religions

Special Issue Reprint

Natural Sciences as a Contemporary *Locus Theologicus*

Edited by
Jacek Rodzeń and Paweł Polak

mdpi.com/journal/religions

MDPI

Natural Sciences as a Contemporary *Locus Theologicus*

Natural Sciences as a Contemporary *Locus Theologicus*

Guest Editors

Jacek Rodzeń
Paweł Polak

MDPI

Basel • Beijing • Wuhan • Barcelona • Belgrade • Novi Sad • Cluj • Manchester

Guest Editors

Jacek Rodzeń
Faculty of Humanities
Jan Kochanowski University
Kielce
Poland

Paweł Polak
Faculty of Philosophy
Pontifical University of
John Paul II
Krakow
Poland

Editorial Office
MDPI AG
Grosspeteranlage 5
4052 Basel, Switzerland

This is a reprint of the Special Issue, published open access by the journal *Religions* (ISSN 2077-1444), freely accessible at: https://www.mdpi.com/journal/religions/special_issues/286348L728.

For citation purposes, cite each article independently as indicated on the article page online and as indicated below:

Lastname, Firstname, Firstname Lastname, and Firstname Lastname. Article Title. *Journal Name*, *Volume Number*, Page Range.

ISBN 978-3-7258-6224-5 (Hbk)
ISBN 978-3-7258-6225-2 (PDF)
https://doi.org/10.3390/books978-3-7258-6225-2

© 2026 by the authors. Articles in this book are Open Access and distributed under the Creative Commons Attribution (CC BY) license. The book as a whole is distributed by MDPI under the terms and conditions of the Creative Commons Attribution-NonCommercial-NoDerivs (CC BY-NC-ND) license (https://creativecommons.org/licenses/by-nc-nd/4.0/).

Contents

About the Editors . . . . . **vii**

Jacek Rodzeń and Paweł Polak
Introduction to This *Religions* Special Issue: Natural Sciences as a Contemporary *Locus Theologicus*
Reprinted from: *Religions* **2025**, *16*, 1020, https://doi.org/10.3390/rel16081020 . . . . . **1**

Giuseppe Tanzella-Nitti
Dialogue Between Theology and Science: Present Challenges and Future Perspectives
Reprinted from: *Religions* **2024**, *15*, 1304, https://doi.org/10.3390/rel15111304 . . . . . **8**

Christoph Böttigheimer
Natural Science as a Modern Locus Theologicus Alienus
Reprinted from: *Religions* **2024**, *15*, 1445, https://doi.org/10.3390/rel15121445 . . . . . **30**

Zbigniew Liana
Criteria for the Acceptability of Scientific Theories as *Locus theologicus*: A Methodological Analysis of Catholic Church's Reactions to the Cases of Galileo and Darwin (Bellarmine—Pius XII—John Paul II)
Reprinted from: *Religions* **2025**, *16*, 153, https://doi.org/10.3390/rel16020153 . . . . . **42**

Shoaib Ahmed Malik
Science as Divine Signs: Al-Sanūsī's Framework of Legal (*sharʿī*), Nomic (ʿ*ādī*), and Rational (ʿ*aqlī*) Judgements
Reprinted from: *Religions* **2025**, *16*, 549, https://doi.org/10.3390/rel16050549 . . . . . **81**

Christopher C. Knight
Some Eastern Orthodox Perspectives on Science-Engaged Theology (and Their Relevance to Western Christians)
Reprinted from: *Religions* **2025**, *15*, 1189, https://doi.org/10.3390/rel15101189 . . . . . **104**

Robert J. Woźniak
Scientific Imagination as *locus* of Theology
Reprinted from: *Religions* **2025**, *16*, 467, https://doi.org/10.3390/rel16040467 . . . . . **118**

Kamil Trombik
The Idea of Mathematicity of the Universe as a *Locus Theologicus*: Michael Heller and Representatives of "The Kraków School of Philosophy in Science"
Reprinted from: *Religions* **2025**, *16*, 54, https://doi.org/10.3390/rel16010054 . . . . . **137**

Christopher Barina Kaiser
The Agencies of God's Word and Spirit: Modern Science as a "Sacred Reminder"
Reprinted from: *Religions* **2025**, *15*, 367, https://doi.org/10.3390/rel15030367 . . . . . **151**

Dominique Lambert and Michał Oleksowicz
The Quest for Intelligibility as Mediation Between Science and Theology
Reprinted from: *Religions* **2025**, *16*, 421, https://doi.org/10.3390/rel16040421 . . . . . **182**

Tadeusz Sierotowicz
Theology of Science as an Intertextual Reading: The Bible, the Book of Nature, and Narrative Paradigm
Reprinted from: *Religions* **2024**, *15*, 293, https://doi.org/10.3390/rel15030293 . . . . . **201**

Jacek Rodzeń and Paweł Polak
Contemporary Theologies of Science in the Light of Bonaventure's *De Reductione Artium ad Theologiam*
Reprinted from: *Religions* **2025**, *16*, 368, https://doi.org/10.3390/rel16030368 . . . . . **220**

About the Editors

Jacek Rodzeń

Jacek Rodzeń received his doctoral degree (PhD in philosophy, with a specialization in the philosophy of science) from the Faculty of Philosophy at the Pontifical University of John Paul II in Kraków and his post-doctoral degree (habilitation in the history of science) from the Institute for the History of Science of the Polish Academy of Sciences in Warsaw. He currently serves as an Associate Professor in the Department of 19th-Century History, Faculty of Humanities, at the Jan Kochanowski University in Kielce, Poland. His research focuses on the historical relationship between science, technology, and Christianity. He is a member of the Commission on the History of Science and the Commission on the Philosophy of Science of the Polish Academy of Arts and Sciences in Kraków.

Paweł Polak

Paweł Polak is Professor of philosophy at the Faculty of Philosophy of the Pontifical University of John Paul II in Kraków, Poland (Chair of History and Philosophy of Science and Technology). He holds a Ph.D. in philosophy from the Pontifical University of John Paul II in Kraków and an M.Sc. Eng. in telecommunications from the AGH University of Science and Technology. His interests in philosophy include the relationship between science and religion, the history of Polish philosophy, and the history and philosophy of science and technology. He has published on the theology of science from a methodological perspective and on interactions between science, philosophy, and theology regarding evolutionary theory, the theory of relativity, and entropic concepts. He also published a book on the reception of Einstein's theory of relativity in Poland, *Byłem Pana przeciwnikiem [profesorze Einstein]...* (2012). He is president of the Commission for Philosophy of Science of the Polish Academy of Arts and Sciences and Editor-in-Chief of the journal *Philosophical Problems in Science*, founded by Michael Heller. He is a member of international societies, including the International Society for the History of Philosophy of Science (HOPOS), the Society for Philosophy and Technology (SPT), and the Copernicus Center for Interdisciplinary Studies. He was the winner of the Jan Jędrzejewicz Prize for the History of Science (2013) and the Nicolaus Copernicus Prize for Philosophy of Science (2025).

religions

MDPI

Editorial

Introduction to This *Religions* Special Issue: Natural Sciences as a Contemporary *Locus Theologicus*

Jacek Rodzeń [1,*] and Paweł Polak [2]

[1] Institute of History, The Jan Kochanowski University, 25-369 Kielce, Poland
[2] Faculty of Philosophy, Pontifical University of John Paul II, 31-002 Krakow, Poland; pawel.polak@upjp2.edu.pl
* Correspondence: j.rodzen@ujk.edu.pl

Is science a gift to religion? If so, what does this gift entail? As we increasingly recognize that science and theology should not be viewed as competing models, some questions arise about how we can leverage the complementary benefits of these disciplines. This issue inspired us to undertake a new study, one which invited prominent theologians, philosophers, and scientists to contribute.

In April 2023, the editors of *Religions* asked us to propose a theme for a journal Special Issue covering research into the interaction between science and religion. We therefore chose contemporary science as the *locus theologicus* (theological place) for the issue's theme and invited potential authors from various religious and theological traditions to contribute.

After around two years of work, we managed to gather 11 original articles, all of which underwent a rigorous review process involving many important, and sometimes ardent, discussions. This unique collection of articles sheds valuable light on the current state of research into contemporary science as a *locus theologicus*. The papers offer a variety of original proposals and approaches to the relationship between science and theology. These are unprecedented in the literature, so we believe they collectively represent a milestone in the discussion's development. We also hope they will inspire further projects in the field of science–theology relations.

We initially thought that the theme of the Special Issue was not obvious. This is because the concept of *loci theologici*, including *loci theologici alieni* (secondary theological places), dates back to the post-Reformation theological tradition of the Catholic Church in the 16th century. Our intention, however, was to confront this ancient, late-Renaissance notion with the global state of contemporary theological reflection, which encompasses various religious traditions. In other words, we drew inspiration from this tradition and attempted to breathe new life into it. We also aimed to relate the historical theme of *loci theologici* to contemporary research on the interaction between these traditions and the sciences.

Our concerns were allayed over time, however. We received ten unique papers in total, not counting our joint article, demonstrating for the first time the importance of the sciences as *loci theologici alieni* for various religious and theological traditions. While the theme may have resonated most strongly with authors working within Catholicism, we were pleased to receive original and enriching contributions from authors within the Protestant (Ch. B. Kaiser), Orthodox (Ch. C. Knight), and Muslim (S. A. Malik) traditions.

What follows is a brief overview of the articles included in this collection, thus highlighting ideas that we believe deserve special attention due to their originality and contribution to the matter of religion's interaction with science. Note that we grouped the works based on their subject matter. We finally conclude this review with a summary of this collective study and the conclusions that can be drawn from it.

1. The Role of *Loci Theologici* in the Interaction Between Science and Religion

Before discussing the articles' subject matter, it is fitting to briefly explain the concept of *loci theologici*. In the context of Catholic theology, this concept appeared in a posthumous edition of a work by the 16th-century Dominican Melchior Cano that was titled *De locis theologicis libri duodecim* (About Theological Places, Twelve Books, Cano 1563). Cano organized these "places" (as sources of theology) according to the authority behind them. According to him, behind the *loci theologici proprii* (proper theological places) was the authority of God himself; he includes the Bible and the tradition of the Catholic Church within these. According to Cano, the *loci theologici alieni* (secondary places) also influence our understanding of divine revelation, but these are based on human authority. In his work that specifically concerned the eighth and ninth secondary theological places, the Spanish theologian wrote: "The eighth is the natural reason, which is most widely revealed through all the sciences discovered in the light of nature. The ninth is the authority of the philosophers, who follow nature as a guide (. . .)" (Twelve Books, Cano 1563, p. 4).[1] Thus, these *loci* were "natural reason" and "the authority of the philosophers" in reference to natural knowledge of the world (*scientiae*, *philosophia*). Cano adopted the concept of "*locus*" ("*topos*" in Greek) from Aristotle's work *Topics*, which is a writing on logic in the broadest sense, the so-called *Organon*, so it is a tool of cognition. Aristotle's *topoi* dealt with the principles of correct inference in cognitive processes. In developing his catalogue of *loci theologici*, Cano sought to organize the sources of argumentation and cognition specific to theology. It can be thought of as a compendium of meta-theological knowledge about how to construct and justify theological claims while maintaining the content and methodological standards of 16th-century science.

Contemporary literature for the concept of *loci theologici* is relatively limited, however. Notable studies include the works of authors like Chenu (1977), Körner (1994), Hünermann (2003), Mandreoli (2010), and Bafia (2018). When writing about "modern *loci alieni*," contemporary German theologian Peter Hünermann proposed including the sciences among them, primarily due to their influence on the current worldview, something that is crucial for developing non-anachronistic theological interpretations (Hünermann 2003, pp. 228–29). For the Polish physicist and theologian Michael (Michał) Heller, it is not simply the methods and presuppositions of science that are *loci theologici* but rather "the whole of science" (Heller 2010, p. 42). Another Polish scientist, the logician and theologian Jerzy Dadaczyński, recently wrote that "science, to which reason refers, is the source of theological cognition" (Dadaczyński 2015, pp. 86–87 and footnote 14). It can therefore be concluded that these contemporary scholars advocate a maximalist approach to *loci theologici alieni*, including the modern sciences in their multifaceted forms (i.e., languages, theories, and methods).

In the first two articles, astronomer and theologian Giuseppe Tanzella–Nitti and theologian Christoph Böttigheimer consider the role and usefulness of the concept of *loci theologici alieni* in modern science and its relationship with religion, particularly Christianity. Tanzella–Nitti highlights an important development that occurred with the emergence of modern, mathematically based empirical sciences and the formation of a new image of nature. Indeed, the earlier theological depiction of nature as God's work was superseded by mathematized knowledge of nature, with theology's influence being minimized. From this perspective, the idea of *loci theologici alieni* being applied to our secular knowledge of the world also became problematic or superfluous. Tanzella–Nitti therefore highlights the need to overhaul the modern perception of this idea by developing a new theology of nature that draws on the latest scientific knowledge. At the same time, he emphasizes a broad understanding of science as a potential *locus theologicus alienus*, not only in terms of its theories and methods but also as a human and social enterprise. According to Tanzella–

Nitti, this wider perspective enables the development of theological approaches that point to the salvific presence of the divine *Logos*/Word (i.e., the Second Person of the Trinity) within the realm of science.

In his article, Böttigheimer draws attention to the concept of *loci theologici* in Cano's work, referring to them as *domicilia*, places of "residence" for the Word of God. In doing so, he subtly distinguishes between theological places (*loci proprii*) and places of theology (*loci alieni*). Like Tanzella–Nitti, Böttigheimer notes that when looking through the lens of modern science, it is very difficult to discern the activity of the *Logos*/Word in the world. Nevertheless, developing such a perspective is one of the most important intellectual tasks for theologians, who, in the case of Catholic theologians, have clear signposts from the most recent Church documents and papal teachings. Böttigheimer's biblical-Christian conception of the world is presented through the perspective of the divine plans of creation and salvation. This vision portrays God's active presence in the world (ontological *domicilium*), with theology corresponding to this on the cognitive–scientific level. Böttigheimer discusses several philosophical–theological approaches, inspired by the achievements of modern science in tackling this question.

2. Science as a Locus in Christian and Muslim Theology

Although we did not envisage the inclusion of purely historical articles in the issue, we did allow for the presentation of texts that provide examples from the history of theology and/or science when they connect to contemporary science and theology in terms of content or form. Notably, this section features works by authors from various religious traditions. For modern science, this demonstrates the potential for universalizing the concept of *loci theologici alieni*, despite it originating centuries ago in the Catholic tradition.

Zbigniew Liana, a philosopher and historian of science, considers three historical examples where theologians used certain criteria to accept scientific theories as *loci theologici alieni*, or in other words, potential influences on the reformulation of Christian doctrine. More specifically, these are the views of Robert Bellarmine on the Copernicus–Galileo heliocentric concept; Pope Pius XII on the theory of human evolution; and Pope John Paul II on the same theory. Liana analyzes how the aforementioned theologians used the categories of demonstration and hypothesis in relation to the aforementioned scientific theories. He points out the peculiar evolution of these meanings and comes to the important conclusion that not only can scientific theories be considered *loci theologici* but also the methodological tools used by theologians. In this manner, Cano's original idea can be seen manifesting to some extent in the modern context.

The work of chemist and theologian Shoaib Ahmed Malik in this collection demonstrates how science, its achievements, and its methods can present a subject of analysis for theologians within and across religious traditions. Written from a Muslim perspective, Malik's work discusses the relationship between religious doctrine and human knowledge, both scientific and philosophical, as presented by the 15th-century theologian and imam Muḥammad ibn Yūsuf al-Sanūsī's in his work *The Preliminaries of Theology* (*al-Muqaddimāt*). Malik notes that al-Sanūsī's works and the Ashʿarī theological tradition they represent are not treated in his article as an authoritative interpretation of Muslim doctrine but rather an exemplary framework for analyzing issues like God's actions in the world, causality, and the possibility of miracles. These issues remain relevant to the relationship between Muslim theology and modern scientific knowledge.

The article by astrophysicist and theologian Christopher C. Knight presents modern science as a *locus* of theology from the perspective of Eastern Orthodox Christianity. Knight discusses his vision of theology by relating it to three issues, namely the understanding of natural theology, the relationship between the human mind and the Mind of God,

and divine action. Knight's work has two purposes: First, he seeks to demonstrate the differences between Western Christian theology (i.e., Protestant and Roman Catholic) and Eastern Christianity through these examples. Second, he discusses how Western theology has been enriched by the ideas of the Orthodox tradition. In doing so, Knight emphasizes the spiritual, mystical, and pneumatological dimensions of the latter tradition. Regarding the issue of divine action, Knight refers to the concept of the creator–savior presence in the world as the *Logos* of God, as developed by patristic theologian Maximus the Confessor.

Theologian Robert J. Woźniak's work addresses the role of scientific imagination in theology and the corresponding role of theological imagination in science. In the former case, Michal Heller's work serves as a guide to the history of the evolution of scientific imagination. The importance of scientific imagination as a *locus* of theology is especially evident in our image of the world, which is shaped mainly by science. Theology should accept this image, at least to some extent, to avoid being anachronistic. Woźniak also considers the potential impact of mathematics on theology, particularly with regard to the precision of argumentation and the imaginative dimension (e.g., Nicholas of Cusa's theology). Historical examples of how elements of Christian doctrine have influenced secular knowledge may also be interesting, such as the Nicene Creed's influence on concepts of time and space or the influence of the Cappadocian fathers' Trinitarian theology on the ontology of relations.

Philosopher and theologian Kamil Trombik primarily focuses on the epistemological, ontological, and theological significance (*locus theologicus*) of the intriguing effectiveness of mathematized scientific methods for learning about nature. Trombik examines the views of the Kraków School of Philosophy in Science, a group of researchers inspired by Michal Heller's work on this subject. A key aspect of the perspectives here is linking scientific endeavor to theological interpretation and connecting the mathematical nature of scientific cognition—or in stronger formulations, the mathematical nature of reality—to the concept of a rational Creator of the world or even a God-Mathematician. Trombik also notes, however, some limitations to the heuristic power of such a theological hypothesis. One possible issue is how the image of a God-Mathematician can be reconciled with the image of God as the source of the existential and axiological dimensions of human life.

3. Scientific Endeavor from the Theological Point of View

The final group of articles in this issue relates to how the sciences play the role of *loci theologicus*. Contemporary research on this topic has been inspired by the work of authors like Michal Heller (1996), Christopher B. Kaiser (1996), Tom McLeish (2014), and Paul Tyson (2022). Although the theology of science particularly relates to the phenomenon of science itself, the efficacy of its methods, and the values it assumes, the earlier articles in this issue demonstrate how science conceived as *locus theologicus alienus* can serve as a source of interesting forms of argumentation, useful methodological elements, and conceptual inspirations for theology.

The astrophysicist and theologian Christopher B. Kaiser wrote the opening article in this series. He addresses the issue of modern science as a sacred reminder. Kaiser applies Donald Walhout's concept of a "sacred reminder," which originally dealt with other religions, to remind people of forgotten or overlooked aspects of their own religion. According to Kaiser, science plays a similar role in Christian theology today. He demonstrates how reflections by renowned physicists John Archibald Wheeler and Stephen Hawking can advance theological reflection on God's role in the world. Much like Woźniak, Kaiser points out that science (physics) allows for the expansion of imagination, something that theologians use. He points out how inspiration from modern physics can further Trinitar-

ian theological reflection based on the exegesis of the New Testament and the writings of second-century Irenaeus of Lyon.

Another article by physicist and philosopher Dominique Lambert and philosopher Michał Oleksowicz indicates how the concept of intelligibility can serve as a means for theological reflection to stem from the sciences. This is because the concept necessarily assumes the sciences and can therefore facilitate mutual articulation or mediation (i.e., the proposed relationship between science and theology). The authors' analysis focuses on the worldview where this mediation occurs. The article represents an interesting attempt to refine the conceptual worldview based on the analytical concept of language that was introduced by Kazimierz Ajdukiewicz of the Lvov–Warsaw School.

Astronomer and philosopher Tadeusz Sierotowicz then offers yet another perspective on science's influence on theology by addressing it as an intertextual reading. Referring to Swiss theologian Hans Urs von Balthasar's concept of three domains of truth, Sierotowicz points out that adopting "a third domain of truths that genuinely belong to creaturely nature yet do not emerge into the light of consciousness until they are illuminated by a ray of the supernatural" changes one's perspective on the sciences. According to Sierotowicz, it is not the individual results but rather the theology of science itself—or in other words, the theological reflection on the scientific enterprise—that is the proper *locus theologicus*. Sierotowicz also presents an interesting analysis of the methodology and epistemology of the theology of science, referring in an original way to the results of the philosophy of science and the Midrash tradition.

The final article of philosophers and historians of science Jacek Rodzeń and Paweł Polak presents a comparative analysis of three concepts of the theology of science, as formulated by Michal Heller, Christopher B. Kaiser, and Tom McLeish. A notable aspect of their comparison is the use of Bonaventure's 13th-century text *De reductione artium ad theologiam* as a reference point for theological reflection. Bonaventure's Augustinian-based theology turns out to align well with contemporary proposals, much better than the still-dominant Thomistic proposal. Three areas of inspiration are highlighted, namely the concept of illumination ("a theological completion"), the question of exemplarism ("a Christology of science"), and reduction ("a theological teleology of science"). Turning to Bonaventure's classical theology for inspiration in the theology of science provides an important theological complement to the other considerations presented in this collection and reveals further directions for exploration.

4. Conclusions and Research Perspectives

The articles in this collection demonstrate that religion cannot fulfill its role or uphold its values without engaging with contemporary intellectual culture. Likewise, culture cannot fully develop while ignoring the significance of religion or marginalizing its role. This mutual dependency is particularly evident in theology. While this discipline is based primarily on divine revelation, it cannot serve religious communities without considering their culture and knowledge of the current world. The articles collected here demonstrate the enduring value of the idea of *loci theologici* and show that its relevance extends beyond just one particular theology or religion. Cano's *loci theologici* concept is an expression of this idea, a conviction that the tools and resources for acquiring and justifying knowledge represent an intellectual ecosystem for theology. We hope this volume will inspire further reflection on science as a *locus theologicus*.

Author Contributions: Conceptualization, J.R. and P.P.; writing—original draft preparation, J.R.; writing—review and editing, P.P. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Acknowledgments: This collection and therefore the Special Issue of *Religions* would not have been possible without the cooperation and professionalism of many people. As guest editors, we would like to thank all the invited authors who contributed their original views to this endeavor. We thank them for taking the time to write original articles and for persevering through the sometimes-exhausting editorial process despite their many other obligations. We would also like to thank the numerous reviewers who supported this project through their valuable feedback, thus significantly enhancing the quality of the submitted manuscripts. We also thank the editors of *Religions* for making the publication of this collection of original articles possible. We believe it will enrich and stimulate the debate on the relations between science and religion/theology. Last but certainly not least, we would like to express our deepest gratitude to the Assistant Editor of *Religions*. Without her invaluable assistance and wise support, the completion of the Special Issue and e-book would not have been possible.

Conflicts of Interest: The authors declare no conflicts of interest.

List of Contributions:

1. Tanzella-Nitti, Giuseppe. 2024. Dialogue Between Theology and Science: Present Challenges and Future Perspectives. *Religions* 15: 1304.
2. Böttigheimer, Christoph. 2024. Natural Science as a Modern Locus Theologicus Alienus. *Religions* 15: 1445.
3. Liana, Zbigniew. 2025. Criteria for the Acceptability of Scientific Theories as Locus theologicus: A Methodological Analysis of Catholic Church's Reactions to the Cases of Galileo and Darwin (Bellarmine—Pius XII—John Paul II). *Religions* 16: 153.
4. Malik, Shoaib Ahmed. 2025. Science as Divine Signs: Al-Sanūsī's Framework of Legal (sharʿī), Nomic (ʿādī), and Rational (ʿaqlī) Judgements. *Religions 16*: 549.
5. Knight, Christopher C. 2024. Some Eastern Orthodox Perspectives on Science-Engaged Theology (and Their Relevance to Western Christians). *Religions 15*: 1189.
6. Woźniak, Robert J. 2025. Scientific Imagination as locus of Theology. *Religions* 16: 467.
7. Trombik, Kamil. 2025. The Idea of Mathematicity of the Universe as a Locus Theologicus: Michael Heller and Representatives of "The Kraków School of Philosophy in Science". *Religions* 16: 54.
8. Kaiser, Christopher Barina. 2024. The Agencies of God's Word and Spirit: Modern Science as a "Sacred Reminder". *Religions* 15: 367.
9. Lambert, Dominique, and Michał Oleksowicz. 2025. The Quest for Intelligibility as Mediation Between Science and Theology. *Religions* 16: 421.
10. Sierotowicz, Tadeusz. 2024. Theology of Science as an Intertextual Reading: The Bible, the Book of Nature, and Narrative Paradigm. *Religions* 15: 293.
11. Rodzeń, Jacek, and Paweł Polak. 2025. Contemporary Theologies of Science in the Light of Bonaventure's *De Reductione Artium ad Theologiam*. *Religions* 16: 368.

Notes

[1] Octavus ratio naturalis est, quae per omnes scientias naturali lumine inventas latissime patet. Nonus est auctoritas philosophorum, qui naturam ducem sequuntur (. . .)." (our translation).

References

Bafia, Stanisław. 2018. *O źródłach teologii* Melchiora Cano przestrogą dla teologów. *Forum Teologiczne* 19: 205–16.

Cano, Melchior. 1563. *De locis theologicis libri duodecim*. Salmenticae: Excudebat Mathias Gastius.

Chenu, Marie-Dominique. 1977. Les lieux théologiques chez Melchior Cano. In *Le Déplacement de la Théologie*. Actes du Colloque Méthodologique de Février 1976. Edited by Yves Congar. Paris: Editions de Beauchesne, pp. 45–50.

Dadaczyński, Jerzy. 2015. O niektórych (możliwych) obszarach badań teologii nauki. In *Teologia nauki*. Edited by Janusz Mączka and Piotr Urbańczyk. Kraków: Copernicus Center Press, pp. 75–94.

Heller, Michael. 1996. A Program for Theology of Science. *Studies in Science and Theology* 4: 41–44.

Heller, Michael. 2010. *The Sense of Life and the Sense of the Universe: Studies in Contemporary Theology*. Kraków: Copernicus Center Press.

Hünermann, Peter. 2003. *Dogmatische Prinzipienlehre. Glaube—Überlieferung—Theologie als Sprach- und Wahrheitsgeschehen*. Münster: Aschendorff.

Kaiser, Christopher B. 1996. Scientific Work and Its Theological Dimensions: Toward a Theology of Natural Science. In *Facets of Faith and Science*. Edited by Jitse Van der Meer. Lanham: University Press of America, vol. 1, pp. 223–46.

Körner, Bernhard. 1994. *Melchior Cano "De locis theologicis libri duodecim". Ein Beitrag zur theologischen Erkenntnislehre*. Graz: Styria-Medienservice.

Mandreoli, Fabrizio. 2010. Il *De locis theologicis* di Melchor Cano. Appunti su un metodo teologico interpretato sui "tempi lunghi". *Rivista di Teologia dell'Evangelizzazione* 14: 281–301.

McLeish, Tom C. B. 2014. *Faith and Wisdom in Science*. Oxford: Oxford University Press.

Tyson, Paul. 2022. *A Christian Theology of Science: Reimagining a Theological Vision of Natural Knowledge*. Grand Rapids: Baker Academic.

Disclaimer/Publisher's Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.

religions

MDPI

Article

Dialogue Between Theology and Science: Present Challenges and Future Perspectives

Giuseppe Tanzella-Nitti [1,2]

[1] School of Theology and DISF Research Center, Pontifical University of the Holy Cross, 00186 Rome, Italy; tanzella@pusc.it
[2] Vatican Observatory, 00120 Vatican City, Vatican City State

Abstract: In order to consider the natural sciences as a contemporary locus theologicus, I here examine the meaning and implications of the "dialogue between theology and the sciences". Although widely used, this expression has different meanings. I try to clarify who the interlocutors of the dialogue are, where the dialogue takes place, and what the goals of the dialogue itself are. A coherent agenda to encourage the use of the sciences in theological work should include (a) the design and implementation of interdisciplinary curricula to help those scholars who are seriously interested to be trained in this field; (b) an emphasis on the role of philosophy and philosophical sources in the study of the sciences and theology; (c) going beyond the epistemological level and developing the dialogue also at the anthropological level; (d) the identification of a number of key issues for theological and religious studies that are expected to become more urgent in the coming years. Finally, the use of the sciences as a locus theologicus is expected to bear two main fruits: first, to offer a positive, speculative insight to the work of theologians and, second, to contribute to a responsible development of the dogmatic teachings of the Church.

Keywords: science and theology dialogue; interdisciplinary curricula; theology of nature; philosophical dimensions of scientific activity; scientific humanism; dogmatic development of Church's teachings

1. Introduction

If we recall the typology proposed some years ago by Ian Barbour as "ways of relating science and religion" (Barbour 1997; originally presented in Russell et al. 1988; see also Laracy 2023), consisting of the four views of "conflict" (scientific materialism, biblical literalism), "independence" (contrasting methods, different languages), "dialogue" (boundary issues, methodological parallels), and "integration" (theology of nature, systematic synthesis), we should place the program of using the natural sciences as a contemporary locus theologicus in the fourth and last of his views. This means to have overcome views of conflict and independence and to have gone through the experience of dialogue. The manner in which such an experience is conducted, the results it produces, and, above all, the content and methods it brings to bear, will in large part determine the outcome of those programs that Barbour puts under the label of "integration". If the dialogue is limited to clarifying misunderstandings and pointing out the exegesis to be adopted in science or theology, or if it remains at the level of public debate that oscillates between apologetic and mystical tones, then it is unlikely to produce serious work for the academy.

If we look at the books or essays published since the 1980s and devoted to the so-called "science and religion dialogue", most of them, especially in continental Europe, are intended for the general public; usually, they do not treat the subjects under investigation with the same depth we find in other interdisciplinary subjects. The main purpose of these essays, which are often presented under the heading "Science and Faith" or "Science and Religion", is to emphasize the compatibility and harmonious coexistence of the two perspectives, the scientific and the religious, with arguments that most of the public may find convincing,

but that more qualified readers would still consider insufficient. In these works, the terms religion, theology, faith, spiritual life, are often used as synonyms. Generally speaking, with a few exceptions, they are all similar to each other, differing only in the biography of their authors.

Works and studies aimed at developing such a "dialogue" in a propaedeutic way for possible subsequent programs of "integration" are more common in the US and the UK, but still few in continental Europe. There are attempts to present a possible "theology of nature" and use scientific findings to argue about a dogmatic development of the teachings of the Church. For an exhaustive review of the dialogue between theology and the sciences, please refer to the work by Perry and Leidenhag (2023). A concise but insightful overview was provided about 20 years ago by Robert Russell (2002). To be propaedeutic for a later integration program, the dialogue needs a terminological rigor, a good knowledge of both scientific and theological sources, and a good familiarity with the history of philosophy. Usually, these qualities are poorly represented in works whose purpose is merely to demonstrate the compatibility of the two perspectives. By the way, those authors who support the "conflict" thesis do not write essays under a specific label (conflict or dialogue), but use them to publish popular science books presenting chapters or pages strongly critical of the theological or religious perspective.

The transition from the view of "dialogue" to that of "integration" is not trivial. If dialogue is carried out in a superficial or hesitant way, favoring only a conservative mindset without opening horizons, integration easily appears as an overly complex, even dangerous program. The temptation arises, then, to return to the safer vision of "separation" without conflict. For this reason, I propose in these pages to take a closer look at the situation of the contemporary dialogue between science and theology: Where is it taking place? What are its main trends? How are its main issues being addressed? In fact, a better knowledge of what the dialogue consists of, and how it is undertaken, can prepare the ground for the development of a "science-engaged theology" (Perry and Leidenhag 2023; Moltmann 2003) and for the use of the natural sciences in the work of theologians (Austin 1976; Messer 2020; Tanzella-Nitti 2009a), that is, for a view in which scientific knowledge of nature can play the role of a locus theologicus.

This approach would be fully consistent with a perspective that Christian theology had in mind when it considered nature, that is, creation, as a conceptual site from which speculative or moral reflections could emerge. This perspective was adopted by Church Fathers such as Ambrose of Milan, Basil of Caesarea, Gregory of Nyssa, Augustine of Hippo, and Maximus the Confessor, to name a few. We find it in Medieval authors such as Hildegard of Bingen, Francis of Assisi and Bonaventure of Bagnoregio, and it enters the Renaissance with several Christian authors, although mixed with other forms of spirituality. With the beginning of the Modern Age, when the concept of nature was transformed into the new concept of the "scientific knowledge of nature", this locus theologicus was gradually lost. It was thought that nature, precisely as an object of scientific knowledge, could no longer support the task of being examined by theologians. Nature could continue to be an object of interest for theology only if mediated by perspectives different from science: poetry, literature, arts, humanities. One of the tasks of theology in the 21st century should therefore be to return to the study of nature both as an object of scientific knowledge and as an effect of God's creation. In short, memento naturam, that is, "remember Nature", as Perry and Leidenhag (2023, pp. 1–2) cleverly suggest. This transversal and stereoscopic vision, capable of enriching both disciplines, could lead the natural sciences to become once again a theological locus for our scientific age.

2. Places, Subjects, and Aims of the Dialogue

Scholars who want to approach the subject of how theology and the natural sciences enter into dialogue should consider and examine the following:

(a) who are the interlocutors of the dialogue;
(b) what are the places where the dialogue is developed; and

(c) what are the actual goals of the dialogue itself.

These clarifications may seem obvious, but they are often glossed over or taken for granted, creating some confusion and bringing the whole issue back into too general, at times superficial, terms.

Consider, for example, how science and theology interact differently in a Religious Studies classroom or in a School of Theology than they do in the mass media or in public debates. Interviews, papers, and conversations have different weight and depth depending on who the author is and what his or her background and profile is. Topics concerning science and theology will be approached differently by an author who is a believing scientist (who usually has never studied philosophy or theology); an "ordained scientist", i.e., a priest who is active in the field of science but has never received a Ph.D. or other advanced degree in theology; a professional theologian who is interested in science but has no specific expertise in any scientific discipline; or, finally, a scholar who has a double Ph.D., one in science and one in a theological discipline.

Again, all this seems obvious to people who work in the academy and are accustomed to critically reflect on what they read and hear, yet these differences are usually overlooked by many media operators and not a few popularizers of science. So there are tacit interactions that affect the whole thing; a professional theologian, for example, who is not trained in science may know scientific theories and results through the lens of popular literature or public debate, and only in a few cases may be able to understand more deeply what a scientific theory really says. I offer a course on science and theology at my university; when the course begins, many students—including future theologians—tell me that this subject is hardly relevant to them, because the vast majority of scientists around the world are atheists. This is an example of how a superficial, mass-media view influences the academy.

Let us now focus on the places of dialogue. In the Anglo-Saxon context, there are state or non-confessional university campuses that host chairs of theological studies, and even chairs of religion and science, as in Germany, the United Kingdom, and the United States. This is not the case in Latin countries such as Italy, France, or Spain, to name but a few. In the latter countries the academic dialogue between science and theology can only take place in the Ecclesiastical Universities, where theology is present; on the other hand, these universities do not have any school of natural sciences. In Latin countries, the interdisciplinary dialogue takes place in intellectual circles outside the academy, such as independent schools, institutes, or associations. As a consequence, recommendations and proposals addressed to English or North American universities cannot easily be put into practice in Italian, French, or Spanish universities.

Recent official documents addressed by Pope Francis to the Pontifical and Ecclesiastical Universities contain new and interesting recommendations for the development of interdisciplinary studies, including topics related to science and religion (Francis 2018, *proemio*). John Paul II strongly encouraged interdisciplinary studies and dedicated many allocutions and writings to both theologians and scientists (John Paul 1988; Russell et al. 1990; Strumia 1987), especially during the General Assemblies of the Pontifical Academy of Sciences (Pontifical Academy of Sciences 2003; Sánchez Sorondo 2009). The Vatican Council II (1965), which spoke of the "signs of the times" with reference to the values contained in contemporary culture (see *Gaudium et spes*, nn. 4, 11), also encouraged Ecclesiastical Universities (especially theological schools) to collaborate with all the other universities, motivating theologians and the faithful to be informed about scientific results: "May the faithful, therefore, live in very close union with the other men of their time and may they strive to understand perfectly their way of thinking and judging, as expressed in their culture. Let them blend new sciences and theories and the understanding of the most recent discoveries with Christian morality and the teaching of Christian doctrine, so that their religious culture and morality may keep pace with scientific knowledge and with the constantly progressing technology". (*Gaudium et spes*, n. 62; see also see *Gaudium et spes*, nn. 44; *Optatam totius*, nn. 13, 15; *Gravissimum educationis*, nn. 10–12).

The way in which the relationship between science and theology is explained and perceived by the public also depends on the goals that motivate the debate engaged. The same author may write a book to reply to an attack on Christianity issued by an atheist scientist (Haught 2008) or, instead, to explain how the natural sciences can improve the work of theology (Haught 1999). Books on Genesis 1 that aim to demonstrate the compatibility of creation and evolution may give too narrow an idea of the "theology of creation" since they do not comment on the rich theology of the Logos and its implications for understanding physical reality. Essays aiming at discussing the Catholic Church's view on bioethics could only cite a few specific documents of the Church's Magisterium, which alone cannot give a complete idea of how the Roman Catholic Church sees and judges the work of science.

