctrine of creation; divine causality; evolution; general and particular providence; Langdon Gilkey; Niklas Luhmann; Paul Tillich; structuring causality; Alfred North Whitehead.

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It is indeed a privilege to respond to the three perceptive and variegated critiques by Langdon Gilkey, Richard McClelland and Robert Deltete, and Rudolf Brun of my article, "The Idea of Creation and the Theory of Auto-poietic Processes" (1998a). I shall reply in two steps. First, I will point out briefly three main reasons and motivations for introducing the theory of autopoietic systems into the science-theology dialogue. By doing so, I hope to clarify how this approach relates to other related strategies within the current discussion. Against this background, I then reply to the three responses separately without pretending to tie all ends into just one knot.

RELATING DIVINE CREATIVITY AND AUTOPOIESIS

In my article (Gregersen 1998a) I pursued three interrelated goals, two relating to the subject matter and one methodological. The first and per-haps the most conspicuous aim was to propose a thought model that es-capes the trap of putting God's activity in contrast to the self-productivity of God's own creatures. Probably I am here in line with a substantial trend in modern theology. I am in fact convinced that the emerging new con-sensus within theology that understands God's creativity as constituting, supporting, and proliferating the capacities of the world of creation is deeply indebted to the science-theology discussions of the last decades. The Newtonian principle of *inertia* considered matter to be self-sustaining and self-moving; modern genetics considers the capacity for self-formation and self-reproduction to be intrinsic to biological organisms. Theology, I think, is learning how to appreciate these principles of self-productivity better than did the theologies of the past. The basic intuition is that the creation of a self-organizing nature manifests the self-giving nature that God eter-nally *is.* If we have a trinitarian conception of God, the degree of self-limitation implied in God's creativity in the world external to God (*ad extra*) can even be perceived as a mode of God's *internal* self-realization; if we understand it thus, there is no reason to see the self-limitation of God as a result of metaphysical constraints externally imposed upon God.[1]

  Introducing the concept of autopoiesis in discussing the self-productiv-ity of God's creatures, however, may add some elements to this picture. I point out that autopoietic productivity is not meant to be a self-creation from scratch; rather, autopoiesis is a prolific self-development of systems already at play—theologically speaking already created and sustained by God. In order to prevent a conflation with the specific theological concept of God's creation, I therefore usually prefer the term *self-productivity* over *self-creativity*. This, of course, is a matter of convenience and not of prin-ciple. As long as the semantic ambiguity in the concept of creativity is kept in mind (God's creativity being constitutive, nature's creativity being constituted), one is free also to use *creativity* as a broader term covering both the ontological firstness of God's creativity and the temporal self-development of natural systems.

While this conceptual strategy marks a classical delineation in my approach, the idea of autopoiesis also implies a radicalization. Whereas the term *self-organization* usually suggests that the elements of a system remain self-identical and that they are only synthesized differently in different self-organizing systems, the idea of autopoiesis suggests that the elements themselves are produced and reproduced *within the local systems themselves*. This step underlines the time- and context-dependent character of productivity while also radicalizing the range of the self-exploratory freedom of natural systems. In short, *autopoiesis is less than self-constitution, but more than self-organization*.

But do not misunderstand me. By *elements* I do not mean the constitutive elements of matter, such as quarks and atoms; rather I refer to system-specific elements. Examples are *neurons*, which are produced, upheld, and developed only within the multiple synaptic couplings of the brain, and *words*, which exist and make sense only for language users within cultural systems (otherwise words would be mere sounds). Just as words are produced and developed by users of language in ever new contexts, so are neurons built up and transformed during the development of the physiological system. The pathways are built as the systems develop; they are not preset in detail by blueprints of nature. The immense fertility of autopoietic systems is actually provided by this openness to change during the passage of time.

The Plurality of Type-Different Systems

The theory of autopoietic systems belongs to what has been called *third-generation systems theory* (Luhmann [1984] 1985, 20–27). The concept of *system* itself reaches back to antiquity, when systems were understood as harmonious wholes consisting of well-adjusted parts; the *part-whole* distinction was fundamental to this classic notion of system. With the emergence of modern systems theory in the middle of this century, Ludwig von Bertalanffy and others defined systems as functional units that regulate the input-output relations between themselves and their environments. The most important distinction of this second-generation systems theory was thus the *system-environment difference*. The presupposition of a harmonious whole consisting of homogenous parts was abandoned in favor of an awareness of the intrinsic instability of temporalized functional systems; by this theoretical move, thermodynamics and evolutionary theory were eventually combined.

Now third-generation systems theory has emphasized the importance of *self-reference*. It is only through an internal functional closure that systems are able to differentiate and stabilize themselves in relation to their environments. According to this paradigm, it does not make sense to distinguish between open and closed systems. All systems are open for input

of energy, but it is exactly the self-referential closure that makes possible the interaction of one system with the others in the environment (Luhmann [1984] 1985, 25; 1990). Thus, the coevolutionary interpenetration of type-different systems such as brain systems, mental systems, and socio-cultural systems acts as a trigger for self-productivity.[2] Concepts of self-organization and autopoiesis belong to this third-generation systems theory. In both cases, self-productivity is perceived as a *system-relative* phenomenon. As mentioned above, the concept of autopoiesis implies that sometimes new elements are even produced within the local system.

This emphasis on the self-referential basis of self-development explains my second motivation for entertaining a dialogue between Christian creation theology and the theory of autopoietic systems: systems theory allows us to pay more attention to the *pluriform character* of systems-in-environments.[3] Self-organizing systems are interconnected, and yet they exhibit an astonishing degree of untranslatable *type differences*. Because all systems obey the same fundamental laws of physics, they are part of a coherent physical system; seen from a physical purview, therefore, the world appears as structurally uniform, continuous, and whole. However, a purely physical perspective leaves out of account the important differences that emerge within the world of nature. The actual interactions between particular systems (say, brain system, psychological system, and social communication system) are not fully determined by physical laws, even if all that happens within the world must be consistent with these laws.[4] Despite the constraints of general physical laws and despite the constraints provided by pressure from other systems, self-organizing systems exhibit some self-determination. As long as a self-recursive system is sustainable, it is the *internal functioning* of the system that determines which elements the system picks up, dispels, or ignores and the manner in which the elements are conjoined or juxtaposed. Thus, process autonomy prevails: Words in language may be expressive, but they cannot speak to neurons; likewise, neurons may emit exciting signals, but they cannot secrete a linguistic meaning (only human persons who form part of the coevolution of physiological, psychological, and sociocultural systems can do so). Even if human languages exist only by virtue of the neural networks of brains-in-bodies, neural systems can not be translated into linguistic sentences. Although it supervenes the brain system, the system of communication produces a world of shared meanings that transcend the local brain. In any case, *the theory of autopoietic systems denies the possibility of giving a full causal account of the intersystemic interactions from the purview of one privileged system* (including physics).

