STUDI

SCIENCE-MEDIATED NATURAL THEOLOGY: UNRAVELING THE BURDEN OF PROOF

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Abstract: The burgeoning field of science and religion has only partially inherited the natural theology of old. Whereas the latter has had to undergo painful updating, the former covers a broader spectrum of topics. However, the challenge of understanding God through natural means remains a central theme in this enduring dialogue. This paper seeks to resume the classical understanding of natural theology within the context of modern science, highlighting opportunities that the scientific worldview offers for enhancing our access to the divine. In this endeavor, a perennial risk lies in claiming to have reached God too hastily. To avoid that temptation, I will discuss when and why one may transition from an epistemic conundrum to an ontological claim in a scientific context. More specifically, I will argue for the critical role of philosophy from science, not of science, as the ingredient 'sine qua non' to carry out said transitioning.

Keywords: Science and Religion, Natural Theology, Knowledge of God, Ontological Pluralism, Epistemic Singularities.

Riassunto: I recenti studi di scienza e religione hanno ereditato solo in parte la teologia naturale di un tempo. Mentre quest'ultima ha dovuto subire un doloroso aggiornamento, i primi coprono un più ampio spettro di argomenti. Tuttavia, la sfida di comprendere Dio attraverso mediazioni naturali rimane un tema centrale di questo dialogo. Questo articolo cerca di riprendere la comprensione classica della teologia naturale nel contesto della scienza moderna, evidenziando le opportunità che la visione scientifica del mondo offre per migliorare il nostro accesso al divino. In questo sforzo, un rischio perenne è quello di affermare di aver raggiunto Dio troppo frettolosamente. Per evitare questa tentazione, discuterò quando e perché si può passare da una questione epistemica a un'affermazione ontologica in un contesto scientifico. Più specificamente, sosterrò il ruolo critico della filosofia dalla scienza, non della scienza, come ingrediente *sine qua non* per effettuare tale transizione.

Parole chiave: Scienza e religione, Teologia naturale, Conoscenza di Dio, Pluralismo ontologico, Singolarità epistemiche.

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I. INTRODUCTION

Almost a decade ago, the late Pope Benedict XVI sounded the alarm regarding the problems of Catholic theology in the present era. Interviewed in his retirement by a journalist, Peter Seewald, who would become his biographer, the journalist addressed the following question to the pope:

> The question which concerns us anew time and time again is: where is this God, actually, of whom we speak, from whom we hope for help? How and where can one locate Him? We now see further out into the universe […], but as far as we can see now, nowhere is there anything that can be thought of as remotely like heaven, where God is supposedly enthroned.[1]

At the end of a book composed of many questions and answers and dealing with different topics, the big question for believers and nonbelievers resurfaced again, as it could not be otherwise. If man is a being for God, he cannot but look for Him on any occasion, even after a relaxed session with a former pope.

Benedict XVI's answer inspires much of this contribution in honor of Prof. Tanzella-Nitti, who continually endeavored to respect the double relationship between faith and reason in his theological writings. Nonetheless, if we pay heed to the former pope's answer, one may as well wonder if theology as such has been able to come to terms with Ratzinger's implicit challenge in his answer:

> Yes, because there is not something, a place, where He sits. God Himself is the place beyond all places. If you look into the world, you do not see heaven, but you see traces of God everywhere. In the structure of matter, in all the rationality of reality […]. You must completely do away with these old spatial notions, as they really do not work any more. Because the all is certainly not infinite in the strict sense of the word, although it is so vast that we humans may refer to

[1] BENEDICT XVI, P. SEEWALD, *Last Testament: In His Own Words*, Bloomsbury, London 2016, 237-238.

> it as infinite. And God cannot be found in some place inside or outside; rather, His presence is something wholly other.
> It is very important that we renew our thinking in many respects, completely clear away these spatial things, and grasp matters afresh […]. Here *theology still has to go thoroughly to work and provide human beings with conceptual possibilities again. Here the translation of theology and faith into the language of today has tremendous lacunae*. Here there is much to do; to bring forth new conceptual schemes, and to help human beings to understand today that they are not to look for God in any kind of place."[2]

It is beyond the scope of this contribution to explain why theology has turned a blind eye when confronted with this challenge. Briefly stated, whereas theology is called to combine both wings of the human spirit,[3] it has yet decided to live either on the shore of explicating parenetical faith for believers or on the shore of critical reason in textual criticism. Despite some glaring exceptions, theology has decided to abandon any attempt to provide a language respectful of the scientific framework that might help the *intellectus quaerens fidem*, not to mention any new representations for the *fides quaerens intellectum*.[4] One may perceive some tiredness in theology and its withdrawal towards the realm of spiritual theology. Even if the latter could provide links with psychology, the natural sciences remain as not entirely trustful companions, i.e., as uncharted theological territory.

Remarkably, the most recent attempts to start a dialogue between science and religion at the time of writing have arisen from the scientific field.[5] Though based on good intentions, whether said attempts are successful is a different story.[6] One could even hesitate that such attempts deserve the qualification of theological. Nevertheless, they unquestionably speak the most influential language of today, namely, scientific language, and have become extensively read and criticized. Part of this contribution

[2] *Ibidem*, 238. The italics are mine.

[3] Cfr. John Paul II, *Encyclical Letter Fides et ratio*, September 14, 1998, «Acta Apostolicae Sedis» 91 (1999) 5-88, no. 1.

[4] Cfr. J. Sánchez-Cañizares, *La purificación de las representaciones en el diálogo entre ciencia y fe*, «Estudios Filosóficos» LXXII (2023) 49-65.

[5] Cfr. M.-Y. Bolloré, O. Bonnassies, *Dieu, la science, les preuves – L'aube d'une revolution*, Guy Trédaniel, Paris 2021; J.C. González Hurtado, *Nuevas evidencias científicas de la existencia de Dios*, Voz de papel, Madrid 2023.

[6] Cfr. J. Sánchez-Cañizares, *Recensión de "Dios, la ciencia, las pruebas: el albor de una revolución"*, «Scripta Theologica» 56/1 (2024) 235-239.

will also criticize those books and endeavor to improve their intentions, but one must also credit them for taking the bull by the horns.

A typical approach in theology regarding science is to define the field of play and state what science can (or cannot) do. Usually, theologians deem the object of science limited by its materiality and measurability. In my opinion, these are two of the biggest misunderstandings of science made up by believers of "lazy faith"[7] who do not care to confront the universal goal of scientific knowledge. In simpler words, the unapologetic character of recent theology has become "an-apologetic," i.e., neglect of how current science speaks of the world and neglect of the effort to find a common framework respectful of how the world is and becomes. Unlike the upshot of early Christians' message in the ancient world, who could not refer to Moses and the prophets when talking to non-Jews,[8] the current Christian message is not only misunderstood but merely not understood by unbelievers, as it cannot be made coherent with what we know about the universe.

The problem can only be alluded to in this contribution. However, there is something I can do here: I can illustrate the most promising topics for theology to engage in a serious and honest discussion with science, mainly physics, and, at the same time, show why there seems to be so little gain in this confrontation (Section 3). In the second part of the paper, I will follow a different strategy for the dialogue by tackling the thorny issue of epistemology: to showcase what counts a scientific explanation and why that is so (Section 4); to reveal the assumptions hidden behind theories and models in contemporary science (Section 5); and to make a proposal about when and why we should be allowed to make the jump from epistemology to ontology, providing new insights for theology from science (Section 6), namely, a science-mediated natural theology, before reaching my concluding remarks (Section 7). However, before dealing with such topics, one needs to introduce a quick view of the problems of contemporary natural theology (Section 2).