On this last point, I would like to add that the ethical issues and debates raised by the social implications of technology are generally not the best place for a serene dialogue between science and theology, simply because, in such a context, science is seen mainly as a "source of problems". A few years ago, in a bookstore, I opened an anthology of documents of the Church's Magisterium and looked at the index of subjects; the only entry related to the topic of "science" was "science, limits of". Actually, the anthology contained many documents that had a positive view of the work of science, but the idea that science is something dangerous and should be limited is still commonplace in not a few ecclesiastical circles.

What if we consider authors who are active in the academy? It seems to me that the goals of the dialogue between theology and science, even when promoted by scholars, are first and foremost to correctly address boundary issues and hot topics. Few scholars are interested in broader and more challenging goals, such as building a new a unity of knowledge capable of integrating scientific and humanistic perspectives (McLeish 2019; Nicolescu 2002; Slattery 2020; Kaiser 2021). Most of the interdisciplinary literature aims at clarifying errors and misunderstandings regarding some typical hot-button issues, such as the exegesis of Genesis 1; the creation versus evolution debate; ex nihilo creation of the cosmos versus origin from a quantum vacuum; and finality in nature versus utter chance, etc. Much effort is made to separate scientific and theological perspectives, to define territories, to recall the different scopes of science and theology. A widespread approach is to describe what theology and science could say about the beginning of the universe, the origin of life, the ultimate scenarios of the cosmos, the post-human and trans-human future of *Homo sapiens*, and so on.

Nevertheless, the Academy and a number of institutions and societies seriously engaged in the dialogue between science and theology have also promoted studies on deeper theological questions, which are more difficult to address because they require not only some necessary epistemological clarifications but also and above all a higher level of conceptual synthesis. Among these questions, we certainly have the following: how to understand divine action in nature; what is the relationship between the history of the cosmos and the history of salvation; what is the religious heritage of *Homo sapiens*; how to explain the cosmic centrality of the incarnate Word-Logos in an extraterrestrial cosmological context; how to reconcile divine Providence and miracles with the scandal of physical evil; what the theological doctrine on a new creation has to say to physical cosmology. Many of these "higher level questions" were already mentioned in John Paul II's letter to George Coyne, dated on 1 June 1988. It is not by chance that one of the most serious attempts to work on science and theology was born precisely in this historical and cultural context, giving rise to the well-known Vatican-CTNS Conference series on *Scientific Perspectives on Divine Action* (Russell et al. 2008). It is in this same climate that a good number of scholars decided to undertake the program to promote unprecedented Encyclopedias and collective works, which began to be published just at the turn of the millennium (Tanzella-Nitti and Strumia 2002; Van Huyssteen 2003; Harrison 2010; Stump and Padgett 2012; Runehov and Oviedo 2013).

The remarks I have made about themes, places, and goals may, I think, prove useful in framing a reflection on the past and present of the dialogue between science and theology. In the following sections, I will offer, in a rather schematic way, a number of suggestions that might inspire the future work to be made, with some emphasis on Catholic theology. In doing so, I have in mind a dialogue whose interlocutors are scholars and intellectuals, a dialogue that should take place in the academy, and whose goals are to provide a better science and a better theology.

The essentials of my proposal for the work to be done can be summarized as follows:

- Design and implement specific interdisciplinary curricula;
- Improve the teaching of philosophy and enrich the philosophical sources used in the "science and theology" studies;
- Work to upgrade the dialogue from the epistemological to the anthropological level;
- Highlight a number of key issues for the agenda of theologians that are expected to become more urgent in the coming years;
- Allow the natural sciences to offer theology a positive, speculative insight and, consequently, to contribute to a responsible development of the Church's dogmatic teaching.

3. Designing Interdisciplinary Curricula: The Need for University Programs on Science, Philosophy, and Theology

All scholars interested in the dialogue between science and theology—I would say all scholars sensitive to the ideal of a cultured person—share the wish that graduate and undergraduate curricula should have a broader interdisciplinary breath. As is well known, US universities allow more flexibility in the construction of a personal program of study than do European institutional programs. In general, the need to introduce historical and philosophical perspectives into the training of scientists is more vivid and urgent today than in the past. The situation is well presented in an article entitled "Why Science Needs Philosophy" (without a question mark at the end), written by a group of top scientists, including the renowned Italian quantum physicist and bestselling author Carlo Rovelli (Laplane et al. 2019). While offering an interesting set of guidelines to foster philosophically engaged scientific research, the authors declare "The reconnection between philosophy and science is both highly desirable and more realizable in practice than suggested by the decades of estrangement between them" (Laplane et al. 2019, p. 3951).

Regarding the need for a dialogue between science and philosophy, it should be mentioned that several decades ago some authors proposed a new approach called "philosophy in science", which should be developed alongside an already existing "philosophy of science". While the former is concerned with the critical evaluation, from outside, of the knowledge associated with the scientific method, the latter seeks to highlight the philosophical reflections that arise from within scientific or technological activity (see Heller 2019; Polak 2023). In the 1980s, this perspective gave rise to the journals *Philosophy in Science*, published in Tucson, AZ, and *Zagadnienia Filozoficzne w Nauce*, published in Krakow, and promoted by scholars such as Andrzej Pacholczyk, Michael Heller, Joseph Życiński, and William Stoeger.

Promoting dialogue between the humanistic and scientific disciplines in our university curricula provides a fertile humus in which a dialogue between science and theology can later develop and bear fruit. Only scholars who study the history of ideas, who are aware of the influence of a particular philosophical view of nature on the formulation of a physical theory, who recognize how a researcher's personal biography can impact on his or her scientific program, will be better prepared to work on issues at the intersection of the sciences, philosophy, and theology (Allen and Marcacci 2024). In fact, only a better acquaintance with the historical, philosophical, and even sociological context of scientific activity can lead scientists to appreciate the role that a particular theological worldview may have played in the study of nature.

In principle, the best work on topics that concern scientific culture and Christian theology should be done by those scholars who have a double academic degree in a

scientific and a humanistic discipline. For this reason, during the preparation of the Interdisciplinary Encyclopedia, directed by Alberto Strumia and myself, we required that at least 60% of the contributors meet this requirement. The same requirement is active today in its online version in progress (*Interdisciplinary Encyclopedia of Religion and Science*, at https://inters.org/interdisciplinary-encyclopedia). Although demanding, this requirement remains a relevant aspect for the future of the dialogue; if we look at the list of articles published in the main journals on science and religion, authors with a double advanced academic degree in both science and theology remain today a minority.

So, an interdisciplinary perspective is certainly useful for future men and women of science attending a university program. What about the interdisciplinary formation of candidates for theological studies? According to a long tradition, the teaching of the natural sciences was part of the study programs of the ecclesiastical seminaries and pontifical universities of the 18th and 19th centuries. Since the 20th century, the situation has changed dramatically, and training in the natural sciences is no longer present in the formation of the clergy. Unlike the ratio studiorum of the seminaries of the 19th century—which included the teaching of physics, astronomy, chemistry, botany, mathematics, and logic—the contemporary study programs of theology students cannot include such kind of disciplines due to the enormous development that scientific research has experienced in our time. The familiarity with the sciences that the clergy had in previous centuries seems to have been lost.

For those who love data, quantitative evidence of such a change is provided by the biographical profiles contained in the monumental 16-vol. *Dictionary of Scientific Biographies*, edited by Gillispie (1980). It turns out that in the 18th century, the percentage of scientists who were also clergymen of Christian churches was about 30% of all recorded biographies. This percentage drops sharply to 10% in the early 19th century, before dropping to very few profiles in the 20th century. Although these data do not prove the "efficiency" of the dialogue between theology and science—the biographies refer only to scientists who were also clergymen, but not necessarily theologians—they do provide an important indication; a significant number of scholars, initially trained in philosophy and theology, later decided to devote themselves to do research in some field of science. Nowadays, especially in Latin countries, the clergy's knowledge of the natural sciences is quite deficient. For this reason, I think, funding programs aimed at strengthening the scientific culture of the clergy, such as those promoted by the John Templeton Foundation, are most welcome.

Usually, at least in continental Europe, the vast majority of students of theology—and then the majority of future theologians—come from the clergy. At present, lay people involved in theological study and research are a large minority. Now, the official curricula approved by the Dicastery for Culture and Education of the Catholic Church for theological schools and seminaries around the world make it difficult to introduce new disciplines and new courses in the Bachelor of Theology (BA) programs. In fact, this is the only university degree held by 90% of the Catholic clergy. In the specialized graduate programs (MA), there is, in principle, room for the introduction of interdisciplinary courses and some basic instruction in the natural sciences. Designing and implementing such programs, however, requires a certain sensitivity to the sciences, as well as a proper appreciation of the epistemological value of scientific knowledge. Typically, theologians who wish to have some training in the sciences must enroll in a new university curriculum, choosing a program in physics, chemistry, or some of the natural sciences, which takes several years. And this is a cultural investment difficult to realize for priests engaged in pastoral work. The majority of clerics or seminarians who wish to enrich their scientific culture must do so on their own, usually by reading popular scientific literature or attending lectures promoted by cultural Institutes or Associations.

What was recommended by the Vatican Council II and encouraged by various Popes regarding the dialogue between scientific culture and theology has not yet been put into practice in the majority of the educational institutions of the Catholic Church. In my opinion, one of the greatest tasks in the coming decades for the "Science and Theology

Movement"—to name it in some way—will be to translate these moral encouragements and desires into a practical renewal of theological studies, introducing a better knowledge of science into the Church's seminaries and ecclesiastical universities. To achieve this goal, a roadmap to pursue could be as follows:

In the next decades of the 21th century, we should gradually develop for the natural sciences what theological studies developed for the humanities in the 20th century, when they included in their programs new subjects such as history, psychology, philology, anthropology, or sociology. Specialized graduate studies in theology (MA) should include courses on "Science and Theology", for instance, presenting more in depth a number of topics under public debate, or developing a historical, philosophical, or epistemological perspective on the relationship between these two fields. Ph.D. dissertations on topics at the intersection of science, philosophy, and theology should also be encouraged. Last but not least, it is important to improve the scientific level of studies on science and theology and to raise the academic prestige of those scholars who choose to work in this dialogue. The depth of the peer review process required for publication should also become more demanding. In this way, the fruits of the studies carried out in this field—books, journals, associations, conferences, study groups, etc.—will be able to reach the Academy (I use a capital A here) without being confined to the narrow circles in which they originate.

In my opinion, the role of ecclesiastical theological schools, especially in the Catholic environment, remains strategic. In fact, the focus on *science and religion studies* adopted by the theological schools promoted by the Churches born of the Reformation is too general for *theology* to return to using nature as a locus theologicus and the natural sciences as a positive resource for the theologian's theoretical activity. Theology is not religion.

4. How to Improve Philosophy's Propaedeutic Role in "Science and Theology" Studies?

A number of factors seem to have weakened the propaedeutic and mediating role that philosophy is expected to play when the scientific community confronts the big questions raised by the natural sciences and proposes them to the general public. I would like to mention here three factors that seem to have had some weight.

(a) Ultimate questions about "the origins", man's place in the cosmos, and the meaning of it all, are now raised primarily by scientists. In contrast to Modernity, contemporary philosophy seems to have dismissed them. As a result, these questions are addressed and framed essentially within the scientist's personal and existential worldview, and much less within a more universal, historical, and philosophical context.

(b) Since the second half of the 20th century, philosophy of science has become more skeptical about the possibility of knowing the truth (truth in science and truth in general). The reading of scientific works made by philosophers prompted science to abandon a realist framework in favor of an idealist or conventionalist one. As a result, a large number of scientists, who used to be genetically realist in their approach to the physical phenomena, have given up on dialogue with philosophers. Sometimes, scientists have the impression that philosophers are abstract intellectuals who do not have enough understanding of experimental research work.

(c) Finally, many of the big questions raised by the natural sciences have directly or indirectly introduced a notion of *God*. The first context into which scientists have brought the "science and God debate" was sacred Scripture, not philosophy. As a result, the discussion between science and theology began to revolve around biblical exegesis, making the need for recourse to philosophy less obvious.

This state of affairs led many scientists to create "their own" philosophy. This was done on the basis of their feelings and experiences, in accordance with the materialistic or spiritual attitude they had developed in their youth. Only few scientific researchers have been introduced to the great philosophical traditions used to discuss being and becoming, causality and contingency, language and its interpretation, chance and finality, life and death. For the majority of them, many philosophical tools remain abstract, unfamiliar concepts. A number of philosophical concepts—being, truth, chance, finality, etc.—have

been interpreted as merely empirical concepts and transformed into quantitative properties of matter, energy, and space-time, into probabilities to be calculated, or into formal logic to be written down.

A certain difficulty in reasoning in terms of metaphysical ontology, and thus a certain difficulty in understanding the action of a causality that is transcendent with respect to space and time, has led some scientists to present arguments at the intersection of science and philosophy without concern for maintaining sufficient epistemological and metaphysical rigor. The need for adequate philosophical depth becomes even greater when the interdisciplinary debate is to include the concept of God. The number of popular science books that contain the term "God" in their title is now so great that it would be pointless to give a bibliographic listing of them here. Indeed, there are different philosophical images of God, not all of which are equivalent. Knowledge of the origin and meaning of these images becomes indispensable when the confrontation between science, philosophy, and theology is carried out on the theological or biblical terrain. Many misunderstandings and conflicting views of the relationship between God and nature result from a failure to define which philosophical image of God a particular author is referring to. A recent example is the widespread debate surrounding a best-selling book on God and Science (Bolloré and Bonnassies 2021; Rovelli and Tanzella-Nitti 2024; Sánchez Cañizares 2024).

For all these reasons, I believe that the development of the dialogue between theology and the sciences, including that which should lead to a re-evaluation of the knowledge of nature as an appropriate theological locus for the elaboration of a better theology, one suitable for our times, depends and will depend in the future on the depth of interdisciplinary philosophical studies. Philosophy has always been an attractive meeting point between the sciences and theology. A program to be pursued with determination, then, is to arouse the interest of scientists (and theologians too!) in the study of great philosophers and great philosophical problems. They must be known more in depth, without being content to have only an approximate view of it.

The discussion thus shifts to the philosophical sources and to the authors who deserve to be studied, a topic on which I would like to say a few more words. If in the 20th and 21st centuries a significant part of the philosophy of nature and the philosophy of science has perhaps not offered an adequate mediation for the dialogue between science and theology, then it is reasonable to look for this mediation in some authors of the past. This should not be surprising, since our current sophisticated and theoretical scientific frameworks can also be understood and interpreted in terms of philosophical, logical, and aesthetic dimensions that belong to meta-physical views already suggested in earlier times.

Among the authors of the past who could still offer some valuable insights, I would like to mention Aristotle and Thomas Aquinas. The majority of scholars involved in the dialogue between science and theology consider Aristotle to be a philosopher who is no longer relevant because his physics has been far surpassed. In reality, a better knowledge of the context of Aristotle's thought, combined with a proper hermeneutic, could enable us to make more use of his thought. His doctrine of causation, the notion of formal causality, the composition of reality in terms of potency and act, matter and form, as well as his deep philosophy of being, are all topics that still provide a useful *philosophical* insight into natural phenomena. In recent decades, there has been a revival in the study of Aristotelian metaphysics and natural philosophy. This has led some authors to speak of "Aristotle's revenge" (Feser 2018).

Aristotle's thought on nature was enriched by a theological perspective thanks to Thomas Aquinas, who understands nature in the light of creation. Today, Aquinas' philosophy is used in the dialogue between science and theology by a limited number of Catholic scholars, mainly in France, Spain, and Italy. There is a significant revival of Aquinas in the Dominican schools of the United States, where his writings are widely used, especially in the philosophy of nature, to frame and interpret the relationship between God and nature, God's causality, and the causality of creatures (Tabaczek 2024). Aquinas' metaphysics and philosophy of nature are used to discuss the philosophical foundations

and the meta-empirical presuppositions of scientific knowledge of nature (Augros 2004; Maldamé 2001b; Strumia 2007, 2009), including life (Carreño 2015, 2017). Scholars of Aquinas find his thought particularly suitable to search for a "unity of knowledge" and for demonstrating the unity that all physical reality acquires when understood in the light of creation. Inspired by Aquinas' thought, scientific enterprise as a whole can be presented as a naturale desiderium cognoscendi veritatis, and then as part of the human naturale desiderium videndi Deum. Scientific activity, then, is a *personal* commitment to truth, a *personal* search for God (Tanzella-Nitti 2012).

However, the scholars of Thomas Aquinas face a major challenge. In his time, the causality of natural phenomena did not include emergence, complexity, non-locality, top-down causality, holistic and systemic approaches, all of which we are taught by contemporary physics and biology. To interpret and explain these new perspectives in terms of a classical doctrine of causation, as used in natural philosophy or metaphysics, requires a huge and insightful work of "translation" (Dodd 2012; Tabaczek 2021). Aquinas' philosophy still has a good chance of dialoguing with a world that hosts these "new kinds of causes", but it is clear that his thought cannot be used in a naïve way (Wallace 1968; Verschuuren and Koterski 2016; Tanzella-Nitti 2023).

A good way to increase the mediation of philosophy in the study of "science and theology" is to ask scholars to broaden their philosophical *sources* and admit different philosophical *methods*. Classical metaphysics and multi-layered ontology should be used as well as process philosophy. English speaking and continental European countries seem to have "their own authors" and pay less attention to other philosophical traditions. British and American scholars of the science–theology dialogue—the prominent group today—are much more familiar with the works of Karl Rahner, Paul Tillich, Wolfhart Pannenberg and Jürgen Moltmann, while theologians such as Henry de Lubac, Romano Guardini, Joseph Ratzinger, Jean Danielou, or Hans Urs von Balthasar are much less read and used. European continental scholars are more familiar with the Church Fathers (I mean other than Augustine of Hippo, who is obviously well studied by everyone) and Medieval authors such as Bonaventure of Bagnoregio or Hugh of St. Victor. A number of inspiring Renaissance and Modern philosophers, such as Nicholas of Cusa and Blaise Pascal, are used in very narrow circles, in the U.S. or in Europe. Authors belonging to the Orthodox Sophiology movement, such as Solov'ëv, Bulgakov, or Florenskij, would also be very inspiring for an innovative theology of nature, but they seem to be known to only a small number of people.

There are contemporary sources and philosophers who are frequently and rightly cited by all groups of scholars involved in the science–theology dialogue—think of Pierre Teilhard de Chardin, Michael Polanyi, or Thomas Torrance—while others seem to remain somewhat in the shadows, although they would have much to say—think of Charles Sanders Peirce, Antonio Rosmini, Maurice Blondel, Henri Bergson, Jacques Maritain, Etienne Gilson, Jean Ladrière, Evandro Agazzi, or Enrico Cantore, to name but a few. A better intellectual cross-fertilization between different schools and groups of scholars would certainly bring fresh ideas and more fruits to the dialogue between science and theology.

5. From the Epistemological to the Anthropological Level: A Helpful *Upgrade* for the Science and Theology Dialogue

To date, most of the issues discussed in the field of science–theology studies concern the search for a correct epistemology capable of addressing in a meaningful and non-equivocal way what is proper to the scientific method and what is proper to other methods on which philosophical or theological knowledge is based. This is, of course, a preliminary and necessary work that lies at the foundation of all further dialogue. It is also part of an epistemological work to provide an accurate biblical exegesis to be used to compare the contemporary scientific worldview with a view of nature understood as God's creation. As expected, scholars are so engaged in clarifying, explaining, separating, and highlighting the ways in which science, philosophy, and theology acquire and communicate their own

knowledge. Interdisciplinary studies carried out at the epistemological level are mainly concern with methods, sources to be used, ways of reasoning, etc., including the different ways in which conclusions and inferences can be made, e.g., causal, statistical, hypothetical, by abduction.

The aim of the epistemological moment of any interdisciplinary research is to produce unambiguous and sufficiently clear statements capable of expressing what we can affirm, with a certain degree of confidence, in one or more specific fields of knowledge. In doing so, we are in principle able to suggest (or even demonstrate) whether statements coming from different domains of knowledge can be judged as independent, compatible, consistent with, or even contradictory among themselves.

Normally, the epistemological approach focuses more on the subject's knowledge than on the *subject acting for an end*. We are interested in what he or she can actually grasp of reality, starting from sense experience and applying the laws of rigorous reasoning. In general, the world of aims, feelings, ideals, desires, intellectual passions, and ultimate goals is left aside. There have been attempts in past decades to assess the role that the subject's *personal world* might have for any kind of knowledge (Polanyi [1958] 1998, [1967] 2009; Damasio 1998). Thanks to these attempts, a new understanding of scientific knowledge is gradually emerging today, different from the idea that doing science is merely an impersonal, neutral, and totally objective activity. A symptom of this state of affairs can also be seen in the rise of the "internalism–externalism debate" within some currents in the philosophy of science (Kornblith 2001). Actually, the personal world of the subject is important whenever existential or spiritual dimensions are involved, as is to be expected in a dialogue between science and theology, since philosophical, theological, and religious world views are here presupposed and implicated.

5.1. Science as Personal Knowledge and a Fully-Engaging Activity

Several authors have pointed to specific domains in which "personal dimensions" of knowledge are at work. These include, to name just a few, subjective, implicit, and tacit aspects related to one's personal worldview (Polanyi [1967] 2009); historical, existential, and religious contexts of the scientist's activity and mind (Torrance 1984; Jaki 1987); value judgments associated with any measurement (Rudner 1953); implicit metaphysical views in representing what reality is: matter, spirit, life, ensemble of relations, etc. (Capra 1975; Penrose 1999, 2005; Smolin 1998; Rovelli 2022); and, especially when conceptualizing the universe as a whole, in cosmology (Gal-Or 1987).

To move from the epistemological to the anthropological level means to focus on the human persons who dialogue, that is, the scientist and the theologian, and to focus on *the very purpose of the dialogue*, that is, the search for truth. In this way we reintroduce the world of ultimate goals into scientific activity. Speaking of the anthropological dimensions of scientific research means that research, insofar as it is *scientific*, needs ends. It is thanks to the exercise of their personal freedom that researchers choose the goals and purposes of their investigation, plan an experiment, overcome failures, and nurture the motivations of their scientific enterprise. In Part III of his work *The Action*, first published in 1893, Maurice Blondel pointed out that, precisely because of this phenomenology, science seems "to transcends itself"; to do science we need ends, but ends are not the object of the scientific method (Blondel [1893] 2021, pp. 54–108).

To carry out a dialogue between science and theology, capable of accessing the anthropological level without remaining at the level of mere epistemological clarifications, means to study such aspects as are outlined below:

(1) The sense of wonder that scientists feel when they study nature (A. Einstein, M. Planck, H. Poincaré, P. Dirac); (2) their reverence toward the "mystery" of being (J.C. Maxwell, A. Einstein); (3) the role of intellectual passions (W. Heisenberg, M. Polanyi) and that of (4) inner and personal motivations of research (H. Poincaré, P. Duhem, F. Enriques, L. de Broglie); (5) to discuss the ultimate purposes of scientific research (T. Dobzhansky, J. Barrow, P. Davies); (6) to reflect on the "religious dimension" of scientific activity (R. Boyle,

P. Teilhard de Chardin); (7) to present scientific knowledge as an integral part of human dignity (E. Cantore, F. Barone); (8) to reflect on the social responsibility of scientists; the more they know, the more they must be at the service of all (John Paul II); (9) to underline the commitment of scientists to peace (A. Einstein, B. Russell, E. Amaldi); (10) to explore the dialogue between science and art (J. Barrow); (11) to emphasize that ultimate, existential questions arise from the *very heart* of scientific activity (P. Teilhard de Chardin, A. Einstein, P. Davies); and (12) to overcome of the "neutral" and impersonal view of technology (R. Guardini, G. Simondon).

In a few words, accessing the anthropological level means to underline that scientific activity is not foreign to the dimensions of *logos*, *ethos,* and *pathos* (Tanzella-Nitti 2009b). According to Christopher Kaiser (2021), there is enough room to systematize and develop a *Theology of Scientific Endeavour*.

For their part, theologians must also equip themselves to enter into a dialogue with scientists that includes the personalistic aspects of research. Among the theological subjects that are particularly suited to this goal, I would like to recall some that I consider strategic in this regard.

First of all, theology is called to take seriously *God's revelation through nature*. In contemporary theology of revelation, this aspect has been almost dismissed, and it is important to keep it alive (Ganoczy 1997; Fries 1996, §§19–25; Tanzella-Nitti 2022a, pp. 121–235). Before revealing himself through a history of salvation, God gave and continues to give witness to himself as Creator of heaven and earth (Vatican Council II 1965: *Dei Verbum*, nn. 3 and 6). This has relevant consequences for the relationship between man and nature, since God's revelation in the created world is, ultimately, the source of those feelings and experiences that many scientists encounter: contemplation, wonder, awe, reverence, prayer, beauty, rationality, intelligibility, and so on.

Second, it is important to develop a theology of the *Logos as Verbum*, not just a theology of the Logos as *ratio*. Understanding the Logos of creation (Jn 1:1–3; Heb 1:1–3) as the source of the rationality and intelligibility of the natural world is a fruitful interpretation that Christian theology has developed on the basis of biblical data, employing in part a classical Platonic perspective. However, a second relevant meaning of the Greek term *logos*, as is well known, is that of "word", Latin Verbum, which emphasizes the "personal" dimension of the First Principle who created the world. Now, it is precisely this personal dimension that is responsible for what the researcher, as a human person, experiences when confronted with the natural world and its laws. Nature is the effect of a *personal word*, it conveys a silent voice that appeals to every human being, asking him or her to take a position before the mystery of the being of the cosmos, before the mystery of one's own existence. "Others, to find God, read a book. It is a great book the very beauty of creation: look, contemplate, read the upper world and the lower world. God has not written in ink letters by which you could know him. He has placed before your eyes what He has created. Why do you seek a louder voice? Shout to you heaven and earth, 'I am God's work.'" (Augustine of Hippo, *Sermons*, 68, 6).

Third, in the dialogue between science and theology, the many possibilities contained in the *Eastern theological reflection on Sophiology* should be carefully explored (P. Florenskij, S. Bulgakov, V. Solov'ëv). A theology of *Sophia* is able to convey a more personalistic view of the cosmos, whose eternal ideas belong to the Trinitarian life of God Creator. Again, the theological perspectives of Logos–Verbum and Sophia, which are more personalistic in character, can counterbalance the Western perspective of Logos–Ratio, since the latter tends to emphasize the rational and logical dimensions of creation. In order to have a healthy dialogue between science and theology, we must breathe with both lungs, the lungs of the Western and the Eastern tradition.

5.2. The Program of a Scientific Humanism

In the context of the strengthening of the anthropological perspective of scientific and theological studies, I would like to briefly mention the program of a "scientific

humanism". An expression used by various authors with different meanings (M.C. Otto, M. Shermer, M. Gorran, O.L. Reiser), I refer here to the meaning given to it by the Italian-American philosopher Enrico Cantore (1977, 2002, 2023), also present in some reflections made by Federigo Enriques ([1911] 2016), Francesco Barone (1994), and Silvano Tagliagambe (2000, 2016).

According to Cantore, scientific humanism understands science as a human activity and emphasizes the *human* dimensions of scientific inquiry: creativity, imagination, philosophical presuppositions, ethical motivations, and existential and religious inspirations. These dimensions are relevant to both theoretical activity and the practice of discovery. Scientific humanism holds science to be a value in itself and an important source of dignity for all human beings. "The essential contribution of science to humanism consists in nothing less than giving to man a new awareness of himself" (Cantore 1977, p. 398). It aims to offer and communicate a correct and faithful view of science, protecting it from the risk of ideological manipulation, which more often occurs when society and public opinion support an instrumental, neutral view of scientific activity. Scientific humanism helps to avoid dangerous misinterpretations of science and to give science its true image. Science and technology, in fact, are often presented as either the solution to all of humanity's problems and the guarantee of a happy future, or, conversely, as a threatening and dehumanizing drive that creates fear and insecurity. Scientific humanism points out that this ambiguous and ideologically clothed image of science is at the root of contemporary social, educational, and environmental crises; such a misconception of science does not help to understand the true social role of scientists, a role that authors such as John Brockman (1995) and Yuval Harari (2015, 2018) understand as leading and governing humanity with the same methods and dynamics they use in scientific work.

From a philosophical point of view, scientific humanism could contribute to the renewal of the philosophy of science by proposing to frame it in a new way, as a *philosophy of scientific activity*. Based on the fact that science is a personal activity and not a tool or a process to be analyzed, a "philosophy of scientific activity" would be more appropriate to our times. This philosophical perspective could be nourished by the classical "philosophy of action" developed by Thomas Aquinas and Maurice Blondel, and more recently by authors as Edmund Husserl and Karol Wojtyla.

Scientific humanism brings scientific activity closer to other human and philosophical experiences; science is understood as a search for truth, as part of a dialogue between man and nature, generated and nourished by reverence and wonder, capable of promoting solidarity and the common good. In a special way, scientific activity should be considered a service and a factor of human progress; it is called to promote the culture of all, to shorten distances and to free man from superstition and errors. Scientific knowledge is everyone's right, an asset to which all people should have access. According to the view of "scientific humanism", the gap between the human sciences and the natural sciences is reduced or even bridged. Scientific and technological progress are no longer seen as the antithesis of human values; in order to safeguard and promote all that is *human*, it is not necessary to limit or halt science, but rather *to drive science in a humanistic way*. This was the valuable insight offered a century ago by Romano Guardini ([1927] 1994) in his *Letters from Lake Como. Explorations in Technology and the Human Race*.

How might the program of scientific humanism contribute to the vision of the sciences as a possible new theological locus? It could do so underlying the moral, free dimension of scientific work. This means that in a contemporary Social Doctrine of the Church, an important role should be reserved for technical and scientific activity as part of human activity seen in the light of God's plan for the created world (see Vatican Council II, *Gaudium et spes*, nn. 33–39). In essence, science would be a theological locus of moral theology, since every scientific and technological activity is part of the work of human beings created in the image and likeness of God. Theology, thus, finds in science a strong ally not only in the search for truth, but also in the search for and practice of the good. A clear example of that

is the reflection on the many applications of an "Artificial Intelligence for Social Good", AI4SG, as outlined by Luciano Floridi (2023, pp. 142–79).

Biblical theology could also benefit from the perspective of scientific humanism. Parallels can be traced between the character of the scientist and the profile of the wise man in the Wisdom Books of Scripture, suggesting the view of a *sapiential scientific humanism*. According to the Wisdom Books, the wise man does not know the Word of God because it is proclaimed by a prophet, but he recognizes this word present in nature; he hears it in his conscience. The wise man observes, examines, ponders, reflects, and draws conclusions from the behavior of natural elements (natural sciences) but also from the behavior of human beings (social sciences). He behaves like a man of science today.

In conclusion, by focusing on the anthropological dimensions of scientific activity, science and theology realize that they are no longer facing each other, to defend their own territory and expertise; instead, they are both on the same side, united by the common goal of promoting all that is human.

6. Some Key Questions for Future Studies in Science and Theology: Developing Ongoing Research and Expanding the Agenda

6.1. Present and Future Role of History in the Science and Theology Dialogue

Starting from Pierre Duhem's pioneering works on the role of history in the development of science, historical studies about the interactions between science, philosophy, and theology have been widely carried out throughout the 20th century by several authors. Among them are Alexander Koyré, Emil Grant, Alistair Crombie, John Brooke, Peter Harrison, and many others. Although these works have had a relatively limited circulation among the general public, they have contributed to overcome many misconceptions and oversimplifications about the interaction between Christian theology and the so-called scientific revolution. Thanks to these studies, we know today that Christian theology of creation contributed positively to the rise of the scientific method; that belief in a Creator did not endorse a mechanistic or a deterministic view of nature; and finally, that the history of the relations between science and theology was often challenged by ideological reconstructions (Numbers 2009). The work for the next decades should be to let these results have a wider outreach in public opinion, schools, and media.

In view of the above-mentioned need to develop the anthropological dimensions of the dialogue between science and theology, another fascinating task for historians would be to increase the number of studies on the characters and personalities of scientists, that is, how their belief in the divine or in a God Creator influenced the way they did science, their attitude toward nature. A few scientists have been studied in this regard, especially Isaac Newton, but also James Clerk Maxwell, Pierre Duhem, Pierre Teilhard de Chardin, and Albert Einstein. Many others, however, are still waiting to be examined more in depth: Robert Boyle, Niels Steensen, Friederich Gauss, George Cuvier, Augustine Cauchy, Henri Poincaré, and Werner Heisenberg, to name a few.

New historical studies should be also encouraged concerning the role of imagination, metaphors, and creativity in science. They would be very helpful in filling (or at least shortening) the gap between the human and the natural sciences, contributing to support the idea that it is advisable to reintroduce some humanities into science curricula. Amos Funkestein's inspiring work *Theology and the Scientific Imagination from the Middle Ages to the Seventeenth Century* (Funkestein 1986) and, more recently, Tom McLeish's *The Poetry and Music of Science: Comparing Creativity in Science and Art* (McLeish 2019) offer good examples of that, marking a road to follow.

6.2. Exploring the Feasibility of a "Theology of Nature" and of a "Theology of Science"

In the coming decades, a serious attempt should be made to understand whether a "theology of nature" and a "theology of science" could be established and gradually introduced into *theological academic work*. For this to happen, these two disciplines must have a clear epistemological status and be built on solid theoretical foundations. There is

room for that, as witnessed by the suggestions made by outstanding authors such as Ian Barbour (1997), Michael Heller (1996), Alexandre Ganoczy (1997), Alistair McGrath (2001), John Haught (2007), R.J. Russell (2008), or Denis Edwards (2017). However, we need more systematic proposals, able to gain theologians' interest, not only that of scientists. Once implemented, these new disciplines will have to be truly theological in character in terms of sources and methods. Although theology of nature and theology of science will necessarily be in dialogue with the history of philosophy, they are not part of a program of philosophy (Peters 2005). On the proposal of a "theology of nature", see also the essays by Berry (2003), Case-Winters (2016), Hendry (1980), Winslow (2020), and Pannenberg (1972, 1993). Theology of nature and theology of science are not the same, although some authors use them as synonyms, when referring to nature as "nature as it is studied by the sciences". Theology *of science*, which began to develop in the 1980s and initially had an impact on the local Polish philosophical milieu thanks to the works of Michael Heller and Józef Życiński, should also have its own status and object (Oleksowicz 2019, 2020; Tyson 2022; Harris 2024).

A number of topics that clearly belong to a *theology of nature* are capable of establishing a fruitful dialogue with the natural sciences and suggest the natural sciences as a locus theologicus. I would like to suggest the following ones:

6.2.1. God's Revelation Through Nature

When developed by theologians, theology of revelation put much effort into discussing God's revelation through the history of salvation; it has paid less attention to explaining the way in which nature is the effect of a Word-Logos. This latter topic seems to be more frequently addressed by philosophers or even by believing scientists.

The Nature in which God manifests Himself is the *same* Nature that is the object of the analysis of science. God's revelation is part of what in the continental European tradition we call Fundamental theology, and it is then distinguished from a theology of creation properly said, which is part of a classical program of Dogmatic theology. At the intersection with a theology of nature, God's revelation in nature should be related to all kinds of knowledge that have nature as their subject. Because of its theological character, God's revelation in nature must be distinguished from (and not confused with) a "natural knowledge of God". The latter is part of a philosophical program called "natural theology" in the continental European tradition. God's revelation in nature can easily include the study of the metaphor of nature *as a book*, which is familiar to both scientists and theologians. The metaphor has a complex and fascinating historical path and deserves to be studied carefully, avoiding oversimplifications. I think it contains very inspiring suggestions for "science and theology" studies, and only a few authors and sources have been examined in depth until today.

In relation to God's manifestation in nature, in the last decades the panentheistic concept of God and His relationship to the world is gaining in importance. Authors sympathetic to this concept, such as A.N. Whitehead, Ch. Hartshorne, A. Peacocke, and J. Życiński, place their theological views in the context of the results of science. This perspective deserves an important place on the theologian's agenda as an interesting example of how the dialogue between theology and science can stimulate reflection on the Christian concept of God.

6.2.2. Creation, Information, and Finality

In relation to God's revelation in nature, and as part of a theology of the Logos, a *theological* reflection on the presence of "information" in nature should be one of the priorities on the agenda of a contemporary theologian in dialogue with the sciences. In a cosmos created in the Word-Logos, as suggested by the Judeo-Christian revelation, information can be considered an *original* component of the world and a condition for giving meaning to its evolution throughout history. A world created in the Logos possesses a positive amount of information. Along with matter and energy, information is recognized

as a necessary component of the natural world. Thanks to the primordial role of information, natural entities are something *given*, they have a quidditas, i.e., specific formal properties.

The attention given by the natural sciences to the concept of information is promising for a meaningful dialogue between science, philosophy, and theology (Davies and Gregersen 2010; Strumia 2019). Indeed, the search for the origin of information opens to the idea of personal intentionality (Krzanowski 2024); the search for the philosophical meaning of information opens to the idea of formal causality (Tanzella-Nitti 1997). Both quests provide a fruitful context for discussing the presence of finality in nature. This could also be the place for a new, more philosophically rigorous approach to the Anthropic Principle (Barrow and Tipler 1986).