From this point of view, it seems to me that much theology has been taken captive by a monistic thought scheme. According to Thomistic theology, for example, there is a rational order of all things which preexists in the mind of God, who has set the goal and who eternally knows how to

accomplish it (Aquinas, *Summa Theologiae* 1. 22.1–2). In secularized form, the deterministic worldview of early and later modernity seems to have inherited this model of hierarchical explanation. I would argue that neither pays sufficient attention to the fact that we live in a multicentered world reflecting the inner richness and variation of God's creation.

THEOLOGY1 AND THEOLOGY2: THE TWOFOLD ROLE OF THEOLOGY IN THE SCIENCE-THEOLOGY DIALOGUE

This second emphasis of ontological pluralism relates to a third, methodological issue. Systems theory has the ambition to be universal in scope and thus particularly helpful for interdisciplinary purposes. Because of the immense complexity of autopoietic systems, however, we should realize that no abstract thought scheme is able to grasp the particularities of type-different systems. It is thus impossible to formulate a unified linguistic system that does full justice to disciplines as different as science and theology. My point is not that we should refrain from attempts to construe general concepts but that our search for universal descriptions should always be accompanied by *respecifications* as we move from one context to another. Furthermore, there is a constant need to distinguish between the internal perspective of natural languages and the external perspective of highly abstract concepts like systems theory or other scientific concepts. If these limits to general kinds of reasoning are not acknowledged, our awareness of the differences between meaning systems becomes flawed.

I fear that a failing awareness of this problem haunts much of the current science-theology discussion. In particular, the theology part of the dialogue is often almost evanescent and is often replaced by quasi-metaphysical constructs of a very general kind, though with some religious resonance. As far as I can see, we are facing a real dilemma here, for the conjoining of different meaning universes (such as scientific theories and religious language) demands bridging concepts of a more general kind. On the other hand, these concepts are not in themselves able to articulate what actually matters to religious life, unless these concepts are redescribed theologically.

I see no easy way out of this dilemma, but a solution might be found between a two-language approach, which claims that science and religion are totally separated from each another (which simply does not hold true), and large-scale syntheses of philosophical theology, which so often end up in such abstractions as classical theism, pantheism, or (usually ill-defined) panentheism. In my view, the best way out is to allow for a kind of shift of perspective between scientific and theological points of view and thus leave behind the pretense of a bird's-eye view that we don't possess.

I therefore propose a distinction between *theology1*, understood as a second-order redescription of the *internal meaning* of first-order religious utterances (in my case Christian faith), which are always part of a publicly

available tradition (in my case the Christian church), and *theology2,* which is concerned with the *external coherence* and interrelations between sentences rooted in different contexts of meaning (Gregersen 1998b). As suggested by Hans W. Frei, the divisive issue between types of current theology is perhaps no longer the much-discussed divide between conservatives and liberals. The issue is rather whether a theology is sensitive to the difference between internal and external descriptions, or takes the position that a philosophical supertheory can be construed under which all different meanings, including a Christian self-description, can be sufficiently covered (Frei 1992, 28–55). With Frei, I think that theology should be attentive to the particular logics of meaning uttered in particular religious traditions, rather than seek for a religious common place that does not exist in the reality of lived faith. Christian faith, in other words, should not prematurely be translated into the philosophicalized or scientificalized language of an abstract theology2. As opposed to Frei, however, I think that bridging philosophical concepts are unavoidable in any theology2 and should be pursued consistently and not in a purely ad hoc manner.

In my article (1998a, 347–53) I thus expend some energy on interpreting Genesis 1–2 and on tracing the concept of divine blessing in the Bible and later theological interpretation. I did not proceed this way in order to provide some historical background information for my science readers, or in order to show that the Bible was right after all. Rather, my motivation was to re-present some important internal motives in the biblical traditions, which have therefore also been incorporated in the living Christian tradition (though not sufficiently incorporated, as I argue). This discussion thus represents a modest piece of such a theology1 (a second-order redescription of the internal logic of communal Christian faith), which I take to be a necessary precondition for another section, the "constructive theology of self-production" (1998a, 353–62). The latter is definitely a piece of theology2 (a third-order reflection on the external coherence between creation theology and third-generation systems theory) with a frequent and, I hope, consistent use of bridging concepts.

I do not mean to deny that there will always be a kind of natural violation (Frei 1992, 21) between theology1 and theology2, because some degree of circularity is to be expected between first-order religious speech, second-order theological redescription, and third-order reflection on coherence and difference. But my point is that any idea of a homogeneous, all-encompassing supertheory (often a mix of science, metaphysics, and some theology) should be avoided, and a new sensitivity to the multi-perspective character of our dialogue should be cultivated. Because I did not state this methodology explicitly in my text (but used it only to structure my argument), I may have led some of my readers to misunderstand my approach as an exercise in pure philosophical theology. In the following, I hope to correct this impression.

REPLY TO LANGDON GILKEY

Writing in the interdisciplinary fields of science and theology always en-
tails the danger of losing contact with the real issues of one's own disci-
pline, and I am therefore particularly grateful to Langdon Gilkey for his
generous theological support of my approach. With his usual acumen,
Gilkey notices that the subject matter of my article is perhaps not so much
the idea of creation in the abstract (despite the title) as the issue of divine
providence. How can we speak contemporarily about God's continuous
concern for the particulars of creation, about God accompanying the life
histories of individuals and communities, and about God's creative inter-
action with the world of nature? Gilkey also observes that a plausible doc-
trine of particular providence is available only if we give up the notion of
the world as one uniform being, basically self-identical in all its parts, and
if we are ready to adopt the view that "nature represents a plurality of
different kinds" of systems and processes (Gilkey 1999, 111).