[7] Cfr. S. COLLADO, *La religión en la ciencia contemporánea: impertinencias e inspiración*, «Scientia et Fides» 1/1 (2013) 63-85.

[8] Cfr. JOHN PAUL II, *Fides et ratio*, no. 36; J. SÁNCHEZ-CAÑIZARES, *La revelación de Dios en la creación: las referencias patrísticas a Hch 17,16-34*, Edusc, Roma 2006.

II. The Toils of Natural Theology

Alister McGrath, one of the most renowned authors in the field of science and religion, has recently presented six different approaches to natural theology, focusing on the Western tradition.[9] His first two approaches consider natural theology a branch of philosophy that investigates what human reason unaided by revelation can tell us concerning God (case 1) or about the existence of God on the grounds of the regularity and complexity of the natural world (case 2).[10] What differentiates these cases is whether one proceeds from pure reason or engagement with the world of nature, in a renewed version of 18th-century physico-theology. Through both approaches, one would aim to avoid the "scandal of particularity" inherent to a historical revelation.[11]

The four remaining approaches refer to the natural tendency of the human mind to desire or be inclined toward God (case 3), the analogy or intellectual resonance between the human experience of nature and the Christian gospel (case 4), the deficiency of the "naturalist" accounts of the natural world to give a comprehensive and coherent interpretation of the natural order (case 5), and, lastly, a theology of nature, namely a specifically Christian understanding of the natural world as a development of a theology of creation (case 6).[12] It is not difficult to see that all these approaches are interconnected and, consequently, McGrath aims to unify them within a "Grand Theory" or metanarrative which creates space for these diverse notions of natural theology.[13]

In my opinion, such classification helps us understand what the starting point and emphasis in each of these approaches might be. I would like, however, to proceed with a "change of basis" in what one may dub the "vector space of McGrath's natural theologies." A change of basis concerned with the dialogue between science and religion. Undoubtedly, case 6 can be seen as the goal of a theology of creation, but, as a goal,

[9] Cfr. A.E. McGrath, *Re-Imaging Nature: The Promise of a Christian Natural Theology*, Wiley-Blackwell, Chichester 2017, 18-22.

[10] Cfr. *ibidem*, 18-19.

[11] Cfr. Sánchez-Cañizares, *La revelación de Dios en la creación*, 87.

[12] McGrath, *Re-Imaging Nature*, 21-22.

[13] *Ibidem*, 25.

it can hardly be the starting point for a dialogue between science and religion, including believers and nonbelievers on an equal footing. Case 1 seems too general and hardly useful for the dialogue because of two related reasons: the specification of reason as "unaided by revelation" or as a well-defined single epistemic tool seems too far-fetched. In other words, everybody appeals to reason or reasons in a human dialogue, and what is reasonable or stands to reason can be highly volatile in the development of the argument. To wit: case 1 seems to be assuming a clearly-cut logical space of research that need not be the case.

On the other hand, cases 3 and 4 appear to be well-founded but, perhaps, a bit hasty for starters. In a sense, they remind the Catechism of the Catholic Church when referring to the proofs of the existence of God as different from proofs in natural sciences; the former are proof "in the sense of 'converging and convincing arguments,' which allow us to attain certainty about the truth."[14] Certainly, the human person with "his openness to truth and beauty"[15] may follow such path in order to attain the mystery of (a desired) God. That being said, one may wonder what happens if the understanding of truth and beauty differs from what a believer may naively think to be the common understanding. Let me illustrate this case with two examples:

First, as already said, the Catechism clearly distinguishes between proofs for the existence of God and proofs in the natural sciences. However, it also states that "[t]hese 'ways' of approaching God from creation have a twofold point of departure: the physical world, and the human person."[16] Now, it is unavoidable that science mediates the approach from the physical world. One could still claim to embrace the lay-person position, where contemplation of nature inspires awe and wonder. But such a position can drive to non-objectifiable, non-sharable subjectivity. More explicitly, the Catechism speaks of heeding "movement, becoming, contingency, and the world's order and beauty."[17] But what the layman understands by those concepts usually needs correction from the scientific picture. Prudently, the Catechism does not say much about

[14] *Catechism of the Catholic Church*, no. 31.

[15] *Ibidem*, no. 33.

[16] *Ibidem*, no. 31.

[17] *Ibidem*, no. 32.

how to understand those concepts that, although philosophical, have undergone a relevant change in their meaning through the mediation of natural science, particularly physics. A second example of misunderstanding is this: theology has frequently appealed to natural law or human ethics to defend moral absolutes across history; unfortunately, very few nonbelievers accept what natural law or human ethics amount to in the narrative of Christian theologians. The imagined common ground is shakier than initially thought.

On the contrary, McGrath's cases 2 and 5 offer a more promising common ground: that of science. Of course, I am not saying this always has to be the case or, even worse, that this scientific starting point supersedes every other despite history and cultural contexts. I willingly admit the historical and cultural tailwind for science and its inherently temporal achievements—but achievements! Even if the epistemic robustness of science can be lower than expected by many and its historical breakthroughs remain provisional, science is nowadays the most relevant and reliable actor for the progress of human knowledge. In this sense, it provides an excellent—and impossible-to-ignore—common ground for the interaction of faith and reason. An essential part of that interaction is the rational access to God through what traditional theology has called *praeambula fidei* (preambles of faith): those truths about God that can be known using natural reason. Now, said *praeambula fidei* are scientifically mediated.

III. Opportunities in Physics for Natural Theology

Throughout this section, I will concentrate on the most promising scientific topics for engaging in a fruitful dialogue between science and religion.[18] I will present the opportunities and the potential risks lurking

[18] In this Section, I will reuse some of the material already published in J. Sánchez-Cañizares, *Accepting Benedict XVI's challenge: Looking for new representations in religious teaching*, in D. Evers, M. Fuller, A. Runehov (eds.), *Creative Pluralism? Images and models in science and theology, Studies in Science and Theology*, vol. 18, Martin-Luther-University Halle-Wittenberg, Halle 2022, 115-124; Idem, *Quantum Mechanics: Philosophical and Theological Implications*, in G. Tanzella-Nitti, I. Colagé, A. Strumia (eds.), *INTERS – Interdisciplinary Encyclopedia of Religion and Science*, 2019 (www.inters.org); Idem, *Entropy, Quantum Mechanics, and Information in Complex Systems: A Plea for Ontological Pluralism*, «European Journal of Science and Theology» 12/1 (2016) 17-37; Idem, *Universo singular: apuntes desde la física para una filosofía de la naturaleza*, UFV, Madrid 2019.

when a cursory agreement seems reachable. In this way, I will prepare the terrain for an epistemic dialogue that may result in an ontological gain in the second part of the paper (Sections 4-6).