6.2.3. The Natural World Between Promise and Fulfillment

Biblical theology in the first half of the 20th century interpreted creation as part of the covenant between God and humanity. While such a view has the advantage of promoting a unified understanding of the divine plan of salvation, it sometimes runs the risk of diminishing the ontological consistency of created nature as such. Indeed, the Hebrew term that Scripture uses for covenant (*berith*) also admits the meaning of oath, commitment, and promise. Seen in this light, the Word that gave rise to creation can be understood as a "promise", and the history of creation can be understood as the unfolding of a dynamic from promise to fulfillment.

From the perspective of the natural sciences, the phenomenal appearance of the natural world and the dynamics of the many processes at work in the cosmos suggest that *nature transcends itself*. The material universe and life within it embody a "promise". As Bergson ([1907] 2022) and Teilhard de Chardin ([1934] 1969, [1948] 2021) pointed out years ago, matter and life reveal themselves to be the subject of an ongoing evolutionary process on a cosmic scale that seems to point beyond itself. One of the most intriguing and exciting tasks of a theology of nature, then, is to reveal what this promise means, toward what fulfillment it is moving, and to show whether this information is available to all as part of God's revelation to humanity (Ellis 2002).

6.2.4. The Christological Dimension of the Physical Cosmos

A theology of nature should explore the consequences that the world created through the Word (and in the sight of the Word made flesh) bears for the intelligibility and historicity of nature. Although the Trinitarian breath of a theology of nature should also include the role of the Holy Spirit, it is only as the Son-Logos that God the Creator has entered into history, taking upon Himself matter, space, and time (Torrance 2005). It is not surprising then that many of the themes recognized as objects of study by a theology of nature find their deeper understanding when examined in the light of the Incarnate Word.

Among the Christological dimensions of the created world in dialogue with the natural sciences, we should mention the following:

(1) Created by an intentional and personal Word, and in the sight of the Word made flesh, the whole cosmos is indeed a uni-verse, that is, its laws and physical properties must show a strong *identity* and a clear *universality*, because of the unity of its Cause and the universal extension of His power; (2) insofar as the Word is embodied (lex Incarnationis), we expect the primacy of *cognitive realism* and the role of induction over other possible idealistic approaches; (3) nature itself should show a clear dialogical dimension, since the word that the cosmos is was a Word sent by God to human beings; (4) since every personal Word bears a meaning and a purpose, then information is expected to be an original component of a cosmos created in the Word-Logos; (5) once understood in the light of the Word made flesh, the entire cosmic history and the evolution of life can be studied within a unified framework, something "thought out" within a single design; (6) part of this design is the presence of fragility, pain and death, which have a final and definitive unfolding in the mystery of Christ's death and resurrection.

Among the authors who have underlined the fruitfulness of these perspectives, in a way collecting the legacy of Teilhard de Chardin, we mention Jean-Michel Maldamé (2001a), Denis Edwards (1991, 2019), Lucio Florio (2008), and Niels Gregersen (2015). A theology of nature centered on the mystery of Christ also explores the many implications of the so-called *deep Incarnation* (Gregersen 2016; Edwards 2019) and produces reflections in the ambit of a Christian view of ecology (Deane-Drummond and Artinian Kaiser 2018).

6.2.5. To Think in Terms of a Physical History of Salvation

A pivotal task for a theology of nature in the contemporary scientific context is to begin to think in terms of what we might call "a physical history of salvation". Unlike from the *biblical* history of salvation, a *physical* history of salvation should study, understand, and explain the history of salvation in the context of our physical universe, its space-time scales, its ongoing transformations and future scenarios. The biblical history of salvation, which focused on liberation from moral evil, sin, slavery, or from attacking enemies, so that a people could freely profess their worship of the one true God, must now be read in a cosmic context. It must also include, on some level, liberation from physical evil, ignorance, finiteness, weakness, loneliness, and death. It is a liberation that restores dignity to the role of the human being, and to life in general, in a universe no longer viewed as unfamiliar, tragic, and impersonal. A physical history of salvation must always have at its center the paschal mystery of the risen Christ, but this mystery now demands to be read with a cosmic, unprecedented breath.

Conceptually, the history of salvation—which is the history of God's and of human freedom—has a clear priority over any evolutionary history of life and cosmos, which proceeds without the contribution of human free will. However, the former intersects with the latter; salvation takes place in the context of a physical and biological history. The realism of the Christian Incarnation—according to which the Son, when taking up human nature, also took upon Himself all relations with the created world—suggests that this intersection, with all its consequences, should be taken seriously.

A theology of nature that reflects on the physical history of salvation is expected to address the following major issues:

(1) Understand the creation of the human being in the image and likeness of the Creator God within the physical and biological historical context of the appearance of *Homo sapiens* on the planet Earth. As a consequence, understand the primitive revelation of God to human beings (both transcendental and categorical) as part of the religious heritage of *Homo sapiens*. (2) Interpret how divine Providence is consistent with the presence of physical evil in a cosmic history that includes (a) the long geological transformations experienced by our planet; (b) the struggle for survival suffered by biological species; and (c) the arduous, painful, but also extraordinary journey of the genus Homo until the appearance of *Homo sapiens*. (3) Place the space-time future of the cosmos and the earthly future of humankind within the theological context of a world created *in progress*, a world entrusted to the intelligent and free human cooperation with God's plan, while the whole universe is moving towards its fulfillment in the *eschaton*. (4) Understand the uniqueness of the Christian event (Incarnation, Redemption, and Resurrection) within our extremely enlarged cosmic context.

This last issue introduces the following additional questions: How could the uniqueness of the Christian Incarnate Word hold not only on a planetary scale (religions on the Earth) but also in a cosmic context (extraterrestrial life in the universe, if any)? Does contemporary physical cosmology oblige Christian theology to relativize or diminish the significance of the Christian event? How can the earthly mystery of Christ be associated with any possible revelation of God through nature and with all the gifts of salvation that this divine revelation brings?

6.3. Dialogue on Ethics and Science

What about regarding the dialogue between science and theology in the ethical sphere? In addition to what I said earlier about the anthropological dimensions of scientific activity and the contribution that a scientific humanism can make to the social and moral progress of the international community, I would like to report here some additional insights.

Although ethical issues are perceived by the public as the most pressing—think of biotechnology, human enhancement, and AI—I suggest that we do not begin with them when we decide to develop a dialogue between theology and scientific thought. Ethical issues demand to be read and framed within an appropriate epistemology: What can we know? Can we think rationally in terms of truth, nature, ultimate ends? Can we argue about what is good or evil before knowing what is true or false? Moreover, we should discuss human nature and its ultimate ends also in light of what we know about the physical, biological, and historical evolution of human life.

An important view to convey is that once science is understood as a human, fully engaged activity, then any ethical dimension of scientific activity is somehow intrinsic to science itself. If they act honestly, without ideological constraints, scientists are capable of knowing which of their actions are good and which ones are bad. The idea of a supposed "neutrality" of science and technology should be overcome; technical skills are not neutral and impersonal "instruments" like a hammer in someone's other hand. The technology developed by scientists is part of their personal, responsible, and *human* action. Scientific or technical action is the action of all those who apply science or technology: researchers, managers, workers, politicians, etc.

This view has a direct consequence on the way of understanding "freedom of research". Autonomy of science and freedom of scientific research are concepts related to a *personal subject*. In fact, freedom and autonomy are the freedom and autonomy of scientists, not the freedom and autonomy of laboratories, processes, protocols, products, etc. Those who (inaccurately) refer to the autonomy of science to support and justify any research activity and any technical application seem to forget that, if freedom and autonomy belong to a personal subject, then they are inseparable from his or her specific responsibility. There can be no freedom without responsibility.

Scholars studying the relationship between science and theology in the ethical domain should remember that while ethical issues arise in the context of scientific knowledge, they more often concern the technological applications of science. These are designed and promoted for economic, marketing, and social purposes, or because they correspond to a particular view of human life, especially the way in which human health and happiness are understood. The way in which these ethical issues can be framed in a "dialogue between science and theology" depends strictly on the views of the authors, on contextual and social circumstances, and on the laws and rights that govern the relationship between religion(s) and the State in a given country. Taking all these factors into account helps to approach ethical problems as complex and embodied questions. The difficulties often encountered in ethical questions raised by science or technology depend in large part on the fact that at the root of any ethical value system is an anthropology, and at the root of any anthropology is an ontology. In short, at the basis of our view of the human beings, of his or her ultimate purposes, is that which we locate at the foundation of the being and nature of all things, whether an impersonal cosmos or the wise design of a Creator.

7. Conclusions

The academic formation and research commitment of scholars with a dual training in the natural and human sciences, the latter including religious studies and theology, is strategic for promoting a responsible and fruitful dialogue between Christian theology and contemporary scientific thought. A comprehensive dialogue is expected to include both the epistemological and the anthropological levels and to be open to an integrated, personalistic, and non-reductionist view of scientific activity.

There are two main outcomes that theological work can derive from a fruitful dialogue with the natural sciences and the knowledge of the world that they bring.

The first is to use the definite knowledge we have today about the cosmos, nature, and life as a source of positive theological speculation. This should lead to a "theology of nature", whose epistemological status deserves to be defined more in depth. The present epoch is somewhat similar to the historical context of the Medieval universities, when Scripture and theological reflection were brought into relationship with the various sources of knowledge gathered by the academy. A more lively dialogue with the natural sciences would lead to a significant progress in the understanding of the Word of God and in the explanation of the history of salvation to men and women characterized by scientific reason. This was the program envisaged by the Magisterium of John Paul II, which has been also encouraged by some authoritative interventions of Francis (Francis 2018), especially the Letter *Ad theologiam promovendam* (Francis 2023).

The second result of a theological encounter with the natural sciences is the possibility of a gradual and homogeneous development of the Church's dogmatic teaching, as has happened in other periods of history. In this case, the fruits of the dialogue would concern not only the work of theologians, but the authoritative teaching of the Church's Magisterium, what the faithful are called to believe. In truth, they would not be changes in what is believed, but new insights within divine Revelation, the Word of God, received once and for all. Every development of dogma is a "new" knowledge that deepens what is already known. This deepening requires a careful discernment and, in the Catholic Church, it must be carried out under the prudent guidance of the Church's Magisterium, especially that of the Ecumenical Councils.

In both cases, we move from the vision of "dialogue" to that of "integration", to recall Barbour's classification, and in both cases a scientific knowledge of nature would play the role of a locus theologicus. In the first case, we will support the use of the natural sciences in the work of theologians, as it has already been done for the human sciences; in the second case, we will improve the dogmatic and, to a certain extent, the moral teaching of the Church, as it must be presented in catechesis, in pastoral activity, and in the wide-ranging apostolate of all the believing faithful (Tanzella-Nitti 2022b, pp. 491–531).

The dialogue between science and theology is a two-way dialogue. There are things that science offers to theology and things that theology offers to the work of scientists. But there is an important distinction. While the sciences offer objective knowledge and data to the work of theologians, theology offers its contribution to scientists as *personal human beings*, as subjects of an integral experience. Theology has no data, no quantitative or measurable knowledge to offer the scientific method; rather, it brings to the scientist a vision of reality, a vision of the cosmos and of life that can enrich the intellectual gaze with which men and women of science approach the study of nature.

Science can help theologians to do a better theology, a theology that can take advantage of an improved knowledge of the natural world. Thanks to contemporary science, theology can better understand what it means *to be a creature in a created world*. Because of the contemporary scientific worldview, terms such as world, universe, nature, time, life and death, take on a weight that was unimaginable years ago. Our improved knowledge of the physical world also allows theology to learn that there is a fine-tuning in our universe, established at a very early stage of cosmic evolution, upon which the possibility of the emergence of life is based. The Christian "theology of the body" today receives new insights from the scientific knowledge that our material body has a very long cosmic and biological history, so that in a sense it summarizes the whole of creation. Contemporary cosmology has also provided an unprecedented broadening of horizons; the time between the nucleosynthesis of the first chemical elements and the appearance of life on Earth was incredibly long, as was the time between the first bipedal primates and the appearance of *Homo sapiens*. Last but not least, the question of the presence of life in the cosmos, in environments other than our solar system, remains open. It is hard to imagine that all this

new knowledge will not, sooner or later, be translated into both a theological advance and a dogmatic development of the Church's doctrine.

The theological vision of a created world, a world brought into being by the love of the Creator, also brings no less important insights to the work of scientists. If nature is understood as creation, then it is intelligible and bears a meaning; it is ready to be studied inductively, and it is capable of allowing scientists to deduce universal properties from local ones. If human beings are the image and likeness of God, then we are able to understand the Word through which creation is made; we possess a true freedom that transcends our biological nature; we have been entrusted by God with the wise stewardship of creation and are able to participate in God's creative power through our work, which includes scientific and technological progress. Theology suggests to scientists that time is *history*, that there was an origin and there will be an end. It also suggests that evolution is a meaningful process, because the physical universe embodies a Promise (with a capital P) and is moving toward a fulfillment. Finally, theology encourages scientists that there is a truth worth seeking and that scientific work is a personal, meaningful commitment to Truth (with a capital T). This is not far from what Paul Davies envisaged at the beginning of one of his most renowned books: "Science is a noble and enriching quest that helps us to make sense of the world in an objective and methodical manner. It does not deny a meaning behind existence. On the contrary. [. . .] the fact that science works, and works so well, points to something profoundly significant about the organization of the cosmos". (Davies 1992, pp. 28–29).

Looking to the future, both paths of dialogue are of paramount importance. It is certainly a challenge for theologians to incorporate scientific findings into their research and to allow them to inform their reflection. But it is no less interesting, and even provocative, for scientists to think that philosophical and theological wisdom, namely the Judeo-Christian tradition, has something to say about some relevant questions they find in their research. I am referring to that new vision of reality as a web of relationships, to that deeper understanding of matter, information, and life that contemporary science is increasingly called to embrace, to that quest for beauty and meaning that accompanies and nourishes all scientific work.

Both theologians and scientists appreciate the truthful, non-conventional dimension of scientific knowledge. Both observe their efforts with optimism, without any sense of frustration. The dialogue between them is called to explore the possible consonance that exists between the "openings" to philosophical and existential questions that science manifests and the "meanings" that theology and the Word of God offer precisely to these openings.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: No new data were created or analyzed in this study. Data sharing is not applicable to this article.

Conflicts of Interest: The author declares no conflicts of interest.

References

Allen, Paul, and Flavia Marcacci, eds. 2024. *Divined Explanations. The Theological and Philosophical Context for the Development of the Sciences (1600–2000)*. Leiden: Brill.

Augros, Michael. 2004. Reconciling Science with Natural Philosophy. *The Thomist* 68: 105–41. [CrossRef]

Austin, William. 1976. *The Relevance of Natural Sciences to Theology*. London: Macmillan.

Barbour, Ian Graeme. 1997. *Religion and Science. Historical and Contemporary Issues*. San Francisco: Harper & Row.

Barone, Francesco. 1994. Scienza e umanesimo per una nuova unità della cultura. *Nuova Civiltà Delle Macchine* 12: 9–14.

Barrow, John, and Frank Tipler. 1986. *The Anthropic Cosmological Principle*. Oxford: Clarendon Press.

Bergson, Henri. 2022. *Creative Evolution*. London: Taylor and Francis. First published 1907.

Berry, Robert James. 2003. *God's Book of Works. The Theology of Nature and Natural Theology*. London: T&T Clark.

Blondel, Maurice. 2021. *Action. Essay on a Critique of Life and a Science of Practice*. Notre Dame: University of Notre Dame Press. First published 1893.
Bolloré, Michel-Yves, and Olivier Bonnassies. 2021. *Dieu, la science, les preuves*. Paris: Trédaniel.
Brockman, John. 1995. *The Third Culture: Beyond the Scientific Revolution*. New York: Simon and Schuster.
Cantore, Enrico. 1977. *Scientific Man. The Humanistic Significance of Science*. New York: IHS Institute.
Cantore, Enrico. 2002. Umanesimo Scientifico. In *Dizionario Interdisciplinare di Scienza e Fede*. Edited by Giuseppe Tanzella-Nitti and Alberto Strumia. Roma: Città Nuova and Urbaniana Unversity Press, pp. 1399–409.
Cantore, Enrico. 2023. *Umanesimo scientifico e mistero di Cristo. Raccolta di scritti (1956–2002)*. Edited by Claudio Tagliapietra. Roma: Edusc-SISRI.
Capra, Fritjof. 1975. *The Tao of Physics: An Exploration of the Parallels Between Modern Physics and Eastern Mysticism*. New York: Bantam Books.
Carreño, Juan Eduardo. 2015. From self movement to esse. The notion of life and living being in Thomas Aquinas. *Angelicum* 92: 347–76.
Carreño, Juan Eduardo. 2017. The Possibility of an Artificial Living Being in the Light of the Philosophy of St. Thomas Aquinas. *Angelicum* 94: 635–71.
Case-Winters, Anna. 2016. *Reconstructing a Christian Theology of Nature*. London: Routledge.
Damasio, Antonio. 1998. *Descartes' Error. Emotion, Reason and the Human Brain*. New York: Harper Collins.
Davies, Paul. 1992. *The Mind of God. The Scientific Basis for a Rational World*. New York: Simon & Schuster.
Davies, Paul, and Niels Gregersen, eds. 2010. *Information and the Nature of Reality. From Physics to Metaphysics*. Cambridge: Cambridge University Press.
Deane-Drummond, Celia, and Rebecca Artinian Kaiser, eds. 2018. *Theology and Ecology Across the Disciplines. On Care for Our Common Home*. London: Bloomsbury.
Dodd, Michael. 2012. *Unlocking Divine Action. Contemporary Science and Thomas Aquinas*. Washington, DC: Catholic University of America Press.
Edwards, Denis. 1991. *Jesus and the Cosmos*. New York: Paulist Press.
Edwards, Denis. 2017. *Christian Understanding of Creation. The Historical Trajectory*. Minneapolis: Fortress Press.
Edwards, Denis. 2019. *Deep Incarnation. God's Redemptive Suffering with Creatures*. Maryknoll: Orbis Books.
Ellis, George. 2002. *The Far Future Universe. Eschatology from a Cosmic Perspective*. Radnor: Templeton Foundation Press.
Enriques, Federigo. 2016. *L'anima Religiosa della Scienza*. Roma: Castelvecchi. First published 1911.
Feser, Edward. 2018. *Aristotle's Revenge. The Metaphysical Foundations of Physical and Biological Science*. Neunkirchen-Seelscheid: Editiones Scholasticae.
Floridi, Luciano. 2023. *The Ethics of Artificial Intelligence. Principles, Challenges, and Opportunities*. Oxford: Oxford University Press.
Florio, Lucio. 2008. Cosmic Christology and Pneumatology. Updating a Traditional Theological Topic to Approach a Dynamic Universe. In *Sens Ludzkiej Prozygody*. Edited by Valdemar Cisto and Zbigniew Kubacki. Warszawa: Wydawnictwo Rhetos, pp. 153–58.
Francis, Pope. 2018. *Veritatis gaudium*. Apostolic Constitution. Vatican Website. Available online: https://www.vatican.va/content/francesco/en/apost_constitutions/documents/papa-francesco_costituzione-ap_20171208_veritatis-gaudium.html (accessed on 1 August 2024).
Francis, Pope. 2023. *Ad theologiam promovendam*. Apostolic Letter, Vatican Website. Available online: https://www.vatican.va/content/francesco/it/motu_proprio/documents/20231101-motu-proprio-ad-theologiam-promovendam.html (accessed on 1 October 2024).
Fries, Heinrich. 1996. *Fundamental Theology*. Washington, DC: The Catholic University of America Press.
Funkestein, Amos. 1986. *Theology and the Scientific Imagination from the Middle Ages to the Seventeenth Century*. Priceton: Princeton University Press.
Gal-Or, Benjamin. 1987. *Cosmology, Physics, and Philosophy. Including a New Theory of Aesthetics*. New York: Springer.
Ganoczy, Alexandre. 1997. *Teologia della Natura*. Brescia: Queriniana.
Gillispie, Charles Coulston. 1980. *Dictionary of Scientific Biographies*. 16 vols. New York: Charles Scribner's Sons.
Gregersen, Niels. 2015. *On the Scope and Depth of Christology*. Minneapolis: Fortress Press.
Gregersen, Niels. 2016. Deep Incarnation. From Deep History to Post-Axial Religion. *Theological Studies* 72: 1–12. [CrossRef]
Guardini, Romano. 1994. *Letters from Lake Como. Explorations in Technology and the Human Race*. Grand Rapids: Eerdmans. First published 1927.
Harari, Yuval Noah. 2015. *From Animals into Gods. A Brief History of Humankind*. London: Vintage Books.
Harari, Yuval Noah. 2018. *21 Lessons for the 21st Century*. London: Vintage Books.
Harris, Mark. 2024. A Scientist-Theologian's Perspective on Science-Engaged Theology: The Case for "Theology of Science" as a Sub-discipline within Science and Religion. In *God and the Book of Nature Experiments in Theology of Science*. Edited by Harris Mark. London: Routledge.
Harrison, Peter, ed. 2010. *The Cambridge Companion to Science and Religion*. Cambridge: Cambridge University Press.
Haught, John. 1999. *God After Darwin. A Theology of Evolution*. Boulder: Westview Press.
Haught, John. 2007. *Christianity and Science. Toward a Theology of Nature*. Maryknoll: Orbis Books.

Haught, John. 2008. *God and the New Atheism. A Critical Response to Dawkins, Harris, and Hitchens*. Lousville: Westminster John Knox Press.
Heller, Michael. 1996. *The New Physics and a New Theology*. Notre Dame: Notre Dame University Press.
Heller, Michael. 2019. How is philosophy in science possible? *Philosophical Problems in Science* 66: 231–49.
Hendry, George. 1980. *Theology of Nature*. Philadelphia: Westminster Press.
Jaki, Stanley. 1987. *Uneasy Genius. The Life and Work of Pierre Duhem*. Dordrecht: M. Nijhoff.
John Paul, Pope, II. 1988. To the Reverend George Coyne S.J. Director of the Vatican Observatory, June 1, 1988. In *Pontifical Academy of Sciences. 2003*. Rome: Papal Addresses, pp. 292–300.
Kaiser, Christopher. 2021. *Toward a Theology of Scientific Endeavour. The Descent of Science*. London and New York: Routledge.
Kornblith, Hilary, ed. 2001. *Epistemology. Internalism and Externalism*. Oxford: Blackwell.
Krzanowski, Roman. 2024. Information and Biblical Logos Rivisited. *Theology and Science* 22: 474–84. [CrossRef]
Laplane, Lucie, Paolo Mantovani, Ralph Adolphs, Hasok Chang, Alberto Mantovani, Margaret McFall-Ngai, Carlo Rovelli, Elliott Sober, and Thomas Pradeu. 2019. Why Science needs Philosophy. *Proceedings of the National Academy of Sciences of the United States of America* 116: 3948–52. [CrossRef]
Laracy, Joseph. 2023. Science and Religion. Ian Barbour's Legacy. In *Interdisciplinary Encyclopedia of Religion and Science*. Edited by Giuseppe Tanzella-Nitti, Ivan Colagè and Alberto Strumia. Available online: https://inters.org/ian-barbour-legacy (accessed on 1 August 2024).
Maldamé, Jean-Michel. 2001a. *L'universe du Big Bang. Le Christ et le Cosmos*. Paris: J. Vrin.
Maldamé, Jean-Michel. 2001b. San Tommaso e i fondamenti della scienza. *Annales theologici* 15: 283–306.
McGrath, Alister. 2001. *A Scientific Theology. 1. Nature*. London: T&T Clark.
McLeish, Tom. 2019. *The Poetry and Music of Science. Comparing Creativity in Science and Art*. Oxford: Oxford University Press.
Messer, Neil. 2020. *Science in Theology. Encounters between and the Christian Tradition*. London: T&T Clark.
Moltmann, Jürgen. 2003. *Science and Wisdom*. Minneapolis: Fortress Press.
Nicolescu, Basarab. 2002. *Manifesto of Transdisciplinarity*. Albany: State University of New York Press.
Numbers, Ronald, ed. 2009. *Galileo Goes to Jail. And Other Myths About Science and Religion*. Cambridge, MA: Harvard University Press.
Oleksowicz, Michael. 2019. Teologia della scienza. Lo status quaestionis e possibili sviluppi ulteriori. *Aisthema* 6: 204–27.
Oleksowicz, Michael. 2020. Do we need a Theology of Science? *Cauriensia* 15: 755–70. [CrossRef]
Pannenberg, Wolfhart. 1972. Doctrine of the Spirit and the Task of a Theology of Nature. *Theology* 75: 8–21. [CrossRef]
Pannenberg, Wolfhart. 1993. *Toward a Theology of Nature. Essays on Science and Faith*. Edited by Ted Peters. Louisville: Westminster John Knox Press.
Penrose, Roger. 1999. *The Emperor's New Mind. Concerning Computers, Minds, and the Laws of Physics*. Oxford: Oxford University Press.
Penrose, Roger. 2005. *The Road to Reality. A Complete Guide to the Laws of the Universe*. New York: Vintage Books.
Perry, John, and Joanna Leidenhag. 2023. *Science-Engaged Theology*. Cambridge: Cambridge University Press (Cambridge online). [CrossRef]
Peters, Ted. 2005. Natural Theology versus Theology of Nature. *Theology and Science* 3: 1–2. [CrossRef]
Polak, Pawel. 2023. Philosophy in Technology. A Research Program. *Philosophical Problems in Science* 75: 59–81. [CrossRef]
Polanyi, Michael. 1998. *Personal Knowledge. Towards a Post-Critical Philosophy*. London: Routledge. First published 1958.
Polanyi, Michael. 2009. *Tacit Dimension*. Chicago: University of Chicago Press. First published 1967.
Pontifical Academy of Sciences. 2003. *Papal Addresses to the Pontifical Academy of Sciences (1917–2002) and to the Pontifical Academy of Social Sciences (1994–2002)*. "Scripta varia", n. 100. Vatican City: Libreria Editrice Vaticana.
Rovelli, Carlo, and Giuseppe Tanzella-Nitti. 2024. Universo. Un disegno poco intelligente. La scienza non può dimostrare l'esistenza di Dio. *Corriere della Sera*, March 21.
Rovelli, Carlo. 2022. *Helgoland. The Strange and Beautiful Story of Quantum Physics*. New York: Penguin Books.
Rudner, Richard. 1953. The Scientist Qua Scientist Makes Value Judgments. *Philosophy of Science* 20: 1–6. Available online: https://www.jstor.org/stable/185617 (accessed on 1 August 2024). [CrossRef]
Runehov, Anne, and Luis Oviedo, eds. 2013. *Encyclopedia of Sciences and Religions*. Dordrecht, Heidelberg, New York and London: Springer Reference.
Russell, Robert John. 2002. Science and Theology, Dialogue between. In *Interdisciplinary Encyclopedia of Religion and Science*. Edited by Giuseppe Tanzella-Nitti, Ivan Colagè and Alberto Strumia. Available online: https://inters.org/dialogue-science-theology (accessed on 1 August 2024).
Russell, Robert John. 2008. *Cosmology. From Alpha to Omega*. Minneapolis: Fortress Press.
Russell, Robert John, Nancey Murphy, and William Stoeger, eds. 2008. *Scientific Perspectives on Divine Action. Twenty Years of Challenge and Progress*. Vatican City and Berkeley: Vatican Ob servatory Publications—The Center for Theology and the Natural Sciences.
Russell, Robert John, William Stoeger, and George Coyne, eds. 1988. *Physics, Philosophy and Theology. A Common Quest for Understanding*. Vatican City: Libreria Editrice Vaticana and University of Notre Dame Press, pp. 21–48.
Russell, Robert John, William Stoeger, and George Coyne, eds. 1990. *John Paul II. On Science and Religion*. Vatican City: Libreria Editrice Vaticana and University of Notre Dame Press.
Sánchez Cañizares, Javier. 2024. Review to Michel-Yves Bolloré and Olivier Bonnassies, Dios, la ciencia, las pruebas. El albor de una revolución. *Scripta theologica* 56: 235–39.

Sánchez Sorondo, Marcelo, ed. 2009. *I papi e la scienza nell'epoca contemporanea*. Milano: Jaca Book.
Slattery, John, ed. 2020. *T&T Clark Handbook of Christian Theology and the Modern Sciences*. London: T&T Clark.
Smolin, Lee. 1998. *The Life of the Cosmos*. New York: Oxford University Press.
Strumia, Alberto. 1987. *L'uomo e la scienza nel magistero di Giovanni Paolo II*. Casale Monferrato: Piemme.
Strumia, Alberto. 2007. *Il problema dei fondamenti. Da Aristotele a Tommaso d'Aquino all'ontologia formale*. Siena: Cantagalli.
Strumia, Alberto. 2009. *Il problema dei fondamenti. Un'avventurosa navigazione dagli insiemi agli enti passando per Gödel e Tommaso d'Aquino*. Siena: Cantagalli.
Strumia, Alberto. 2019. Information. Recent Perspectives for the Natural Sciences. In *Interdisciplinary Encyclopedia of Religion and Science*. Edited by Giuseppe Tanzella-Nitti, Ivan Colagè and Alberto Strumia. Available online: https://inters.org/information-natural-sciences (accessed on 1 August 2024).
Stump, James, and Alan Padgett, eds. 2012. *The Blackwell Companion to Science and Christianity*. Malden: Wiley-Blackwell.
Tabaczek, Mariusz. 2021. *Divine Action and Emergence. An Alternative to Panentheism*. Notre Dame: University of Notre Dame Press.
Tabaczek, Mariusz. 2024. *Theistic Evolution. A Contemporary Aristotelian-Thomistic Perspective*. Cambridge: Cambridge University Press.
Tagliagambe, Silvano. 2000. La vittoria di Babele. Dalla filosofia naturale alla separazione dei linguaggi. *Civiltà delle Macchine* 18: 5–15.
Tagliagambe, Silvano. 2016. Ragione scientifica e saggezza umana. Il problema della verità nella scienza e nella filosofia. *Divus Thomas* 119: 44–91.
Tanzella-Nitti, Giuseppe. 1997. The Aristotelian-Thomistic Concept of Nature and the Contemporary Scientific Debate on the Meaning of Natural Laws. *Acta Philosophica* 6: 237–64.
Tanzella-Nitti, Giuseppe. 2009a. *Faith, Reason and the Natural Sciences. The Challenge of the Natural Sciences to the Work of Theologians*. Aurora: The Davies Group.
Tanzella-Nitti, Giuseppe. 2009b. La persona, soggetto dell'impresa tecnico-scientifica. *Paradoxa* 3: 96–109.
Tanzella-Nitti, Giuseppe. 2012. Religion and Science as Inclinations towards the Search for Global Meaning. *Theology and Science* 10: 167–78. [CrossRef]
Tanzella-Nitti, Giuseppe. 2022a. *Scientific Perspectives in Fundamental Theology. Understanding Christian Faith in the Age of Scientific Reason*. Claremont: Claremont Press.
Tanzella-Nitti, Giuseppe. 2022b. *Teologia della Rivelazione. Fede, Tradizione, Religioni*. Roma: Città Nuova.
Tanzella-Nitti, Giuseppe. 2023. Tommaso d'Aquino e il pensiero scientifico contemporaneo. In *Vetera Novis Augere. Le risorse della tradizione tomista nel contesto attuale. Vol. 1: Bilancio e prospettive*. Edited by Serge-Thomas Bonino and Luca Tuninetti. Roma: Urbaniana University Press, pp. 151–79.
Tanzella-Nitti, Giuseppe, and Alberto Strumia, eds. 2002. *Dizionario Interdisciplinare di Scienza e Fede. Cultura Scientifica, Filosofia e Teologia*. 2 vols. Roma: Urbaniana University Press-Città Nuova.
Teilhard de Chardin, Pierre. 1969. *Comment je crois*. Paris: Seuil. First published 1934.
Teilhard de Chardin, Pierre. 2021. *The Human Phenomenon*. Easterbourne: Sussex Academic Press. First published 1948.
Torrance, Thomas Forsyte. 1984. *Transformation and Convergence in the Frame of Knowledge. Explorations and Interrelations of Scientific and Theological Enterprise*. Grand Rapids: Eerdmans.
Torrance, Thomas Forsyte. 2005. *Space, Time and Incarnation*. London: T&T Clark.
Tyson, Paul. 2022. *A Christian Theology of Science. Reimaging of a Theological Vision of Natural Knowledge*. Grand Rapids: Baker Academics.
Van Huyssteen, Wentzel, ed. 2003. *Encyclopedia of Science and Religion*. New York: MacMillan-Gale Group.
Vatican Council II. 1965. *Documents of the Second Vatican Council*. Vatican Website. Available online: https://www.vatican.va/archive/hist_councils/ii_vatican_council/index.htm (accessed on 1 August 2024).
Verschuuren, Gerard, and Joseph Koterski. 2016. *Aquinas and Modern Science. A New Synthesis of Faith and Reason*. Kettering: Angelico Press.
Wallace, William. 1968. Thomism and Modern Science: Relationships, Past, Present and Future. *The Thomist* 32: 67–83. [CrossRef]
Winslow, Lisanne. 2020. *A Trinitarian Theology of Nature*. Eugene: Pickwick Publications.

Disclaimer/Publisher's Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.

religions

MDPI

Article

Natural Science as a Modern Locus Theologicus Alienus

Christoph Böttigheimer

Department of Fundamental Theology, The Catholic University of Eichstaett-Ingolstadt, 85072 Eichstätt, Germany; christoph.boettigheimer@ku.de

Abstract: God's word is the starting point of all theological knowledge and is conveyed through different objectivations. Since the 16th century, the authorised places of testimony of the Word of God have been referred to as "loci theologici". The Dominican Melchior Cano distinguished ten homes of the divine word of revelation, whereby he counted human reason, philosophy, and the history of mankind among the loci alieni. The Second Vatican Council valued the non-theological sciences and granted them autonomy, which is developed in the first part of the essay. Today, it is mainly the insights of natural sciences that enrich theology but also challenge it, especially when the theological view is not narrowed anthropocentrically but is oriented towards the whole of creation. In this case, the question underlying the second part arises as to how the goal of creation can be considered together with the intrinsic lawfulness of nature. It will be shown that this question offers theology the opportunity to reflect on its statements on creation, as well as unanswerable questions.

Keywords: theological knowledge; loci theologici; science and religion; natural sciences; theology

1. Introduction

What the church is, Martin Luther wrote in the Schmalkaldic Articles, "a child of seven years knows, [. . .] namely the holy believers and 'the shepherds who hear their shepherd's voice'" (Schmalkaldische Artikel 2014, III). Although a closer look at ecclesiology reveals it to be a complex and complicated treatise, we cannot disagree with Luther that the church is fundamentally a community of hearing and storytelling under the Word of God. The church is not constituted by itself, but lives exclusively from the remembrance, visualisation and testimony of God's word; it is "creatura verbi". Without the word of God "it cannot exist" (Luther 1883–2009 (WA), 1,13,38f.), the Wittenberg reformer remarked, which is why he could also conclude the other way round: "If the word of God flourishes, then everything in the church flourishes" (WA 5,131,26). In the Second Vatican Council's Constitution on Revelation "Dei Verbum", this fact is expressed as follows: God's Word is the "power and strength" of the Church (Dei Verbum 1965 (DV), 21).

Christianity is not a revealed religion (religio revelata), but a religion that develops in accordance with divine revelation, i.e., the divine word throughout history (religio secundum revelationem), and that continually draws sustenance from the living divine word event. Determining the content of this Word of God and updating it within the respective time is the task of the church in general and of theology in particular, which has developed a special theological doctrine of knowledge and principles for this purpose since the 16th century. It deals with the question of the conditions, rules, and methods under which the word of God occurs in the church and how the church gains its theological insights from the word of God. The question of theological principles also plays a significant role. The principles and sources from which theology draws its insights are closely related to the theological understanding of the word of God. If the understanding of revelation changes, for example, by assuming that God also speaks to people outside the church, then non-ecclesiastical principles of theological knowledge must also be assumed. In today's theology, the question to what extent, for example, culture or science can be seen as principles of theological knowledge is widely discussed.

The first part of this article deals with this problem. After a brief introduction to the genesis of the theological doctrine of knowledge and principles, the following question is addressed: How can the traditional doctrine of theological principles be updated today? Is it also necessary in the present time to take the natural sciences into account when acquiring theological knowledge? The thesis in this context is that God also reveals himself outside the church, in the midst of his creation, which is why his word also comes up where nature becomes the subject of scientific investigation. Accordingly, the natural sciences, which in modern times have often been seen as a threat to theology and the church, are valuable partners in dialogue with theology. In this context, the follow-up question immediately arises: How is the epistemological status of the natural sciences to be classified? Are they original places where God's word is witnessed, or does it only come up for discussion in a derivative, i.e., subordinate way? This question leads to the second part of this article. The thesis here is: Although science is not a direct place of testimony of the divine word, such as Scripture or tradition, it is an important place of testing for theological insights. On the basis of knowledge of nature, theological insights can be questioned, which contributes to their modification and deepening. In the third part, the extent to which the natural sciences are currently putting theological statements to the test is exemplarily developed on the basis of the statement of faith in God's plan of creation. It becomes apparent that, against the background of scientific knowledge, contemporary theology can hardly make its talk of a divine plan of creation that aims at God himself understandable. Problems are caused by both cosmological and evolutionary biological insights.