   Because my own thinking on these issues has been influenced by Gilkey's
work, I shall try to locate my own theological use of the concept of auto-
poietic self-productivity more precisely in relation to Gilkey's theology of
providence. In 1963 Gilkey wrote a seminal article asking how it is that
we find creative reconstructions within all parts of traditional doctrine, the
only exception being the doctrine of providence.[5] Gilkey saw the primary
cause of this situation in the aftereffects of the liberal heritage, namely, in
the implausibility of the idea of a cosmic-historical progress, and in the
curious persistence of the expectation of a visibility of divine providence
despite the Reformers' notion of God's hiddenness (1963, 175–77). I am
afraid that Gilkey's description applies even today. The idea of Providence
does not play any visible role in current constructive theology, and most of
the energy expended on the subject is devoted either to historical studies
or to the philosophical question of the internal consistency of a classic
theism. Today we can perhaps add a third factor that explains the absence
of providence in the current drive toward a theological self-insulation. The
issue of providence has always been part of a public theology. Whereas
neoliberal theology has tended to generalize the notion of providence (the
creation of the world at large being God's one and only act), some postlib-
erals' programs have attempted virtually to bracket all kinds of metaphysi-
cal questions, thereby excluding the question of God's transformative
presence in the world of nature. Today we face a widespread complacency
about speaking of God's presence in the world in terms of "me and my
church," which from the start excludes questions about God and nature.

   Gilkey's own constructive effort to bring the issue of providence back
into theological awareness was presented in Part 3 of his *Reaping the Whirl-
wind* (Gilkey [1976] 1981), in my view the most complex and advanced
theological account of providence since Barth's *Church Dogmatics* III/3

(1950). Gilkey here proposed an original synthesis of the Tillichian notion of God as Being-itself and the Whiteheadian notion of God's lure for future possibilities. In his response to my article, Gilkey notices some structural similarities between my theological use of autopoietic theory and the theology of Tillich and Whitehead. This would be great company, but I think that I am in fact closer to Gilkey's synthesis in *Reaping the Whirlwind* than to either of the two figures taken separately.

Gilkey interprets my position as exemplifying Tillich's concept of *theonomy*, understood as a "divine presence—or action—as undergirding, making possible, and bringing to perfection the creature's autonomy, self-creativity, and creativity of culture" (Gilkey 1999, 112). With this formulation I would certainly agree. But it seems to me that Tillich's concept of theonomy was confined to his theology of culture. Beginning in the early 1920s, Tillich sought to identify forms of culture (particularly religious socialism, expressionist art, and a substance-oriented ethics) in which cultural autonomy was grounded in the "depth" of divine being and thus was self-transcendent by virtue of the "Spiritual presence."[6] Also in Tillich's *Systematic Theology,* the concept of theonomy comes up in relation to the ontological and revelational grounding of human reason (Tillich [1951] 1978, 83–86, 147–50), and again in his interpretation of the "Spiritual presence" in culture and ethics (Tillich [1963] 1978, 249–68, 271–75).

However, Tillich felt that "a theology of the inorganic" was lacking in his time ([1963] 1978, 18). In Part 4 of *Systematic Theology,* Tillich developed his concept of "the multidimensional unity of life" to meet this need. I think that we find here a closer analogy between my use of autopoietic theory and Tillich. At some points Tillich demonstrates an astonishing awareness of the indelibly pluralistic and context-specific organization of reality. Even if such categories as time, space, and causality have a universal application, Tillich admits that they acquire new meanings in new contexts: "Things are not *in* time and space; rather they *have* a definite time and space. Inorganic space and organic space are different spaces; psychological time and historical time are different times; and inorganic and spiritual causality are different causalities" ([1963] 1978, 18). This amazing statement exhibits a clear awareness of the *system-relative* character of environments (there is not one self-identical environment, because they are differently perceived and enacted), and of the *type-different forms of causality*. It is nonetheless fair to say that Tillich's overwhelming concern was to present a view in which the different dimensions make up one whole in which there "cannot be mutual interference," one hierarchic system in which "there is a gradation of value among the different dimensions" ([1963] 1978, 15, 17).

From the perspective of systems theory, Tillich thus seems to oscillate between the classical concept of the world as a self-contained, hierarchic system and the system-relative idea of systems as units functioning in

relation to system-specific environments. However, it seems that in the end the thought model of life as a unified whole takes the upper hand in Tillich's thought, though without the ancient pretense of harmony. There is always a precarious balance to be established between the polar elements of freedom and destiny, between individualization and participation.

Tillich's view of providence was thus guided by a general concept of teleology and potentiality. "Creation is creation for the end: in the 'ground,' the 'aim' is present" ([1963] 1978, 398). According to Tillich, creation has no purpose outside itself but has its aim in itself. From the point of view of the creator, the purpose of creation is simply "the exercise of [God's] creativity," and from the point of view of the creature, "the purpose of creation is the creature itself and the actualization of its potentialities" ([1951] 1978, 263). Speaking of providence as a symbolic mode of expressing God's "directing activity," Tillich therefore translates providence as "the divine condition." God is not to be understood as an additional, intervening factor, but as "the quality of inner directedness present in every situation" ([1951] 1978, 267). In this manner, Tillich was able to say that God's directing creativity is always mediated "through the freedom of man and through the spontaneity and structural wholeness of all creatures" ([1951] 1978, 266). So far, this general structure seems perfectly valid. I am more doubtful of the framework of an "inner aim" potentially present in the "ground" of being, which then awaits its actualization in history. Tillich's overriding theological scheme was that of a primordial "essence," the potential ground and abyss of existence, which is then actualized in the existential estrangement of history in order finally to be "essentialized" in eternal life. My problem in connection with this restatement of the classical *exitus-reditus* scheme is not only that God's creation is seen as a metaphysically destined "fall" ([1951] 1978, 255f.). Problematic also is the idea that creativity is conceived as a realization of an inherent potency of the past rather than as something radically new emerging out of the coevolution of type-different systems. After all, the path is laid down from the beginning, not in the process of walking. In consequence, temporality is tamed by the logic of potentiality-and-actualization.