1. The Big Bang Theory and the Doctrine of Creation

It is worth remembering that the perspective on the universe has been changing throughout the history of humanity. With the arrival of modern science, especially with the absolute conception of space and time sponsored by Newton and his followers and theorized by Kant, the usual view of the universe corresponded to that of an infinite and immutable environment, the scene of the dynamics of a material reality that, in a certain way, would be foreign to the theater where it takes place. The theory of relativity, especially the general theory, will begin to change this conception and allow the scientific study of the universe as a whole object—something unthinkable before the 20th century. Without a doubt, the big bang theory of the Belgian priest Georges Lemaître, which remains the basis of the standard cosmological model to this day (the so-called Lambda Cold Dark Matter model, or ΛCDM), represented a turning point in the scientific representation of the universe, which went from being a static spatial whole to a dynamic spatio-temporal unity, inseparable from the matter-energy that fills it.

Thus, it is not surprising that, after some centuries in which the religious doctrine of creation and the scientific understanding of the universe were at odds, the arrival of the big bang theory was perceived as external support for the Christian vision of a finite and created universe, with a beginning of time: "In fact, it would seem that present-day science, with one sweeping step back across millions of centuries, has succeeded in bearing witness to that primordial 'Fiat lux' uttered at the moment when, along with matter, there burst forth from nothing a sea of light and radiation, while the particles of chemical elements split and formed into millions of galaxies."[19] As is well known, these words of Pius XII, spoken barely twenty years after the formulation of the big bang theory, did not arouse Lemaître's enthusiasm. The scientist and priest became aware of the risk of identifying God's creative action with a concrete scientific model.

[19] Pius XII, *The Proofs for the Existence of God in the Light of Modern Natural Science: Address to the Pontifical Academy of Sciences*, November 22, 1951, no. 44.

However, the temptation for believers to benefit from science for once was too strong. Thirty years later, in a similar context, another pope, Saint John Paul II, stated that: "Any scientific hypothesis on the origin of the world, such as the hypothesis of a primitive atom from which derived the whole of the physical universe, leaves open the problem concerning the universe's beginning. Science cannot of itself solve this question: there is needed that human knowledge that rises above physics and astrophysics and which is called metaphysics; there is needed above all the knowledge that comes from God's revelation."[20] Fair good, even if some clarifications on the meaning of the term "beginning" in this speech would be more than welcome. But this speech was extended by quoting Pius XII's previous one, and his mention of "the work of creative Omnipotence, whose strength raised up by the powerful fiat uttered billions of years ago by the creating Mind, has spread through the universe, calling into existence, in a gesture of generous love, matter teeming with energy."[21]

That such wording could bother even the most brilliant minds became evident when one of the most renowned scientists at the time, the late Stephen Hawking, who was present at the speech of Saint John Paul II, replied with an interpretation of the papal words in which he saw a frontal attack on his investigation of the moment:

> At the end of the conference the participants were granted an audience with the Pope. He told us that it was all right to study the evolution of the universe after the big bang, but we should not inquire into the big bang itself because that was the moment of Creation and therefore the work of God. I was glad then that he did not know the subject of the talk I had just given at the conference – the possibility that space-time was finite but had no boundary, which means that it had no beginning, no moment of Creation. I had no desire to share the fate of Galileo, with whom I feel a strong sense of identity, partly because of the coincidence of having been born exactly 300 years after his death.[22]

Hawking was referring to his then cosmological theory, developed in collaboration with James Hartle, called "no boundary condition,"

[20] John Paul II, *Address to the Plenary Session and to the Study Week on the Subject 'Cosmology and Fundamental Physics'*, October 3, 1981, no. 2.

[21] *Ibidem.*

[22] S.W. Hawking, *A Brief History of Time*, Bantam, New York 1988/1998, 119-120.

where the use of an imaginary time allegedly softens the singularity of the big bang until eliminated. This theory had some technical problems due to the recourse to imaginary time through what is known as a Wick rotation, but, as a scientific theory, it could and should run its course. The underlying problem is that the big bang is merely a theory that tells us nothing about the singularity from which the universe supposedly arises. It turns out crystal clear, therefore, that the big bang theory does not provide proof of the temporal beginning of the universe.[23] The reason is that the big bang refers to a space-time singularity in the classical solutions of general relativity. The latter may mean that we do not know enough physics yet to understand what happened.

One needs to specifically have a theory of quantum gravity to go beyond the big bang. But the temptation to identify God's creative act with the singularity of the big bang is huge, exposing the former to confrontation with new cosmological theories that seek to avoid said singularity: for example, the various theories about the multiverse or Roger Penrose's cyclical cosmology.[24] The problem seems to be that the Christian representation of creation still largely depends on a God who "sets the universe in motion." Such a dominant image forgets that "creation" primarily means a fundamental relationship of creatures with God that extends throughout the whole history of the universe. Therefore, and this is a crucial idea not yet well explained in religious instruction, creation does not occur in time: creation encompasses all time.

Moreover, philosophy can still object that, even if the universe had existed from an infinite time, it would not be equivalent to divine eternity since existing from an infinite time would merely involve the infinite succession of events of a created time. One cannot just identify the concept of eternity with that of an unlimited temporality without beginning or end. Eternity, as Boethius would very much like to explain, is much more than an infinite temporal existence[25].

[23] Cfr. G. Tanzella-Nitti, *Creation*, in G. Tanzella-Nitti, I. Colagé, A. Strumia (eds.), *INTERS – Interdisciplinary Encyclopedia of Religion and Science*, 2024, III, 3 (www.inters.org).

[24] Cfr. R. Penrose, *Cycles of Time: An Extraordinary New View of the Universe*, The Bodley Head, London 2010.

[25] "Aeternitas est interminabilis vitae tota simul et perfecta possessio." (Boethius, *De consolatione philosophiae*, V, 6).

However, it would be a habitual view among theologians that the absolute principle of time is implicit in the creation passages of Scripture once they are understood in light of the entire biblical content, as taught from the earliest times of the Christian era and was later emphasized by the teachings of the Church.[26] Nevertheless, it must be noted in light of this that, although it continues to quote the Dogmatic Constitution *Dei Filius* of the First Vatican Council—which refers to God who "from the beginning of time, made from nothing the two orders of creatures, the spiritual and the corporal," dating back to the Fourth Lateran Council (1215)—, the Catechism of the Catholic Church, in its number 293, refrains from supporting the theological opinion that embraces an absolute origin of time. In short, the medieval controversy about creation *ab aeterno* is still latent in this entire discussion.[27] Paying attention to this controversy should lead to improving our representations of creation, using, also in theology, for example, the relationship of the different elements and protagonists of the story that develops in a book with its author.

Consequently, the big bang theory may be completed in the future with other cosmological theories that extend it temporally into the past. But even if the big bang were the ultimate and definitive theory, we cannot know how long the gestation of the cosmos has lasted: time, in the proximity of a singularity, is not necessarily isochronous to our familiar way of measuring it.[28] Under no circumstances is the question of the temporal beginning of the universe equivalent to that of its metaphysical origin: the origin of being, which is the appropriate framework to refer to the mystery of creation. Lemaître already had to inform Pope Pius about it. Those authors who claim that the big bang corresponds perfectly to the idea we have of the creation of the universe by God[29] are not only saying too much but can lead believers to wrong representations of creation. The latter encompasses all temporality and does not necessarily imply, as Aquinas warned, an absolute beginning of time.

[26] Cfr. Tanzella-Nitti, *Creation*, no. 2.

[27] Cfr. J.I. Saranyana, *La creación "ab aeterno". Controversia de santo Tomás y Raimundo Martí con san Buenaventura*, «Scripta Theologica» 5 (1973) 127-174.