2. First Part: Doctrine of the Loci Theologici

The origin of Christianity and the Church lies in God's Word. This is also the source of all theological knowledge; it is the principium essendi and principium cognoscendi of the church and theology. However, God's word, from which theological knowledge is formed, is nowhere to be found or heard directly in the church—it is only witnessed to in a mediating way. Where does this happen? Where is God's Word witnessed to in an authoritative way? Only within or also outside the Church? In the early days of Christianity, it was initially assumed that mediation took place purely within the church. However, this changed over time. A brief outline of this development should help to better locate the question of the epistemological relevance of the natural sciences.

In the early church, the witness of Jesus Christ, who was understood as the "cornerstone" (Eph 2:20; Rev 21:14), was respectively the incarnation of the divine word (John 1) and was therefore the first, all-decisive point of reference for the church and faith. Furthermore, the statements of faith of the "apostles and prophets" were regarded as constitutive (Eph 2:20), which is why their written testimony was already recognised as having a special, normative function for the knowledge of God's word at the end of the apostolic era. The tradition of the apostles was the highest norm of Christian faith and theological knowledge. In confrontation with the Gnostic movement, which claimed an esoteric knowledge for itself, the apostolic succession of office emerged as a further criterion (Acts 14:23; 20,28; 2 Tim 1:6). As a result, the proper witnessing of the apostolic tradition was guaranteed by the bishops in historical succession. In addition, the central contents of the divine word were summarised in the so-called "regula fidei" or "regula veritatis" (rule of faith or truth) before there were any symbols of baptism and faith. In the early church, they expressed faith or the awareness of faith and were considered the first canon of the church even before the canonisation of the Holy Scriptures. Finally, in the 5th century, the "Commonitorium" of Vincent of Lérins became significant, which led to the development of the principle of tradition: According to this, "what has been believed everywhere, always and by all" counts as God's word (*Corpus Christianorum, Series Latina* 1985, 64, p. 149).

Thus, God's word is transmitted within the Church through various objectifications: Holy Scriptures, apostolic testimony, regula fidei, symbols of faith, tradition, etc. It is attested to and secured in different ways at different sources. Following the ancient concept of topos, the instances of testimony from which theological knowledge is formed

(Seckler 1997, p. 1014) were called "loci theologici". Because theology is based on the Word of God, which can only be experienced and witnessed historically, topology is of outstanding importance for it: it represents "principles on which evidence can be built where strict scientific principles are not given. In their field, the topoi serve to determine the respective specific quality of the presuppositions (premises). Thus, topics are a way of considering and remembering that is orientated towards problems [...]. Topics select the discursively true from human discourse. It goes back to prior knowledge, without which there can be no science at all". (Lehmann 1985, p. 518). On the basis of these topoi or loci, theology gains knowledge of the truth of faith and finds answers to questions such as: Which statements belong to the authentic doctrine of the church? What arguments can be used to affirm and defend these statements of faith? Why do the individual theological loci have a special authority? The topoi, or loci, are of outstanding significance for theology because theology is a speculative science of faith that does not fall under any scientific concept based on verifiability.

Due to Reformation disputes and the development of separate confessional churches, the question arose in the 16th century as to whether God's word is found only in Scripture or also in church tradition, and what the authentic doctrine of the church is. Because of theological controversies criteria of theological convictions had to be revealed with the result that a systematic elaboration of a theological epistemology was now carried out; on the Protestant side by Philipp Melanchthon ("Loci communes rerum theologicarum" [1521], "Loci communes theologici" [1535], "Loci praecipui theologici" [1559]) and Johann Gerhard ("Loci theologici", 9 volumes [1610–1622]) and on the Catholic side with Johannes Eck ("Enchiridion locorum communium adversus Lutteranos" [1525]), Robert Bellarmine ("Disputationes de controversiis Christianae fidei adversus hujus temporis haereticos", 4 volumes [1586–1593]) and in particular in the work of the Dominican friar Melchior Cano ("De locis theologicis"). In his Loci theologici, he based the proof of intellectus fidei on topical dialectic; today he is considered the father of the theological doctrine of knowledge. Of his work, which actually comprised fourteen volumes, only the first twelve were published posthumously in Salamanca in 1563 (Körner 1994).

Cano, a contemporary of Martin Luther, described the principles and instances in which the Word of God is normatively presented as loci theologici. The loci are "domicilia", homes of the divine word of revelation, "living and active witnesses" of the Word of God, "in which knowledge occurs and has occurred" (Seckler 2013, p. 278).[1] Although each place where the Word of God is found has its own inviolable authority to bear witness, they should not be viewed in isolation, as they are part of a comprehensive process of transmission. According to topical dialectics, the truth of the Word of God can only be recognised in the interaction of the various loci theologici. Cano went on to list ten loci theologici. While the first seven are first-order loci (loci proprii), as they are based on the authority of revelation (the internal), the other three are subordinate loci (loci alieni), as they are based on the authority of the external. Within the loci propii, Cano also distinguished between the "propria et legitima theologiae principia" as the theology's own instances of witnessing to the Word of God (Holy Scripture and apostolic traditions) and the theology-derived, i.e., interpretative loci of the Church. These included the faith practised by the faithful as a whole (the Church), the decision-making bodies (councils and popes/hierarchical magisterium), and theology (Church Fathers and theologians/scholastics). Although the area of loci alieni is distinct from that of loci proprii, it is by no means completely separate from it. Since scientific theology corresponds to the intellectual-historical situation, this has authority for theological knowledge, contrary to the Protestant view, which according to Cano applies in particular to reason (ratio naturalis), philosophy, and human history.

Cano's loci theologici doctrine has become influential not only, but especially for Catholic theology. Today, however, it is important to develop it further in line with changing social and cultural conditions. "The updating refers to the redefinition, categorisation, and use of the various loci proprii as well as to the characteristics of today's loci alieni". (Hünermann 2004, p. 207) What is to be subsumed under the loci alieni today? They were

redefined both at the Second Vatican Council and in the post-conciliar period, with six loci crystallising according to Peter Hünermann: philosophies; the world of science; culture; society; religions; and history (ibid., p. 224). Within the scientific landscape, the modern natural sciences occupy a prominent position and are to be counted among the loci alinei if only because they advance to the question of God. This is especially true when they ask about their prerequisites and consequences. In particular, the question "Why is there something rather than nothing?" remains unanswered for them, as Leibniz once expressed it (Leibniz 1961, p. 602), as does the question of whether everything that could be carried out may be done. Furthermore, the prevailing opinion today is that man, who attempts to explore the laws of nature, is not sinning against God but, on the contrary, is fulfilling the divine mandate to create. The Creator God is not in competition with His creatures and their efforts to gain knowledge; on the contrary, He is great wherever people cherish and care for His creation, which may also involve the use of science and technology. Thus, despite their atheistic method, the natural sciences are related to the question of God and are anything but insignificant for the development of the divine word. In the following, the growing influence of the natural sciences on faith will be outlined, and, in connection with this, the question will be answered to what extent these are to be counted among the loci alinei according to Catholic understanding. Why can't theological knowledge ignore them, and what epistemological status is to be attributed to them?

3. Second Part: Natural Science as a Place of Theology

In the modern era, alongside historical awareness, reason in particular has generally gained in importance, thereby increasing its influence on culture and religion. The Fathers of the Second Vatican Council already explicitly emphasised "that in the field of education, the mathematical, scientific, and anthropological disciplines" are gaining in importance, and "in the practical field, the technology based on these disciplines" (Gaudium et Spes 1965 (GS), 5). Instead of regretting this, a "positive value" is consciously recognised in the "cultivation of the natural sciences" (GS 57), even though the Catholic Church found this difficult for centuries.

Until the emergence of modern science, God was regarded as the actual reality, to which the world took a back seat, but now the world became the actual and explainable reality—the age of science and technology dawned. Max Weber (1864–1920) coined the term "disenchantment of the world" (Weber 1989, p. 13) to describe the realisation that there were "in principle no longer any mysterious, unpredictable powers" and that "all things could—in principle—be controlled by calculation". As a result of the technical-empirical rationality or atheistic method of modern natural science, the world had lost its charm. In the face of an objectified nature and a world dominated by scientific thinking, belief in God suffers a progressive loss of meaning. If scientific, technical, etc. feasibility is predominantly relied upon for the accomplishment of everyday tasks and practical life decisions, God must inevitably become meaningless. "In the secularized world God become increasingly superfluous as a hypothesis for explaining phenomena within the world; her lose his function in regard to the world". (Kasper 2012, p. 10) While it is widely believed that physical and material reality is a self-contained, self-regulating causal system, there is no longer any room for the biblical faith, which is based on the special action of God in the world. However, if belief in God is nevertheless maintained, it inevitably displays deistic traits. This means that God's act of creation is limited to the beginning of creation. God is conceived in his absolute transcendence, as the deus otiosus, who leaves the world to its own natural laws, functions and mechanisms, with the consequence that there can no longer be any inner-worldly activity of God, but only the course of things. In fact, "[s]ince a few years ago [...] sociologists believe that they have been able to observe an increased tendency towards a 'deistic' understanding of God among young and old alike". (Grom 2009, p. 40) God and the world are neatly separated: "What the proclamation says about the God of creation and providence (insofar as it still speaks of the latter at all), people try to fit into their world of faith; what they learn from scientific information is stored in

their world of knowledge". (Grom 2009, p. 41) However, such behaviour implies a latent tendency towards practical atheism. "Many perceive a world ordered by natural law as a rigid mechanism that interposes itself between man and God and prevents his influence on our lives: Is there no longer any action of God in the sense of intervention, but only the course of things, the world machine and its distant designer?" (Grom 2009, p. 45).

For quite a few believers, the gap between knowledge of the world and knowledge of God seems increasingly unbridgeable. Critically, Arthur Peacocke asked whether it is realised enough that "the traditional words are used in creeds and worship by a twentieth-cenhrry Christian, [but] the content of their belief often bears only a distant genetic relation to what was believed in the context of the thought-world centuries, or even a millennium, ago" (Peacocke 1993, p. IIX). Today's world views and world experiences are completely different from the perception of the world of Jesus or the apostle Paul. When theology and the Church consider their own situation and that of today's believers, those who are unsettled and doubtful due to scientific findings must not be overlooked, especially if it is taken seriously that, according to the Second Vatican Council, the "Church in the world of today" has the duty to "investigate the signs of the times and interpret them in the light of the Gospel" (GS 4).[2] The paradigm "signs of the times" stands for significant events that shake people's history and bring about a hopeful awakening in which faith recognises God's call—in the midst of profane reality (Heimbach-Steins 1997, p. 116f.). In these so-called signs of the times, the ongoing divine word can become audible, provided that the signals are interpreted theologically. "The signs of the times refer [. . .] to the practice of believing thought, which 'processes' the historical experience" (Ruggieri 2006, p. 69). Insofar as these signs are reflected on the basis of the Gospel, they can be seen as places that bear witness to the hidden presence and power of God in the world and in history. According to Melchior Cano's differentiation, however, they are to be regarded less as theological places (loci propii) than as places of theology (loci alieni). This means that they are less constitutive witnessing instances of the Word of God and independent sources of theological knowledge than "contexts within which theological insights are opened up, made comprehensible, and interpreted in an actualising way, i.e., fields of theology with a specific hermeneutical horizon". (Knapp 2012, p. 48) Modern (natural) sciences are one of these places, or "revelation-laden facts" (Bauer 2012, p. 206), where theological knowledge has to withstand tests.

The intellectus fidei can be illustrated and deepened with reference to natural knowledge, provided that theological insights prove to be compatible with and stand up to scientific findings. This does not mean that scientific knowledge should be unduly burdened or even appropriated by theology, but rather that it should be made clear from a theological point of view that faith in the God of Jesus Christ as creator and redeemer of the world is complementary to natural knowledge. If contradictions can be resolved and it can be shown that a religious interpretation and a scientific explanation of the world enrich each other, this would promote the rational responsibility of faith. In this context, it is not insignificant that the Second Vatican Council, which pursues a dual perspective ad intra and ad extra, acknowledges modern science and recognises its autonomy in the investigation of its specific areas of reality. The "earthly realities" have "their own laws and values [. . .] which man must gradually recognise, use and shape", which is why the demand for autonomy is justified; this corresponds to "the will of the Creator" (GS 36). The Council Fathers are convinced that methodological research "will never come into real conflict with faith, because the realities of the profane realm and those of faith have their origin in the same God". (GS 36) The autonomy of modern science is therefore based on a theonomy that is founded on the theology of creation. Although a fundamental contradiction between faith and knowledge is ruled out, it is openly acknowledged that "the new research and results of the natural sciences [. . .] demand new investigations from theologians" (GS 62). Accordingly, theology cannot simply ignore the results of other sciences; it must be interdisciplinary if it wants to make the work of God understandable outside the church by means of non-theological rational insights.

Scientific insights can fundamentally contribute to a deeper understanding of faith in God, as Pope John Paul II repeatedly emphasised after the Second Vatican Council. In his encyclical "Fides et ratio", he pointed out that it is "illusory to think that faith possesses greater persuasive power in the face of weak reason; on the contrary, it is in serious danger of being reduced to myth and superstition". (No. 48) Faith needs reason—also scientific reason, as he assured on 1 June 1988 in his letter to George V. Coyne S.J., the director of the Vatican Astronomical Observatory at that time: "The scientific disciplines too, as is obvious, are endowing us with an understanding and appreciation of our universe as a whole and of the incredibly rich variety of intricately related processes and structures which constitute its animate and inanimate components. This knowledge has given us a more thorough understanding of ourselves and of our humble yet unique role within creation". (Pope John Paul II 1988) Among the "processes and structures", John Paul II also counted evolution, whose theory he considered to be a "serious hypothesis" or "more than an hypothesis" (Pope John Paul II 1996, p. 382) and compatible with the Christian faith. Pope Francis also interprets "nature as a marvellous book [. . .] in which God speaks to us and allows a reflection of his beauty and goodness to shine forth". (Pope Francis 2015, 12) Incidentally, Thomas Aquinas was already convinced that knowledge about nature would not jeopardise faith, but rather enrich it: "It is, therefore, evident that the opinion is false of those who asserted that it made no difference to the truth of the faith what anyone holds about creatures, so long as one thinks rightly about God [. . .]. For error concerning creatures, by subjecting them to causes other than God, spills over into false opinion about God". (Thomas Aquinas 1955–1957 (ScG), 2,3)

The theology of creation cannot remain unaffected by the advancement of scientific knowledge. If, according to the biblical doctrine of creation, everything that exists is due to God's free and continuous act of creation (creatio continua), then nature bears the signature of the Creator, as the First Vatican Council expressly taught (Denzinger 2017 (DH), 3004, 3026) and was also confirmed by the Second Vatican Council (DV 3; 6; Nostra Aetate 1965, 2). Although the revelation of creation reveals far less about the nature of God than the revelation of Christ, this does not alter the fact that traces of God are inscribed in nature and that the scientific examination of it is to be understood as a place of theology. This implies that scientific findings about nature, such as its evolutionary development or inherent laws, have a direct impact on faith in creation, either in the form of deepening or in the form of correction. Today, it is above all the insights into the autonomous process of evolutionary development of reality that challenge theology and which in turn evoke further theological questions. They are plunging the belief in a personal Creator God, who acts in the world in a planned and effective manner, into a serious crisis. Albert Einstein already confessed that he could not believe in a God "who is concerned with the fate and actions of human beings". (Einstein 1997, p. 175) How can the belief in a Creator God who takes care of all that he has created (Wis 11:24–26), the visible as well as the invisible, including human beings, be reconciled with the realisation of the autonomous evolutionary process? On the basis of this question, the relevance of the natural sciences as a place for theology will be exemplarily clarified and it will be shown that questions arise for theology in the discourse with natural sciences, which can currently only partially be answered by theology. What does theology say about the divine plan of creation and how can this be reconciled with the lack of purpose in evolution?

4. Third Part: Creation Plan and Scientific Enquiries

The biblical creation narratives express that everything that exists was created freely and unconditionally ("creatio ex nihilo"[3]) by the Creator God (2 Macc 7:28; Rom 4:17; Heb 11:3) and is maintained in existence by him through his word. Martin Luther expressed the fact that everything is due to God's creative activity as follows: "Where he does not begin, nothing can be or become; where he ceases, nothing can exist". (WA 21, 521, 20f.) The ultimate, deepest being of all reality borne by God is an aetiological statement that must not be misunderstood in the sense of temporal causality. It is therefore thanks to

the creative reason, origin, and Lord of the world as a whole that created reality hovers above nothingness; it participates in God's creatorship. Being created therefore means being together with God (Ebeling 1979, p. 223f.). Martin Buber paraphrases John 1:1. "In the beginning was relationship" in the context of Genesis 1 and Proverbs 8 (Buber 1962, p. 22), which means that there is a fundamental relationality between the Creator and the creation. Statements about the meaning and purpose of the world, man, and history are derived from this relational creation process: On the one hand, everything intended and created by God is to be regarded as meaningful and good in principle—"God looked at everything he had made: and behold, it was very good" (Gen 1:31)—and on the other hand, according to the purpose of divine creative action, everything is ordered towards God as the ultimate reference point of all reality, towards completion, the Seventh Day of Creation, the resting of God in the midst of his creation (Gen 2:2f.). In the New Testament, the cypher "kingdom of God" stands for the purpose of unclouded communion between God and everything created by him. God is thus "the origin and [also] the goal of all things" (DH 3004), as the First Vatican Council succinctly put it.

In view of the autonomy of nature, the principle of fitness and adaptation (survival of the fittest) and coincidence, but above all in view of the ambivalence of human freedom in the sense of freedom of choice, the perfection of the world (Rom 6:4; 8:18-30; 2 Cor 5:17; Gal 6:15; Eph 2:10, 15; Col 3:10; Aph 21:1; Rev 21:1–22:5, etc.) only seems possible if God himself guarantees it. According to the classical interventionist understanding of God, he is able to intervene directly and effectively in world history. The goal of creation will not materialise either through evolution or thanks to human volitional decisions, as both human egoism and the non-directionality of the evolutionary process speak against it. In natural philosophy, views differ on the extent to which we can speak of a teleology of the biosphere (Toepfer 2004): While organisms are understood as self-referential functional systems on the one hand, a purposefulness caused by selection is assumed on the other (Toepfer 2013). However, even in this case, a distinction must be made between an internal finality and a general purposefulness as well as an intentional, meaningful objective. Last but not least, the divine goal of creation is of eschatological nature and thus beyond cosmic and organismic evolution. God himself must therefore be responsible for the purpose of his creation that he himself has determined. The assumption of a corresponding divine action is a central object of faith, which, like all other statements of faith, must not lead to a counterfactual assertion but must be made comprehensible by means of reason and in harmony with non-theological scientific findings. Because the differentiation between theology and the natural sciences does not imply a separation, it must be possible to prove that God's special, caring work to realise his purpose of creation is compatible with the modern natural sciences. If the natural sciences are taken seriously as an important place for theology, this task must be considered beneficial for theology, even if, as will be shown shortly, it is confronted with considerable difficulties as a result.

Doctrine of secondary causes: If we want to take into account the causal closedness of the physical world and therefore assume that God does not intervene directly in the natural process, it seems obvious at first to explain God's interventionist action with the help of the Thomasian doctrine of secondary causes, as further developed by Karl Rahner (Rahner 1992, pp. 87–89) and Béla Weissmahr (Weissmahr 1973a, pp. 47–61; 1973b; 1997, pp. 23–42). According to Thomas Aquinas, God does not act in a direct way, whereby he would become an inner-worldly cause, but rather he directs the world from within by means of the creaturely, free secondary causes (causae secundae): he is "in a more original sense the cause of every act than the second cause of action" (ScG, III, 67), because "the second agent always acts by virtue of the first"[4]. An action is thus based on two agents that are located on different levels and mediated by being. God acts secundum ordinem, or as the Catholic Adult Catechism puts it: "God creates things in such a way that they are empowered to co-operate in their own development". (*Katholischer Erwachsenen-Katechismus* 1985, p. 94) Because the natural sciences are only concerned with the creaturely level, the level of secondary causes, the metaphysical dimension is closed to them; they lack

a sense of primary causality. Although this rules out a contradiction between theological and scientific statements and preserves the principle of world-immanent causality, the question arises as to how the causa prima can make instrumental and teleological use of the creaturely causae secundae without jeopardising the self-reliance and freedom of creation. Although an attempt can be made to answer this question by means of a compatibilist concept of freedom, the question of theodicy then arises in a more acute way: If the God of Christian faith in creation is able to influence and direct the natural process and course of the world by means of secondary causes, why then is there so much suffering and evil in the world?

Interventionism: Direct interventionism explicitly affirms what the doctrine of secondary causes attempts to circumvent, namely the possibility of direct and targeted intervention by God. In doing so, it attempts to preserve the laws of nature by limiting "divine action, divine providence and dominion" to indeterminate free spaces, more precisely to quantum physical indeterminacies and chaotic instabilities (Jordan 1972, p. 156). "And perhaps it is down there, inside the strange field of the quantum, that our human spirit and the spirit of that transcendent being we call God are caused to meet" (Guitton 1998, p. 119). By not violating the physical laws of conservation or the inner-worldly causal relationships, God would not have to take on the role of a stopgap; rather, he has created nature in such a way that it possesses an intrinsic openness, as a result of which his actions could not be physically recognised. In this way, man's freedom of belief is preserved. The critical question here, however, is how creation can be thought of as created with wisdom (Ps 104:24) if these very structures of order prove to be an obstacle to God's action and have to be circumvented by limiting God's interventionist action to indetermenisms. This is aggravated by the fact that the connection between indeterminacies in the micro realm and physical processes in the macro realm has not yet been scientifically clarified. It remains unclear how God's action, which is limited to the microcosm, can lead the world to its fulfilment. What is most serious from a theological point of view, however, is that in the wake of interventionist action, a real relationship between God and the world is assumed and thus changeability and temporality are inscribed into the nature of God; he would be dependent on natural and historical events (Grössl 2014, p. 411) and, deprived of his transcendence, would become an inner-worldly natural force.

Panentheism: Unlike the doctrine of secondary causes and interventionism, panentheism does not assume that God the Creator and creation are in opposition but that they are immanent, that creation is in God. He is the all-encompassing reality, without simply placing the world and God as one—"in him we live, we move and we are" (Acts 17:28). The alterity, autonomy, and self-organisation of the created remain intact, as does the absolute transcendence of God, in that God does not act supranaturalistically from without but from within, so that he is "beyond the difference of difference and indifference" (Reményi 2017, p. 292). For process theology, which developed from Alfred North Whitehead's process philosophy and emphasises the ongoing process of becoming something new, the alternative of interventionism and non-interventionism no longer exists, as the division into matter and spirit, subject and object has been overcome. "This is the specific meaning of process-theological panentheism: that the world is *'in'* God means that God is related to everything and that these relationships co-constitute him". (Brüntrup 2019, p. 299). God did not create the universe out of nothing but is in a reciprocal, spiritual interaction with primordial matter. All entities have a spiritual aspect; the spiritual is an intrinsic property of the physical. With his creative and reciprocal love, God creates ever more complex structures of order[5] and just as the world is in the process of becoming, so are parts of God. He offers events better possibilities and encourages created things to be new and good (enjoyment) and thus opens up a creative future (Faber 2003, pp. 19–43; Enxing 2014). In this way, the evolutionary process designs its purposefulness out of infinite creative freedom (Keil 2009, 2013).[6] As the "poet of the world", God guides creation "with tender patience leading it by his vision of truth, beauty, and goodness". (Whitehead 1979, p. 346).

Critical questions regarding Panentheism also arise in connection with the Council of Chalcedon. Although the issues discussed there are primarily Christological and not theological, conclusions can be drawn from the doctrine of the two natures regarding the relationship between God and the world, which cannot be defined as either mixed or separate. Furthermore, critical questions are raised about the position of panentheism, which is complex in itself and often manages without an analogous concept when it comes to God: Is a God who is only present in a formative and purposeful way and for whom the future is open still Lord of creation in such a way that he can guarantee the achievement of his goal that creation becomes a "house of God and a house of life for all" (Zenger 2003, p. 2)?[7] Will the evolutionary universe, which is probably limited in time to 10^{36} years, ever achieve a perfect state of development free of suffering of its own accord, stimulated by the creative spiritual power of God? It is conceivable that the process-theological God "may have given his best because he simply could not give any more. However, in this case, the best might not be good enough" (Kreiner 1998, p. 120), because his superiority and free sovereignty over creation are conditioned by creation itself.

Open Theism: The so-called "Open Theism" (Pinnock et al. 1994), which was discussed in American Evangelicalism in the 1980s and 1990s, not only takes a critical look at process theology, but above all opposes classical theism, which ascribes philosophical attributes to the divine in an incoherent manner. In contrast to metaphysical speculation, Open Theism is biblically based; it seeks to integrate aspects of process theology into the biblical belief in revelation in a critical debate. According to biblical testimony, God is conceived as the creator of all things, his personhood is emphasised, as is his love and the associated conditions of free will. The free love of God and the libertarian freedom of man are the reason why God's omniscience about the future is not fixed, but dynamic with regard to contingent events; consequently the future is open due to the free and morally responsible actions of people. This relativises God's sovereignty and his foreknowledge or predestination. Open theism and process theology agree that there is a reciprocal relationality between God and man as a self-determined actor and that God can neither be thought as supratemporal nor immutable and omniscient. However, there is a significant difference between the two theologies in their attitude towards metaphysics and in the power that is granted to God. In contrast to process theology, some open theists place their hope in the sovereignty of God despite the freedom of will. Although he has granted man a free will on the basis of a voluntary self-restriction, he has not thereby forfeited the power to fulfil his plan of creation. Libertarian freedom is only bound to the time of the world, whereas in the eschaton, perfect freedom can no longer reject divine love. The new beginning is therefore based on a compatibilist freedom. "The libertarian freedom of man is designed for the historical probation of the community with God and is destined, in receiving and responding to God's love, to come ever closer to the compatibilistic freedom that characterises the existence of the redeemed in eternity. For man, the fulfilment of the end of time thus means the sealing of his biographically substantiated participation in the love of the Creator" (Schmid 2019, p. 379). However, why this only becomes powerful in the realisation of the eschatological reality of salvation and not already in relation to the incomprehensible suffering and evil in the world is an open question of open theism.

5. Conclusions

In today's world dominated by the so-called exact sciences, scientific findings must be taken seriously as places of theology (locus theologicus alieni). This is where theological statements have to prove themselves. Compatibility problems force theology to critically reflect on traditional statements of faith against the background of more recent scientific research findings, which can lead to further-reaching questions within theology. In this way, the natural sciences take on a kind of guardianship over theology. This challenge is to be seen as an opportunity to make the rationality of faith in God understandable in line with the times and to interpret the content of the Christian faith in a contemporary way. While the church has sometimes been critical of scientific progress, it has always endeavoured

to permeate faith with reason, knowing full well that truth can only be recognised in the combination of faith and knowledge.[8] A theology that takes a targeted look at the signs of the times and wants to make the intellectus fidei comprehensible in the present (aggiornamento) will therefore consciously seek dialogue with the natural sciences, in particular with biology, physics, cosmology, and anthropology.

Both biological evolution and the theory of the development of the universe challenge creation theology in various ways. As has been shown, this applies, among other things, to the plan of creation designed for the fulfilment of salvation in God. Explicating it as reasonable proves to be extremely complex on closer inspection. Although the biblical statements are explicitly or implicitly based on a divine plan of creation and salvation, it is anything but easy for theology to demonstrate that God's incessant and effective care for the realisation of his creation goal is compatible with autonomous scientific thinking. All theological attempts to find a solution reveal unsolved problems. The solution cannot be sought in denying the theological relevance of scientific research since the theories of organic and cosmic development are well founded. Rather, it must be frankly admitted that theology is currently challenged less by the *how* of communicating faith than by the *what* of Christian faith. In the future, a reasonable and convincing self-interpretation of the Christian faith will essentially depend on the extent to which it succeeds in consciously seeking out extrinsic places of theology (locus theologicus alieni) and proving the truth of faith there. This applies in particular to the natural sciences, which have become so influential in society that, according to the Second Vatican Council, culture today "arises from the tremendous progress of science and technology" (GS 56). As much as theology must pay attention to the compatibility of its statements with other scientific findings, it must also be aware that its statements extend far beyond those of the natural sciences due to their hermeneutic character and that God's creation remains an unfathomable mystery despite its revelation, which is why theological approaches to solutions are always accompanied by open questions that in turn lead to ever further reflection.

Funding: This research received no external funding.

Data Availability Statement: No new data were created or analyzed in this study. Data sharing is not applicable to this article.

Conflicts of Interest: The author declares no conflicts of interest.

Notes

1 While Thomas Aquinas accepted the truth of the articles of faith on which the theological argumentation is based as being guaranteed by God himself, Cano was aware of the essential historical mediation of the Word of God.

2 The Council also uses the syntagm "sign of the times" in: (Presbyterorum Ordinis 1965, 9), in (Apostolicam Actuositatem 1965, 14) and in (Unitatis Redintegratio 1964, 4).

3 The phrase "creatio ex nihilo" was laid down by Leo the Great in 447 in order to rule out any dualism. God is the *sole* principle of the world, which is therefore good. Although it is only mentioned twice in Scripture that God created the world out of nothing (Job 26:7; 2 Macc 7:28), God is also referred to as "Lord of heaven and earth" (Neh 9:6; Jdt 9:12; LK 10:21) and emphasises that he created "everything" (Jn 1:3; 1 Cor 8:6, Col 1:16f.).

4 (Thomas Aquinas 1888, I, q.105 a.5): "Similiter etiam considerandum est quod, si sint multa agentia ordinata, semper secundum agens agit in virtute primi, nam primum agens movet secundum ad agendum".

5 (Whitehead 1979, p.346): "God's rôle is not the combat of productive force with productive force, of destructive force with destructive force; it lies in the patient operation of the overpowering rationality of his conceptual harmonization. He does not create the world, he saves it".

6 In the background is a libertarian concept of freedom. Libertarianism is characterised by the ability to be either one way or the other.

7 William Hasker states in relation to process theology: "God so conceived cannot create the heavens and the earth out of nothing, nor can he part the Red Sea for the people of Israel, nor can he raise Jesus from the dead as a pledge of victory over sin and eternal life" (cited in: Callen 2018, p. 75).

8 "Faith and reason [fides et ratio] are like two wings on which the human spirit rises to the contemplation of truth; and God has placed in the human heart a desire to know the truth—in a word, to know himself—so that, by knowing and loving God, men

and women may also come to the fullness of truth about themselves (cf. Ex 33:18; Ps 27:8-9; 63:2-3; Jn 14:8; 1 Jn 3:2)". (Pope John Paul II 1998, Preface).

References

Bauer, Christian. 2012. Zeichen der Zeit? Ortsbestimmungen des Zweiten Vatikanums. *Lebendige Seelsorge* 63: 203–10.

Brüntrup, Godehard. 2019. Das Prozessparadigma. In *Handbuch Analytische Religionsphilosophie. Akteure—Diskurse—Perspektiven*. Edited by Klaus Viertbauer and Georg Gasser. Stuttgart: J.B. Metzler, pp. 295–307.

Buber, Martin. 1962. *Das dialogische Prinzip (1923)*. Heidelberg: Schneider.

Callen, Barry L. 2018. *God as Loving Grace: The Biblically Revealed Nature and Work of God*. Eugene: Wipf and Stock Publishers.

Constitution on Divine Revelation: Dei Verbum. 1965. Available online: https://www.vatican.va/archive/hist_councils/ii_vatican_council/documents/vat-ii_const_19651118_dei-verbum_en.html (accessed on 23 August 2024).

Corpus Christianorum, Series Latina: Lateinische christliche Schriftsteller der ersten acht Jahrhundert. Bd. 64. 1985. Turnhout: Brepols.

Declaration on the Relation of the Church to non-christian Religions. Nostra Aetate. 1965. Available online: https://www.vatican.va/archive/hist_councils/ii_vatican_council/documents/vat-ii_decl_19651028_nostra-aetate_en.html (accessed on 25 November 2024).

Decree on Ecumenism: Unitatis Redintegratio. 1964. Available online: https://www.vatican.va/archive/hist_councils/ii_vatican_council/documents/vat-ii_decree_19641121_unitatis-redintegratio_en.html (accessed on 23 August 2024).

Decree on the Apostolate of the Laity: Apostolicam Actuositatem. 1965. Available online: https://www.vatican.va/archive/hist_councils/ii_vatican_council/documents/vat-ii_decree_19651118_apostolicam-actuositatem_en.html (accessed on 23 August 2024).

Decree on the Ministry and Life of Priests: Presbyterorum Ordinis. 1965. Available online: https://www.vatican.va/archive/hist_councils/ii_vatican_council/documents/vat-ii_decree_19651207_presbyterorum-ordinis_en.html (accessed on 23 August 2024).

Denzinger, Heinrich. 2017. *Kompendium der Glaubensbekenntnisse und kirchlichen Lehrentscheidungen: Enchiridion symbolorum definitionum et declarationum de rebus fidei et morum (DH)*, 45th ed. Edited by Peter Hünermann. Freiburg i. Br.: Herder.

Ebeling, Gerhard. 1979. *Dogmatik des Christlichen Glaubens, Bd. I*. Tübingen: Mohr Siebeck.

Einstein, Albert. 1997. *Einstein Sagt. Zitate, Einfälle, Gedanken*. Edited by Alice Calaprice. München: Piper.

Enxing, Julia. 2014. Anything flows? Das dynamische Gottesbild der Prozesstheologie. *Herder Korrespondenz* 68: 366–70.

Faber, Roland. 2003. *Gott als Poet der Welt: Anliegen und Perspektiven der Prozesstheologie*. Darmstadt: Wissenschaftliche Buchgesellschaft.

Grom, Bernhard. 2009. Deistisch an Gott glauben? Biblische Spiritualität und naturwissenschaftliches Weltbild. *Simmen der Zeit* 227: 40–52.

Grössl, Johannes. 2014. Ewige Kontingenzpläne. Eine eternalistische Konzeption göttlichen Handelns in der Welt. *Zeitschrift für Katholische Theologie* 136: 405–22.

Guitton, Jean. 1998. *Gott und die Wissenschaft. Auf dem Weg zum Meta-Realismus*, 3rd ed. München: Deutscher Taschenbuch-Verlag.

Heimbach-Steins, Marianne. 1997. "Erschütterung durch das Ereignis" (M.-D. Chenu). Die Entdeckung der Geschichte als Ort des Glaubens und der Theologie. In *Visionen des Konzils: 30 Jahre Pastoralkonstitution "Die Kirche in der Welt von heute"*. Edited by Gotthard Fuchs and Andreas Lienkamp. Münster: LIT, pp. 103–21.

Hünermann, Peter. 2004. *Dogmatische Prinzipienlehre: Glaube—Überlieferung—Theologie als Sprach- und Wahrheitsgeschehen*. Münster: Aschendorff.

Jordan, Pascual. 1972. *Der Naturwissenschaftler vor der religiösen Frage: Abbruch einer Mauer*, 6th ed. Oldenburg: Gerhard Stalling.

Kasper, Walter. 2012. *The God of Jesus Christ: New Edition*. London: Bloomsbury Publishing.

Katholischer Erwachsenen-Katechismus Bd. 1: Das Glaubensbekenntnis der Kirche. 1985. München: Verlagsgruppe Engagement.

Keil, Geert. 2009. Wir können auch anders: Skizze einer libertarischen Konzeption der Willensfreiheit. *Erwägen Wissen: Ethik* 20: 3–16.

Keil, Geert. 2013. *Willensfreiheit*, 2nd ed. Berlin: De Gruyter.

Knapp, Markus. 2012. Das Wort Gottes, seine Überlieferung und Erkenntnis: Die Lehre von den loci theologici. In *Religionsunterricht als Ort der Theologie*. Edited by Norbert Mette. Freiburg i. Br.: Herder, pp. 33–55.

Körner, Bernhard. 1994. *Melchior Cano De locis theologicis: Ein Beitrag zur theologischen Erkenntnislehre*. Graz: Styria-Medienservice.

Kreiner, Armin. 1998. *Gott im Leid: Zur Stichhaltigkeit der Theodizee-Argumente (QD 168)*, 2nd ed. Freiburg i. Br.: Herder.

Lehmann, Karl. 1985. Dogmengeschichte als Topologie des Glaubens. Programmskizze für einen Neuansatz. In *Dogmengeschichte und Katholische Theologie: Festschrift für Heinrich Bacht SJ, Alois Grillmeier SJ und Adolf Schönmetzer SJ*. Edited by Karl Lehmann, Werner Löser and Matthias Lutz-Bachmann. Würzburg: Echter, pp. 513–28.

Leibniz, Gottfried Wilhelm. 1961. Principes de la nature et de la grâce. In *Die philosophischen Schriften von Gottfried Wilhelm Leibniz*. Edited by Carl Immanuel Gerhardt. Hildesheim: Georg Olms, pp. 598–606.

Luther, Martin. 1883–2009. *Dr. Martin Luther's sämmtliche Werke*. 120 Bände. Erlangen: Heyder.

Pastoral Constitution on the Church in the modern World: Gaudium et Spes. 1965. Available online: https://www.vatican.va/archive/hist_councils/ii_vatican_council/documents/vat-ii_const_19651207_gaudium-et-spes_en.html (accessed on 23 August 2024).

Peacocke, Arthur. 1993. *Theology for a Scientific Age: Being and Becoming—Natural, Divine, and Human*. Second enlarged edition. London: SCMB Press.