I am not aware that Gilkey has ever taken issue with Tillich on this matter.[7] I think, however, that it is one of the great accomplishments of Gilkey's theology of providence that he has temporalized the essentialist strain of Tillich's ontology. In Gilkey's work the logic of essentialism gives way to a logic of radical historicity; consequently Tillich's thought model of latent potentialities is transformed into a notion of real possibilities which only *are* when they *become*: "if in that fundamental sense events are self-created, then events become actual, formed, definite—what they are— *only as and when they occur*, and in no other way" (Gilkey [1976] 1981, 200; emphasis mine).

Gilkey thus adds to Tillich an analysis of "temporal passage" based on

human historical consciousness. This analysis is worked out with a metaphysical assist from Whitehead. Gilkey's theological point is that God is not only the principle of being but also the principle of "providential possibility": Logos ([1976] 1981, 302). As such God is the "source of newness" who makes possibility possible and makes those possibilities that are relevant in the given situation impinge on actuality (Gilkey 1976, 151–54). In Gilkey's reconstruction, divine Logos is not obsessed with preestablished order but exceeds the role of continuing creation: "One of the creative roles of God—distinct from but related to that of his being and his continuing creation and recreation of our being over time—is that he gives to each occasion, and so to each person and community, an ordered vision of possibility, a leap beyond the present actuality yet one in relation to it. Thus is our creativity possible" (Gilkey [1976] 1981, 252). As is evident, this is Whitehead's idea of the divine Lure transformed into Christian theology. Gilkey, however, avoids the Pelagian tendency inherent in Whitehead's explanatory scheme. Correcting Whitehead, Gilkey holds that "creativity" is not an eternal principle alongside God and the Eternal Forms.[8] Because any capacity for self-actualization depends on God's primordial creativity, there can be no competition between God's creativity and the creativity of God's own creatures. Thus, Gilkey reinterprets Whitehead's category of creativity as finally identical with the power of God ([1976] 1981, 414 n. 34). The Christian doctrine of creation out of nothing demands a one-principle ontology.

Thus, on the question of final principles, Gilkey follows Tillich and not Whitehead. God is "the power of being in everything and above everything" (Tillich [1951] 1978, 236; cf. Gilkey [1959] 1965, 44–58), not just the "chief exemplification" of general metaphysical principles (Whitehead [1929] 1978, 343). Despite this fundamental *ontological* correction, Gilkey redeems Whitehead's basic *cosmological* scheme when it comes to explaining how the interlacing of actuality and possibility is conditioned by divine providence and thus gives occasion to "decisions" from the side of the creatures. (1) The "preserving" or "sustaining" providence of God provides the precarious continuity necessary from moment to moment for the transition of creatures from the past into the present (this relates to Whitehead's concept of the *datum*). (2) The "accompanying" or "concurring" providence of God provides the elementary duration that constitutes our feeling of a presence without which there would be no room for self-determination (this relates to Whitehead's concept of *prehension*). (3) The "directive" providence provides creatures with a graded vision of relevant possibilities without which the array of possibilities would be either chaotic or purely ideal (this relates to the interplay between God's "initial aim" and the creature's "subjective aim" in the processes of *satisfaction* and *decision*).[9] Thus, self-determination is made possible by the active presence of the transtemporal God in radically temporal processes.[10]

I think that my proposal to speak about God's "structuring causality" as one in which divine action is conceived of in terms of a localized (system-relative) informational influence (1998a, 361–62) conforms with this model of temporal passage. I hope, as suggested by Gilkey, that a theological use of autopoietic theory can be a useful supplementary model to our historical experience of self-maintenance and self-determination (compare Gilkey 1993, 199–204). Perhaps it should be noted, though, that the term *autopoiesis* does not have universal extension (see below). Hence, I do not speak of God's structuring causality in relation to all kinds of natural systems but only in relation to developmental systems, where probabilities change in the course of their development. In many cases (particularly in fundamental physics) it seems that the laws remain exactly the same, even if the processes appear to be astonishingly different from a phenomenological point of view. Thus, there seem to be relatively uniform as well as self-differentiating systems in the world of nature. In my view, this fact demands from theology a corresponding differentiated view of divine activity (Gregersen 1997a).

Something similar may be said about the relation between autopoietic systems theory and Whitehead's cosmology. As noted by Niklas Luhmann, the basic understanding of self-reference was already present in Whitehead's notion of the internal stages of actual occasions as preconditioning their connectivity with the wider nexus of things. Luhmann therefore provisionally suggests that autopoiesis should be seen as functionally equivalent to Whitehead's concept of "process" and the concept of "component" or "part" as equivalent to "actual occasion" (Luhmann 1982, 369f.). Indeed, according to both theories, entities interact with their environments by virtue of internal self-adjustments; likewise, both theories imply an epistemic as well as an ontological pluralism. The difference, as I see it, is that whereas Whitehead's theory by nature is universal in extension (and has not, as far as I know, received any respecification by later Whiteheadian philosophy), autopoietic theory is designed to grasp the specific self-referential codes of different *kinds* of systems. Whereas the awareness of type difference seems to be evanescent in process philosophy, the sensitivity to particularity has been at the forefront in the theoretical development of systems theory. Personally, I believe that just as theology should be careful to stay in contact with its own primary domain (context-specific religious communication), theology should pay attention to the different domains of reality when redescribing natural phenomena from the point of view of a particular religious tradition. Without particularity, no specificity.[11]

Reply to Richard T. McClelland and Robert J. Deltete

I wish to thank McClelland and Deltete for putting so much acuteness into their response. This shows that philosophy may potentially play a

clarifying role in the dialogue between theology and science. It is also evident, however, that we are speaking from different theoretical traditions. Whereas they come from the background of philosophical theology within an analytical tradition, I am trained in theology within a hermeneutical tradition, and I am not quite sure whether McClelland and Deltete have sufficiently realized the fact of interdisciplinarity. They regret that I am not using "the standard terminology of inductive logic" but fail to notice that I am definitely not pursuing a piece of natural theology proceeding with "strong analogies" from world and God in order to "defend" a classical theism with an associated "natural teleology."