[28] Cfr. Tanzella-Nitti, *Creation*, III, 3.

[29] Cfr. Bolloré, Bonnassies, *Dieu, la science, les preuves*.

In the field of cosmology, in my opinion, the arguments underlying the temporal asymmetry of the universe, based on the Second Law of Thermodynamics, to reject a strictly cyclic universe, or those related to the fine-tuning of the fundamental constants, especially the extremely low entropy of the big bang, become much more interesting for the dialogue between science and religion and the development of a science-mediated natural theology.[30] These arguments, above all, show the limitations of an exclusive scientific way of thinking, which forgets the ontological and epistemic assumptions that science itself needs to develop.[31] But such arguments do not, strictly speaking, constitute proof of creation or the existence of a Creator. On the other hand, the appeal to a strong anthropic principle—that the universe has been designed for intelligent life to appear—can be enormously attractive. Yet one should not overlook the scientific criticism that Penrose dedicated to the anthropic principles: the universe is much further out of thermodynamic equilibrium than would be strictly necessary for life to appear.[32] Anthropic principles, when carelessly assumed, may become pure cosmetics: they explain very little.

2. Quantum Mechanics and the Problem of Determination in Nature

In the standard interpretation of Quantum Mechanics (QM), we encounter two distinct processes: (i) the deterministic and unitary evolution of the wave function, according to the Schrödinger equation, once the initial conditions have been established, and (ii) the indeterministic and non-unitary collapse of the wave function after a measurement into one of the possible outcomes regarding that specific measurement, then becoming an actual event, with a probability given by the square amplitude of this possible outcome before the measurement (the Born rule). How can the discontinuous and probabilistic wave function collapse come about through the interaction (measurement) between two parts of the physical reality? Such is a way of stating the QM measure-

[30] Cfr. Sánchez-Cañizares, *Recensión de "Dios, la ciencia, las pruebas"*, 237; cfr. R. Penrose, *The Road to Reality: A Complete Guide to the Laws of the Universe*, Jonathan Cape, London 2004, 730.

[31] Cfr. M. Artigas, *La mente del Universo*, Eunsa, Pamplona 2000.

[32] Cfr. Penrose, *The Road to Reality*, 762-765.

ment problem or paradox. The collapse of the wave function is, in its essence, unpredictable and also non-computable.[33] In other words, we do not possess a complete causal picture of how natural determination occurs.[34] This partly explains the variety of interpretations of QM, depending on the interpreters' different ontological and epistemological assumptions: "the multiplicity of coexisting interpretations highlights the need for a meta-scientific perspective to evaluate the different interpretations of the theory."[35]

The problem of understanding the transition from the quantum to the classical world remains one of the most elusive problems in our current understanding of the universe. We lack a unified theory that explains how nature determines itself at different physical scales. Therefore, it is conceivable that God's causal action is present in every natural process, regardless of the physical scale involved. To put it bluntly, lacking sufficient cause for natural determination, some researchers see in it an opportunity to make room for divine action in the world. In particular, the "non-interventionist objective divine action" (NIODA) project[36] has tackled this classical challenge of natural theology.

Proponents of NIODA argue that an interventionist God would face challenges when trying to reconcile omniscience and omnipotence with the need to address all imperfections present in creation from the beginning. Additionally, they seek to avoid the potential pitfalls of con-

[33] Cfr. J. Sánchez-Cañizares, *The Mind-Brain Problem and the Measurement Paradox of Quantum Mechanics: Should We Disentangle Them?*, «NeuroQuantology» 12/1 (2014) 76-95.

[34] Cfr. J. Arana, *Los sótanos del universo: La determinación natural y sus mecanismos ocultos*, Biblioteca Nueva, Madrid 2012.

[35] C. Vanney, *Is Quantum Indeterminism Real? Theological Implications*, «Zygon» 50 (2015) 736-756.

[36] Cfr. R.J. Russell, N.C. Murphy, C.J. Isham, *Quantum Cosmology and the Laws of Nature: Scientific Perspectives on Divine Action*, Vatican Observatory Publications, Città del Vaticano 1993; R.J. Russell, N.C. Murphy, A.R. Peacocke, *Chaos and Complexity: Scientific Perspectives on Divine Action*, Vatican Observatory Publications, Città del Vaticano 1995; R.J. Russell, W.R. Stoeger, F.J. Ayala, *Evolutionary and Molecular Biology: Scientific Perspectives on Divine Action*, Vatican Observatory Publications, Città del Vaticano 1998; R.J. Russell, *Neuroscience and the Person*, Vatican Observatory Publications, Città del Vaticano 1999; R.J. Russell, P. Clayton, K. Wegter-McNelly, J.C. Polkinghorne, *Quantum Mechanics: Scientific Perspectives on Divine Action*, Vatican Observatory Publications, Città del Vaticano 2001.

flating divine causality with natural causality, thereby falling into the conceptual trap known as the "god of the gaps." The NIODA project implicitly adopts a view of nature that allows for non-physical causal powers to exist, suggesting that there are causes that cannot be fully understood or explained through the methods of physics alone. This perspective acknowledges the possibility that God can objectively act within nature without violating any of its laws.[37]

On the other hand, the NIODA project, in its pursuit to ascribe a role to God in determining specific effects within nature, inevitably faces the issue of God's involvement in the evolutionary process, which leads to suffering and holds God accountable for the physical evil stemming from evolution[38]. Regardless of God's benevolent intentions in the long run, He remains implicated in the outcomes of natural processes and must thus assume responsibility, as posited within the framework of NIODA.

Be it as it may, there are compelling reasons to think that one cannot pigeonhole God's action in nature in clear-cut epistemic categories. That is why NIODA may be scoring. Moreover, since scientific knowledge and reality are not straightforwardly equivalent and some epistemic limits of scientific theories are acknowledged, one may argue that chance and randomness become more congruent with finality and the theological account of God's relationship to the world. Random outcomes of experiments in nature seem to make room for divine causality in processes that might be both contingent and guided because "the causality of God, Who is the first agent, extends to all being, not only as to constituent principles of species, but also as to the individualizing principles […]. It necessarily follows that all things, inasmuch as they participate in existence, must likewise be subject to divine providence."[39] Ontological indetermination of QM, however, paves the way

[37] Cfr. J. Sánchez-Cañizares, *NIODA and the Problem of Evil: God as Ultimate Determiner*, «Religions» 14 (2023) 1037.

[38] E. Qureshi-Hurst, *Does God Act in the Quantum World? A Critical Engagement with Robert John Russell*, «Theology and Science» 21 (2023) 106-121.