Pinnock, Clark, Richard Rice, John Sanders, William Hasker, and David Basinger, eds. 1994. *The Openness of God: A Biblical Challenge to the Traditional Understanding of God*. Lisle: InterVarsity Press.

Pope Francis. 2015. Encyclical Letter "Laudato Si'". On Care for Our Common Home. May 24. Available online: https://www.vatican.va/content/francesco/en/encyclicals/documents/papa-francesco_20150524_enciclica-laudato-si.html (accessed on 23 August 2024).

Pope John Paul II. 1988. Letter of His Holiness John Paul II to Reverend George V. Coyne S.J. Director of the Vatican Observatory. Available online: https://www.vatican.va/content/john-paul-ii/en/letters/1988/documents/hf_jp-ii_let_19880601_padre-coyne.html (accessed on 23 August 2024).

Pope John Paul II. 1996. Message to the Pontifical Academy of Sciences. In *The Quarterly Review of Biology*. vol. 72, No. 4 (Dec., 1997). pp. 381–83. Available online: https://www.jstor.org/stable/3037603?seq=1 (accessed on 25 November 2024).

Pope John Paul II. 1998. Encyclical Letter "Fides et ratio". On the Relationship Between Faith and Reason. Available online: https://www.vatican.va/content/john-paul-ii/en/encyclicals/documents/hf_jp-ii_enc_14091998_fides-et-ratio.html (accessed on 23 August 2024).

Rahner, Karl. 1992. *Foundations of Christian Faith: An Introduction to the Idea of Christianity*. New York: The Crossroad Publishing Company.

Reményi, Matthias. 2017. Vom Wirken Gottes in der Welt: Zugleich ein Versuch über das Verhältnis von Naturwissenschaft und Theologie. In *Gottes Handeln in der Welt. Probleme und Möglichkeiten aus Sicht der Theologie und analytischen Religionsphilosophie*. Edited by Benedikt Paul Göcke and Ruben Schneider. Regensburg: Friedrich Pustet, pp. 282–300.

Ruggieri, Giuseppe. 2006. Zeichen der Zeit. Herkunft und Bedeutung einer christlich-hermeneutischen Chiffre der Geschichte. In *Das Zweite Vatikanische Konzil und die Zeichen der Zeit heute*. Edited by Peter Hünermann in Verbindung mit Bernd Jochen Hilberath and L. Boeve. Freiburg i. Br.: Herder, pp. 61–70.

Schmalkaldische Artikel. 2014. *Die Bekenntnisschriften der Evangelisch-Lutherischen Kirche. Vollständige Neuedition*. Edited by Irene Dingel. Göttingen: Vandenhoeck & Ruprecht, pp. 713–88.

Schmid, Manuel. 2019. Bewährte Freiheit. Eine Rekonstruktion und Weiterführung des theologischen Freiheitsbegriffs im Offenen Theismus. In *Streit um die Freiheit. Philosophische und theologische Perspektiven*. Edited by K. v. Stosch u. a. Paderborn: Ferdinand Schöningh, pp. 365–91.

Seckler, Max. 1997. Loci theologici. In *Das Lexikon für Theologie und Kirche (LThK) Bd. 6*. Freiburg i. Br.: Herder, pp. 1014–16.

Seckler, Max, ed. 2013. Die ekklesiologische Bedeutung des Systems der loci theologici: Erkenntnistheoretische Katholizität und strukturale Weisheit. In *Seckler, Max. Glaubenswissenschaft und Glaube: Beiträge zur Fundamentaltheologie und zur Katholischen Tübinger Schule, Bd. 1*. Tübingen: Francke, pp. 257–87.

Thomas Aquinas. 1888. Summa theologiae. Available online: https://bkv.unifr.ch/de/works/sth/versions/summa-theologiae/divisions/2 (accessed on 20 November 2024).

Thomas Aquinas. 1955–1957. Summa contra Gentiles. Available online: https://web.archive.org/web/20181116104137/https://dhspriory.org/thomas/ContraGentiles2.htm#3 (accessed on 20 November 2024).

Toepfer, Georg. 2004. *Zweckbegriff und Organismus, Über die teleologische Beurteilung biologischer Systeme*. Würzburg: Königshausen & Neumann.

Toepfer, Georg. 2013. Teleologie [Version 1.0]. In *Glossar naturphilosophischer Grundbegriffe*. Edited by Thomas Kirchhoff. Available online: http://www.naturphilosophie.org/teleologie-glossareintrag/ (accessed on 9 September 2024).

Weber, Max. 1989. Science as a vocation. In *Max Weber's Science as a Vocation*. Edited by Peter Lassman. London: Unwin Hyman, pp. 3–31.

Weissmahr, Béla. 1973a. Gibt es von Gott gewirkte Wunder? Grundsätzliche Überlegungen zu einer verdrängten Problematik. *Stimmen der Zeit* 191: 47–61.

Weissmahr, Béla. 1973b. *Gottes Wirken in der Welt. Ein Diskussionsbeitrag zur Frage der Evolution und des Wunders*. Frankfurt a. M.: Knecht.

Weissmahr, Béla. 1997. Gottes Wirken in der Welt. Das Verhältnis von göttlicher und innerweltlicher Ursache. In *Glaube im Kontext naturwissenschaftlicher Vernunft*. Edited by Rainer Isak. Freiburg i.Br.: Herder, pp. 23–42.

Whitehead, Alfred North. 1979. *Process and Reality. An Essay in Cosmology*. Edited by David Ray Griffin and Doland W. Sherburne. New York: Free Press.

Zenger, Erich. 2003. Jenseits der Geschichte: Anmerkungen zur so genannten "Urgeschichte" der Genesis (Gen 1–11). *Bibel und Kirche* 58: 2–5.

Disclaimer/Publisher's Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.

religions

MDPI

Article

Criteria for the Acceptability of Scientific Theories as *Locus theologicus*: A Methodological Analysis of Catholic Church's Reactions to the Cases of Galileo and Darwin (Bellarmine—Pius XII—John Paul II)

Zbigniew Liana

Faculty of Philosophy, The Pontifical University of John Paul II in Kraków, 31-002 Kraków, Poland; zbigniew.liana@upjp2.edu.pl

Abstract: The categories of demonstration and hypothesis appear constantly in the texts of Catholic theologians confronted with the new science of Copernicus and Darwin. They were used by Robert Bellarmine to reject Galileo's scientific and realistic interpretation of Copernican theory. They were equally used by some neo-scholastic theologians against Darwin's theory of evolution and reappeared in the official texts of Pope Pius XII and John Paul II. My paper will analyze these selected historical texts to show whether and how the epistemology and methodology adopted by their authors determined their acceptance or rejection of scientific theories as potential *Loci theologici*. Moreover, the historical-comparative approach should reveal in this theological tradition, for all its officially declared continuity, the progressive evolution of views on the meaning and role of demonstration and hypothesis in science, as well as official Catholic theology's dependence on the historically changing notion of science and its method. This will allow me to discuss the idea of a changing scientific methodology as another very specific locus theologicus, this time metatheoretical. I will propose the idea of a non-absolute autonomy or relative dependence of theology on available meta-scientific solutions.

Keywords: Galileo; Bellarmine; Darwin; Pius XII; Humani Generis; John Paul II; science–religion issues; demonstration; hypothesis; Catholic theology and methodology of science

1. Introduction

Much has been written about the cases of Galileo and Darwin and the reaction of the Catholic Church. Several aspects of these issues have already been examined, including methodological and epistemological aspects, which will be addressed in this paper. However, the situation is different in the two cases. In the case of Galileo, a number of studies focus not only on the problem of Galileo's method (as in Wallace 1988a, 1988b, 1995), but also on the problem of its relationship to the philosophical method accepted by the Church authorities of his time, especially Bellarmine, in the context of the interpretation of the Scripture (cf. McMullin [1967] 1988, 1998, 2013; Ashworth 1986; Baldini 1992; Coyne and Baldini 1985; Moss 1985). And it is this last question that is most relevant to the present study.

In the case of Darwin, there are several studies on his method (cf. Ayala 2009, pp. 10038f., and especially refs. 27–34; Ruse 1975; Thagard 1977; Warner 2009; Pence 2018, 2021–2022) and numerous studies on evolution and Christian thought (cf. Brooke 1991) and his bibliographic essay; Dupree 1986; Gregory 1986). One of the most studied

problems seems to be that of evolution and creation (see, e.g., McMullin 1985; Andersen and Peacocke 1987; Schmitz-Moormann 1992), as well as that of divine action (see Russell et al. 1998). However, there are almost no studies on the methodological issues of Darwin's theory in relation to Catholic theology. Although Artigas et al. (2006) cite some 19th-century Catholic theologians who expressed methodological criticisms of evolutionary theory, the study is more historical than methodological.

And, most importantly, there has been no attempt, at least to my knowledge, to methodologically compare these two specific cases of the encounter between modern science and Catholic theology and to draw more general conclusions. The aim of this article is, therefore, to fill, at least in part, these three lacunae: in the methodological analysis of Darwin's theory in relation to Catholic theology; in the methodological comparison of the two cases, Darwin and Galileo; and in offering general methodological and meta-methodological conclusions in terms of the tension between continuity and change in the methodology assumed by Church authors.

Typical problems in the relationship between science and faith concern the situation where science and religion are seen as a set of ideas or beliefs about the world and man, with science using reason and experience and theology using faith to create these ideas or theories. From this point of view, the question is: What is the relationship between these two perspectives on understanding the world and man? For example: what is the relationship between the biblical account of the creation of the world and the theory of evolution; what is the relationship between the biblical image of the world and the theories of Copernicus, Galileo, Newton, Einstein, etc.? This approach to the science–religion question can be called the "objective" approach because it involves different explanations of the world in which we live and of which we are a part.

But to answer these "objective" problems, both religion and science must give a prior answer, at least implicitly, to a question belonging to what we might call the "meta-objective" or epistemological approach: What is the cognitive status of these two different perspectives on knowing the world, scientific and religious, and how do they relate to each other in this respect? Traditionally, answers to these questions have taken the form of specific practical stances. It was not until the 20th century that theorists of the science–religion relationship began to classify these stances in terms of different positions. In this context, several possibilities have been discussed, for example, conflict, independence or separation, the supremacy of one approach over the other, integration, dialogue, etc. (cf. Stenmark 2013).

Christian theology must answer, for example, the question of whether a scientific approach opposed to a biblical or theological one can lead to a reinterpretation of Scripture and a reinterpretation of theological statements. In the case of a positive answer, it has to answer another question: Under what methodological and epistemological conditions can this happen? A negative answer to the first question must lead either to a radical separation of religious knowledge from scientific knowledge or to its superiority and supremacy over science. A positive answer, on the other hand, excludes these two extreme positions and opens the way to other intermediate solutions.

The present text does not deal with "objective" problems but with "meta-objective" issues. Assuming a positive answer to the first question in Catholic theology, I will set out to analyze the theologians' answer to the second question, i.e., the question of the methodological and epistemological conditions that scientific theory must satisfy in order to be able to imply changes in the interpretation of Scripture and theology.

More specifically, this analysis aims to answer three questions. The first question concerns the methodological and epistemological criterion used by official representatives of Catholic theology since Galileo in their argumentation for the acceptance or non-acceptance

of scientific theories as capable of influencing theology or, in other words, the criteria for a scientific theory to be a potential *locus theologicus*.

To answer this question, in the next three sections, I will examine three historical cases and three texts. One will concern Galileo and his conflict with the Holy Office or Roman Inquisition in the person of Cardinal Robert Bellarmine (for the use and meaning of the term "the Holy Office", see (Fantoli [1994] 1996, pp. 35, 46) (note 63), and (Artigas et al. 2006, pp. 8f.)). The other two will concern Darwin, the first being Pius XII's encyclical *Humani Generis* (AAS, vol. 37 (Pope Pius XII 1950)) and the second being John Paul II's Address to the Pontifical Academy of Sciences (AAS, vol. 89 (John Paul II [1996] 1997)) on the theory of evolution. After a presentation of the historical background of each case, I will undertake the methodological analysis that will be guided by the two fundamental and, in fact, opposing methodological concepts of demonstration or proof (*demonstratio*) and hypothesis. This analysis will depend on the historical context and will, therefore, have to address other historically relevant methodological problems. Then, in the final Section 5.1, I will compare the three cases with each other, showing the similarities and differences in the methodological and epistemological criteria adopted.

On the basis of this historical and comparative analysis, another question will be posed in the following Section 5.2. It will concern the possibility of interpreting these three cases in terms of continuity and change in the methodological position of the Church's theology over the centuries.

The answer to the second question will, in turn, be a determinant for the answer to the last question (Section 5.3): Is Catholic theology autonomous in adopting a particular methodological and epistemological stance when defining the boundary conditions for the influence of scientific theories on theology? The question is that of the dependence of theology on science itself and its historically variable nature as interpreted in philosophy, or, in other words, whether Catholic theology chooses its epistemology and methodology independently or is objectively limited in its choices by the evolution of science and its methodology. If the latter is the case, the methodology can be recognized as another specific *locus theologicus*, a meta-objective *locus*.

But before turning to the first case, that of the acceptability of Copernican theory, it is necessary to make a few preliminary remarks about the object of the study and the approach chosen.

This paper does not apply to all religions, not even to Christianity as a whole. I limit my analysis to the Catholic Church and, in particular, to its official representatives and their statements, which could be called (for a lack of a better expression) an "official" Catholic theology ("Magisterium" might be too strict, it seems). It is not limited to the teaching of Popes but also includes the statements of the Cardinals of the Holy Office (see above) and theologians who worked for this Congregation, known as Consultors, while excluding the ideas of other Catholic theologians who have not always been in full agreement with the actual statements of the Church (cf. Schmitz-Moormann 1987). This is also how I have chosen the cases studied, guided above all by their historical significance from the point of view of the science–religion relation.

However, insofar as my paper aims to make a general conclusion that goes beyond the cases studied, my text also refers more broadly to the heritage of Western Christianity before the division of the 16th century. The relationship between Catholic theology and science in Galileo's time, and, also, in the 20th century, remains, it seems, difficult to understand without reference to the ancient theology in which it has its roots, in particular the work of Augustine of Hippo (cf. Pope Leo XIII 1893, ASS 26, pp. 282, 286; McMullin 2013).

A few remarks are also necessary regarding the research method used in this paper. The choice of three historical cases was not accidental but, as already mentioned, motivated by their exceptional importance for understanding the official position of the Catholic Church on science–religion issues. The cases of Galileo and Darwin are two of the best-known and most recognizable problems the Church has had to face that gave rise to the greatest controversy.

There is, however, a specific reason for choosing these three cases. It is the occurrence of almost identical methodological terminology in all three texts. The terms in question are "hypothesis" and "demonstration", the former appearing in all three texts and the latter in the first two and in one of the official translations of the third text. Each time, these terms are used in opposition to one another to assess the value of the scientific theory and its capacity to influence theology. I found this terminological similarity sufficiently revealing and intellectually intriguing to ask and answer the above questions.

Moreover, these three cases will enable us to study the continuity and possible evolution of the Church's position because they are separated in time. As is well known, the element of tradition plays an important role in the Catholic Church. But perhaps behind the declarations of continuity, we will be able also to identify significant changes.

A brief justification is also needed for the initial assumption, namely, that Catholic theology recognizes in principle the possibility of the influence of non-theological science on theology itself and the interpretation of Scripture. Of course, it is easy to identify specific situations in the history of the Catholic science–theology relationship that could be interpreted in terms of domination or separation, but I am not so much interested in individual historical cases as in certain dominant theological-philosophical trends that take the form of certain principles or rules. It seems that all three texts we are about to examine can find their common ground in certain principles formulated by Saint Augustine and in his positive solution to the question of the relationship between the interpretation of Scripture and the teachings of pagan philosophy. This position will be substantiated in the final section of this paper.

Last but not least, the drawing of general conclusions based on the analysis of three selected cases could suggest that the paper uses an inductive method of generalization. On the contrary, in line with the criticism of such an attitude in modern and contemporary philosophy of science, these three cases provide the basis for the formulation of an explanatory hypothesis, which they confirm. According to this hypothesis, generally formulated, Catholic theology can be said to have a non-absolute autonomy or a relative dependence on available methodological solutions that change over time, and for this reason, methodology can be said to be a *locus theologicus* in itself. The real confirmation or falsification, however, would involve testing it on other historical cases, but this is a task for another text.

2. Bellarmine's Letter to Foscarini

2.1. Historical Background

Let us start with the analysis of the statement made by Cardinal Bellarmine in his 1615 letter to Foscarini.[1]

The importance of this text is exceptional as it concerns the first serious confrontation between Roman Catholic theology and the newly emerging empirical science. The cases of Galileo and Copernicus defined the modus operandi of the Roman Catholic Church for several centuries with regard to the achievements of the new science when they were in apparent contradiction with Scripture and official theology. Although the letter to Foscarini is not an official letter but a private one, Cardinal Bellarmine's theological "prestige" was so high, as noted by Fantoli ([1994] 1996, p. 185), that even his private opinion can

be considered representative of the Roman Church of that time and its posture toward Copernicus' theory.

The letter was written in the wider context of the theological discussion triggered by Galileo's positions on Copernicus' theory. From the moment he made telescopic observations of the Moon, Venus, Mercury, and Jupiter in 1609–1610 (see Fantoli [1994] 1996, pp. 110ff.; cf. Finocchiaro 1985, p. 338), Galileo began to proclaim more and more boldly to the public that the fundamental assumptions of Copernicus' theory about the mobility of the Earth and the immobility of the Sun and its central position in the Universe should be treated as true assumptions about the actual structure of the world and not simply as a purely mathematical device aimed at improving on Ptolemy's calculations.

Galileo's theses provoked strong reactions from many theologians. They claimed that Copernicus' theory contradicted common sense and the common interpretation of Scripture. Galileo accepted the challenge. He began to defend his position for several years. This defense took the form of a theological dispute over the principles of scriptural interpretation. Galileo wrote several detailed letters on the subject, which he circulated among leading figures in ecclesiastical and theological circles in Rome. He also submitted some of these polemical letters to Cardinal Bellarmine, a member of the Holy Office, for his opinion.

However, some theologians supported Galileo in his defense of Copernicanism. Among them was Foscarini, superior of the Carmelite order in Rome. At the beginning of 1615, he published a short letter in which he defended the thesis that Copernicus' theory could be reconciled with the affirmations of Scripture. This work having been severely criticized by a consultor of the Holy Office, Foscarini wrote up the defense and sent it, along with the original text, to Bellarmine for his opinion. Bellarmine's opinion was formed very quickly, and Foscarini received the letter as early as April of the same year (see McMullin 2013, p. 208n.; Arcangeli 2016). In it, Bellarmine presents his personal and, at the same time, quasi-official position on Copernicus' theory.

Let us quote the two most epistemologically and methodologically important passages from Bellarmine's letter:[2]

> First I say that it seems to me that your Paternity and Mr. Galileo are proceeding prudently by limiting yourselves to speaking *suppositionally*[3] and *not absolutely*, as I have always believed that Copernicus spoke. For there is no danger in saying that, by *assuming*[4] the Earth moves and the sun stands still, one saves all of the appearances better than by postulating eccentrics and epicycles; and that is sufficient for the mathematician. However, it is different to want to affirm that in reality the sun is at the center of the world and only turns on itself, without moving from east to west, and the earth is in the third heaven and revolves with great speed around the sun; this is a very dangerous thing, likely not only to irritate all scholastic philosophers and theologians, but also to harm the Holy Faith by rendering Holy Scripture false . . .
>
> Third, I say that if there were a *true demonstration*[5] that the sun is at the center of the world and the earth in the third heaven, and that the sun does not circle the earth but the earth circles the sun, then one would have to proceed with great care in explaining the Scriptures that appear contrary; and say rather that we do not understand them than that what is demonstrated is false. But I will not believe that there is such a demonstration, until it is shown me. *Nor is it the same to demonstrate that by supposing* the sun to be at the center and the earth in heaven one can save the appearances, *and to demonstrate that in truth* the sun is at the center and the earth in the heaven; for I believe the first demonstration may be available, but I have very great doubts about the second, and *in case of*

> *doubt one must not abandon* the Holy Scripture as interpreted by the Holy Fathers (Bellarmine 1989, pp. 67f., italics are mine).

Several expressions by Bellarmine in which he sets out his views on the two fundamental assumptions (suppositions) of Copernicus' theory—the thesis of the Earth's mobility and the thesis of the Sun's immobility—deserve particular attention and epistemological or methodological analysis.

These are essentially expressions derived from Aristotle's logic, which was the basis of scholastic philosophy and theology, to which Bellarmine refers in his letter. This logic was, in fact, at the heart of the entire scientific culture of the time; Galileo himself claimed that he was always guided by Aristotle's logic in his research and that he shaped his scientific method on this very basis (see Galileo 1896, vol. 18, p. 248; cf. Wallace 1988a, p. XIII). Of course, there were many different interpretations of this logic, but the basic categories were the same.

It is worth noting that Galileo and Bellarmine were essentially inspired by the same Aristotelian logical tradition developed at the Jesuit Collegio Romano. Bellarmine studied logic in the 1560s with the Jesuit Francesco Tomitano. Galileo studied Aristotle's logic privately in the late 1580s, most probably on the basis of manuscripts by Tomitano's disciples and successors at the Collegio Romano—Lorini and Vallius (see Wallace 1988a, pp. XVIIIff.).

However, at the time of the theological discussion in question, Bellarmine's and Galileo's views on Aristotle's logic, in particular on the ideas of demonstration and hypothesis, diverged significantly. This fact was probably one of the most important reasons for Galileo's condemnation in 1616 as it made mutual understanding between Galileo and the Holy Office almost impossible. Although they used the same logical terms, they gave them different meanings.

2.2. The Demonstration and Hypothesis by the Time of Galileo

The Aristotelian understanding of science was based on the idea of demonstrated knowledge. However, not all kinds of demonstrations were expected to meet the criteria of scientificity or true demonstration. In this line, Bellarmine makes a distinction between a true demonstration and a demonstration *ex suppositione* or *ex hypothesi*.[6] By drawing this distinction, Bellarmine claims that the latter is not a true demonstration and, as a result, is not concerned with reality but only with mathematical calculations. With this, he expresses another Aristotelian axiom, namely, that only physics and metaphysics are genuine sciences that present the true causes of things. Mathematics, on the other hand, because of its idealization cannot be about the real world or physical causes. A true demonstration should be physical or metaphysical rather than mathematical.

However, two opposing interpretations of this passage of Bellarmine's statement have emerged in historiography (see Giostra 2015, p. 258). One, which can be described as the received view, defends—in line with the position taken by Andreas Osiander in his anonymous "Notice to the Reader" to the first edition of Copernicus' *De Revolutionibus*—the so-called mathematical "fictionalism" of Bellarmine and the Jesuits of the Collegio Romano (cf. Ashworth 1986, p. 158; Fantoli [1994] 1996, p. 23). According to the fictionalist view, Bellarmine saw mathematical astronomy (both Ptolemaic and Copernican) as mere fictional tools for describing celestial movements and "saving phenomena", without any implications regarding the real or physical structure of the world.[7] In the 1980s, Ugo Baldini challenged this view. According to him, the Jesuits of the Collegio Romano and Bellarmine himself did not exclude the possibility of relating mathematical astronomy to the real world on the condition of providing physical proof (i.e., based on Aristotle's physics) of their assumptions (see Baldini 1992, pp. 292f. 316f.; cf. Giostra 2015, p. 259; Coyne and Baldini

1985, pp. 105f.). Baldini's interpretation of Bellarmine's words was, however, alien to Galileo himself. Galileo's reply (cf. note 11 below) shows that he interpreted these words as an expression of the "fictionalist" approach.

The term "true demonstration" does not appear in the logical writings of Aristotle. However, in the *Posterior Analytics* (I, 3), a work that presents his logical theory of scientific knowledge, he contrasts a demonstration in the strict sense, in Latin translations *demonstratio simpliciter* (i.e., demonstration without qualification), with a demonstration in the broad sense, i.e., with qualifications—*demonstratio secundum quid* in Latin—which arises when some of the necessary conditions of the demonstration in the strict sense are not fulfilled (cf. Zabarella 1586, pp. 411f., 423f.; cf. Baldini 1992, pp. 308ff.). A demonstration from supposition (*ex suppositione* or *ex hypothesi*) is a demonstration in the broad sense because its premises are not absolutely true as is required for a true demonstration or *demonstratio simpliciter* but only accepted as true conventionally by agreement.[8] The renowned Paduan logician and natural philosopher Giacomo Zabarella (see Liana 2020, pp. 59ff.; Mikkeli and Baker 2024), who exerted considerable influence on the Jesuits from the Collegio Romano and, consequently, on Galileo (see Wallace 1988a, 1988b, 1995; de Jong 1989), in his commentary on the distinction made by Aristotle, stated that knowledge acquired from a supposition is, in fact, not knowledge at all.[9]

We can, therefore, reasonably assume that it was this Aristotelian epistemological distinction that led Bellarmine to claim in his letter that it would be one thing to demonstrate that the earth actually moves and that the sun remains motionless at the center of the world and quite another to demonstrate celestial phenomena simply by hypothetically assuming the truth of these ("by supposing"). McMullin's (1998, p. 279) claim that Bellarmine's fictionalism had biblical rather than Aristotelian origins does not contradict this hypothesis. If McMullin is correct, only Bellarmine's motivation would be different, but the idea of fictionalism itself remains Aristotelian. The same is true of Baldini's interpretation.[10]

Thus, according to Bellarmine, the two basic hypotheses of the Copernican theory are not true, either in themselves or demonstrated by a true demonstration, but only hypothetically. As such, they cannot influence the interpretation of the Holy Scripture. Only if they were demonstrated as truths, should theologians begin to think about changing the literal interpretation of the Bible.

As mentioned above, Galileo, defending himself against Bellarmine's theses, wrote several short papers.[11] His defense went in several directions. From our point of view, two arguments are the most important. Firstly, Galileo refutes Bellarmine's narrow interpretation of the Aristotelian idea of "supposition". In his view, we need to distinguish between two types of suppositions in astronomy (Galileo 1895, pp. 357ff.; cf. Moss 1985, p. 45). Alongside the frivolous ideas of human imagination, there are also true hypotheses (*ipotesi vere, supposizioni vere*), demonstrated by necessary demonstrations (*dimostrazioni necessarie*). In the case of such hypotheses, the demand is for recognition of their absolute truth in relation to the nature of the world.[12] Secondly, he considers his own necessary demonstrations of Copernicus' suppositions as true demonstrations, sufficient to recognize the necessary truth of these suppositions and to reject the contrary theses adopted by Ptolemy and his followers. Consequently, he regards the Copernican suppositions as sufficiently demonstrated to require a reinterpretation of the Scripture on these matters.

Both of Galileo's arguments were well supported by the Aristotelian logical tradition. In his *Posterior Analytics*, Aristotle gives the term "hypothesis" or "supposition" several meanings, the primary of which designates true and demonstrated principles of a demonstration *simpliciter*, as opposed to axioms and definitions that are known in themselves (cf. *Posterior Analytics*, I, 2; in Bekker's numbering 72a, 15–24). From this point of view, there can be a true demonstration from a supposition, which is the opposite of the demonstration *ex*

suppositione mentioned by Bellarmine, i.e., a demonstration from a mere supposition or hypothesis.[13] The discussion of the Aristotelian understanding of supposition in the context of true demonstration can be found in all Renaissance commentaries on the *Posterior Analytics*.

The idea of a true demonstration, different from the perfect demonstration *simpliciter*, was also developed in Aristotelian schools of logic, particularly in the Italian Padua. It took the form of the so-called *regressus.* In his *Posterior Analytics* (I, 13), Aristotle gave yet another typology of demonstration, more relevant to the theory of scientific knowledge. He distinguished between a demonstration from a cause and a demonstration from an effect. The former is identical to the perfect demonstration *simpliciter*, while the latter is a less perfect demonstration with qualification (*secundum quid*), in which one of the conditions necessary for the perfect demonstration, namely, knowledge by means of a cause, is not fulfilled (see Zabarella 1586, pp. 418, 420ff.). The criterion for this division was ontological since scientific knowledge (*episteme*), as Aristotle understood it, had to be knowledge of the belonging of a certain attribute to a certain thing by means of a necessary and immediate cause. Thus, the perfect demonstration *simpliciter* was to provide such causal knowledge.

Aristotle called the causal demonstration *dioti* and the demonstration from effect *hoti*. In the English literature, they are sometimes referred to as "why-demonstrations" and "fact-demonstration", respectively (cf. Berquist 2007). The Latin tradition developed specific names. A why-demonstration was commonly called "demonstratio propter quid". Sometimes, it was also referred to as "demonstratio a priori" where "a priori" means that the premises must be prior to the conclusion, not from the point of view of the knower (or, as Aristotle says, better known to us) but rather in the order of nature (in themselves). In this latter sense, the cause is "naturally" prior to the effect. Such demonstrations were supposed to give knowledge of the effect by means of its necessary cause found in the middle term of the demonstrative syllogism.

The fact-demonstration, on the other hand, has been given many different names in the Latin tradition: *demonstratio quod* or *demonstratio quia* or *a posteriori*. The demonstration that proceeds from effect to cause is just one type of fact-demonstration[14]. According to Aristotle, such a demonstration led to knowledge of an unknown (to us) cause from a known (to us) effect. It was about a fact because it demonstrated only the existence of a cause from the knowledge of the existence of an effect. It, therefore, provided only factual knowledge of the cause, without any knowledge of its nature and essence. On the contrary, in the perfect demonstration *simpliciter*, such a cause had to be known at the outset not only as existing but also as the cause of the effect: either as a self-evident primary cause or as a secondary cause demonstrated by means of a demonstration *simpliciter*.

It was, therefore, commonly accepted among Aristotelians that, on purely logical grounds, only *demonstratio simpliciter* was able to provide true knowledge of things. However, during the Renaissance, natural philosophers and logicians came to realize that perfect *demonstratio propter quid* was suitable mainly for metaphysics and mathematics but not for the natural sciences (esp. physics and medicine), and that this type of demonstration is practically non-existent in these sciences. Natural causes are largely unknown *to us*, to use Aristotle's terms, so they have to be first discovered and demonstrated to exist from known effects and not *simpliciter* (cf. Zabarella 1586, pp. 418, 424ff.).

The Idea of Regressus

A problem had to be solved. If the natural sciences do not use perfect why-demonstrations, they cannot be sciences at all, or, at least, they must be reduced to a very restricted domain. This conclusion, however, ran counter to the common belief that the natural sciences were true sciences. The problem, then, was how to preserve the scien-

tific status of the natural sciences and how to work out an appropriate why-demonstration for them.

To solve this problem in line with Aristotle's teaching, logicians at the school of Padua, where the empirical medical tradition had developed since the Middle Ages, developed the idea of the *regressus* procedure. The problem of *regressus* became one of the most fundamental and debated logical problems in the Renaissance. Contemporary research on Galileo shows that he took the idea of the *regressus* from the logicians of the Collegio Romano, who, in turn, had taken it from Paduan Giacomo Zabarella. Moreover, Galileo developed it in a highly creative way.[15]

In the most general terms, the *regressus* procedure was aimed at transforming an imperfect fact-demonstration into a perfect why-demonstration. From a formal point of view, it was a simple procedure consisting of the appropriate rearrangement of the three terms of the syllogism.[16] But from an epistemological point of view, it was necessary to introduce an additional intermediate step in order to render a distinct (*cognitio distincta*) cause by which the initial effect was to be demonstrated and which was only known in a confused way (*cognitio confusa*) through the initial fact-demonstration. In the Paduan tradition, this step took the form of a specific intellectual analysis, called mental exchange (*negotiatio*) or mental examination (*examen mentale*), or mental consideration (*mentalis consideratio*). Galileo speaks only of an "intermediate stage". According to Wallace (1995, p. 95), it was this intermediate stage of the *regressus* that Galileo developed most ingeniously, using, for example, mathematical demonstrations.

As we can see, the demonstrations built on the basis of *regressus*, and such were those Galileo put forward in support of his assumptions challenged by Bellarmine, were not, because they could not be, true demonstrations in Bellarmine's sense, i.e., demonstrations *simpliciter* based on premises known by themselves.[17]

We will not go any further into this dispute. Let us confine ourselves to drawing a few conclusions relevant to the rest of the analysis. The dispute was essentially logical and methodological and concerned the understanding of "true" demonstration and the notion of demonstration *ex suppositione*.[18] Bellarmine, at least in Galileo's eyes, took from Aristotelianism a very narrow understanding of *hypothesis* as an entirely arbitrary supposition, for which there is no place in a true demonstration, which must proceed from premises that are first true by virtue of a kind of intellectual self-evidence. According to this point of view, which we will call conservative, Copernicus' theory could not acquire scientific status because of the impossibility of providing demonstrations *simpliciter* of its two basic premises. Galileo, as a naturalist, better understood the limited nature of demonstrations *simpliciter* and used the idea of *regressus*, foreign to Bellarmine and the Holy Office, according to which demonstrations *ex suppositione* can also be true demonstrations and hypotheses can become well-proven theses, but not *simpliciter* or the way expected by Bellarmine.

In Baldini's different approach to Bellarmine's letter, this conclusion would have to be somewhat different without recourse to the idea of demonstration *simpliciter.* But as we have said, Galileo understood this letter in a very traditional way; and it is likely that many theologians of the Holy Office would have done the same. Baldini (1992, p. 292) acknowledges that famous Jesuit philosophers of the time, who did not belong to the Collegio Romano, presented the traditional, conservative Aristotelian approach to the methods of astronomy and physics and to the idea of *demonstratio simpliciter*. Therefore, more conservative theologians were more likely to adopt this position.

3. *Humani Generis* of Pius XII

3.1. Historical Background

The second text is Pius XII's encyclical *Humani Generis* (AAS 37 (Pope Pius XII 1950))[19], in which he addresses the theory of evolution and its relationship with theology.[20]

Its importance lies in the fact that it is the Roman Church's first official statement on the theory of evolution. This is not to say that Catholic theologians and Vatican officials had not noticed the theory's emergence beforehand. Only a dozen years after the publication of Darwin's *On the Origin of Species*, the first articles by Catholic theologians supporting the theory of evolution and proclaiming its compatibility with Scripture and the Christian faith were published. From the outset, these articles were accompanied by denunciations to the Holy Office by theologians who considered the theory of evolution to be contrary to Church teaching.[21] At the time, however, the Holy Office wanted to avoid openly condemning the theory of evolution. Perhaps it was preoccupied with the still vivid memory of the Galileo affair and the Church's discreet withdrawal from the condemnation of Copernicus' theory at the beginning of the 19th century (cf. Fantoli [1994] 1996, pp. 496ff.). Awareness of the similarity between the two cases is strikingly attested to by the first decree of the Congregation of the Index in 1878 on the placing on the Index of Caverni's book, quoted in the English translation by Artigas et al. (2006, p. 47):

> *De' nuovi studi della filosofia. Discorsi di Raffaello Caverni a un giovane studente.* This work merits serious and special attention. In it, Darwinism is expounded and partly approved . . . Until now the Holy See has rendered no decision on the system mentioned. Therefore, if Caverni's work is condemned, as it should be, Darwinism could be indirectly condemned. *Surely there would be cries against this decision; the example of Galileo would be held up*; it will be said that this Holy Congregation is not competent to emit judgements on physiological and ontological doctrines or theories of change. But we should not focus on this probable clamor. With his system, Darwin destroys the bases of revelation and openly teaches pantheism and an abject materialism. Thus, an indirect condemnation of Darwin is not only useful but even necessary, together with that of Caverni, his defender and propagator among Italian youth (italics are mine).

The decree was adopted unanimously by nine cardinals. Pope Leo XIII approved the decree, giving it the force of law (ibid., pp. 47f.), but the content of the decree was never published, and only its existence and the legal effect of the ban on the distribution of Caverni's book became known, without the reasons for the ban being made public. It was, therefore, not explicitly known that the condemnation concerned Darwin's theory of evolution (ibid., pp. 13ff., 47).

In later cases, persuasion and "behind-the-scenes" pressure were also used on individual Catholic authors who supported the theory of evolution to withdraw their books from print themselves or to retract them publicly. In return, they were promised that no official action would be taken against them. Nevertheless, these cases were relatively well known to the Church and theologians, if only through the Catholic press.[22] All this created a widespread opinion that the Church tacitly rejects de facto the theory of evolution (see ibid., pp. 270–83). Today, we also know that the work of the famous Jesuit and paleontologist Pierre Theilard de Chardin in the first half of the 20th century in favor of reconciling the Christian faith with the idea of biological evolution was one of Pius XII's motivations for speaking out on the theory of evolution.[23]

As can be seen, prior to the publication of Pius XII's encyclical, the Vatican's position on the theory of evolution remained deeply hidden in the Vatican archives, and its disclosure to the public took the form, at most, of leaks in the Catholic press and much speculation

about a few decisions of the Congregation of the Index. The encyclical was, therefore, the first official voice of the Roman Church on the subject.