In my own words, I am engaged in "a constructive attempt to formulate a theology of self-productivity within a Trinitarian framework" (from the abstract), and I do so in two steps. First, I argue for the logical *compatibility* between the concept of creation and the concept of self-productive nature; second, I argue for the *fertility* of using autopoietic theories in a theology of creation, insofar as it "facilitates an array of theological interpretations of the relation between God and nature" (Gregersen 1998a, 335). McClelland and Deltete notice the first but apparently not the second and more prominent aim. Consequently, they can only regard my interpretation of Genesis (a piece of theology1) as something "sandwiched" in between the "real" arguments (McClelland and Deltete 1999, 102). Perhaps philosophy needs to cultivate philosophy1 styles of thinking in analogy to the need for theology1 styles of thinking.

Before arriving at the interesting points of discussion, I wish to remove a few obvious misrepresentations. First, I do not want to "defend" a general doctrine of continuous creation. "Die Welt als Schöpfung verstehen und verantworten" was in fact not the title of my paper, as they believe, but the name of the conference where I presented my paper (published as Gregersen 1997b); besides, the German *verantworten* refers here to ethical responsibility, not to a theoretical defense. Second, I have never expressed an aim to show "that the natural world has a built-in teleology that is similar to the teleology posited by theism and that one would expect to find if CC [continuous creation] is true" (McClelland and Deltete 1999, 103). Because Christian faith implies that God is the creator of the laws of nature, I do in fact believe that theology needs an interpretation of the meaning of the laws of nature. The whole thrust of my argument, however, is to propose a radically temporalized and localized form of divine interaction with self-organizing systems which certainly differs from the classical notion of inbuilt teleology (1998a, 364–65 n. 21). I can therefore also agree with the authors that the extent of pain and misfortune in evolution is not exactly a result "like the teleology posited by the theist" (see below my reply to Brun).[12]

Now there are limits as well as strengths to any approach, and among the virtues of McClelland and Deltete is their insistence on method and

conceptual clarity. First they ask whether I am committed to a circular form of reasoning when using biological theories as a hermeneutical guide for construing theism and theism as a hermeneutical guide for interpreting biological theories. This is in fact a pointed criticism. They also ask me whether my references to a "coherence of thought models" imply (a) a mere logical consistency, (b) a claim that autopoietic theory illumines creation theology, or (c) a claim that autopoietic theory gives inductive support for continuous creation.

Whereas I can rule out interpretation (c), I am certainly engaged in both the question of (a) logical consistency and the elaboration of (b) mutual illumination between systems theory and creation theology. In a more recent article, "A Contextual Coherence Theory for the Science-Theology Dialogue" (1998b, 193–201), I used Nicholas Rescher's coherence theory (Rescher 1992, 1995) as a suitable epistemology for establishing a disciplined set of "contextual interlinkages" between semantic worlds as different as science and theology.

Empiricist and coherentist paradigms indeed imply different epistemic virtues.[13] Whereas empiricism works by establishing a safe home of putatively safe data in order to proceed from there by way of inductive reasoning, coherentism starts out in a larger set of holistic theories in order to rule out more inefficient theories in favor of more workable theories. If empiricism regards human knowledge as a set of planks to be added to one another, coherentism regards human knowledge as a raft consisting of mutually corroborating planks of knowledge (DePaul 1995).

According to Rescher, evaluation of competitive cognitive systems takes place by a recursive twofold cycle of theoretical self-substantiation (= consistency) and of successful empirical implementation (= substantial coherence with data) (Rescher 1992, 176–80). Essentially the same twofold rationality is implicit in my article, namely, (a) the argument for theoretical self-consistency and (b) the demonstration of illuminative power in relation to a given problem. Hence, McClelland and Deltete are right in observing a degree of circularity in my approach. This is part of any hermeneutical endeavor, as it is also part of a pragmatic coherentist epistemology like Rescher's. I would of course concede that not all kinds of circular reasoning are unproblematic. There is a vicious circle of reasoning, which is characterized by a high degree of self-repetition and a low degree of successful implementation on data. On this view, the ideal kinds of cognitive systems are those that exhibit a *circulus infinitus*, that is, an infinite (or at least extensive) capacity for theoretical self-substantiation but at the same time a pragmatic power of illuminating still more propositions and theories that we, with *prima facie* good reason, think are somehow in touch with reality.

McClelland and Deltete also challenge my article on other points. Apart from the question of "theistic teleology" (which relies on misinterpretation),

they also raise doubts about my theological use of Fred Dretske's distinction between structuring and triggering causes. Allow me therefore to explicate some of my reasons for doing so. First, Dretske's theory is designed to show the import of reasons or intentions in a world of physical causes; obviously God-talk also implies referring to an *intentional* agent as in Dretske's computer model (I didn't actually use the terrorist and bomb example, as do McClelland and Deltete, but I admit that the formal structure of the argument is the same). Second, Dretske argues that there are two kinds of causes, structuring and triggering; the first cannot be efficient without the second, whereas the second cannot always be fully understood without the first (namely, in cases where reasons play a coconstituting role in the explanation of behavior). Now the interesting thing is that the subject behind the structuring cause (the computer programmer) does not need to be identical with the triggering cause (the fingertips of the users of the computer). By analogy, God doesn't interfere in the world of nature as a triggering cause between other causes; God does not alter the energy budget of the world but makes the world *use its energy* in new and unforeseen ways. Third, I argue that structuring causality, in the case of the transtemporal God, must be thought of as continuous, though always spatiotemporally contextualized. Speaking of God as restructuring the probabilities therefore does not mean introducing a third mode of causality but is simply a reiteration of structuring causality, though always with reference to time and circumstance.

What is here redescribed theologically is the Popperian point that the course of evolution does not seem to be guided by self-identical laws. In Popper's words, the objective propensities are changed as the evolutionary processes go on. The change of probabilities is part of standard observations within the sciences of higher level complex systems and is what one would expect from the purview of autopoietic systems theory. Again, this fact of changing possibility spaces does not warrant a theological interpretation by way of inductive logic, but it certainly makes a theological redescription *possible* with reference to our current scientific worldview (van Huyssteen 1998b, 159–66).