[39] T. Aquinas, *Summa Theologiae*, I, q. 22, a. 2; International Theological Commission, *Communion and Stewardship: Human Persons Created in the Image of God*, LEV, Città del Vaticano 2004, no. 69.

for a new theology of nature in which God's eternity grounds creatural time shunning any predetermination of sorts. Unreachable in his ineffable mystery, creatures always experience God as their future source of determination.[40]

In addition, the quantum feature of entanglement may still inspire a more holistic and ecological view of creation. Albeit in different manners and degrees, we dwell in a non-local universe in which everything is interconnected—everything is interrelated.[41] Extreme sensitivity to boundary conditions is a hallmark of our universe, allowing for the emergence of complex structures. Such remarkable features could ultimately stem from quantum entanglement, decoherence, and top-down determination. Moreover, if God acts in the universe at the utmost level of totality, then He could be causally influencing in a top-down manner without abrogating the laws and regularities that operate at the myriad sub-levels of existence that constitute that world. One might think of God as providing the ultimate top-down causation for natural determination.[42]

QM's ontological indetermination thus permits us to contemplate the universe as a place where openness, flexibility, and even freedom could naturally emerge.[43] But is this not what one should expect of a creation stemming from a personal Creator? With all its difficulties and paradoxes, QM leads toward a more mature view of nature, supersed-

[40] Cfr. W. Pannenberg, *Systematic Theology*, vol. 2, T&T Clark International, London-New York 2004.

[41] Cfr. Francis, *Encyclical Letter Laudato si'* (May 24, 2015), «Acta Apostolicae Sedis» 107 (2015) 847-945, no. 70, 92, 120, 142.

[42] Cfr. Sánchez-Cañizares, *Quantum Mechanics*; Idem, NIODA *and the Problem of Evil*.

[43] God's action and an open universe may go together if God's determination of nature is understood in a non-interventionist way, as NIODA proposes. A possible way to understand this is considering God's determinative action in nature as eternal (not different from creation) and global so that it cannot be grasped with scientific methodology but only intuited in an open universe, i.e., a universe that is not physically causally closed. Cfr. A.R. Peacocke, *God's Interaction with the World: The Implications of Deterministic 'Chaos' and of Interconnected and Interdependent Complexity*, in R.J. Russell, N.C. Murphy, A.R. Peacocke (eds.), *Chaos and Complexity: Scientific Perspectives on Divine Action*, Vatican Observatory Publications, Città del Vaticano 1995, 281; Vanney, *Is Quantum Indeterminism Real?*

ing stifling, old-fashioned scientific, philosophical, and theological perspectives. The limits of our scientific knowledge—as shown by QM—might aim at acknowledging its ontological foundations as necessary presuppositions of the scientific endeavor itself.

> [I]f the logos of all being, the being that upholds and encompasses everything, is consciousness, freedom, and love, then it follows automatically that the supreme factor in the world is not cosmic necessity but freedom […]. [T]his means that together with freedom the incalculability implicit in it is an essential part of the world. Incalculability is an implication of freedom; the world can never—if this is the position—be completely reduced to mathematical logic […]. A world created and willed on the risk of freedom and love is no longer just mathematics.[44]

Unquestionably, this is a promising path for science-mediated natural theology.

3. The Mind-Brain Problem and the Unity of Complex Dynamical Systems

The Catechism refers to the human person as a *via* to attain God.[45] In natural sciences, this path is closely related to the mind-brain problem: the existence of a mind that, allegedly, is irreducible to the workings of the human brain. Even if neurosciences could pinpoint the neural correlates of consciousness, a different matter is to explain the emergence of subjectivity—what it is like to be like oneself—or free will. Despite the ruckus caused in the 1980s by Libet's experiments,[46] the usual view among philosophers is that said experiments do not say anything about human free will.[47]

The mind-brain problem contains a whole complex of issues stemming from neurosciences and the field of philosophy of mind. There are different attempts in the market of ideas to tackle the issue.

[44] J. Ratzinger, *Introduction to Christianity*, Ignatius Press, San Francisco 1990/2004, 128. I will resume this quote at the end of Section 6.

[45] Cfr. *Catechism of the Catholic Church*, no. 31, 33.

[46] Cfr. B. Libet, E.W. Wright, C.A. Gleason, *Readiness-potentials preceding unrestricted 'spontaneous' vs. pre-planned voluntary acts*, «Electroencephalography and Clinical Neurophysiology» 54/3 (1982) 322-335.

[47] Cfr. M.E. Schlosser, *The neuroscientific study of free will: A diagnosis of the controversy*, «Synthese» 191/2 (2014) 245-262. For a recent, opposite take on this, cfr. R.M. Sapolsky, *Determined: A Science of Life Without Free Will*, Penguin Press, New York 2023.

For our interests, what seems more relevant is the existence of projects aiming at naturalizing the mind or human subjectivity. These projects need not be mistaken for naturalism or physicalism. On the contrary, they might showcase the presence of immateriality in nature, bridging the modern Cartesian gap between matter and spirit. There is room for immaterial features in nature and, consequently, for the possibility of immaterial causal influence of the spirit, ranging from the human soul to God himself.

More interestingly, in the face of the mind-brain problem, the complete reductionist project seems to fall apart. Many perspectives witness such a failure: Penrose's three worlds,[48] Whitehead's two worlds,[49] or the scientific construction itself, as one of the most spiritual activities carried out by the human being. New principles lift off in nature according to some incomputable plan that, for human beings, takes on the form of a remarkable blending of randomness and necessity in epistemology and indetermination and determination in metaphysics. It seems that the last epoch in evolutive history must count on the presence of human activities: knowledge, freedom, and love.[50] If that is so, there is room to understand the presence of the human person in continuity with nature,[51] as the apex of evolution, and as the recapitulation of the non-human universe thanks to their immaterial knowledge.[52] The last element in a series shares both features of continuity and discontinuity, so that the emergence of the human soul might signal the takeoff of immateriality in the natural world.

These last considerations bring us naturally to the question of the emergence of complexity in the universe. The human mind belongs here but in its unique and singular way. We have this exceptional case of conti-

[48] Cfr. PENROSE, *The Road to Reality*, 17-21.

[49] "[T]he world for me is nothing else than how the functionings of my body present it for my experience. The world is thus wholly to be discerned within those functionings […]. And yet, on the other hand, the body is merely one society of functionings within the universal society of the world" (A.N. WHITEHEAD, *Modes of Thought*, MacMillan, New York 1938, 224-225).

[50] Cfr. RATZINGER, *Introduction to Christianity*, 255.

[51] Cfr. J. NOVO, *Evolución, para creyentes y otros escépticos*, Rialp, Madrid 2019.

[52] Cfr. J. SÁNCHEZ-CAÑIZARES, *Immaterial Knowledge as Ultimate Emergence*, «European Journal of Science and Theology» 18/6 (2022) 113-128.

nuity and discontinuity for human beings: these are complex systems, ultimate in their material complexity. Of course, God is the God of humans, but not only. He is also the God of all creation, a creation where there is room for a plurality of causal principles in keeping with the specific nature of each being. Remarkably, despite such plurality, complex systems keep their unity and distinguish themselves from the rest of creation, resembling the personal distinctions in the Trinity's bosom. Unity and plurality, spirit and matter, have a place in God's creation.

Complexity is a catchword that may help theological reflection. For the mathematical evolutionists, "All the 'fitting' between mathematics and the regularities of the physical world is done within the minds of physicists who comprehend both."[53] Fair enough, all normativity could be a construction of the human mind, but if human brain working is not different from any other physical or biological system, how does normativity stem from a universe without normativity? Somehow, normativity itself is beyond evolution's epistemic framework.[54] Science itself is beyond evolution's epistemic framework because the "aim of science is not just the manufacture of new toys: it is the enrichment of the human spirit."[55] Complex dynamical systems (CDS) undoubtedly point toward an irreducible interplay between different levels of reality.[56]

CDS are partly independent of their parts, which often become replaceable components.[57] It is thus problematic to deny some ontic independence for the upper levels of complexity in nature. New types of entities and qualitatively different regimes emerge as the upshot of irreversible phase transitions. With the onset of new regimes, the system top-down constrains its lower-level behavior. A different method is thus necessary to approach the emergent level of complexity: a redefinition

[53] G. Lakoff, R.E. Núñez, *Where Mathematics Comes From: How the Embodied Mind Brings Mathematics into Being*, Basic Books, New York 2000, 344.