However, the encyclical *Humani Generis* was not intended by its authors to focus on the theory of evolution. Its main aim was to defend traditional scholastic[24] and neo-Thomistic theology and philosophy against the growing onslaught of new philosophical currents, such as existentialism, materialism, or historicism, to which more and more Catholic theologians and philosophers were adhering (see Dondeyne 1951, pp. 14–16). But for the encyclical's authors, one of the most pernicious new ideas was the philosophical idea of a universal or cosmic evolution designed to explain "the origin of all things". According to the encyclical, proponents of this idea preached "the monistic and pantheistic opinion that the world is in continual evolution" (HG 5), and that there is, therefore, no Absolute and no unchanging essence of things.[25] By contrast, for scholastic and neo-scholastic philosophy and theology, the idea of an Absolute and the idea of an unchanging essence of things were beyond question.

The essential subject of the encyclical was therefore strictly philosophical questions in their relation to Catholic theology. The problem of the empirical theory of evolution appears, as it were, on the margins of the fundamental philosophical problem. Questions relating to the theory of evolution occupy less than 10% of the text of the encyclical (HG 5 and HG 35–37).

3.2. Methodological Statements on Evolution

In its first section (HG 5), the encyclical states that the theory of evolution is the specific source of this mistaken philosophical idea of universal evolution. At the same time, the encyclical asserts that philosophers have accepted this theory too hastily, given that it has not yet been "fully proved" (Latin: *invicte probata*)[26] in the empirical sciences. So here, we have the same methodological thesis as in Bellarmine's letter, namely, that a scientific idea must first be fully proven before it can be an authentic source of philosophical, let alone theological, ideas.

The encyclical deals at greater length with the Darwinian theory of evolution in its final section (HG 35–37). In giving the reason for this interest, the Pope emphasizes that it directly affects the Church's teaching on the creation of man and the interpretation of the text of Genesis in Scripture. In this context, the encyclical addresses three questions: the evolutionary origin of the human body, the evolutionary origin of the human soul, and the question of polygenism.

The encyclical excludes from the outset the possibility of freely discussing the question of the evolution of the human soul. The basic argument is derived from a dogma of faith: "for the Catholic faith obliges us to hold that souls are immediately created by God" (HG 36).

The encyclical also prohibits Catholic theologians from freely discussing polygenism on the question of the origin of the human body because, as it states, "now it is in no way apparent how such an opinion can be reconciled with that which the sources of revealed truth and the documents of the Teaching Authority of the Church propose with regard to original sin" (HG 37). This prohibition, as can be seen, is considerably weaker than the previous one, and the statement itself is sufficiently ambiguous to have provoked much speculation about Pius XII's real intentions regarding polygenism. Roman cardinals tried to clarify the formula but to no avail. Pius XII explicitly told the cardinals that the encyclical's formulations were "deliberately cautious and that it is good that it should remain as it is, without further clarification" (see Kemp 2023, p. 25).

The situation is quite different, however, when it comes to the evolution of the human body. Given "the present state of the human sciences and sacred theology", the encyclical

states that the Church "does not forbid"[27] (HG 36) the study and discussion of this question by "men experienced in both fields", subject, of course, to certain conditions defined by the Church's Magisterium.

These three methodologically different positions of the Church find their justification in the encyclical in the form of conditions that must be met by scientific theories in order for them to cause any change in Catholic theology. The encyclical also tells how to proceed when these conditions are not met.

From a methodological point of view, the encyclical contrasts demonstrated knowledge with hypotheses having only "some sort of scientific foundation" (HG 35). The encyclical also calls the latter "conjectural opinions" (Latin: *opiniones coniecturales*, HG 35. 37). According to the encyclical, "conjectural opinions" must be rejected if they directly or indirectly contradict the dogmas of the Church. This is undoubtedly the situation in the case of the question of the creation of the human soul. In the case of polygenism, the situation is more complicated since the encyclical merely states that, given the current state of science and theology, it is impossible to see how this hypothesis can be reconciled with the dogma of original sin. It thus suggests that the situation could change in the future.

However, with regard to the human body, it is possible to theologically examine the evolutionary hypothesis, that is, the hypothesis of "the origin of the human body as coming from pre-existent and living matter". The discussion, nevertheless, cannot be completely free. The status of an unproven hypothesis implies that the theory of evolution should be considered by theologians and scientists on an equal footing with the opposite hypothesis (HG 36):

> However, this must be done in such a way that the reasons for both opinions, that is, those favorable and those unfavorable to evolution, be weighed and judged with the necessary seriousness, moderation and measure.

Moreover, both sides in this discussion should be willing to submit to the final judgment and decision of the Church, which alone has the authority to interpret Scripture and the dogmas of the faith authentically.

Here we are dealing with a kind of usurpation on the part of the Church's Magisterium to determine the cognitive value of all those scientific hypotheses that have not been demonstrated, and which contradict the very foundations of the Christian faith. This interpretation is confirmed by a text by Karl Rahner, one of the most prominent theologians of the time. In a text on the question of monogenism and polygenism, he writes that the terms "coniecturalis opinio" and "hypothesis", which the encyclical applies to the question of polygenism (but also to the theory of evolution), mean that these concepts can be considered false (empirically) and rejected on the basis of a source of knowledge other than natural science, thus suggesting theological sources (see Rahner 1963, p. 232).

It should be noted, however, that Rahner's interpretation was not a common one, especially among followers of neo-scholastic philosophy. A different and more conciliatory interpretation of the encyclical was given, for example, by Dondeyne (1951, pp. 14–16). He agrees with the charges against the encyclical that the Pope's expressions unnecessarily diminish the "soundness" and "degree of certainty of the evolutionist hypothesis". But he does not think they should be taken too seriously ("il n'y a pas de quoi s'émouvoir outre mesure"; ibid., p. 16). These should not be taken too literally as the Pope does not make infallible statements about the status of empirical sciences. The encyclical is not even a philosophical document, let alone a document on empirical sciences. At best, the Pope's wording should be considered an embarrassing way of expressing his caution by a theologian who does not quite need to know about the sciences and is looking at them from the point of view of someone forced to look at them from the outside.

Thus, it can be said that the methodological position of *Humani Generis* represents a kind of radicalization of Bellarmine's position in his letter to Foscarini. Like Bellarmine, Pius XII believes that a scientific theory should be proven beyond all doubt in order to imply modifications of theological ideas. Unproven hypotheses cannot be taken seriously by theologians. A peculiar novelty in relation to Bellarmine is revealed in the thesis that the Church can have the final say on the veracity of such conjectural natural hypotheses insofar as they do not agree with the traditional interpretation of Scripture and faith. Bellarmine's position is *implicit*, whereas Pius XII formulates it explicitly. *Humani Generis* continues in this regard the line taken by the Magisterium of the Roman Church from the 2nd half of the 19th and early 20th centuries.[28]

And yet, despite the similarities, the methodological positions of Bellarmine and Pius differ significantly. This difference is rooted in different historical and philosophical contexts, more specifically, in a different methodology of empirical science. While both are based on scholastic methodology, with its roots in the logic of Aristotle, Pius XII's text shows the influence of a different methodology, in particular the 19th-century version of modern empiricism. The encyclical does not explicitly adopt the methodological formulations of modern empiricism; nevertheless, many of the expressions used in the encyclical do not seem to be reconcilable with the traditional scholastic view of Aristotle's conception, to which Bellarmine and the Holy Office referred in the Galileo case.

3.3. "Humani Generis" and Empiricist Tradition

Let us pay attention to the three formulations of the encyclical. Since the English translation is not a faithful translation of the text of the Latin original, but a peculiar interpretation of it, I give these texts in both English and the original Latin:

(1) "in the case of clearly proved facts" (HG 35); Latin: "ubi de factis agitur reapse demonstratis",

(2) "when there is rather a question of hypotheses, having some sort of scientific foundation" (HG 35); Latin: "ubi potius de 'hypothesibus' sit quaestio, etsi aliquo modo humana scientia innixis",

(3) "they act as if the origin of the human body from pre-existing and living matter were already completely certain and proved by the facts which have been discovered up to now and by reasoning on those facts" (HG 36); Latin: "ita sese gerant quasi si ipsa humani corporis origo ex iam exsistente ac vivente materia per indicia hucusque reperta ac per ratiocinia ex iisdem indiciis[29] deducta, iam certa omnino sit ac demonstrata".

First of all, the term "fact" (Latin: *factum*) used in the encyclical in the context of the scientific method is foreign to traditional Aristotelian terminology. In that tradition, as in other pre-modern traditions, the Latin term "factum" occurred at most as the name of a human work or other causal agent, in its basic participle sense of something done or made. The reference to natural phenomena did not appear until the empiricism of Francis Bacon, and then in the 17th-century empiricism of the English Royal Society (cf. Shapiro 2000, pp. 105ff.). The ideas of English empiricism were developed in the 19th century when the concept of fact became common in the methodology of empirical sciences.

Moreover, the phrase "proved facts" (*de factis demonstratis*) occurring in the encyclical refers to the specific notion of *general fact* corresponding to the notion of *law* in 19th-century empiricism (cf. e.g., Herschel 1831, pp. 102, 175, 185; Comte 1830, p. 5). To speak of the demonstration of a particular fact would bear the hallmarks of a typical overstatement, especially since the Latin text speaks of the demonstration of these facts on the basis of reality itself (*reapse*), that is, on the basis of experience or particular facts. Moreover, the word "reapse" comes from the language of Aristotelianism and scholasticism, which the English "clearly" does not fully capture.

A further remark also applies to the English translation. In the Latin original, the word "factum" occurs only once, while in the English translation the word "fact" appears three times. The last two occurrences render the Latin "indicium". It is an ambiguous word and can be translated as "indication", "sign", "evidence", or "fact". It can be relatively easily related to the methodological terminology of Scholasticism and Aristotelianism where demonstration from effect was also called "demonstration from the sign" (*a signo*) (cf. Zabarella 1586, pp. 261, 426). In this Aristotelian perspective, "indicium" would mean the observable effect of a hidden cause. This type of *a posteriori* method always starts from particular sentences, that is, from particular facts. The English translation, thus, refers to the terminology of empiricism to an even greater extent than the Latin original.[30]

Another expression that draws on the empiricist tradition is "hypotheses, having some sort of scientific foundation" (*aliquo modo humana scientia innixis*). The encyclical is not concerned with the nature of this link, but such a methodological link between hypotheses—understood as unproven explanations of phenomena—and science is in itself a procedure foreign to Aristotelianism and Scholasticism.

In the methodology of the sciences, the notion of hypothesis appeared only in the 17th century in the aforementioned Royal Society, usually in connection with the notion of fact (see Shapiro 2000, pp. 143–45). Similarly, the encyclical links these two concepts. However, it was not until 19th-century empiricism that a methodological understanding of the heuristic function of hypotheses in science was developed. Guided by the already widespread awareness of the limitations of the empirical method developed by Bacon and by analyses of the changing practice of science, authors such as Auguste Comte, John F. W. Herschel, and John S. Mill introduced the concept of hypothesis into the very heart of the heuristic method in science. Mill speaks explicitly of the "Hypothetical Method" in science (Mill 1843b, p. 13).

In the view of these authors, hypotheses were an effective tool for the search for new laws and theories and, ultimately, for true causes (*verae causae*) in nature.[31] However, this was new to the ideas of the founders of English empiricism, Bacon and Newton. Newton maintained that there was no room in science for any hypothesis, either metaphysical or physical. He is famous for the phrase "hypotheses non fingo" (I frame no hypothesis), which appears in the *Scholium generale* added to the second edition of the *Principia* (see Newton 1713, p. 484; [1848] 1995, pp. 442f.).[32]

Herschel writes that one should not be afraid to create hypotheses and theories. With hypotheses, new putative causes are introduced into theories, by which they "afford us motives for searching into analogies" (Herschel 1831, p. 196).

However, all empiricists, whether Herschel, Mill, or Comte, were aware of the arbitrariness of hypotheses. Their use in science, therefore, had to be subject to methodological limitations. They could not be completely arbitrary ideas but ideas built on the basis of previous experience and logically linked to the whole network or classification of previous knowledge (cf. Mill 1843b, pp. 10ff.). The most important feature of scientific hypotheses, however, was to be the possibility of transforming them into true or false sentences about reality, by verifying or refuting them on the basis of empirical predictions deduced from such hypotheses and theories.

From a logical point of view, the idea of deductive and empirical verification, then called the deductive method, was a new, inverted version of Bacon's method of complete induction, necessary to justify the use of hypotheses and theories in science (cf. Mill 1843b, p. 13). Whereas Bacon's inductive method was to consist in a critical analysis of experience and its progressive generalization, deductive verification was to consist in checking all the individual predictions or effects of an assumed hypothesis, i.e., the facts predicted by the hypothesis. This is why the empirical methodology of the 19th century refers to the

demonstration, not just the confirmation, of hypotheses or theories by facts. Mill (1843b, p. 15) puts it as follows:

> It appears, then, to be a condition of a genuinely scientific hypothesis, that it be not destined always to remain an hypothesis, but be certain to be either proved or disproved by that comparison with observed facts which is termed Verification.[33]

We can, therefore, assume that when the author of the encyclical criticizes the position of those who treat the hypothesis of the origin of man as if it had already been deduced on the basis of the facts gathered so far and the relevant reasoning (*per indicia hucusque reperta ac per ratiocinia ex iisdem deducta*), and thus, as if it were already completely certain and demonstrated (*iam omnino certa sit ac demonstrata*), he alludes (consciously or not) to the methodological ideas of empiricism and, in particular, to the ideas of induction and verification.[34]

However, another interpretation cannot be ruled out either: namely, that the author of the encyclical had in mind Aristotle's imperfect fact-demonstration, that is, proof from effects or signs, and that he interpreted the method of modern empirical sciences this way. But then he would be accepting as authentic proof what Galileo unsuccessfully defended in his polemic with Bellarmine and the Holy Office as sufficient "dimostrazioni necessarie".[35]

Regardless of the interpretation chosen, in both cases, there is a significant departure from the ideal of scientific knowledge (*episteme*) and the ideal of *demonstratio simpliciter* adopted by scholastic philosophy from Aristotle. Neither induction by generalization nor verification nor proof from effect is by any means a perfect demonstration *simpliciter* of Aristotle's logic.

Therefore, it is clear that the authors and translators of the encyclical were, consciously or not, influenced by 19th-century empiricism and its ideal of scientific knowledge, different from the Aristotelian and scholastic ideal.

The concession to a new ideal of scientific knowledge on the part of official ecclesiastical neo-scholasticism was not, however, devoid of justification. Indeed, there is a link between the epistemology of modern empiricism and the epistemology of the neo-scholastic encyclical. Although modern thought from the outset rejected Aristotelian induction as a reliable method of knowing first principles and, also, to a large extent, the idea of syllogistic demonstration, it nevertheless retained elements of the Aristotelian ideal of scientific knowledge as certain, true, and, above all, demonstrated. Today, this new ideal is sometimes referred to as the Bacon—Descartes ideal (see Watkins 1984, pp. 126ff.). Admittedly, the new understanding of the ideal criteria of scientificity (certainty, truth, and demonstration) was significantly different from Aristotle's. Moreover, it was otherwise different in rationalism and otherwise in empiricism, but the original terminology and intuitions remained the same. A plausible hypothesis can be advanced, it seems, that the use of the same terminology by neo-scholasticism and modern epistemology was that necessary common minimum, which, over time, enabled different methodological and epistemological paradigms to converge. Without such a convergence, it seems unthinkable that neo-Thomistic authors—at least some of them—would recognize the new empirical science as authentic knowledge capable of effecting a change in the interpretation of Scripture and theology, insofar as it is true and demonstrated knowledge and not merely hypothetical.[36]

3.4. Darwin Confronts Empiricism: A New Idea of Scientific Hypothesis

The idea of a common element also makes it possible to understand the astonishing compatibility of empiricism and neo-scholasticism in the 19th century (and the following century too) in casting doubt on the scientific character of the natural selection hypothesis. The encyclical's contention that the theory of evolution is not sufficiently justified in "facts" or "indicia" largely reflects 19th-century empiricism's critique of the theory of evolution.[37]

As soon as *On the Origin of Species* was published, Darwin's good friends and acquaintances with whom he corresponded, such as Asa Gray, questioned the idea of natural selection as an adequate true cause (*vera causa*). Darwin himself mentions it in his letters, for example to Charles Lyell from 23 February 1860 (see F. Darwin 1887, vol. 2, pp. 289f.). And yet Newton's idea of *vera causa* was fundamental to the methodology of British empiricism.

Similar criticisms of Darwin's theory were also voiced by John Herschel, whose methodological texts Darwin appreciated and studied. In a brief note accompanying his earlier article, Herschel (1861) rejected the idea of natural selection as the governing cause of organismal evolution, accusing it of being an arbitrary, fictitious, and "mysterious" explanation of the mechanism of transformation. In his view, its explanatory value was comparable to that of explaining the origin of Shakespeare's or Newton's works by a purely random and mechanical juxtaposition of letters and words, in the manner typical of the fictional inhabitants of the flying island Laputa from Swift's *Gulliver's Travels*:

> We can no more accept the principle of arbitrary and causal variation and natural selection as a sufficient account, *per se*, of the past and present organic world, than we can receive the Laputan method of composing books (pushed *à l'outrance*) as a sufficient one of Shakespeare and the [Newton's] Principia. (Herschel 1861, p. 12).

The idea of natural selection in no way satisfied the postulate of verification. As a "mysterious" force, it did not allow empirical predictions to be derived and tested. It remained a fictional idea of the imagination, the veracity of which could not be established by experience and facts. Therefore, it did not meet the criteria of scientificity adopted by 19th-century empiricism. As Charles H. Pence put it[38]:

> It should start to be clear, then, why Herschel wouldn't have liked Darwin's science. There was just no way, given the biological knowledge available at the time (or even available now!) to go look at every single change in the history of life, and think about how to describe it in terms of natural selection. And there was no way in Darwin's day to go produce new cases of natural selection to make sure that it worked right. (Pence 2021–2022).

Darwin had his own answer to these objections. We cannot discuss Darwin's epistemology in detail here, so we will confine ourselves to two pertinent observations.

The first concerns the question of true cause (*vera causa*) and the "mysterious" nature of natural selection. Darwin was well aware that he could not explain the intrinsic nature of natural selection, what it is, and its internal mechanism. However, he found an extremely strong historical argument in his favor and against his critics. Reading David Brewster's *Life of Newton* (cf. Brewster 1855, pp. 282ff.), Darwin discovered that an almost identical objection regarding *vera causa* was also made by Leibniz against Newton and his force of gravity, namely, that he could not show what gravity itself is.[39] Leibniz accused Newton that the force of gravity he had introduced was an "occult quality", not just one whose cause is merely unknown but cognizable but one that transcends the nature of creatures and is rather proper to God himself.[40] So, even if Darwinian natural selection remained a mysterious or occult force, it was undoubtedly one in good company that 19th-century empiricists did not question. So, in Darwin's mind, the proponents of empiricism were not entirely consistent in criticizing his idea of natural selection.

Secondly, Darwin had different views from 19th-century empiricists on the status of hypotheses and theories in science and on the role of verification. In this respect, William Whewell's ideas were closer to his own than Herschel's (cf. Thagard 1977; Ruse 1975). In 1856, even before the publication of *On the Origin of Species*, he wrote of his hypothesis, called elsewhere "natural selection" (see E. Darwin 1841, C9v; Barlow 1963, p. 205), that it

was neither definitive nor the best formulated, but that it would probably be replaced in time by a better hypothesis. This, he thought, was the typical way of doing science:

> To be brief, I assume that species arise like our domestic varieties with much extinction; and then *test this hypothesis* by comparison with as many general and pretty well-established propositions as I can find made out,—in geographical distribution, geological history, affinities, &c. &c. And it seems to me that, supposing that such hypothesis were to explain such general propositions, we ought, *in accordance with the common way of following all sciences, to admit it till some better hypothesis be found out*. (A Letter to Asa Gray from 20 July 1856; in: (F. Darwin 1887, vol. 2, pp. 78f.), italics are mine).

He wrote the same thing a few years later in a letter to William Wallace, this time about his highly controversial pangenesis hypothesis, which he himself described in his autobiography in: (F. Darwin 1887, vol. 1, p. 93) as "well abused":

> "My dear Wallace. You cannot well imagine how much I have been pleased by what you say about "Pangenesis" . . . What you say exactly and fully expresses my feeling, viz. that it is a relief to have some *feasible explanation of the various facts*, which can be *given up as soon as any better hypothesis is found*. It has certainly been an immense relief to my mind; for I have been stumbling over the subject for years, dimly seeing that some relation existed between the various classes of facts. . . .." (A Letter to Alfred R. Wallace from 27 February 1868; in: (F. Darwin 1887, vol. 3, pp. 79f.), italics are mine).

In defense of this hypothesis, C. R. Darwin (1868, vol. 2, p. 357) referred to William Whewell's *The Philosophy of Inductive Sciences*, in which the latter asserts that even incomplete or partially false hypotheses can be useful to the development of science (Whewell 1840, vol. 2, p. 225). In turn, Darwin wrote in his autobiography (cf. F. Darwin 1887, vol. 1, p. 93) that the very possibility of linking (explaining) many hitherto dispersed facts by a hypothesis constitutes its scientific value since the adoption of such a hypothesis can lead to a better understanding of the facts and, consequently, to seeking and finding in the future its empirical confirmation.

Admittedly, Darwin confirms his commitment to empiricism in the same autobiography when he writes that "an unverified hypothesis is of little or no value" in science. However, this is not the empiricism of Herschel or Mill. For Darwin, actual verification of a hypothesis was not a necessary condition for a hypothesis to be considered empirical. For him, a sufficient condition for the empirical character of a hypothesis was the possibility of the future confirmation of the hypothesis by new, yet unknown, facts:

> Towards the end of the work I give my well-abused hypothesis of Pangenesis. An unverified hypothesis is of little or no value; but if anyone should hereafter be led to make observations by which some such hypothesis could be established, I shall have done good service, as an astonishing number of isolated facts can be thus connected together and rendered intelligible. (Autobiography, in: F. Darwin 1887, vol. 1, p. 93).

Similar views on the empirical nature of the hypothesis were propounded by William Whewell (see Weber 2000, p. 173).[41] As is well known, future developments in science and the philosophy of science proved Darwin, rather than Herschel, right. By the middle of the 20th century when the encyclical was published, all biologists and even some neo-scholastic philosophers were already adopting a very similar interpretation of the evolution hypothesis.[42] According to the neo-scholastic philosopher Dondeyne (1951, pp. 14–15), mentioned above (see Sections 3.1 and 3.2, note 25), at that time, none of the biologists, including those close to the Church, regarded the theory of evolution as "a fact that can

be established directly", as the encyclical demanded, nor did they believe that it could be "verified" definitively by facts. On the contrary, all agreed that it was "only" a hypothesis, but not just any hypothesis, rather an "eminently plausible" and "verifiable in its many consequences", hypothesis that "cannot be rejected without being replaced by another one, at least as plausible". As such, it was universally accepted by scientists, according to Dondeyne, as the best available explanation of empirical data, certainly better than the explanation based on the idea of "successive creation".[43]

But in the 19th century, the idea of the usefulness in science of an unproven or even partially false hypothesis seemed difficult to accept from the point of view of conservative empiricism, and even more so from the point of view of methodologically conservative neo-scholasticism. The inertia of philosophical ideas often causes philosophy to lag behind the development of science and its method. Empiricism made concessions to unverified hypotheses only in the 1930s (cf. Carnap 1936, pp. 427f.).[44] The official neo-scholasticism of the Catholic Church in the person of Pius XII in the mid-20th century was ready to accept the empiricist ideal of demonstrated and verified knowledge but was, apparently, not ready to recognize the scientific value of unverified but only well-confirmed hypotheses, even though at that time, this was already an idea widely accepted by scientists and by some neo-scholastic philosophers.

4. John Paul II's Address

4.1. Historical Background

Our last text is John Paul II's Address to the Plenary Session [of the Pontifical Academy of Sciences] on "The Origins and Early Evolution of Life" (John Paul II, 22 October 1996). This is an official speech, the original of which was written and presented in English (John Paul II 1996) and translated into the Vatican's three other official languages, Italian, Spanish, and French, but only the French version was published in *Acta Apostolicae Sedis* (AAS vol. 89 (John Paul II [1996] 1997), pp. 186–90). The differences between these various language versions are worth highlighting and will be examined below. The text is devoted almost entirely to the question of the theory of evolution since this was the theme of the assembly of the Pontifical Academy of Sciences (PAS).[45]

This text, unlike the other two, does not require a broader discussion of the methodological context of its origins in order to be understood. However, a few important facts should be mentioned here. Firstly, it was the Second Vatican Council, held in 1962–1965, which changed, albeit not radically but at least profoundly, the Catholic Church's attitude toward the modern world, including science and technology (see Kozhamthadam 2007). The main lines of this change are to be found in the Constitution on the Church in the Modern World *Gaudium et Spes* (AAS 58 (Gaudium et Spes [1965] 1966), henceforth as GS with section number), which expresses a profound desire to adopt a dynamic worldview in place of the static Aristotelian one, not without the influence of the idea and theory of evolution (see Kozhamthadam 2007, pp. 617f.). The Archbishop of Krakow, Karol Wojtyła, the future Pope John Paul II, was involved in the preparation of *Gaudium et Spes* (see Newton 2008, p. 389). The Constitution twice affirms the idea of the legitimate or rightful autonomy of science (GS 36 and 59) and deplores cases in which this autonomy has not been sufficiently respected, as in the case of Galileo, thus reinforcing the belief that faith and science are mutually opposed (GS 36). Another important contribution of the Second Vatican Council to the relationship between science and religion was the adoption of a new approach to the interpretation of Scripture, taking into account recent developments in the hermeneutics (see *Dei Verbum*, AAS 58 (Dei Verbum [1965] 1966), esp. sct. 12). This new approach to biblical interpretation is an important aspect of John Paul II's speech (see John Paul II 1996, sct. 2).

Another important fact that should be mentioned here is John Paul II's (Karol Wojtyła) interest in the relationship between science and religion while he was still Archbishop of Kraków in the 1960s and 1970s (cf. Russell et al. 1990, p. v; Trombik 2019, pp. 275–78). He continued the meetings he initiated in Kraków for many years as Pope in Castel Gandolfo (see Russell et al. 1993, pp. 1f.). This tradition was certainly an important factor in his commitment as Pope to the relationship between science and religion. His Message of 1 June 1988 to George Coyne, S.J., Director of the Vatican Observatory, on the relationship between science and religion (John Paul II [1988] 1989) was widely echoed in the scientific and philosophical world. His approach has been called "the new vision from Rome" (Russell et al. 1990), and "the first major Pontifical statement on science and religion in three decades" (Russell et al. 1993, p. 2).

Inspired by the Pope's statement, George Coyne proposed that a series of five conferences be organized over a decade by the Vatican Observatory and the Center for Theology and the Natural Sciences in Berkeley, USA. The common theme would be Scientific Perspectives on Divine Action. The third conference was held in Castel Gandolfo in June 1996. The theme was Molecular and Evolutionary Biology. John Paul II sent a cordial greeting to the participants of the conference, in which he expressed his appreciation for the whole series of conferences as "an important contribution to that exchange *between religion and science* which I have made every effort to promote since the first days of my Pontificate" (see (Russell et al. 1998, p. 1); originally, the text was printed in *L'Osservatore Romano*, 29 June 1996; the italics are original). This conference was not directly linked to the meeting of the Pontifical Academy of Sciences, but the topics were virtually the same. Moreover, John Paul II addressed both events, and his Address to the Pontifical Academy of Sciences was included, along with his Message to the conference, in the publication that followed the conference (Russell et al. 1998).

4.2. "Address" and "Humani Generis": Methodological Comparison

In a manner typical of pontifical documents, the Pope refers to the declarations of his predecessors, in particular Pius XII's *Humani Generis*. In an equally typical manner, he emphasizes the positive contribution of Pius XII to the explanation of the problem of the theory of evolution from a theological point of view and omits questions that might have been considered more controversial, implicitly enclosing them in the common category of the different state of scientific and theological knowledge at the time the encyclical was written.

From our point of view, what matters most is the statement on the theory of evolution, which takes into account the changed context of the development of science, philosophy, and theology. The Pope writes:

> "4. [. . .] Today, almost half a century after the publication of the Encyclical, new knowledge has led to the recognition of more than one hypothesis in the theory of evolution. It is indeed remarkable that this theory has been progressively accepted by researchers, following a series of discoveries in various fields of knowledge. The *convergence*, neither sought nor fabricated, of the results of work that was conducted independently is in itself a *significant argument in favour* of this theory.
>
> What is the significance of such a theory? To address this question is to enter the field of epistemology. A theory is a metascientific elaboration, distinct from the results of observation but consistent with them. By means of it a series of independent data and facts can be *related and interpreted in a unified explanation*. A theory's validity depends on whether or not it can be *verified*; it is constantly

> tested against the [new] facts; wherever *it can no longer explain the latter* it shows its limitations and unsuitability. It must then be *rethought*.
>
> Furthermore, while the formulation of a theory like that of evolution complies with the need for *consistency* with the observed data, it *borrows certain notions from natural philosophy*." (the italics are mine)

The first sentence of the above quote is the most confusing as it reads differently in English and in the three official translations. The English original, which speaks of "more than one hypothesis", suggests the coexistence of different hypotheses of evolution, for example, empirical and philosophical. The Pope explicitly affirms this a few sentences later (Section 4) when he writes:

> to tell the truth, rather than the theory of evolution, we should speak of several theories of evolution. On the one hand, this plurality has to do with the different explanations advanced for the mechanism of evolution, and on the other, with the various philosophies on which it is based.[46]

In contrast, all three translations say "more than [just] a hypothesis" (Spanish and French) or "more than a mere hypothesis" (Italian).[47] The translations thus suggest the interpretation according to which the theory of evolution already has a scientific status beyond that of a mere hypothesis and, therefore, may have some theological implications. Both possibilities are interesting, but it seems that the original intention has been rendered in English although the version present in the translations is also supported by the following sentences giving a methodological interpretation of the theory of evolution and an argument from convergence in its favor.[48]

The English version shows that the Pope was aware of the current problems of the empirical theory of evolution, at least in the most general terms. It is hard to say who might have been the source of this information. The fact is, however, that at the Castel Gandolfo conference mentioned above, only Paul Davies rejected Darwinism and its idea of natural selection, while the other authors defended neo-Darwinism (see Russell et al. 1998, pp. 151–62). However, in the collection of texts published after the conference, we find a text by Ian Barbour that gives an overview of the many empirical positions known at the time regarding the mechanisms of evolution (Barbour 1998, pp. 420–24). As Barbour notes, the neo-Darwinian synthesis struggled from the beginning to explain many facts, and there were various attempts to "extend" it and to include additional factors responsible for evolution. He also discusses several views "beyond Darwinism", like for example the idea of epigenetic factors. He states that, although these ideas are "controversial and outside the mainstream of the current biological thought, they should not be dismissed if they are able to account for observed phenomena more adequately than neo-Darwinian theory" (ibid., p. 423).

We do not know if this was the source of the Pope's knowledge, but these ideas were certainly present at the time in the Holy See offices that prepared the texts for the Pope. And such an awareness of the many possible empirical solutions to the problems of the current theory of evolution could only encourage the methodological statements present in the Address, especially the idea of the hypothetical and temporal nature of the scientific theories.

The methodological language in the Address is closer to the methodology of Darwin than that of the encyclical *Humani Generis*. Admittedly, the empiricist expression "verification" appears in it, but one can infer from the context that it does not mean definitive verification, i.e., positive confirmation of a theory by all facts that can be deduced from (predicted by) that theory, but confirmation by successive new facts. More significant and more "Darwinian" is the general methodological statement that the accumulation of facts

that are inexplicable on the basis of a given theory consequently leads to the need to revise and modify it ("It must then be rethought"). According to the Address, the theory of evolution, like any other empirical theory, is subject to constant testing by new empirical facts with which it must be consistent, and it is possible that over time, under the pressure of facts incompatible with it, if any, it will be replaced by another, better theory.

We know that this methodological idea of the constant need to replace old scientific theories with new ones, typical of Darwin, struggled to gain acceptance among empirically-minded scientists and philosophers during his lifetime. Nevertheless, it had already become an integral part of the self-awareness of scientists at the turn of the 19th and 20th centuries.[49] However, it was not until a century later, with John Paul II, that it became part of the methodological landscape of official Catholic theology. For Pius XII, defending neo-scholastic philosophy, such an idea must have appeared as another manifestation of the idea of universal evolution leading to the negation of immutable and perennial truth. As we know, he rejected this idea in *Humani Generis* (HG 5).[50]

Another argument in favor of the "Darwinian" methodology of the Address is that it does not require proof or demonstration of the theory of evolution through facts. On the contrary, the text allows for the methodological idea that scientific knowledge likely to have theological implications can be hypothetical in nature. Consequently, the Pope acknowledges that the theory of evolution remains a hypothesis but, nevertheless, considers it already capable of influencing theology while still excluding the spiritual soul or the human person from this influence. It is true that the translations imply, as we noted above, the recognition of the theory of evolution as something "more than a mere" hypothesis. But in so doing, they tacitly assume that the concept of a scientific hypothesis is subject to gradation and that only a pure (mere) hypothesis unsupported by facts cannot be taken into account by theologians. This, however, is not the case with the hypothesis of evolution. According to the Address, it is strongly supported by empirical science.

The author of the Address finds sufficient confirmation in the "convergence" of evolutionary ideas in varied and often distant scientific fields. The process, which has been observed in science for a long time, of independent confirmation of the effectiveness of the idea of evolution in explaining different areas of reality and in different fields of science testifies in favor of its credibility:

> It is indeed remarkable that this theory has been progressively accepted by researchers, following a series of discoveries in various fields of knowledge. The convergence, neither sought nor fabricated, of the results of work that was conducted independently is in itself a significant argument in favour of this theory. (John Paul II 1996, sct. 4).

This argument bears all the similarities of William Whewell's "consilience of inductions" or "coherence argument". According to this argument, the capacity of an idea (cause) to explain an increasingly broad class of phenomena, often initially remote from one another, is strong support for the correctness of the idea or cause put forward (see Snyder 2023, part 3). It was also one of Darwin's arguments in his *On the Origin of Species* (C. R. Darwin 1859, pp. 4, 129, 152, 264, 266, 453, 478) for the superiority of the explanation of biological change by natural selection over other explanations, especially the theory of creation.

It is also worth noting that, while *Humani Generis* was written with the intention of condemning the idea of universal, cosmic evolution, John Paul II recognized the universality of the idea of evolution in the various sciences as a confirmation of its soundness.[51]

Once again, the difference between the English and Italian formulations is significant here. The English text speaks of the capacity "to explain new facts", while the Italian translation uses the traditional phrase "dimostrata dai fatti" (demonstrated by facts).

However, it seems that this translation does not necessarily mean demonstration in the strict sense but only empirical confirmation by new facts. The English text also uses more contemporary methodological language than any of the translations when it speaks of the continuous *testing* of a hypothesis against facts.[52]

Philosophy and Science

Another methodological novelty of John Paul II's text in relation to his predecessors is also his reference to contemporary anti-positivist interpretations of the relationship between philosophy and the empirical sciences,[53] distinguishing but not separating the empirical level of scientific theory from its philosophical aspect. Indeed, he asserts that the theory of evolution is not limited to the level of facts but, also, refers to certain philosophical ideas from the field of natural philosophy.[54] This distinction can be linked directly or indirectly to one of the currents of 20th-century neo-scholasticism, which believed that neo-scholastic natural philosophy could and should be taking into account the achievements of empirical sciences (see d'Amore 1948a, 1948b, 1949).[55] According to this strand of neo-scholasticism, natural philosophy derives philosophical implications from science according to its own philosophical method and principles.[56]

The expressions in the Address are ambiguous in this respect, probably deliberately so that the text cannot be linked to any particular philosophy or philosophical concept. For example, the Pope writes that "empirical explanations of the mechanism of evolution" are "based" on various philosophies (n. 4).[57] Contemporary approaches to philosophy in science tend to avoid the traditional idea of a foundation or basis for philosophical assumptions in science, if any. Rather, a distinction is made between the empirical aspect of a scientific theory and its philosophical implications or interpretations. But the text does not necessarily mean foundation in the sense of scholastic philosophy, which treated metaphysics this way in relation to physics. At the end of the Section 4, the following conclusion is given:

> Hence the existence of materialist, reductionist, and spiritualist interpretations. What is to be decided here is the true role of philosophy and, beyond it, of theology.

Ultimately, the Pope does not pretend to prejudge methodological issues but calls for a discussion on the role of philosophy and theology in the context of theory of evolution, and scientific theory in general.

In the following Sections 5 and 6, the Pope addresses both theological and philosophical problems of the uniqueness of man as a person in relation to the rest of the biological world. He, thus, means the same thing that Pius XII had in mind in *Humani Generis* when he wrote that the human soul is not subject to the laws of biological evolution but comes directly from God. John Paul II, too, denies the possibility of fully explaining the origin of man—as a person unique in God's eyes and endowed with a mind—based on the empirical mechanism of the theory of evolution alone. The Pope rightly believes that no empirical facts can resolve between the materialist interpretation and the Christian interpretation of the theory of evolution and that philosophical analyses are needed in this regard.[58]

We can, therefore, consider that the text of the Address represents a further but not final methodological step in separating in official texts the empirical aspect of the theory of evolution from its philosophical interpretations. Such a separation seems to be a necessary step for a more objective approach of theology to scientific theories and for avoiding their hasty rejection on purely philosophical grounds as it happened in the past and led to the deplorable idea of a conflict between science and Catholic theology (cf. GS 36).