The problem is obviously that this making somebody do something is usually a triggering process itself (people implementing a new computer program also perform some actions involving changes of energy). In my article I admit openly that the analogy to God's structuring causality limps at this point. This anomaly, I argue, is grounded in the anomaly of God's nature. If God in a Tillichian sense is Being itself (the eternal source of existence rather than an actual entity coming into the scene of nature from somewhere else), it is inappropriate not only to imagine God with fingers and hands but also to understand God's interaction with the world as a kind of spiritual influx. God exists "in, with, and under" the world of nature (Martin Luther). My refusal to answer the question "By which

means does God influence the world?" is not a act of despair, as described by my philosopher colleagues. It is a very fundamental statement about the reality of God as presupposed by the logic of Christian faith. I think in fact that the only possible answer to the aforementioned question would be: "God does so through the Holy Spirit that God *is*." This response, however, would hardly satisfy McClelland and Deltete. But frankly, if "the reflective theist" (McClelland and Deltete 1999, 108) wants to have answers to the questions "How does God make this happen?" and "Which means does God use for undertaking changes in the world?" he or she, I am afraid, is not more advanced than the ordinary believer but appears to be a somewhat undeveloped theist.

In short, I do not pretend to have solved the conundrum of the fundamental gap between creator and creature by virtue of the concept of structuring causality. My aim is the more modest one of pointing out a *possible location* and a *mode* of God's *continuous yet nonuniform* interaction with the world of creation. Although I acknowledge that we can speak only hypothetically about God's interaction with nonhuman nature, I have proposed the ongoing change of possibility spectra of higher ordered complex systems of nature as one such (much neglected) location. However, I concur with McClelland and Deltete that the best thing we can do in theology is always to take advantage of the rich philosophical literature on mental causation. With great expectation, therefore, I look forward to seeing the future publication by McClelland and Deltete on divine causation.

REPLY TO RUDOLF B. BRUN

Brun's response is interesting because he, being a biologist, focuses on theological issues. Brun has previously presented his general views on the interrelation of creation and evolution in *Zygon* (Brun 1994), and I am pleased to have this opportunity to discuss his views and relate them to mine.

Brun's objection to my approach is that I do not fully appreciate the insight of modern science that nature is capable of constructing itself. Allegedly I stop halfway, because Brun takes me to mean that the world of nature at its best is only "sometimes self-reproductive" (Brun 1999, 94). This is of course not my position, because I mention (with Alexander Oparin) self-*re*production as one of the three characteristics of living systems as opposed to nonliving systems (Gregersen 1998a, 340). What I do say is that God lets the world be "a self-organizing and even sometimes self-productive world" (1998a, 355; not self-*re*productive, as wrongly quoted by Brun). My point is simply that not all systems are living systems, and not all living systems are self-productive systems that create new components as they go along.

As a matter a fact, *not all systems exhibit the operational recursiveness of autopoietic systems*. Most physical systems are neither autopoietic nor self-organizing but interact mechanically without producing new entities. Often

biological processes are self-organizing without producing new types of elements through the process (think of cell division, for example). Positive examples of radically autopoietic systems are neurons and synaptic couplings, lymphocytes and immune systems, words and discourse systems. These systems are not found everywhere in the cosmos.

I am therefore a bit uneasy when Brun presents a picture of evolution as a grand unifying process, in which "the basic mechanism . . . driving evolution is the synthesis of previously synthesized elements into new entities under appropriate environmental conditions" (Brun 1994, 278). This picture is hardly wrong but is perhaps a bit too grandiose. In particular, I think that Brun's subsequent picture of evolution as reaching from the Big Bang to the emergence of Jungian archetypes (1994, 277–83) does not catch the important differences. When Brun writes, "In this [Brun's] view, there is only one universal, creative process at work in physical as well as organismic evolution" (1994, 283), I am actually not persuaded that this is "what science teaches"; rather this is a piece of worldview making. After all, selection works differently when forming stars, evolving rabbits, and writing poetry, and the same applies to the concept of synthesis. Again, I think we should cultivate an awareness of differences and avoid overgeneralizations where we can.

It seems to me that Brun presupposes the paradigm of second-generation systems theory (see above) of open energetic systems synthesizing elements through external pressure, whereas third-generation autopoietic systems theory argues that the self-referential closure of evolved systems is a precondition for coevolution. As a matter of fact, this latter approach takes the self-productive capacity of nature even more seriously than does Brun (since it also implies the local production of new elements). From one perspective, autopoietic theory is indeed a supplement to macroevolutionary accounts of the general principles of pattern formation. On the other hand, autopoietic theory requires us to be aware of intersystemic differences as well as the precarious causal interpenetration between the different types of systems. In this aim, autopoietic systems theory is a corrective to unilinear pictures of evolution.

Now for Brun's theological approach. Brun makes two interesting theological suggestions. The first thesis relates to a theology of creation: created self-creativity and freedom are motivated by God's love. Without freedom there cannot be love, for the acceptance of love requires a self capable of accepting or rejecting the loving relationship offered by God. As he beautifully puts it, "In order to be able to give oneself away, one first has to become oneself. This becoming requires the freedom to create oneself though one's own history" (Brun 1999, 98).

Brun's argument appears to be an extension of an Augustinian free will argument into a free process argument, and so far I agree with this step. Apart from its theological point, this proposal has the advantage of exon-

erating God from the burden of evil pervading human history and from the burden of evolutionary pains and losses. The problem I have with Brun's version of the free process argument is that it does not seem quite capable of redeeming its purpose. What could possibly be the benefit of freedom for nonhuman creatures if they can never be in a position to accept or reject the offer of divine love, because they don't know what it means? If there is no such benefit, it seems that nonhuman creatures must suffer in order for human beings to be able to accept divine love. To me, this seems to involve an unacceptable form of anthropocentrism.