[54] Cfr. C. Blanco, *Truth in an Evolutionary Perspective*, «Scientia et Fides» 2/1 (2014) 203-219.

[55] I. Stewart, M. Golubitsky, *Fearful Symmetry: Is God a Geometer?*, Penguin Books, London 1993, 128.

[56] Sánchez-Cañizares, *Entropy, Quantum Mechanics, and Information in Complex Systems*.

[57] Cfr. A. Juarrero, *Dynamics in Action: Intentional Behavior as a Complex System*, «Emergence» 2 (2000) 24-57.

of degrees of freedom and phase space turns out to be inevitable. In that sense, the new description is level-dependent and, since it depends on human epistemic interest, human-dependent.[58] As QM suggests, knowledge makes a difference in the world because logical conditioning also makes a real difference. The presence of mind—the subjective side of objective logos—makes a difference in nature.

Despite some attempts to explain the reality of indeterminacy and free will through deterministic chaos,[59] identifying randomness with unpredictability,[60] deterministic chaos itself cannot explain the emergence of upper levels of complexity, as in CDS. There are new sources of determination at different levels because lower levels are not sufficient conditions for upper levels. Hence, it is hardly surprising that one has to complement the principle of sufficient reason with new principles. In that sense, QM's intrinsic indeterminism need not be equivalent to free will; it simply reflects some inherent limitation of physics within the realm accessible to human freedom and spiritual determination. The QM measurement problem might turn out unsolvable.

As a consequence, there are more than clouds on the reductionist horizon and on the possibility that an ultimate "theory of everything" can be formulated as a finite number of principles.[61] No finite set of efficient causes will describe the becoming of the universe, including the mind. "We do not know all the possibilities in the adjacent possible of the biosphere! Not only do we not know what will happen, we do not even know what can happen."[62] To be sure, science resorts to probability distributions to deal with unknowability, but we do not even know the set of possibilities in many cases. This last statement is hardly shocking since

[58] Cfr. SÁNCHEZ-CAÑIZARES, *The Mind-Brain Problem and the Measurement Paradox of Quantum Mechanics*, 91-92.

[59] Cfr. C. ROVELLI, *Free Will, Determinism, Quantum Theory and Statistical Fluctuations: A Physicist's Take*, «Edge» (July 8, 2013): *http://edge.org/conversation/free-will-determinism-quantum-theory-and-statistical-fluctuations-a-physicists-take*.

[60] Cfr. A. EAGLE, *Randomness is Unpredictability*, «British Journal for the Philosophy of Science» 56/4 (2005) 749-790.

[61] Cfr. S.W. HAWKING, *Gödel and the End of Physics* (2002): *https://www.hawking.org.uk/in-words/lectures/godel-and-the-end-of-physics*.

[62] S.A. KAUFFMAN, *Five Problems in the Philosophy of Mind*, «Edge» (August 6, 2009): *https://edge.org/conversation/five-problems-in-the-philosophy-of-mind*.

true novelties and differences appear in the universe, and the principles required to approach said new phenomena can only be a posteriori. The alternative is not between pure determinism and randomness—as, for example, the emergence of the classical world from decoherence illustrates. We need an a priori cognitive, specifically human identification of the problem—what should be the system and the environment and the relevant degrees of freedom—to tackle it.

To sum up, we deal with different levels of reality in CDS and have to invoke some novel constraints or conditions for understanding the emergence of upper levels from lower ones. If someone wishes to maintain a global microscopic determinism, the emergence of higher-level constraints—such as the Second Law of Thermodynamics, the quantum wave function collapse, and the extant information in non-interpreted nature—should be explained from much more basic laws. Otherwise, a diehard reductionist can maintain the view that the emergence of complexity is purely epistemic; were that the case, we can no longer trust our scientific access to reality, undermining the fundamental realism of science and science itself. Certainly, Tegmark is right when affirming that the "quests to better understand the internal reality of our mind and the external reality of our universe will hopefully assist one another,"[63] but theology could spell it out better with the words of Benedict XVI:

> Mathematics, as such, is a creation of our intelligence: the correspondence between its structures and the real structures of the universe—which is the presupposition of all modern scientific and technological developments, already expressly formulated by Galileo Galilei with the famous affirmation that the book of nature is written in mathematical language—arouses our admiration and raises a big question. It implies, in fact, that the universe itself is structured in an intelligent manner, such that a profound correspondence exists between our subjective reason and the objective reason in nature. It then becomes inevitable to ask oneself if there might not be a single original intelligence that is the common font of them both.[64]

Has natural theology dared to explore such a correspondence and its possible consequences? It does not seem so.

[63] M. Tegmark, *Consciousness as a State of Matter*, «Chaos, Solitons and Fractals» 76 (2015) 238-270.

[64] Benedict XVI, *Address to the Participants on the Occasion of the Fourth National Ecclesial Convention in Verona*, October 19, 2006.

IV. How to Relate Science and Theology: what Counts as a Scientific Explanation?

After briefly reviewing the most promising paths for the dialogue between science and theology, in the second, shorter part of this contribution, I will endeavor to show how we can bridge the gap from epistemology to ontology by heeding the structure of scientific theories and models. Remarkably, these structures tell us something about God, as natural language does.[65] True, one cannot transition from science to theology without the epistemic mediation of philosophy. But what does it specifically mean?

From a negative perspective, it means that the dialogue between science and religion always risks being too hasty. One needs a careful elucidation of the scientific concepts, one of the main tasks of philosophy, especially epistemology, before trying to extract from such concepts any relevant information for the comprehension of faith, the *fides quaerens intellectum* of theology. For example, it would be misgiving to deduce that God exists because the probability for the emergence of life in the universe is tiny or, as previously mentioned, because the big bang entails an absolute origin of time.[66]

On the first issue, invoking the low probability of the transition from the non-inert to the living has become a classic argument in the dialogue between science and religion. If hypertrophied, such an argument could lead to embracing less scientifically desirable positions, such as "Intelligent Design." One of the fundamental problems is the difficulty of quantifying the probability of the appearance of life in the universe due to the many conditionings that such a calculation would require and our lack of knowledge of the relevant space of possibilities. But even more worrying is the danger of performing a logical inference from a low probability. To be sure, life is complex, astonishingly complex, and unlikely in the universe, as far as we know, although our sample space is too small compared to the size of the visible universe. Does the passage from the inert to the living constitute proof of the existence of God? It is more than doubtful.

[65] Cfr. R. Williams, *The Edge of words: God and the Habits of Language*, Bloomsbury, New York 2014.

[66] Cfr. Bolloré, Bonnassies, *Dieu, la science, les preuves*.