5. Methodological and Epistemological Conclusions

On the basis of the historical analysis, I will now attempt to answer the questions posed at the outset.

In principle, all three texts admit the possibility of the influence of non-theological science on theology. Bellarmine, in his letter to Foscarini, admits the possibility of a situation in which Copernicus' theory would force a change in the interpretation of Scripture, although he personally doubts that this would ever happen. Pius XII, in *Humani Generis*, also admits such a possibility with regard to the theory of evolution, but only with regard to the evolution of the human body, whereas he excludes such a possibility with regard to the spiritual dimension of man, i.e., the human soul. John Paul II's position is essentially similar in this respect. He repeats the words of Pius XII, with one difference. He puts more emphasis on the dignity of the human person than on the spiritual soul.

The questions we are to answer concern the methodological criterion that a scientific theory must meet in order to have theological implications, according to our authors. First of all, we need to know what it is. Then, whether it is the same or different in all three cases and whether it is a question of methodological continuity or lack thereof. Only after these questions have been answered will it be possible to draw conclusions about the last issue, namely, the nature of the relationship of Catholic theology and the methodology and epistemology of non-theological sciences: to what extent it is or may be dependent on, and to what extent it is independent of, the current state of the methodology of science in choosing one or another criterion of theological acceptability of scientific theories.

5.1. Methodological Criterion: Demonstration vs. Hypothesis

At the outset of my historical analysis, I identified the two key methodological terms of "demonstration" and "hypothesis" as they appear in all three texts, which can, therefore, be used to analyze these texts and answer the questions posed. In line with this assumption, my response will refer to these concepts.

As we have seen, Bellarmine and Pius XII believe, explicitly or implicitly, that only demonstrated knowledge can influence and imply changes in theology. This idea is present in the notion of demonstration as well as in the notion of hypothesis, both of which they use. A hypothesis that has not been demonstrated cannot be taken into account by theologians in the process of forming theological positions. A *demonstration* and *hypothesis* are, therefore, two sides of the same criterion for accepting a scientific theory as *locus theologicus*. In both cases analyzed, the existence of a demonstration is considered a necessary and sufficient condition for acceptance. Likewise, in both of them, being a hypothesis implies the lack of demonstration and, consequently, the lack of acceptance.

The lack of demonstration undermines the theological ambition of the Copernican hypothesis in Bellarmine's eyes. Similarly, the lack of demonstration for Darwin's hypothesis results in Pius XII's appeal to theologians and scientists to exercise the utmost caution with regard to the hypothesis and to refrain from accepting it definitively while being willing to submit to the final judgment of the Church's Magisterium.

However, and it is significant and worth emphasizing here—moving somewhat away from the main issue—that in both cases the affirmation of the lack of demonstration and of the hypothetical nature of the theory was not absolute but only temporary. Both Bellarmine and Pius XII accepted, in principle, the possibility that the methodological status of these theories might change in the future provided that the necessary demonstrations appeared.

This attitude may have had its justification in Aristotle's logic, according to which only perfect demonstration gives ultimate certainty in science and leads to a state of "contemplation" of the truth, without the need to seek it further. The mere lack of demonstration cannot provide such certainty, so there must always remain the possibility of finding an

adequate demonstration in the future, hence the fundamental openness of Aristotle's logic to the constant search for adequate demonstrations. If there was a true demonstration that, for example, Darwin's theory is false, there would be reason to reject it altogether. We also know that many theologians considered the assertion of a theory's philosophical absurdity to be such a demonstration. This was one of the reasons why Copernicus' theory and Galileo himself were condemned in 1616 (see Fantoli [1994] 1996, p. 216). The consultors of the Holy Office very quickly agreed on their position regarding the two Copernican theses defended by Galileo, namely, that the Sun is motionless at the center of the world and that the Earth moves both in relation to the whole system and in diurnal motion. They stated, among other things, that both of these propositions are "foolish and absurd in philosophy." In doing so, they also had confirmation from an authority, Ptolemy's *Almagest* (see Giostra 2015, p. 260).[59] A similar qualification was attributed to the theory of evolution by some Holy Office consultors in the 19th century(cf. Artigas et al. 2006, p. 84).[60] Pius XII was much more cautious in this respect, despite the pressure from the College of Cardinals.[61]

A somewhat different and more natural justification for this attitude can be found in a text that is extremely interesting from this point of view, although it may be seen as highly controversial, even arrogant, by some. This is the text of the theologian Henri Marrou, who, in 1950, in the French periodical *L'Esprit*, undertook a defense of Pius XII against the accusations of scientists who defended the scientific status of the theory of evolution against his *Humani Generis*:

> The fact that the evolutionary hypothesis imposes itself with a kind of practical necessity on all the biologists and geologists of our time, is not a sufficient reason for what remains in the eyes of theologians a strictly logical and simple scientific hypothesis to impose itself with enough authority to force them to readapt a traditional exegesis. Their attitude scandalizes many—so much so that this evolutionary conception of the world has become a normal form of thought, for the men of our time as much as for our scientists. Yes, but in twenty centuries of history, the Church has already seen so many *Weltanschauungen*, by turns as "necessary" and outmoded . . .
>
> We can fully appreciate the gap that separates the *peaceful autarky* of the Catholic theology, which, sure of itself and its future, asserts itself majestically, seemingly indifferent to the changing fashions of the spirit (of which it nevertheless knows, *with the necessary delay and hindsight*, how to *assimilate every contribution*). (Marrou 1950, p. 566; translation and italics are mine).

For Marrou, the Church operates in a much longer perspective than modern science. It cannot, therefore, be too concerned with current scientific and methodological fashions since its primary task is to protect the faith from an error.

However, particular attention should be paid to the second part of this quotation. Indeed, over a sufficiently long period of time and with guaranteed freedom of thought, the Church and its theology end up assimilating everything that proves correct in science over time. This is an example of Catholic theology's "relativization" of historical scientific theories.[62] It is also clear from this text that by the middle of the 20th century, the Church's mentality had not yet been able to fully assimilate the modern idea of scientific progress.

It can only be assumed that similar motives guided Pius XII in Humani Generis, both when he urged theologians and scientists to exercise the utmost caution in addressing the question of the evolution of the human body and when he decided, against the pressure from the cardinals, not to clarify the text on the question of monogenism. Unlike his future successor, John Paul II, Pius XII showed little interest in the sciences, following the principle of peaceful autarky of Catholic theology articulated by Marrou.

But let us return to the main problem, namely, the question of the criterion for the theological acceptability of scientific theories. In his text, John Paul II adopts a different methodological position from that of Bellarmine and Pius XII. He does not require a demonstration of the theory of evolution before it can influence theology. At least, the original English text contains no such term. Unlike previous texts, according to the Address, hypotheses that have not been demonstrated can also have an important theological significance. However, the lack of a requirement for demonstration does not imply the lack of any methodological condition. This condition is implicitly expressed in the form of the convergence argument adduced in favor of the plausibility of the evolution hypothesis. This shows that John Paul II's text adopts a much weaker criterion than a demonstration. This criterion can be expressed in general terms as a *sufficient confirmation* or *sufficient recognition of the hypothesis* within the empirical sciences themselves and *removing reasonable doubts*.

The absence of a demand for a demonstration in John Paul II's text is not the only methodological difference between the three texts. Another difference, and perhaps even more significant, is revealed in the different meanings that Bellarmine and Pius XII give to this term in their texts. Bellarmine understands by the required demonstration a perfect demonstration in terms of Aristotle's logic, that is, a syllogistic demonstration from the first premises by means of a direct efficient cause or at least something similar if Baldini's interpretation is correct (see Section 2.2 above). Pius XII, on the other hand, understands by demonstration either Aristotle's imperfect demonstration from effects or from signs or, more likely, empirical verification by facts, i.e., a demonstration in the sense of 19th-century empiricism.

An analogous difference is apparent in the use of the term "hypothesis". Indeed, all three texts oppose *hypothesis* to *scientific knowledge*; nevertheless, only Bellarmine excludes hypotheses from the field of science altogether. Pius XII speaks of hypotheses having some scientific basis. John Paul II, on the other hand, fully recognizes the idea of a scientific hypothesis lacking a final demonstration.

Thus, in the case of Bellarmine and Pius XII, we are dealing with a different methodological interpretation of the apparently identical criterion for the acceptability of scientific theories as *locus theologicus*, which was the criterion of demonstrated knowledge as opposed to hypothetical opinion. In the case of John Paul II, the criterion is tempered and becomes that of a sufficiently justified hypothesis.

So can we still speak of methodological continuity in the Church's position? Terminology itself can be misleading, creating the appearance of continuity or discontinuity. However, anyone with even a superficial knowledge of the hermeneutics of historical texts will not look for such continuity at the level of terminology, but at the level of the concepts and ideas behind the terminology.

5.2. Methodological and Epistemological Continuity or Discontinuity?

The question arises as to whether there is anything (or anyone) that could bring all three texts together from the methodological point of view. It seems appropriate at this point to ask about the common source of the idea of the demonstration requirement as a criterion for the theological acceptability of scientific hypotheses. According to Ernan McMullin (2013), this requirement was first formulated by Saint Augustine in antiquity. Significantly, both Bellarmine and Galileo invoked Augustine when talking of the necessity of demonstration; or, more precisely, they referred to the methodological conditions he formulated mainly in *De doctrina christiana* (*On Christian Doctrine*) and *De Genesi ad litteram* (*The Literal Meaning of Genesis*). The same conditions were evoked much later, at the end of the 19th century, by Pope Leo XIII (1893) when he wrote an encyclical "Providentissmus Deus" on the principles of the interpretation of Scripture, including in the face of new

scientific theories. In turn, the text of Leo XIII was invoked by both Pope Pius XII (1950, sct. 2) and John Paul II (1996, sct. 2), quoting the words that "truth cannot contradict truth", a sentence inspired by the sayings of Augustine.

I will briefly outline the methodological conditions formulated by Augustine under which pagan philosophy (science) can force a reinterpretation of Scripture. As we will see, with their help, it is very easy to interpret all three texts and, at the same time, to identify the common element linking the three different approaches to the methodological criterion. Basically, I will use here the results of McMullin's (1998, pp. 291–99; 2013) analysis, expanding and supplementing it using direct references to Augustine's texts.

Augustine's statements referred to pagan philosophy. In antiquity, philosophy was commonly identified with all scientific, non-Christian knowledge.[63] Ancient Christianity had to meet the intellectual challenge of encountering the omnipresent Greek philosophy. The distinctive feature of Augustine's thought was his recognition of the relative autonomy of philosophy (or science) in relation to the Christian faith when it came to the knowledge of the world. He admitted that pagans, thanks to their philosophy, could know the world better than Christians and that it would, therefore, be a disgraceful and dangerous thing if Christians held to a literal interpretation of Scripture against true philosophy (cf. Augustine 1845, p. 261 (I, XIX, 39); 1982, vol. 1, p. 42). Augustine thus ruled out the separation of Christian theology from philosophy (science), and accepted the possibility of reinterpreting theology under the influence of philosophy. He thus gave a positive answer to the question: "Can science influence Christian theology?" Augustine's position, if not immediately, at least from the 12th century onward, played a major role in the self-perception of Christian theology. The same was true of Bellarmine and the Holy Office in Galileo's day.[64]

McMullin identified seven principles in Augustine, some of which are methodological and epistemological in nature and can be used for a comparative analysis of our three cases. The others are eminently theological in nature.

The first principle is called by McMullin (2013, p. 197) *The Principle of Consistency*. It is identical in meaning to the text of Leo XIII quoted above. St. Augustine in his *On Christian Doctrine* asserts that there cannot be two truths, philosophical and religious, but only one, since all truth comes from God (cf. Augustine 2009, p. 53).[65] This principle places the entire discourse on the relationship between Christian theology and science (philosophy) in the realm of epistemology. It expresses the conviction that both disciplines pursue truth, which, as it comes from God, must ultimately be one—hence, the simple consequence. In theology inspired by Augustine's principle, it is assumed by definition that there can be no real contradiction between scientific truth and the truths of faith. All contradictions are, therefore, apparent and must be capable of being resolved. They can only be the fault of someone who wrongly interprets words or things. However, this principle does not determine on whose side the error lies, whether it is on the side of science or the side of the interpreter of Scripture and the theologian.[66] For that, additional conditions or principles are needed.

The next principle, or more appropriately three related principles, expresses the Augustinian understanding of the methodological criterion for regarding scientific (philosophical) theories as acceptable *locus theologicus*. The first is called by McMullin *The Principle of Priority of Demonstration* (PPD). According to it, the reinterpretation of Scripture is permitted and necessary only if secular science can provide a demonstration or proof of the truth of a thesis contrary to the claims of Scripture.[67]

Equally important is *The Principle of Priority of Faith* (PPF), according to which, in the absence of scientific proof, philosophical theses are to be considered invalid.[68] The last of these three principles *The Principle of Priority of Scripture* (PPS) says that in the absence of a demonstration, a Christian should stick to the existing, usually literal interpretation of

Scripture. According to McMullin, the last two principles constitute a kind of limitation on PPD.

It is not difficult to relate the PPD principle to Bellarmine's or Pius XII's demand for demonstration, as well as the PPF and PPF principles to the category of *hypothesis*, which excludes the possibility of accepting an idea or theory and forces adherence to the traditional interpretation of Scripture and theology.

But only in appearance do Augustine's principles seem identical to those of Bellarmine and Pius XII. Both of these authors were associated with a particular philosophy that imposed on them a particular understanding of a "demonstration". Augustine, for his part, cannot be linked to any specific logical or methodological tradition. As we know, in Augustine's time, the Latin world knew very little, if anything, of Aristotle's logic. Plato' logic did not exist either, and Stoic logic had fallen into oblivion at the time (cf. Bobzien 2020). Augustine's understanding of scientific knowledge and demonstration was a matter of common sense.

When speaking of demonstration (*demonstratio*), Augustine (1845, p. 91 (n. 6)) referred to reasoning (*ratiocinatio*) on the basis of true and credible arguments or evidence, which he systematically called "documenta".[69] The opposite of reasoning on the basis of *documenta* for Augustine was an empty rhetoric of a sophisticated and seductive discourse.[70] *Documenta* could be of different kinds. They could be passages from Scripture, rational arguments, observational arguments (Augustine 1845, p. 232), empirical analogies (ibid., p. 239), and even signs pointing to the existence of God (ibid., p. 1063).

For Augustine, not all "documenta" were worthy of belief. Speaking of demonstrations involving the need to reinterpret the text of Scripture, Augustine demanded that they be trustworthy or reliable (ibid., p. 262) and, above all, that they prove the truth beyond all doubt:

> But if, by chance, they were able to prove it with such arguments (*talibus documentis*) that there could be no further doubt (*ut dubitare inde non debeat*), then it must be shown (*demonstrandum est*) that what we said about the skin does not contradict these true reasons (ibid., p. 271).[71]

Augustine refers to the criterion of truth widely accepted since antiquity, namely, intellectual evidence or certainty identified with indubitability. This is certainly linked to Augustine's use of the term "demonstratio". This term has its origin in the term "monstrare", which means to show visually, point out, indicate, and only secondarily, in Aristotle's logic, it takes on the technical meaning of necessary demonstration but only because it shows perfectly and undoubtedly the truth.[72] In antiquity, the metaphor of seeing something clearly meant also intellectual, noetic cognition, not subject to further doubt.

However, as the two criteria given by Augustine—"demonstratio" and "indubitability"—have no precise meaning linked to a specific logic, their understanding is subject to change, depending on the fluctuating context in which they occur.

Each of the authors we have analyzed applies the Augustinian criterion of demonstration in the sense that is consistent with the meta-scientific paradigm they believe to be in force. Bellarmine and the theologians of the Holy Office interpreted Augustine's term according to the paradigm of Aristotle's *episteme* (*scientia*) and in its most conservative form. Galileo, for his part, interpreted Augustine according to a different understanding of the Aristotelian paradigm that had emerged in the circles of natural philosophy in Padua. He saw his *dimostrazioni necessarie*, i.e., demonstrations from effect or sign transformed into *regressus*, as sufficient to force a change in theology. Hence the "inter-paradigmatic" disputes with Bellarmine over the notion of true demonstration.

Pius XII's encyclical was intended as a defense of neo-scholastic, i.e., essentially Aristotelian, philosophy, but it also drew on non-Aristotelian methodological standards devel-

oped in 19th-century empiricism, which must have coincided sufficiently with Aristotelian standards to allow them to be identified, at least in some respects.

As for the text of John Paul II, the mere absence of the term "demonstration" in his text does not invalidate the possibility of linking this text to Augustine's criterion. It can be assumed that he also referred to the PPD principle, except that he understood it in accordance with the methodology of science in force at the end of the 20th century. The only possible understanding of the postulate of demonstration or proof in this new perspective is to demand the strongest possible available justification, one that removes all reasonable doubts.

In explaining these differences in the application of the Augustinian principle of PPD, it may also be useful to refer to the idea of textual hermeneutics. From this point of view, the interpretations of Bellarmine and Galileo should be considered an uncritical and ahistorical attempt at a literal reading of Augustine's criterion. Awareness of the need for textual hermeneutics did not exist in their time. In the case of Pius XII, there is no such certainty; nevertheless, his simultaneous defense of neo-scholastic philosophy and appeal to a different meta-scientific paradigm when evaluating the theory of evolution suggests a lack of sufficient criticism and awareness of this situation.

The case of John Paul II is different. The text shows that he had a much greater awareness of the principles of textual hermeneutics than previous authors, and probably not just of the biblical text but of any text (cf. John Paul II 1996, sct. 2). Thus, his awareness of the principles of hermeneutics may have led him to recognize that the Augustinian criterion requires a critical reading and adaptation to the contemporary paradigm of scientific knowledge. In this perspective, his statement is an interpretation of Augustine's criterion from the point of view of the modern paradigm of scientific knowledge, in which the notion of demonstration in the literal sense has lost its meaning in the empirical sciences, retaining its validity only in the mathematical sciences.

So, if we apply the hermeneutical principles of interpretation to our historical texts and rid them of context-dependent interpretations, we can distinguish a core element of Augustine's criterion that remains common. Scientific, non-theological knowledge must be justified in such a way as to remove reasonable doubts as to its truth or validity. In other words, it cannot be a mere, fanciful hypothesis of the human mind but must be sufficiently tested or confirmed.

5.3. Methodological Dependence or Independence?

A final question remains to be answered, namely, whether Catholic (or more broadly Christian) theology, in establishing criteria for the recognition of scientific theories as capable of modifying theological formulations, can be independent of the methodology of the non-theological sciences. This latter question needs to be differentiated between its factual aspect, i.e., how the authors studied and acted, and its general and normative aspect.

In the three cases studied, the authors were determined by the methodological paradigm they chose. Their methodological ideas were derived from the theory of knowledge at their disposal. From this point of view, it is difficult to speak of independence.

But we have also seen that Bellarmine refused to accept Galileo's methodological perspective, and Pius XII refused to accept Darwin's methodological perspective. At least from Galileo's time onward, the coexistence of two or more distinct methodological paradigms was a historical fact. And the theologian could choose between them whichever he considered best suited to his theological requirements. This is where there is room for limited or relative independence.

The question arises, of course, about the criteria for such a meta-methodological choice. Usually, it has been a conservative principle of caution or prudence.[73] It was emphatically

expressed by Henri Marrou (1950), quoted above (see Section 1 in this chapter). According to him, the Church is only "seemingly indifferent" to sciences and their methodologies, that is, only in the short term. In the long run, however, it is able to assimilate from changing sciences and ideological fashions all that has turned out to be long-lasting. Longer perspective and lack of haste are other names for caution or prudence, necessary in the case of truths of faith that cannot undergo as rapid changes as scientific and philosophical ideas.

The conservative methodological principle of prudence found in theology can be formulated as follows: choose the strongest available criterion for the acceptability of scientific theories in order to best protect the deposit of faith.[74] This is what Bellarmine did, and this is also what Pius XII did. As it seems, John Paul II also followed an analogous, albeit less conservative, precautionary principle when he considered the argument from convergence as sufficient and the strongest available, i.e., philosophical, argument in favor of the theory of evolution.[75]

The analysis of our three texts thus leads to the statement of the relative or non-absolute independence of official theology from the methodology of non-theological science.

The general answer will be slightly different, and can only be hypothetical, i.e., it must take the form of a conditional "if . . . then". First of all, the antecedent of such an answer must include an answer to the question of whether the non-theological sciences can influence Christian theology. The history of Christian thought teaches us that there have been instances of total denial of such a possibility. This position is attributed to many of the early Church Fathers and the supporters of the idea of contempt for the world (*contemptus mundi*). In the 20th century, the representative of such a negative position, albeit for quite different reasons, was one of the two schools of neo-Thomism, whose most famous exponent was J. Maritain. This school proclaimed the independence of scholastic philosophy and, also, of scholastic theology based on this philosophy from the empirical sciences since they move on two ontological and methodological levels that do not intersect: the essences of things and phenomena. From this perspective, theology and the philosophy that serves it can learn nothing from the empirical sciences as such.[76] With such an antecedent, the consequent can only be one: theology is entirely independent of the methodology of the empirical sciences.

However, if, in the spirit of St. Augustine, theology accepts a positive answer, the general answer will be similar to the factual answer: theology can only be relatively independent of the methodology of science. Theology itself does not develop the methodology of science but must draw it from philosophy. What remains is the autonomy of choice between the different methodologies available. Adopting a more conservative position means opting for an older methodology that has been well assimilated by existing theology. With a less conservative approach comes the obligation for theologians (see John Paul II 1996, sct. 3) to keep up to date with current developments in empirical science and meta-science in order to adapt new developments to the requirements of faith.

Still, another answer can be reached by using different time perspectives. In the short historical perspective of a particular theologian, especially one who occupies an official position in the Church's Magisterium, his independence from the methodologies of the sciences is relatively small since the principle of conservative prudence often prevents him from espousing the latest ideas. However, in the longer historical perspective of theology understood as a discipline subject to evolution over time, the relative independence of theology from specific methodologies will become more apparent. By rejecting older methodologies as superseded, theology can free itself from their limitations. Of course, it will always do so from inside a new, currently accepted methodological perspective. Nevertheless, having learned by experience, we need not treat it as definitive.

Agreeing to the essentially common-sense and, thus underdetermined, nature of the methodological criterion for the acceptability of scientific theories by theology is a guarantee of its relative independence from specific methodologies of science. At the same time, however, it forces it to be bound to some specific methodology, at least temporarily. If this is the case, theology that accepts Saint Augustine's fundamental choice cannot avoid being influenced by changing conceptions of science and its methods. Thus, the methodology of science that provides theology with criteria for the acceptability or unacceptability of scientific theories as a *locus theologicus* itself becomes a *locus theologicus* that shapes theological positions. If we accept that scientific theories are an "objective" *locus*, concerning the object of theology, the methodology will, in turn, be a "meta-objective" *locus* concerning the criteria for the acceptability of scientific theories as an objective *locus* in theology.

Funding: This research received no external funding.

Data Availability Statement: No new data were created or analyzed in this study. Data sharing is not applicable to this article.

Conflicts of Interest: The author declares no conflict of interest.

Notes

1 On this letter see Finocchiaro (1989, pp. 300ff.); Blackwell (1991, pp. 89ff.); Fantoli ([1994] 1996, pp. 185ff.); McMullin (1998, pp. 277ff.); Giostra (2015); Arcangeli (2016).

2 For the Italian original see Galileo (1892) and Bellarmine (1892).

3 In the Italian original is the Latin phrase "ex suppositione" (ibid., p. 171).

4 In the Italian original is "supposto che" (ibid.).

5 The Italian original has the Latin phrase "vera demonstratio" (ibid., p. 172).

6 In the original Italian text of the Letter of Bellarmine we first find this Latin phrase "ex suppositione"—translated as "suppositionally"—and next the Italian phrase "supposto che", translated as "by supposing". By the time of Bellarmine and Galileo, the Latin term "suppositio" and its Italian equivalent "supposizio" were commonly used in Aristotelian logic to render the Greek ὑπόθεσις. The Latin phrase "ex suppositione" is equivalent to the Greek "ἐξ ὑποθέσεως" (ex hypothéseos). For example, in the Greek original of the *Posterior Analytics* of Aristotle the expression "ἐξ ὑποθέσεως" appears five times (in Bekker's numbering: Aristotle 1831, pp. 72b.15, 83b.39, 84a.6, 92a.7.20). The Latin translation, attributed (mistakenly) to Boethius, in all these places has "ex suppositione" (see Aristotle 1564, pp. 205^{r}, 222^{r} (2 times), 234^{r} (2 times)).Less commonly, the Latinized forms "hypothesis" and "ex hypothesi" were used to render the Greek term. However, Galileo often uses "ex suppositione" and "ex hypothesi" interchangeably. Similarly, he uses "supposizio" and "ipotesi" interchangeably in his Italian texts. An example of this terminological usage can be found in one of the texts in which he defends Copernicus' theory (see Galileo 1895, vol. 5, pp. 351–63). On this text, see also note 11 below.

7 See McMullin (1998, pp. 279f.) for a non-Aristotelian explanation of the Bellarmine's fictionalism as biblically rather than philosophically motivated.

8 See Aristotle (1564, p. 205^{r}): "si vero non est prima scire, neque qui ex his esse scire, simpliciter, neque propriè, sed ex suppositione, si illa sunt". And the same text in the translation of Zabarella (1582, p. f. 18^{v}b): "si autem non est prima cognoscere, neque illa quae ex his, posse sciri simpliciter, ac propriè, sed ex suppositione, si illa sunt". The English translation renders this passage as follows (Aristotle 1981, pp. 72b, 4f.): "So if it is not possible to know the first [principles], neither it will be possible to *know* without qualification (Latin: *simpliciter*) or in the fundamental (Latin: *proprie*) sense what follows from these, unless it be by hypothesis (Latin: *ex suppositione*), namely if the [premises or principles] are [known]". The first italics are original.Zabarella interprets the Greek original differently. His phrase "si illa sunt" does not mean "if they are [known]", but has a stronger meaning: "if they exist" or "if they are true". For him, this phrase expresses the hypothesis itself, as it stands. It is a hypothetical (i.e., conditional) antecedent of the hypothetical (conditional) sentence with the initial conjunction "si" (if). Cf. his (Zabarella 1580, pp. 75ff.), where he presents different logical meanings of the hypothetical (conditional) sentence.

9 Zabarella (1582, p. f. 18^{v}b; translation is mine): "These words [to know] *absolutely* [*simpliciter*] and *properly* mean the same thing, for knowledge is properly said to be that which is *simpliciter* (absolutely), that is, without any condition, and to this is opposed that which is added: *but by supposition, if they are . . .*; for to know something by supposing something false or unknown is to know nothing at all".

10 Ugo Baldini, contrary to the received view (cf. note 7 and the related text above), argues that Bellarmine, as well as other Jesuits of the Collegio Romano, did not demand from Galileo a demonstration *simpliciter* of the assumptions of Copernican theory,

but only one that explains all the available facts (Baldini 1992, pp. 292, 313, 316). However, even with this understanding of true demonstration as opposed to the demonstration "ex suppositione", the latter notion, as well as the idea of the opposition, remain Aristotelian.

11 In the national edition of Galileo's works by Antonio Favaro, they are jointly named "Considerazioni circa l'opinione Copernicana" (Considerations on the Copernican opinion) (Galileo 1895, vol. 5, pp. 349–70).

12 As an example of suppositions (hypotheses) generally accepted as true, Galileo (1895, p. 357) gives the basic assumptions of Ptolemy's theory, namely that the Earth is immobile and that the Sun is mobile. For Galileo, these assumptions can no longer be considered true and should be replaced by those of Copernicus. In addition, Galileo argues that even the Ptolemaic hypotheses of epicycles and eccentrics should not be considered as a work of pure fantasy, since Ptolemy himself considered them, not without reason, to be real and true hypotheses.

13 Hence, both opposite meanings are Aristotelian. But as we noted above (note 10), according to Baldini, Bellarmine too, in line with the positions of the Collegio Romano, accepted an idea of a true demonstration different from Aristotle's perfect demonstration. But even if this were the case, as Baldini claims, Galileo had no knowledge of Bellarmine's intentions.

14 Another one was *demonstratio a causa remota*, from a remote cause (cf. Zabarella 1586, pp. 415ff.)

15 This historical question has been largely debated in the literature since the text of Randall (1940). See Wallace (1988b, 1995); Baldini (1992, pp. 308ff.); Sgarbi (2013, pp. 1f.).

16 See Wallace (1995, pp. 90ff.). Zabarella's definition of the regressus may be stated as follows: "It is a kind of reciprocal demonstration in which, after we have demonstrated the unknown cause through the known effect (*demonstratio quia* or *quòd*), we convert the major proposition and demonstrate the same effect through the same cause, so that we know why the effect exists (*demonstratio propter quid*)." On Zabarella's understanding of *regressus* see also Mikkeli and Baker (2024, p. 5).

17 As Wallace (1995, p. 96) notes, these demonstrations were not always correct. Moss (1985), for his part, shows that Galileo was perfectly aware that he was unable to provide perfect demonstrations *simpliciter* (without qualification) to defend Copernicus' ideas.

18 Maurice Finocchiaro (1985) expressed caution about the idea of "suppositional reasoning" as the only category for interpreting Galileo's methodology.

19 Henceforth abbreviated as HG with section number of the online edition.

20 The encyclical was not the personal work of the pope. Theologians and cardinals of the Holy Office were involved in its creation. The pope, however, gave it its final character. See Kemp (2023). The paper of Kemp provides a detailed account both of the process of producing the encyclical and of later attempts to clarify it.

21 According to Artigas et al. (2006, pp. 32–51), the first case the Holy Office dealt with was that of the Italian priest Raffaello Caverni, who published a whole series of articles and a book on the theory of evolution in 1875–77. The other five denunciations discussed by the authors date from the 1890s.

22 The authors point to the journal *La Civiltà Cattolica*, published by the Jesuits, as the main source (ibid., pp. 26–30).

23 His most controversial theological and philosophical text (*Le Phénomène Humain*), developing his idea of cosmic evolution, did not appear until after his death in 1955, thus several years after the encyclical was published. However, his views were known from other publications. See Kemp (2023, p. 10).

24 A comprehensive introduction to the old and new scholasticism (neo-scholasticism or neo-Thomism) is given by de Wulf ([1907] 2003).

25 In the same vein, one of the Holy Office's 19th-century consultors, Father Tommaso M. Zigliara, wrote in his opinion from 1878 on Caverni's case: "Darwinian evolution . . . is nothing more than the material part of total evolutionism, which is the same as Hegelian pantheism" (Artigas et al. 2006, p. 44).

26 The original Latin phrase can be translated also as "demonstrated beyond doubt" (or definitively, or indisputably).

27 The original version prepared for the pope included "permits", but the pope changed the wording to a more cautious one. See Kemp (2023, p. 14).

28 This defensive position appeared in Pius IX's encyclical *Quanta cura* (Pope Pius IX [1864] 1867), especially in the famous *Syllabus errorum* that followed the encyclical (see *Acta Sanctae Sedis* (ASS), vol. 3 (Pope Pius IX [1864] 1867)). The same position can also be found in Pius X's decree *Lamentabili sane exitu* (ASS, vol. 40 (Pope Pius X 1907)). The defensive posture was largely a reaction to a rapidly secularizing society and culture. The issue itself would require a broader discussion.

29 In the official text posted on *vatican.va*, there is a spelling mistake of "iudiciis" (judgments, opinions), since it is the same "indicia" (facts) referred to earlier in the same sentence (cf. AAS, vol. 37, p. 576).

30 However, it is quite interesting to note that at the same time, some neo-Thomists were using the Italian term "indizio" to designate what might be called empirical evidence (cf. Prete 1948, p. 420).

31 Cf. Herschel (1831, pp. 196ff., sct. 208ff.); Mill (1843b, pp. 3ff.); Comte (1835, pp. 433ff.). The phrase "vera causa" comes from Newton (cf. Herschel 1831, p. 144; Mill 1843b, p. 17).

32 Defending Newton from the charge of error, this sentence was subject to reinterpretation in the 19th century (cf. Mill 1843b, p. 18).

[33] See also Herschel (1831, p. 195); Mill (1843a, vol. 1, pp. 534–47; 1843b, vol. 2, pp. 13ff.); Comte (1835, pp. 434f.). Yet, as J.S. Mill notes (Mill 1843b, p. 17), another prominent English historian and theorist of science of the 19th century, William Whewell, was against such limitations on hypotheses. He rejected Bacon's simple induction and embraced apriorism about general ideas and hypotheses. He also believed that they were subject to constant improvement in the sciences. His position remained largely misunderstood in the 19th century. Only to some extent can it be compared with Popper's falsificationism (cf. Weber 2000, p. 173).

[34] The English translation (HG 36)—"as if . . . [it] were already completely certain and *proved by the facts* which have been discovered up to now" (the italics are mine)—refers more to the idea of verifying a hypothesis with facts, while the Latin text refers more to the idea of Bacon's induction as Newton understood it (*deduced from facts*). For example, Newton in his *Principia* (Newton [1848] 1995, p. 443) writes in a very similar way that all particular propositions of his natural philosophy were "inferred from phaenomena, and afterwards rendered general by induction" (cf. Latin edition, Newton 1713, p. 484).

[35] The expressions of the encyclical are probably deliberately imprecise and a thorough analysis of them would require much more extensive research.

[36] In the first half of the 20th century, two currents in neo-Thomism took shape. One denied any connection between scholastic philosophy and the empirical sciences, while the other regarded such a connection as a condition for developing a Thomistic philosophy of nature. On this subject see d'Amore (1948a, 1948b, 1949), and Kłósak (1980, pp. 14–41). See also notes 53–56, 75, 76 and related texts below (Section Philosophy and Science and Section 5.3).

[37] Awareness of such criticism can already be discovered in the texts of 19th century theologians critical of the theory of evolution. See Artigas et al. (2006, pp. 84, 92, 138).

[38] On this subject, see in more detail Pence (2018), Pence (2021–2022) and Warner (2009).

[39] As soon as Darwin read the text, starting on 23 February 1860 (see note in his notebook "Books Read", in C. R. Darwin (1852–1860), he sent an addition to be inserted into the text of the next American printing of *On the Origin of Species*. In this addition, he quoted Brewster's text, but did not mention his name. The publisher could not insert this addition into the text, so he placed it in the "Supplement", along with other additions (see C. R. Darwin 1860, pp. 426, 431). A similar addition has been added in all subsequent editions of the book (see on the website *Darwin Online*, https://darwin-online.org.uk).

[40] Leibniz termed this type of occult quality additionally as "chimerical" or "scholastic". See Robinet (1991, pp. 41, 64, 175). A similar charge against the force of gravity was also formulated by George Berkeley (see Berkeley 1721, p. 4).

[41] It is also likely that the mention of the intelligibility of facts, made here by Darwin, could be related to Whewell's post-Kantian conception of the fundamental ideas of science and their *a priori* rather than empirical origin. For a more extensive discussion of the philosophy of William Whewell see Snyder (2023).

[42] Pope John Paul II will take a similar methodological approach to the theory of evolution, as we shall see.

[43] According to G. Vanderbroek, whom Dondeyne cites here, and who was a professor of comparative anatomy and anthropology at the Catholic University of Louvain, such creationism leads to unintended paradoxes. For its adherent must also concede to such a statement: God so strangely ordered and created all things so that current scientists can go astray and believe in evolution.

[44] Before empiricism accepted, with difficulty, the existence of unverifiable hypotheses in science, there were conventionalist solutions by Henri Poincarè and Henri Duhem in the late 19th and early 20th centuries, but they were limited to physics. At the time, the incredible variability of scientific theories was a fact, but difficult for scientists to understand and had to be tamed philosophically (cf. Boutroux 1913, p. 162; Poincaré [1907] 2007, pp. 106–11).
It is worth noting, too, that Karl R. Popper, one of the most influential philosophers of science of the twentieth century, as late as the 1970s still had trouble recognizing the empirical and scientific nature of the theory of evolution, albeit for very different methodological reasons from the empiricism of the nineteenth century (cf. Elgin and Sober 2017).

[45] It is worth noting that the Academy was created by Pope Pius XI in 1936, thus renewing the Academy of the Lynx (*Accademia dei Lincei*) and the Pontifical Academy of the New Lynx, which dated back to the 16th and 19th centuries respectively (see PAS, official website https://www.pas.va/en/about/history.html (accessed on 23 January 2025)).

[46] See also Section 5 of the Address.

[47] IT: " non . . . più . . . una mera ipotesi"; FR: "plus qu'une hypothèse", ES: "más que una hipótesis". See John Paul II ([1996] 1997, sct. 4), all translations are available online on the same website.

[48] According to a personal communication [. . .] this difference was discussed by Academy members and it was rather agreed that the English text, being the original, should be considered more official.

[49] See above note 44 for references.

[50] See note 25 and related text above (Section 3.1).

[51] Nevertheless, John Paul II also rejected, like Pius XII, many philosophical interpretations of the theory of evolution that are contrary to Christian faith as regards the specificity of the human person in his relationship with nature. See Sections 5 and 6 in John Paul II (1996, [1996] 1997).

52 See Section 4 in (John Paul II 1996), and (John Paul II [1996] 1997, online edition). The Spanish and French translations use the less philosophical expression that theory is constantly "measured" (or evaluated) on the level of the facts: FR: "constamment *mesurée* au niveau des faits", ES: "*se mide* constantemente por el nivel de los hechos" (the italics are mine).