I would therefore opt for the free process argument with a more modest appeal to the self-exploratory freedom of creation, opened by God's intrinsic love for otherness. The eternal procession of the Son or Logos from the Father, and the corresponding self-differentiation of the Son from the Father, is the principle of God's creation of distinctive otherness and of God's continuous care and respect for otherness.[14] This distinctiveness can be enjoyed by a multitude of creatures below the threshold of human consciousness and culture. Discordance and evil are the price to be paid for living in a self-productive and self-experiencing world. Furthermore, I see no way of dealing theologically with the problem of animal pain and human evil other than by acknowledging that God's creation remains unfinished business. Christians pray daily, "Your kingdom come, Your will be done, on earth as it is in heaven," because they know that powers of evil persist and God's creation is not yet accomplished. This, I think, is plain Christian faith, remarkably different from the attempts of theodicy to justify evil on the basis of the world as it is. Without eschatology (that is, without noticing temporal differences), the so-called problem of evil cannot be solved; a solution should not even be tried.

My approach adds another interpretive plank to this general picture. I have argued that the unavoidable birthing woes of self-productivity should be considered neither as finally good nor as evil, but simply as outside moral judgment. In consequence, I speak of the amoral (not immoral) actions of divine creativity, that is, actions that cannot and do not manifest God's being and willing, even if they must be seen as modes of God's sustaining creativity. Unless one follows the metaphysical exoneration of God in process philosophy and is prepared to give up the ontological doctrine of creation out of nothing, one cannot separate the activity of God from the dark side of creation.[15] In short, even if God creates out of love and God creates for the purpose of fulfillment in love, this does not mean that all worldly processes are open to moral judgment. Moral concepts may be misplaced.

At another point, I also wish to take issue with Brun's concept of freedom. Brun takes the view that "any form of cosmic teleology negates genuine cosmic history" (1994, 277). I agree that the idea of a predetermined teleology is not viable in a Darwinian world. But I think it is an

overstatement to say that "chemistry demonstrates that the generation of new molecules by synthesis from already synthesized ones is practically without limits" (Brun 1994, 278). There are probably quite a number of chemical constraints on evolution. An increasing amount of research is done on this issue, on the basis of both basic biochemistry and theoretical arguments like Stuart Kauffman's. I would argue, therefore, that it is possible to combine a teleological view of physical laws with a strongly historical view of evolution, which could be consistent with a kenotic view of creation (see, e.g., Murphy and Ellis 1997).

Despite these differences, Brun and I agree that categories belonging to the history of salvation should not be equated prematurely with the categories belonging to the history of creation. I can take this view because I insist that we should not expect God's loving nature to be revealed in the amoral processes of evolution. Brun, however, goes a step farther than I do. He suggests "separating the history of creation from the history of salvation" (Brun 1999, 100).

However, is it theologically possible to separate creation and salvation altogether? Hardly. Brun also points at two connections, one "protological," the other "eschatological." The first nexus is given with the aforementioned prologue of creation: God's creation of the world out of love. The second nexus is christological, the "perpendicular" movement of eternity crossing time in the event of Christ. "In Jesus Christ the plan of God is realized for the past, the present, and the future" (Brun 1999, 99). Only in this history—in the walk with Christ—is salvation "within the world." Only here does God intervene in the history of creation.

By this strategy Brun is forced to use paradoxes and contrastive thought patterns when describing the crossings between God and world. The only mediation between God and world is the divine eternity, understood as encompassing past, present, and future. In God there is "no opposition or competition or conflict but peace between origin, movement and goal" (Barth, quoted by Brun 1999, 99). Brun's solution seems to be that though we cannot grasp the interrelation between the history of creation and the history of salvation from the side of historical experience, there is nevertheless no inconsistency from the point of view of God's eternity.

This is a highly respectable solution because it avoids a premature conflation between evolutionary process and divine will. I am not quite sure, however, whether Brun follows Thomas Aquinas, who understands eternity in terms of God's immutability and "absence of movement" (*Summa Theologiae* 1.10.1, 4), or rather follows Barth's Trinitarian dynamism, according to which there are real movements and temporal relations within God's eternity, and therefore also a "readiness for creaturely time" (Barth 1940, 693–98). Obviously, the Barthian approach forbids a strict separation between the accompanying God of providence and the temporal passage of God's creatures (1950). However, whether Brun finally follows

Aquinas or Barth, he can hardly use either of them to make a theological case against my notion of nonuniform divine action (or "particular providence"). It is true that from the purview of eternity there can, according to Aquinas, be no sequential creations. From the perspective of time, on the other hand, Aquinas endorses the idea of particular divine actions in the world through temporal intermediaries (e.g., *Summa Theologiae* 1.105.6–7). By virtue of a temporalized concept of eternity, Barth goes even farther because he does not acknowledge any notion of fixed natural laws and thus questions the whole concept of continuous creation in favor of a theological notion of God's faithfulness throughout history (Barth 1950, 75–83). I was therefore astonished to see Brun questioning the orthodoxy of my position while himself pursuing an atemporal concept of God practically at the verge of deism. For the reasons given above, I don't think Brun's theological position is in line with either Barth or Aquinas, though I see that Brun's theology is undergirded by a strong separation between first-order and second-order causality.

   On the whole, I think that Brun and I share more theological commitments than he is prepared to acknowledge. Though we take opposite positions on the question of God's *causal* interaction with the world, we agree that it is a pressing theological issue to elaborate grounds for a *semantic* coherence between a strong concept of divine ultimacy and the indeterministic world suggested by theories of complex systems. We also share the feeling that evolutionary biology has become a kind of model science, replacing the previous role of physics in generating a worldview. However, we do so for different reasons. Whereas Brun takes evolutionary thinking as having a universal explanatory power, from the formation of stars to the emergence of human archetypes, I take biology as a model science because its departments are internally differentiated into a variety of disciplines, some of them extensions of physical chemistry (biochemistry), others mainly historical-descriptive in nature (e.g., paleontology), and a third form entering into the social domain of cultural communication (e.g., human ecology and sociobiology).