Related to the second question, apart from what I already explained in subsection 3.1, one could claim that if the past were infinite, the present would never have happened.[67] But it is reckless, as Cantor knew well, to play happily with infinity. This kind of argument would also serve to say that if we add an infinite number of addends, the result can never be finite. However, despite Zeno, we now know that this is not the case thanks to infinitesimal calculus. There are convergent series and integrals. Their convergence depends on technical details that one may easily overlook when fast-transitioning from science to theology. One could not say better than the devil is in these details.[68]

There is always the risk of haste: the haste in moving from a scientific problem to the existence of a personal creator God. And there is always the risk of a too-quick dismissal of reductionism in favor of anthropocentrism.[69] It will always be possible for us to find new arguments, unknown today, that explain what we do not know. And these new arguments will raise new questions. In this journey forward, the demarcation criteria between disciplines can become blurred. It seems much more promising, though, to focus on the epistemology of science and see how to summon the link to ontology.

For instance, the principle of sufficient reason has been lately challenged[70] because of its impossible fulfillment within the scientific methodology alone. Such controversy hints at the fecundity of epistemology in a science-mediated natural theology. Let me explain the project more carefully. Since we may never have a workable representation of divine action in nature, not to mention a scientific model, natural theology must sail between two external boundaries: the Scylla of the god of the gaps, in which God ultimately acts at the same level of natural causes, and the Charybdis of making God redundant if, as the primary cause of deism, becomes untraceable in natural processes.[71] The first boundary

[67] Cfr. *ibidem*.

[68] Cfr. SÁNCHEZ-CAÑIZARES, *Recensión de "Dios, la ciencia, las pruebas"*, 238.

[69] Cfr. D.A. FINNEGAN, D.H. GLASS, M. LEIDENHAG, D.N. LIVINGSTONE, *Conjunctive Explanations in Science and Religion*, Routledge, London 2023.

[70] Cfr. R. PEREDA, *El principio de razón suficiente y la ciencia*, «Scientia et Fides» 2/1 (2014) 125-138.

[71] Cfr. SÁNCHEZ-CAÑIZARES, *Quantum Mechanics: Philosophical and Theological Implications*.

is trodden by interventionist accounts of divine action in nature, fostering an incompatible view of science and religion; the second boundary commonly relies in the orthogonality of methods, making the dialogue ultimately impossible.

The challenge, hence, according to the view I am proposing in this contribution, consists of articulating the primary cause and the secondary natural causes and overcoming the risk of a clash with the unwanted boundaries. In scholastic parlance, one could say that the distinction between essence and act of being should not legitimize their separation in God's unique creative action. A God that is both transcendent to and immanent in nature must make a difference in how natural processes develop. As beautifully expressed by Ratzinger, "the model from which creation must be understood is not the craftsman but the creative mind"[72]. The project should then aim at showing the presence of creativity and novelty in nature[73], as opposed to a deterministic and mechanic universe. One may confront said task through the ongoing purification of the epistemic assumptions behind science and theology, where each discipline helps purify the other, namely, the task of philosophy. Only then can we move from epistemology to ontology.

V. Assumptions behind Scientific Theories and Models: Making Explicit the Implicit

Before entering the last section of this paper, we need to pay heed to how scientific theories and models work. In science, one usually uses the term theory for a general set of propositions containing necessary relations between the fundamental quantities of the theory: special relativity relates the speed of light as a constant to the metric of spacetime, the Schrödinger equation of QM links the variation of the wave function to the Hamiltonian expressing energetic relations, and the synthetic theory of evolution introduces variations in the genotype that must remain, a priori, independent of the phenotype adaptation to the environment. However, the connection of theories with experiments and reality requires something more. Models that particularize the theories in specific contexts are the bread and butter of everyday science.

[72] Ratzinger, *Introduction to Christianity*, 126.

[73] Cfr. J. Novo, R. Pereda, J. Sánchez-Cañizares, *Naturaleza creativa*, Rialp, Madrid 2018.

Whereas theories remain at a high level of abstraction, at the level of fundamental principles of nature, models are necessary to test their stem theories. Models need auxiliary assumptions, in the form of, e.g., range of applicability, sensitivity of apparatuses, or differentiation between system and environment, that, strictly speaking, need not belong to the theories. Of course, should one belong to the group of diehard reductive physicalists, one could assume that, with additional and well-motivated simplifications, one could derive the particular auxiliary assumptions from the overarching theory. Simplifications are thus usually employed for practical, epistemic, and computational reasons. But is it always so?

Let me illustrate the problem with a paradigmatic example. Models particularize theories via the almost universal tool of differential equations. Any scholar with an average knowledge of mathematics is well aware that differential equations usually possess a varied number of particular solutions: if differential equations are linear, any sum of solutions is also a solution. But even if differential equations are non-linear, obtaining the specific solution that reproduces the natural process of interest requires external conditions, i.e., initial and boundary conditions. Solutions to differential equations, as mathematical expressions of models, are highly context-sensitive. The crucial point is that such a piece of contextual information belongs to a level of abstraction that is different from that of the dynamical quantities of the model.[74] Moreover, information at distinct levels of abstraction is highly unlikely reducible to information at a unique and fundamental level of abstraction; the risk of infinite regress looms large.

The previous example is not just a technical problem. Philosophers of biology have long recognized the difficulty in scientifically determining, not only synchronically but diachronically, what a specific living system is. Current approaches to the philosophy of life, such as enactivism or ecological psychology, need to assume the system-plus-environment partition in the universe in order to attempt to characterize life

[74] Cfr. R. Bishop, G.F.R. Ellis, *Contextual Emergence of Physical Properties*, «Foundations of Physics» 50/5 (2020) 481-510; G.F.R. Ellis, *On the limits of quantum theory: Contextuality and the quantum–classical cut*, «Annals of Physics» 327/7 (2012) 1890-1932.

phenomena, incurring a manner of circular causality[75] unless different types of causality are permitted. Complex phenomena dwell far from thermodynamic equilibrium, present variegated levels of interactions, and, more importantly, are highly sensitive to contexts for their emergence. Therefore, how should we understand the emergence of systems increasingly complex in the universe, or at least on planet Earth?

VI. From Epistemic to Ontological Emergence

A new way of conceptualizing the emergence of complexity seems unavoidable, according to which boundaries of dynamical systems are best conceptualized as sites of phase changes where a different phase portrait can suddenly appear. Complex systems are the locus of emergent properties[76]. Were that so, the emergence of true novelty defines the system and its degrees of freedom. The mechanical paradigm of a priori defining the phase space for the whole problem is no longer valid;[77] new degrees of freedom may appear as complexity in new systems emerges. What could be considered by some only as an epistemic oddity or a simplified description provides a crucial clue to license a non-trivial transition from epistemology to ontology.

In other words, the epistemic impossibility of predicting the behavior of nature and its processes beyond extremely controlled contexts signals the presence of a kind of causality that is a presupposition, and not a consequence, of every scientific description of individual systems or processes. New forms arise in nature that cannot be predicted in a bottom-up manner by theories and models alone. The emergence of forms exerting formal causation in a timely fashion, in keeping with some unknown teleology for science, allows for a universe in which individuality and relations constitute its deeper metaphysical tissue. But, if that is true, one must also assume the fundamental incompleteness of the laws of nature as de-

[75] Cfr. J. Sánchez-Cañizares, *The Free Energy Principle: Good Science and Questionable Philosophy in a Grand Unifying Theory*, «Entropy» 23/2 (2021) 238; M. Heras-Escribano, M. de Pinedo, *Are affordances normative?*, «Phenomenology and the Cognitive Sciences» 15/4 (2016) 565-589.