Notes

   1.   This theological point is emphasized by Wolfhart Pannenberg in his trinitarian conception of creation. God's "self-realization" in the act of creation *ad extra* is seen as grounded in a new internal actualization (*Vollzug*) of the differentiated reality that God already *is* (Pannenberg 1991, 433–40; 1994, chap. 10.3). Pannenberg also points to the similarity with Rahner's idea of the *kenosis* of the Son as a "Selbstverwirklichung im andern, im Akt der Erschaffung des Menschen" (self-actualization of the Logos in the other, in the act of the creation of humanity) (1991, 23; 1994, chap. 7 I.3 n. 59).
   2.   The concept of interpenetration refers to intersystemic relations, where the handling of complexity within one type of system facilitates the building up and self-development of other systems: see Luhmann [1977] 1981; [1984] 1985, 286–346. The affinity between the concept of interpenetration in third-generation systems theory and the Dobzhansky-Burhoe proposal of a symbiotic coevolution between social habits and cultural systems (rites and myths) and the genetic heritage is obvious. Compare Hefner's synthesis (1993, 107–22).

3.   Important works in the same direction are Welker 1985; Dallmann 1994 (with bibliography).

4.   For some time the problem of relating unity and disunities of the natural world has been a point of discussion between Arthur Peacocke and myself (compare Gregersen 1998a, 363–65 nn. 5 and 21). In a still unpublished paper, Peacocke agrees with me "that we shall have to recognize that the interactions and relations *between* distinctive systems are unlikely to be describable in the same way as those *within* hierarchically stratified systems of stable 'parts'/'elements'" (in press). Whereas weak nonreducibility prevails within a hierarchic system (so that the whole is ontologically dependent on the parts, though our theories of the whole cannot be reduced to the theories of the parts), Peacocke is ready to admit that this may not apply to the interaction between type-different systems: "But when one comes to consider the relation and interaction between *two* type-different systems, each hierarchically stratified within itself, then even if such 'weak' nonreducibility [theory autonomy of the higher level but not process autonomy of that higher level; A. P.'s note] applies to each system regarded separately, yet in their interaction the processes going on at the two higher levels in the respective systems are indeed autonomous with respect to one another—that is what is meant by taking the systems to be type-different at their higher levels, however much they may have similar processes occurring at their lower ones" (Peacocke in press). I feel myself in perfect agreement with this clear distinction between causality *within* a system (where theory autonomy prevails) and causality *between* type-different systems (where a certain degree of process autonomy is effective). For my part, I would concede that the world of nature may be said to make up a world-as-a-whole. The world is a *unity* because of the fundamental physical laws given with the interrelation between the constituent parts of matter; also, the world constitutes an *interlocked nexus of realities* because of the constant interpenetration of type-different systems. Taken in one of these two distinct meanings, the concept of the world-as-a-whole seems to have an ontological correlate and is more than simply "an abstract description" (as I argued in Gregersen 1997a, 75).

5.   "It is interesting that of all major classical doctrines of theology, Providence is the single one which has not been reinterpreted and revitalized by contemporary theology but which has, on the contrary, been generally ignored and in some cases even repudiated" (Gilkey 1963, 174).

6.   "Das Transzendieren der autonomen Formen in Kultur und Gesellschaft, ihr Geprägtsein von einem sie tragenden und zugleich durchbrechenden (nicht zerbrechenden) Prinzip: das ist Th[eonomie]" (Tillich [1931] 1987, 251).

7.   Unfortunately, the book *Gilkey on Tillich* (1990) was not available to me when I was writing this essay.

8.   Whitehead, as is well known, assumes the metaphysical scheme of Plato, according to which there are three "formative elements" which are coeternal and mutually constraining: (1) Creativity, (2) the realm of Forms or Eternal Objects, and (3) the actuality of God as shaper or demiurge (Whitehead [1926] 1960, 86–91). Gilkey breaks with this metaphysical scheme, and anticipated the extensive argument in Neville 1980.

9.   In this interpretation I interpolated the term "directive" providence, which is not mentioned (but is presupposed, I presume) in Gilkey's text (Gilkey [1976] 1981, 303–3), and correlated Gilkey's analysis with Whitehead's more technical analysis of the four stages of self-actualization (compare Whitehead [1929] 1978, 149f.; cf. 83–89).

10.   Wolfhart Pannenberg (1988, 176f.) has criticized Gilkey for constructing his analysis of time on a concept of creativity or decision rather than the other way around. Thus Gilkey is said to obscure how eternity constitutes the nature of time. As will appear, I don't find that this criticism applies. Gilkey's analysis refers to the experience of time as (1) duration and (2) a co-presence of future possibilities, and both elements are conditioned by (1) the being of God and (2) the Logos of God.

11.   It is highly interesting that Gilkey also relates my use of autopoietic theory with the Buddhist Kyoto School. According to Tanabe Hajime, "Other Power" must be "Nothingness" in order to realize itself in the diversity of self-power (Gilkey 1999). Unfortunately I am not able to evaluate the extent to which this view is comparable to the trinitarian view of self-realization through self-limitation. I should note, though, that Francisco J. Varela and others ([1993] 1996) have used the idea of self-organizing connections in cognitive science to illuminate the experience of selflessness under Zen Buddhist meditation techniques.

12.   I shall disregard other misinterpretations by McClelland and Deltete and confine myself to the following: (1) I am not convinced that Kauffman's model actually provides "a full under-

standing of evolution," although Kauffman makes that claim; there is a difference between referring to a position and holding it oneself. (2) I do claim that Kauffman's view of evolution is open to a religious interpretation, but I don't claim that this is the same as an argument for "classical theism." (3) I don't equate the conception(s) of creation in biblical traditions with the abstract schemes of classical theism; to the contrary, my point is that scholastic and early modern theism disregard the multifarious and multiperspectival character of biblical creation faith. For further elaboration, I again refer to Michael Welker's recent contributions to creation theology (1995; some translations in *Theology Today*).

13.   As for the concept of epistemic virtues, see van Huyssteen 1998a, 23–35.

14.   Compare Wolfhart Pannenberg [1991] 1994, 32, 47; chap. 7, I 3: "Die Selbstunterscheidung des Sohnes vom Vater ist das Prinzip der Besonderheit, die zugleich das ihr gegenüber andere in seiner Besonderheit anerkennt."

15.   Evidently I am not, as Brun apparently thinks, a process theologian because I firmly reject Whitehead's ontology of the three principles. However, what I say about the operation of autopoietic processes may well conform to Whitehead's cosmology; compare my reply to Gilkey.

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