[76] Cfr. Sánchez-Cañizares, *Entropy, Quantum Mechanics, and Information in Complex Systems*, 20.

[77] Cfr. S.A. Kauffman, *Investigations*, Oxford University Press, Oxford 2000, X. Idem, *Humanity in a creative universe*, Oxford University Press, Oxford 2016.

scribed by physics and the orthogonality of determinism with an open nature in which God can act from within as its Creator.

Actually, one might ask, if everything is determined and can be explained away by natural laws, what arguments remain in favor of a personal Creator?[78] Aquinas invokes the distinction between primary and secondary causes to boldly affirm that "it is necessary to return those things which are made by nature also to God, as to the first cause."[79] Then, a follow-up question is whether one could find specific traces in the workings of nature—as hinted at by the opportunities mentioned in Section 3—pointing towards the primary-secondary, i.e., divine-natural, structure in causality. Fair well, it seems that scientific knowledge is finally revealing an intrinsically contingent nature of physical processes, making room for natural self-determination according to an open causal structure where God is no stranger but its utmost grounding, the ultimate determiner. As a boon, such a view would also open up new possibilities to understand the problem of evil in modern theodicy.[80]

If the image of a creative nature, open to God from within, supersedes the deterministic paradigm to understand nature, a theological message has to be unpacked.[81] First of all, the misunderstanding of a divine action comparable to natural processes can be overcome, as epistemology shows the principle of physical causal closure of the universe to be a red herring: "The idea that God can bring forth what is new and unusual only by breaking the laws of nature has been overruled by the insight that for all their regularity the laws of nature do not have the character of closed (or, better, isolated) systems."[82] God does not need gaps in nature to act; He acts in nature as his eternal Creator.

Secondly, one may speak of a proto-freedom in the inner workings of nature at many different levels, which paves the way for the ultimate emergence of spiritual human beings through evolution. As pointed out by Ratzinger, but not yet fully developed by natural theology, there is in

[78] Cfr. AQUINAS, *Summa Theologiae*, I, q. 2, a. 3.

[79] "Necesse est ea quae a natura fiunt, etiam in Deum reducere, sicut in primam causam" (*ibidem*).

[80] Cfr. SÁNCHEZ-CAÑIZARES, *NIODA and the Problem of Evil*.

[81] Cfr. IDEM, *Quantum Mechanics*.

[82] PANNENBERG, *Systematic Theology*, 73.

creation a "primacy of freedom against the primacy of some cosmic necessity or natural law […]. [T]ogether with freedom, incalculability implicit in it is an essential part of the world. Incalculability is an implication of freedom; the world can never—if this is the position—be completely reduced to mathematical logic."[83] Moreover, "the last stage of evolution needed by the world to reach its goal would then no longer be achieved within the realm of biology but by the spirit, by freedom, by love. It would no longer be evolution but decision and gift in one."[84]

We live in a universe that tends to life and freedom, but we are also well aware of the risk of freedom, especially in the spiritual life. Very likely, it has been Wolfhart Pannenberg who has more deeply discussed, in dialogue with science, the ambivalent theological meanings of the emergence of individual systems in the universe: individual systems that resemble the self-distinction of the Son in the bosom of the Triune God: "[I]f from all eternity, and thus also in the creation of the world, the Father is not without the Son, the eternal Son is not merely the ontic basis of the existence of Jesus in his self-distinction from the Father as the one God; *he is also the basis of the distinction and independent existence of all creaturely reality*."[85] However, individual systems that only too often turn closed in themselves and reject healthy relations with the rest of the world, being overcome by corruption and sin, expecting the working of the Spirit of God in the dynamics of natural occurrence.[86] The Spirit "has to overcome the rifts that come as creaturely existence makes itself independent."[87]

> Within worldly time it appears as a time-bridging present in the duration of forms. In this duration of creaturely forms, which also brings them together in space, we have a kind of inkling of eternity. The goal of the Spirit's dynamic is to give creaturely forms duration by a share in eternity and to protect them against the tendency to disintegrate that follows from their independence.[88]

[83] RATZINGER, *Introduction to Christianity*, 127-128. See also footnote 43.

[84] *Ibidem*, 255.

[85] PANNENBERG, *Systematic Theology*, 23. The italics are mine. "[A]ll creaturely distinction from God and from other creatures is to be understood as deriving from the Son's self-distinction from the Father and its manifestation." (*ibidem*, 84).

[86] Cfr. *ibidem*, 76.

[87] *Ibidem*, 84.

[88] *Ibidem*, 102.

7. Conclusive Remarks

The fate of Natural theology seems to be doomed to failure. No matter how many caveats and disclaimers theologians introduce in their narratives, one may always focus on their falling short of providing cogent reasons instead of mere plausible reasons. A science-mediated natural theology is very likely also bound to fail. But it may fail less badly. The recipe for a less dramatic failure or even a moderate success, should one beg for the upbeat note, lies in embracing philosophical mediation, particularly the critical role of epistemology. The journey is not easy, to be sure, as one needs to speak the habitual terminology of science and be ready to embark on the philosophical fray. For natural theology, however, entering uncharted territory may turn out rewarding.

One of the main reasons for the abovementioned global failure is the risk of introducing divine action in nature too fast. No natural theology will ever ward off such a threat. My proposal here has been to change perspective. As taught by the lifelong work of Professor Tanzella-Nitti, theology should know better and exorcize its fear of being in hot water. Current science provides magnificent opportunities for a sincere dialogue about our overall understanding of the universe if one speaks the language and knows its limits.[89] By and large, the modern materialistic and non-theistic perspective of nature called physicalism is at pains to be consistent, especially when confronted with epistemology. Nevertheless, physics cannot consistently, namely, in a bottom-up fashion, explain the emergence of the different natural levels. The burden of the proof has now shifted; natural theologians should be happier and more aware of it.

Motivated by these epistemic issues, I have endeavored to present a possible way for a science-mediated natural theology in the last part of this contribution. Natural theology has an enormous amount of resources to offer to expand a sincere dialogue with scientists and intellectuals concerned about the foundations of human knowledge, particularly scientific knowledge. Theologically grounded scientific activity provides reasons for distinctions and relations between natural systems.

[89] Cfr. G. Tanzella-Nitti, *Si può parlare di Dio nel contesto della scienza contemporanea?*, «Scientia et Fides» 4/1 (2016) 9-26.

If the particulars also belong to science, the existence of a coherent link between scientific knowledge and other forms of human knowledge may as well be well-anchored in the deep structure of reality, which can only be that of a trinitarian creation. Let me thus conclude this contribution by paying homage to Professor Tanzella-Nitti with a last expression of such an endeavor in Pannenberg's words:

> Theologically one may see in the rise of each particular form a direct expression in creaturely reality of the working of the Logos, of the divine Word of Creation. This development finds its completed form only in the self-distinction by which the individual creature affirms its uniqueness vis-a-vis all others. Only thus can it also affirm God to be the origin of everything finite in his distinction from all that is creaturely, thus paying him the honor of his deity. For this reason the Logos does not find full manifestation in the isolated uniqueness of an individual phenomenon but in its relations to everything else, i.e., in the total order, which as such extols its Creator.[90]

[90] Pannenberg, *Systematic Theology*, 114.