53 Views similar to those of the positivists on the separation of science and philosophy were also held by representatives of one of the two opposing currents of neo-Thomism, but for different reasons. See also note 36 above (Section 3.3), as well as note 76 and the related text below (Section 5.3).

54 Justifying the importance of the theory of evolution for theology, John Paul II writes (John Paul II 1996, sct. 5): "The Church's Magisterium is directly concerned with the question of evolution, for it involves the conception of man." The question of understanding man is a philosophical and theological issue that goes beyond the purely empirical aspect of the theory of evolution, but empirical science has much to say, because human beings also have a physical dimension that cannot be dismissed.

55 In Cracow, where John Paul II came from, these ideas were developed by Kazimierz Kłósak (1980). The idea of an essential inter-dependence of philosophy and science also inspired other Catholic philosophers in Cracow who did not identify with neo-Thomism, especially Joseph Życiński and Michael Heller, who developed the idea of "philosophy in science". John Paul II was in regular contact with them while still in Cracow and later while at the Vatican. On these topics see Trombik (2019, 2021); Heller ([2011] 2019); Liana (2019), and Polak and Trombik (2022).

56 The aforementioned Polish neo-Thomist, Kazimierz Kłósak, developed a methodological idea, specific to natural philosophy, of non-deductive ("reductive") implications of a philosophical type, which defined the principles of deriving philosophical conclusions from scientific assertions in a neo-scholastic perspective. Kłósak was inspired by the empiricist concept of deductive implications in the sciences themselves (cf. Kłósak 1980, pp. 39ff.).

57 The papal thesis finds confirmation, for example, in the text by French biochemist and Nobel Prize winner Jacques Monod (1970, chap. IX) who interpreted natural selection and the related idea of chance in a materialistic and atheistic way, drawing definitive conclusions about man's absolute solitude in the universe and the absence of any truly transcendent value. The only possible transcendence is man's own self-transcendence, which consists in total (and truly heroic) fidelity to the achievements of science in all areas of human life. So it is not only popes who have failed to clearly separate the empirical theory of evolution from its philosophical interpretation, but scientists too.

58 It has been known since the time of Pierre Duhem (cf. Duhem [1906] 1954, pp. 183–90) that a "crucial experiment" in empirical science is impossible, i.e., that it is impossible to conclusively decide between two alternative theories by reference to facts. Such a situation is even less possible in the case of alternative philosophical interpretations.

59 The Latin translations of the Almagest used slightly different formulations: in Ptolemy (1515, 4^{v} [Lib. 1, Ch. 7]) we read of the greatest possible "stupidity" ("stultitia maior quae esse potest") of such a talk; in Ptolemy (1551, col. 6a) we read instead of being the most ridiculous ("ridiculosissima" or "valde ridiculosum").

60 It should be noted, however, that in the XIX century this type of radical opinion was in the minority. Some consultors spoke out in favor of the texts consulted, while others engaged in serious philosophical or theological critical discussions.

61 See above Section 3.2 on the issue of polygenism.

62 John Paul II's Address also indicates, though not explicitly, other preconditions that were necessary for the approach proposed in the text of Marrou to be possible. One such prerequisite, for example, was the change that took place in the 20th century in biblical hermeneutics and in theological hermeneutics itself, especially after Vatican II (see Address, Section 2; cf. also Section 4.1 above). This issue, although very interesting, must be omitted here due to the size of the text.

63 It's worth noting that such an identification was still current in the time of Galileo and Bellarmine, Newton, and even in the 19th century. According to Auguste Comte (1830, p. VIII), the expression "natural philosophy" was still used in England to designate all the different observational sciences.

64 This Augustinian approach to the theology-science relationship, commonly adopted by official theology, can be seen as an independent argument in favor of my initial assumption, i.e., the positive answer to the question of the possible influence of non-theological science on theology itself (see introductory remarks).

65 In McMullin's terms (McMullin 2013, p. 197), it reads as follows: "The proper meaning of Scripture cannot be in true conflict with the findings of human sense or reason".

66 Cf. Pope Leo XIII (1893; see online edition, 23): "If, then, apparent contradiction be met with, every effort should be made to remove it".

67 In McMullin words (McMullin 2013, p. 197): "(PPD): When there is a conflict between a proven truth about the physical world and a particular reading of Scripture, an alternative reading should be sought".

68 "(PPF): An apparent demonstration on the side of philosophy of something that is contrary to a doctrine of the faith must be set aside" (ibid., p. 198).

69 McMullin (2013, p. 198) renders the Augustinian sentence "quidquid ipsi de natura rerum veracibus documentis demonstrare potuerint" by "whatever they could demonstrate about the nature of things by means of reliable evidence". Cf. Augustine (1845, p. 262 (n. 41); 1982, vol. 1, p. 45).

70 Latin text: "res suscepta non ornamenta verborum . . . sed rerum documenta desiderat" (Augustine 1845, p. 111 (IV, XXI, 46); Augustine 2009, p. 159: "because the object . . . demands, not beauty of diction . . . but fact and proofs").

71 Translation is mine. It differs in part from that of McMullin (2013, p. 197). Cf. also *De doctrina christiana* (Augustine 1845, p. 91 (n. 6)): "Ut autem quae dubia sunt certa fiant, documentis adhibitis ratiocinandum est." In English translation (Augustine 2009, p. 125): "On the other hand, to clear up points that are doubtful requires reasoning and the exhibition of proofs".

72 Latin "demonstratio" is the faithful equivalent of the Greek "ἀπόδειξις" (apódeiksis) used by Aristotle to name the strongest proof.

73 McMullin (2013, p. 202) found a similar principle in Augustine and called it "The Principle of Prudence".

74 An attempt to justify the conservative criterion of prudence would, in turn, require reference to various faith-related values.

75 In this case, the justification for the choice can be sought in the William Whewell's idea of convergence and the aforementioned current of neo-Thomism, which sought relevant philosophical ideas in the empirical sciences (see notes 36 and 54–55 with related texts above, Section 3.3 and Section Philosophy and Science). The papal text can be interpreted as a recognition of the idea of evolution as sufficiently established, even if the mechanism of this evolution is itself subject to the rules of empirical method and the theoretical variation it implies.

76 See notes 36 and 53 and related texts above (Section 3.3 and Section Philosophy and Science). Kłósak (1980, pp. 124ff.) offers a detailed analysis of Maritain's methodological approach, which is considerably more complex than this, but still rejects any direct influence of scientific facts and theories on philosophy.

References

Andersen, Svend, and Arthur Peacocke, eds. 1987. *Evolution and Creation. A European Perspective*. Aarhus: Aarhus University Press.

Arcangeli, Luca. 2016. At the Roots of the 1616 Decree: Robert Bellarmine's Letter to Paolo Foscarini. Interdisciplinary Documentation on Religion and Science 2003–2022. Special Issue: IV Centenary of the Index Congregation's Decree on Heliocentrism (1616). Available online: https://inters.org/copernicanism-bellarmine-foscarini (accessed on 15 November 2024).

Aristotle. 1564. Analyticon Hysteron, Sive Resolutivorum Posteriorum Libri II. In *Aristotelis Stagiritae Organum, seu Libri ad Logicam Attinentes*. Severino Boetho Interprete. Venice: Apud Ioannem Bonadeum, ff. 202^{r}–244^{v}. Available online: https://archive.org/details/bub_gb_GqZCPeg5ep4C (accessed on 16 November 2024).

Aristotle. 1831. Αναλυτικὰ ὕστερα (Posterior Analytics). In *Aristoteles Graece [Opera Omnia]*. Edited by Immanuel Bekker. Berlin: Georg Reimer, vol. 1, pp. 71–100. Available online: https://archive.org/details/Bekker1831 (accessed on 15 November 2024).

Aristotle. 1981. *Posterior Analytics*. Translation with Commentaries by Hippocrates G. Apostle. Grinnell: The Peripatetic Press.

Artigas, Mariano, Thomas F. Glick, and Rafael A. Martínez. 2006. *Negotiating Darwin. The Vatican Confronts Evolution: 1877–1902*. Baltimore: The Johns Hopkins University Press.

Ashworth, William B., Jr. 1986. Catholicism and Early Modern Science. In *God and Nature. Historical Essays on the Encounter between Christianity and Science*. Edited by David C. Lindberg and Ronald L. Numbers. Berkeley: University of California Press, pp. 136–66.

Augustine, Saint. 1845. Sancti Aurelii Augustini Hipponensis . . . Opera omnia. Tomus tertius, pars prior. In *Patrologiae Cursus Completus . . . Series Latina*. Edited by Jacques-Paul. Paris: Migne, vol. 34. Available online: https://books.google.pl/books?id=9gMPAAAAIAAJ (accessed on 16 November 2024).

Augustine, Saint. 1982. *The Literal Meaning of Genesis*. Translated by John Hammond Taylor. New York: The Newman Press, 2 vols.

Augustine, Saint. 2009. *On Christian Doctrine*. Translated by J. F. Show. Mineola: Dover Publications.

Ayala, Francisco J. 2009. Darwin and the scientific method. *National Academy of Sciences of the United States of America* 106 (Suppl. S1): 10033–39.

Baldini, Ugo. 1992. Legem impone subactis. In *Studi su Filosofia e Scienza dei Gesuiti in Italia, 1540–1632*. Roma: Bulzoni Editore.

Barbour, Ian G. 1998. Five Models of God and Evolution. In *Evolutionary and Molecular Biology: Scientific Perspectives on Divine Action*. Edited by Robert J. Russell, William R. Stoeger and Francisco J. Ayala. Vatican City: Vatican Observatory Publications, Berkeley: Center for Theology and Natural Sciences, pp. 419–42. Available online: https://archive.org/details/evolutionarymole0000unse/page/442/mode/2up?view=theater (accessed on 23 January 2025).

Barlow, Nora, ed. 1963. Darwin's ornithological notes. With introduction, notes and appendix by the editor. *Bulletin of the British Museum (Natural History). Historical Series* 2: 201–78. Available online: https://darwin-online.org.uk/content/frameset?pageseq=1&itemID=F1577&viewtype=text (accessed on 23 January 2025).

Bellarmine, Robert Card. 1892. Roberto Bellarmino a Paolo A. Foscarini. Roma 12 aprile 1615. In *Le Opere di Galileo Galilei*. Edizione Nazionale di Antonio Favaro. Florence: Giunti Barbera Editrice, vol. 12, pp. 171–73. Reprinted in 1968. Available online: https://disf.org/bellarmino-foscarini (accessed on 15 November 2024).

Bellarmine, Robert Card. 1989. Letter to Paolo A. Foscarini, on Galileo's Claim in favor of Heliocentrism. In *The Galileo Affair. A Documentary History*. Translated and Edited by Maurice A. Finocchiaro. Berkeley: University of California Press, pp. 67–69. Available online: https://inters.org/Bellarmino-Letter-Foscarini (accessed on 15 November 2024).

Berkeley, George. 1721. *De motu; sive, de Motus Principio & Natura, et de Causa Communicationis Motuum*. Londini: Impensis Jacobi Tonson. Available online: https://archive.org/details/b30774299 (accessed on 16 November 2024).

Berquist, Richard. 2007. *St. Thomas Aquinas. Commentary on Aristotle's Posterior Analytics*. A Translation of Aquinas's Commentary and of the Latin text of Aristotle, with Introduction and Supplementary Commentary by Richard Berquist. Notre Dame: Dumb Ox Books.

Blackwell, Richard J. 1991. *Galileo, Bellarmine, and the Bible*. Including a translation of Foscarini's Letter on the motion of the Earth. Notre Dame: Notre Dame University Press. Available online: https://archive.org/details/galileobellarmin0000blac/mode/2up (accessed on 14 November 2024).

Bobzien, Susanne. 2020. Ancient Logic. In *The Stanford Encyclopedia of Philosophy*. Summer 2020 Edition. Edited by Edward N. Zalta. Available online: https://plato.stanford.edu/archives/sum2020/entries/logic-ancient/ (accessed on 14 November 2024).

Boutroux, Pierre. 1913. [H. Poincaré] L'Oeuvre philosophique. *La Revue du Mois* 15: 155–83. Available online: https://gallica.bnf.fr/ark:/12148/bpt6k1235595/f869.item (accessed on 15 November 2024).

Brewster, David. 1855. *Memoirs of the Life, Writings, and Discoveries of Sir Isaac Newton*. Edinburgh: Thomas Constable and Co., vol. 2. Available online: https://books.google.pl/books?id=Bp8RAAAAYAAJ (accessed on 17 November 2024).

Brooke, John Hedley. 1991. Science and Religion. In *Some Historical Perspectives*. Cambridge: Cambridge University Press.

Carnap, Rudolf. 1936. Testability and Meaning (Part I). *Philosophy of Science* 3: 419–71.

Comte, Auguste. 1830. *Cours de Philosophie Positive*. Paris: Bachelier, vol. 1. Available online: https://books.google.pl/books?id=l4lpUH1l0c0C (accessed on 16 November 2024).

Comte, Auguste. 1835. *Cours de Philosophie Positive*. Paris: Bachelier, vol. 2. Available online: https://books.google.pl/books?id=JD8dUkEBMVAC (accessed on 16 November 2024).

Coyne, George V., and Ugo Baldini. 1985. The Young Bellarmine's Thoughts on World System. In *The Galileo Affair: A Meeting of Faith and Science. The Proceedings of the Cracow Conference, 24–27 May 1984*. Edited by George V. Coyne, Michael Heller and Joseph Życiński. Città del Vaticano: Specola Vaticana, pp. 103–10.

d'Amore, Benedetto. 1948a. Il problema dei rapporti tra scienza e filosofia. *Sapienza. Rivista di filosofia e di teologia* 1: 35–48. Available online: https://archive.org/details/sapienza-1948_1948_1/mode/2up (accessed on 15 November 2024).

d'Amore, Benedetto. 1948b. Scienza e filosofia nei contemporanei neoscholastici. *Sapienza. Rivista di Filosofia e di Teologia* 1: 167–85. Available online: https://archive.org/details/sapienza-1948_1949_2/mode/2up (accessed on 15 November 2024).

d'Amore, Benedetto. 1949. Motivi per la difesa d'una più stretta unione tra scienza e filosofia. *Sapienza. Rivista di filosofia e di teologia* 2: 203–18 (part 1), 424–50 (part 2). Available online: https://archive.org/details/sapienza-1948_1949_2 (accessed on 23 January 2025).

Darwin, Charles R. 1852–1860. 'Books to be Read/Books Read' Notebook. CUL-DAR128. Edited by John van Wyhe. Transcribed by Kees Rookmaaker 4-6.2009, Corrections and Editing by John van Wyhe 6-8.2009, 3.2010-2022. RN12. *Darwin Online*. Available online: https://darwin-online.org.uk/content/frameset?itemID=CUL-DAR128.-&viewtype=text&pageseq=1 (accessed on 17 November 2024).

Darwin, Charles R. 1859. *On the Origin of Species by Means of Natural Selection, or the Preservation of Favoured Races in the Struggle for Life*, 1st ed. London: John Murray. Available online: https://darwin-online.org.uk/content/frameset?itemID=F373&viewtype=text&pageseq=1 (accessed on 23 January 2025).

Darwin, Charles R. 1860. *The Origin of Species by Means of Natural Selection, or the Preservation of Favoured Races in the Struggle for Life*. New Edition, Revised and Augmented. 4th American Printing. Note Also the Supplement (pp. 426–32) with Additions Sent by Darwin for This Edition. New York: D. Appleton. Available online: https://darwin-online.org.uk/content/frameset?itemID=F380&viewtype=text&pageseq=1 (accessed on 23 January 2025).

Darwin, Charles R. 1868. *The Variation of Animals and Plants Under Domestication*, 1st ed. London: John Murray, First Issue. vol. 2. Available online: https://darwin-online.org.uk/content/frameset?itemID=F877.2&viewtype=text&pageseq=1 (accessed on 23 January 2025).

Darwin, Emma. 1841. *One Is Tempted to Think That Bees Created for Fructification of Plants*. [Note] CUL-DAR46.2.C9. Transcribed by Christine Chua and Edited by John van Wyhe [08.2022]. *Darwin Online*. Available online: https://darwin-online.org.uk/content/frameset?itemID=CUL-DAR46.2.C9&viewtype=text&pageseq=1 (accessed on 15 November 2024).

Darwin, Francis, ed. 1887. *The Life and Letters of Charles Darwin, Including an Autobiographical Chapter*. London: John Murray, 3 vols. Available online: https://darwin-online.org.uk/EditorialIntroductions/Freeman_LifeandLettersandAutobiography.html (accessed on 15 November 2024).

de Jong, Everard J. 1989. Galileo Galilei's Logical Treatises (MS 27) and Giacomo Zabarella's Opera Logica: A Comparison. Ph.D. dissertation, The Catholic University of America, Washington, DC, USA. ProQuest 8917018.

de Wulf, Maurice. 2003. *An Introduction to Scholastic Philosophy: Medieval and Modern: Scholasticism Old and New*. Translated by Peter Coffey. Eugene, OR: Wipf and Stock Publishers. The Original French First published in 1904. First published in 1907.

Dei Verbum. 1966. Constitutio dogmatica de Divina Revelatione. *Acta Apostolicae Sedis (AAS)* 58: 817–30, English translation (Dogmatic Constitution on Divine Revelation). Available online: https://www.vatican.va/archive/hist_councils/ii_vatican_council/documents/vat-ii_const_19651118_dei-verbum_lt.html (accessed on 23 January 2025). First published 1965.

Dondeyne, Albert. 1951. Les problèmes philosophiques soulevés dans l'Encyclique «Humani Generis» (part I). *Revue Philosophique de Louvain, Troisième série* 49: 5–56. Available online: https://www.persee.fr/doc/phlou_0035-3841_1951_num_49_21_4326 (accessed on 23 January 2025). [CrossRef]

Duhem, Pierre. 1954. *The Aim and Structure of Physical Theory*. Translated by Philip P. Wiener. Princeton: Princeton University Press. First published 1906.

Dupree, A. Hunter. 1986. Christianity and the Scientific Community in the Age of Darwin. In *God and Nature. Historical Essays on the Encounter between Christianity and Science*. Edited by David C. Lindberg and Ronald L. Numbers. Berkeley: University of California Press, pp. 351–68.

Elgin, Mehmet, and Elliott Sober. 2017. Popper's Shifting Appraisal of Evolutionary Theory. *HOPOS: The Journal of the International Society for the History of Philosophy of Science* 7: 31–55. [CrossRef]

Fantoli, Annibale. 1996. *Galileo: For Copernicanism and for the Church*, 2nd ed. Revised and Corrected. Translated by George V. Coyne S.J. Vatican: Vatican Observatory Publications. First published 1994.

Finocchiaro, Maurice A. 1985. Wallace on Galileo's Sources. *The Review of Metaphysics* 39: 335–44. Available online: https://www.jstor.org/stable/20128318 (accessed on 16 November 2024).

Finocchiaro, Maurice A. 1989. *The Galileo Affair. A Documentary History*. Berkeley: University of California Press.

Galileo, Galilei. 1892. *Le Opere di Galileo Galilei. Edizione nazionale di Antonio Favaro*. Florence: Giunti Barbera Editrice, vol. 12. Available online: https://archive.org/details/le-opere-di-galileo-galilei-edizione-nazionale-volume-12 (accessed on 15 November 2024).

Galileo, Galilei. 1895. *Le Opere di Galileo Galilei. Edizione nazionale di Antonio Favaro*. Florence: Giunti Barbera Editrice, vol. 5. Available online: https://books.google.pl/books?id=dUWQyVCoTJIC (accessed on 15 November 2024).

Galileo, Galilei. 1896. *Le Opere di Galileo Galilei. Edizione nazionale di Antonio Favaro*. Florence: Giunti Barbera Editrice, vol. 18. Available online: https://archive.org/details/agh6462.0018.001.umich.edu/mode/2up (accessed on 15 November 2024).

Gaudium et Spes. 1966. Constitutio pastoralis de Ecclesia in mundo huius temporis. *Acta Apostolicae Sedis (AAS)* 58: 1025–115, English Translation (Pastoral Constitution on the Church in the Modern World). Available online: https://www.vatican.va/archive/hist_councils/ii_vatican_council/documents/vat-ii_const_19651207_gaudium-et-spes_lt.html (accessed on 23 January 2025). First published 1965.

Giostra, Alessandro. 2015. La lettera di Bellarmino a Foscarini 400 anni dopo [Bellarmine's letter to Foscarini 400 years later]. *Alpha Omega* 18: 253–64. Available online: https://www.academia.edu/Documents/in/Robert_Bellarmine (accessed on 21 November 2024).

Gregory, Frederick. 1986. The Impact of the Darwinian Evolution on Protestant Theology in the Nineteenth Theology. In *God and Nature. Historical Essays on the Encounter between Christianity and Science*. Edited by David C. Lindberg and Ronald L. Numbers. Berkeley: University of California Press, pp. 369–90.

Heller, Michael. 2019. How is philosophy in science possible? *Philosophical Problems in Science (Zagadnienia Filozoficzne w Nauce)* 66: 231–49, Translated by Bartosz Brożek and Aeddan Shaw. Available online: https://zfn.edu.pl/index.php/zfn/article/view/482 (accessed on 16 November 2024). First published 2011.

Herschel, John F. W. 1831. *A preliminary Discourse on the Study of Natural Philosophy*. London: Printed for Longman, Rees, Orme, Brown, and Green . . . and John Taylor. Available online: https://archive.org/details/preliminarydisco00hers_0/page/n5/mode/2up (accessed on 15 November 2024).

Herschel, John F. W. 1861. *Physical Geography*. Edinburgh: Adam and Charles Black. Available online: https://books.google.pl/books?id=EAWQiVuUMawC (accessed on 15 November 2024).

John Paul II, Pope. 1989. To the Reverend George V. Coyne, S.J., Director of the Vatican Observatory. *Acta Apostolicae Sedis (AAS)* 81: 274–83. Available online: https://www.vatican.va/content/john-paul-ii/en/letters/1988/documents/hf_jp-ii_let_19880601_padre-coyne.html (accessed on 22 December 2024). First published 1988.

John Paul II, Pope. 1996. Address to the Plenary Session on 'The Origins and Early Evolution of Life'. Online Edition. Available online: https://www.pas.va/en/magisterium/saint-john-paul-ii/1996-22-october.html (accessed on 23 January 2025).

John Paul II, Pope. 1997. Aux Membres de l'Académie pontificale des Sciences réunis en Assemblée plénière. *Acta Apostolicae Sedis (AAS)* 89: 186–90. Available online: https://www.vatican.va/content/john-paul-ii/fr/messages/pont_messages/1996/documents/hf_jp-ii_mes_19961022_evoluzione.html (accessed on 23 January 2025). First published 1996.

Kemp, Kenneth W. 2023. Humani Generis & Evolution: A Report from the Archives. *Scientia et Fides* 11: 9–27. [CrossRef]

Kłósak, Kazimierz. 1980. *Z teorii i metodologii filozofii przyrody. (On the theory and methodology of natural philosophy)*. Poznań: Księgarnia św. Wojciecha.

Kozhamthadam, Job. 2007. Vatican II on Science & Technology. *Revista Portuguesa de Filosofia* 63: 609–29. Available online: https://www.jstor.org/stable/40419531 (accessed on 22 December 2024).

Liana, Zbigniew. 2019. Nauka jako racjonalna doxa. Józefa Życińskiego koncepcja nauki i filozofii nauki—Poza internalizmem i eksternalizmem (Science as rational doxa. Joseph Życiński's understanding of science and philosophy of science—Beyond internalism and externalism). *Philosophical Problems in Science (Zagadnienia Filozoficzne w nauce)* 66: 147–99. Available online: https://zfn.edu.pl/index.php/zfn/article/view/466 (accessed on 16 November 2024).

Liana, Zbigniew. 2020. Giacomo Zabarella, the Author of a Dedication to King Stephen Báthory. *Folia Historica Cracoviensia* 26: 57–89, 104–20. Available online: http://czasopisma.upjp2.edu.pl/foliahistoricacracoviensia/article/view/3736 (accessed on 16 November 2024). [CrossRef]

Marrou, Henri. 1950. «Humani Generis »: Du bon usage d'une encyclique. *Esprit, Nouvelle série* 172: 562–70. Available online: https://www.jstor.org/stable/24250662 (accessed on 15 November 2024).

McMullin, Ernan, ed. 1988. Introduction. Galileo, man of science. In *Galileo. Man of Science*. Princeton Junction: The Scholar Bookshelf, pp. 3–51. Available online: https://archive.org/details/galileomanofscie0000unse/page/32/mode/2up (accessed on 21 December 2024). First published 1967.

McMullin, Ernan. 1998. Galileo on science and Scripture. In *The Cambridge Companion to Galileo*. Edited by Peter Machamer. Cambridge: Cambridge University Press, pp. 271–347.

McMullin, Ernan. 2013. Galileo, and Scripture. *Zygon* 48: 192–220.

McMullin, Ernan, ed. 1985. *Evolution and Creation*. Notre Dame: Notre Dame University Press.

Mikkeli, Heikki, and Tawrin Baker. 2024. Giacomo Zabarella. Online. In *The Stanford Encyclopedia of Philosophy (Summer 2024 Edition)*. Edited by Edward N. Zalta and Uri Nodelman. Available online: https://plato.stanford.edu/archives/sum2024/entries/zabarella/ (accessed on 20 November 2024).

Mill, John S. 1843a. A System of Logic, Rationcinative and Inductive [. . .]. In *Two Volumes*. London: John W. Parker, vol. 1. Available online: https://books.google.pl/books?id=EqVOAAAAcAAJ (accessed on 15 November 2024).

Mill, John S. 1843b. A System of Logic, Rationcinative and Inductive [. . .]. In *Two Volumes*. London: John W. Parker, vol. 2. Available online: https://books.google.pl/books?id=NqZeAAAAcAAJ (accessed on 15 November 2024).

Monod, Jacques. 1970. *Le Hasard et la Nécessité. Essai sur la Philosophie Naturelle de la Biologie Moderne*. Paris: Éditions du Seuil, Translated by Austryn Wainhouse. 1971. As *Chance and Necessity: Essay on the Natural Philosophy of Modern Biology*. NewYork: A. Knopf.

Moss, Jean D. 1985. The Rhetoric of Proof in Galileo's Writings on the Copernican System. In *The Galileo Affair: A Meeting of Faith and Science. The Proceedings of the Cracow Conference, 24–27 May 1984*. Edited by George V. Coyne, Michael Heller and Joseph Życiński. Città del Vaticano: Specola Vaticana, pp. 41–65.

Newton, Isaac. 1713. *Philosophiae Naturalis Principia Mathematica*. [. . .] Editio Secunda Auctior et Emendatior, edidit Rogerus Cotes. Cambridge: University Press. Available online: https://books.google.pl/books?id=SyNF4RBbkIgC (accessed on 15 November 2024).

Newton, Isaac. 1995. *The Principia*. Translated by Andrew Motte. Amherst. New York: Prometheus Books. First published 1848.

Newton, William. 2008. John Paul II and Gaudium et Spes 22: His use of the text and his involvement in its authorship. *Anthropotes. Rivsta di Studi sulla Persona e la Famiglia* 24: 375–412. Available online: https://www.istitutogp2.it/wp/wp-content/uploads/2019/01/2008-2-XXIV.pdf (accessed on 15 November 2024).

Pence, Charles H. 2018. Sir John F.W. Herschel and Charles Darwin: Nineteenth-Century Science and Its Methodology. *HOPOS: The Journal of the International Society for the History of Philosophy of Science* 8: 108–40.

Pence, Charles H. 2021–2022. The Rise of Chance in Evolutionary Theory, Lesson 2. Darwin, Sir John Herschel, and Scientific Reasoning. Available online: https://chance.pencelab.be/lessons/lesson2/ (accessed on 15 November 2024).

Poincaré, Henri. 2007. *The Value of Science*. Translated by George B. Halsted. New York: Cosimo. First published 1907.

Polak, Paweł, and Kamil Trombik. 2022. The Kraków School of Philosophy in Science: Profiting from Two Traditions. *Edukacja Filozoficzna* 74: 205–25. Available online: http://www.edukacja-filozoficzna.uw.edu.pl/nr-742022/ (accessed on 15 November 2024).

Pope Leo XIII. 1893. Providentissimus Deus. Litterae encyclicae de studiis Scripturae sacrae. *Acta Sanctae Sedis (ASS)* 26: 269–92. English Translation: Encyclical of Pope Leo XIII on the Study of Holy Scripture. Available online: https://www.vatican.va/content/leo-xiii/en/encyclicals/documents/hf_l-xiii_enc_18111893_providentissimus-deus.html (accessed on 14 November 2024).

Pope Pius IX. 1867. *Epistola encyclica Quanta Cura* with appendix *Syllabus errorum*. *Acta Sanctae Sedis (ASS)* 3: 160–67, 168–76. Available online: https://www.vatican.va/content/pius-ix/la/documents/encyclica-quanta-cura-8-decembris-1864.html (accessed on 15 November 2024). First published 1864.

Pope Pius X. 1907. Decretum Lamentabili sane exitu. *Acta Sanctae Sedis. Ephemerides Romanae (ASS)* 40: 470–78. Available online: https://www.vatican.va/archive/ass/documents/ASS-40-1907-ocr.pdf (accessed on 23 January 2025).

Pope Pius XII. 1950. Humani Generis. Litterae encyclicae. *Acta Apostolicae Sedis (AAS)* 37: 561–78. Available online: https://www.vatican.va/content/pius-xii/la/encyclicals/documents/hf_p-xii_enc_12081950_humani-generis.html (accessed on 21 December 2024).

Prete, Benedetto O. P. 1948. A proposito di poligenismo. Nota critica. *Sapienza. Rivista di Filosofia e Teologia* 1: 420–21. Available online: https://archive.org/details/sapienza-1948_1948_1/page/420/mode/2up?view=theater (accessed on 15 November 2024).

Ptolemy, Claudius. 1515. Almagestum Claudii Ptolemei Pheludiensis Alexandrini Astronomorum principis … Ductu Petri Liechtenstein Coloniensis Germani. Venetiis (Venice): Ex officina litteraria Petri Liechtenstein. Available online: https://books.google.pl/books?id=jk1QAAAAcAAJ (accessed on 27 November 2024).

Ptolemy, Claudius. 1551. Almagesti seu Magnae compositionis Mathematicae opus, a Georgio Trapezuntio tralatum, Lib. XIII. In *Claudii Ptolemaei Pelusiensis Alexandrini Omnia Quae Extant Opera, Praeter Geographiam* ……. Basil: Officina Henrichi Petri. Available online: https://books.google.pl/books?id=EBJYAAAAcAAJ&newbks=1&newbks_redir=0 (accessed on 27 November 2024).

Rahner, Karl S. J. 1963. Theological Reflexions on Monogenism. In *Idem, Theological Investigations*, 2nd ed. Translated by Cornelius Ernst. Baltimore: Helicon Press, vol. 1, pp. 229–96. Available online: https://archive.org/details/theologicalinves01rahn (accessed on 16 November 2024).

Randall, John H., Jr. 1940. The Development of Scientific Method in the School of Padua. *Journal of the History of Ideas* 1: 177–206. Available online: https://www.jstor.org/stable/2707332?origin=crossref (accessed on 16 November 2024). [CrossRef]

Robinet, André, ed. 1991. *Correspondance Leibniz—Clarke présentée D'après les Manuscrits Originaux des Bibliothèques de Hanovre et de Londre*, 2nd ed. Paris: Presses Universitaires de France.

Ruse, Michael. 1975. Darwin's Philosophical Debt to Philosophy: An Examination of the Influence of the Ideas of John F. W. Herschel and William Whewell on the Development of Charles Darwin's Theory of Evolution. *Studies in the History and Philosophy of Science* 6: 159–81. [CrossRef] [PubMed]

Russell, Robert J., Nancey Murphy, and C. J. Isham, eds. 1993. *Quantum Cosmology and the Laws of Nature: Scientific Perspectives on Divine Action*. Vatican City: Vatican Observatory Publications. Berkeley: Center for Theology and Natural Sciences.

Russell, Robert J., William R. Stoeger, and Francisco J. Ayala, eds. 1998. *Evolutionary and Molecular Biology: Scientific Perspectives on Divine Action*. Vatican City: Vatican Observatory Publications. Berkeley: Center for Theology and Natural Sciences. Available online: https://archive.org/details/evolutionarymole0000unse/page/442/mode/2up (accessed on 21 December 2024).

Russell, Robert J., William R. Stoeger S.J., and George V. Coyne S.J., eds. 1990. *John Paul II on Science and Religion. Reflections on the New View from Rome*. Vatican: Vatican Observatory.

Schmitz-Moormann, Karl. 1987. Evolution in the Catholic Theological Tradition. In *Evolution and Creation. A European Perspective*. Edited by Svend Andersen and Arthur Peacocke. Aarhus: Aarhus University Press, pp. 121–31.

Schmitz-Moormann, Karl, ed. 1992. *Schöpfung und Evolution. Neue Ansätze zum Dialog zwischen Naturwissenschaften und Theologie*. Düsseldorf: Patmos Verlag.

Sgarbi, Marco. 2013. *Aristotelian Tradition and the Rise of British Empiricism: Logic and Epistemology in the British Isles (1570–1689)*. Dordrecht: Springer.

Shapiro, Barbara J. 2000. *A Culture of Fact. England 1550–1720*. Ithaca and London: Cornell University Press. Available online: https://archive.org/details/cultureoffacteng0000shap (accessed on 16 November 2024).

Snyder, Laura J. 2023. William Whewell. In *The Stanford Encyclopedia of Philosophy (Winter 2023 Edition)*. Edited by Edward N. Zalta and Uri Nodelman. Available online: https://plato.stanford.edu/archives/win2023/entries/whewell/ (accessed on 15 November 2024).

Stenmark, Mikael. 2013. Typologies in Science and Religion. In *Encyclopedia of Sciences and Religions*. Edited by Anne L. C. Runehov and Lluis Oviedo. Dordrecht: Springer, p. 2309.

Thagard, Paul R. 1977. Discussion: Darwin and Whewell. *Studies in History and Philosophy of Science* 8: 353–56. [CrossRef]

Trombik, Kamil. 2019. The origin and development of the Center for Interdisciplinary Studies. A historical outline by 1993. *Philosophical Problems in Science (Zagadnienia Filozoficzne w Nauce)* 66: 271–95. Available online: https://zfn.edu.pl/index.php/zfn/article/view/474 (accessed on 16 November 2024).

Trombik, Kamil. 2021. *Koncepcje filozofii przyrody w Papieskiej Akademii Teologicznej w Krakowie w latach 1978–1993. Studium Historyczno-Filozoficzne (Views on Philosophy of Nature at the Pontifical Theological Academy in Kraków from 1978 to 1993: A historical-philosophical study)*. Kraków: Wydawnictwo Scriptum.

Wallace, William A. 1988a. Introduction. In *Galileo Galilei, Tractatio de Praecognitionibus et Praecognitis and Tractatio de Demonstratione*. Edited by William F. Edwards and William A. Wallace. With an Introduction, Notes, and Commentary by William A. Wallace. Padova: Editrice Antenore, pp. I–LXXXIX.

Wallace, William A. 1988b. Randall Redivivus: Galileo and the Paduan Aristotelians. *Journal of the History of Ideas* 49: 133–49. Available online: https://www.jstor.org/stable/2709707 (accessed on 16 November 2024). [CrossRef]

Wallace, William A. 1995. Circularity and the Paduan Regressus: From Pietro d'Abano to Galileo Galilei. *Vivarium* 33: 76–97. Available online: https://www.jstor.org/stable/42569928 (accessed on 16 November 2024). [CrossRef]

Warner, Brian. 2009. Charles Darwin and John Herschel. *South African Journal of Science* 105: 432–39. Available online: http://www.scielo.org.za/scielo.php?script=sci_arttext&pid=S0038-23532009000600014 (accessed on 15 November 2024). [CrossRef]

Watkins, John. 1984. *Science and Scepticisim*. Princeton: Princeton University Press.

Weber, Alan S. 2000. William Whewell. In *Nineteenth Century Science. A Selection of Original Texts*, idem, ed. Edited and introduced by A. S. Weber. Peterborough and Ontario: Broadview Press, pp. 172–89.

Whewell, William. 1840. *The Philosophy of the Inductive Sciences*, 1st ed. London and Cambridge: John W. Parker and J.J. Deighton, vol. 2. Available online: https://archive.org/details/philosophyinduc04whewgoog/mode/2up (accessed on 16 November 2024).
Zabarella, Giacomo. 1580. *Iacobi Zabarellae Patauini . . . Tabulae Logicae*. Venetiis: Apud Paulum Meietum. Available online: https://books.google.pl/books?id=pKNCAAAAcAAJ (accessed on 15 November 2024).
Zabarella, Giacomo. 1582. *Iacobi Zabarellae Patauini In Duos Aristotelis Libros Posteriores Analyticos Commentarii*. Venetiis: Apud Paulum Meietum. Available online: https://books.google.pl/books?id=6AGkBpCSBx8C (accessed on 15 November 2024).
Zabarella, Giacomo. 1586. *Iacobi Zabarellae Patauini Opera logica*. Editio Secunda. Venetiis: Apud Paulum Meietum. Available online: https://archive.org/details/bub_gb_r33zsHB4yFEC/mode/2up (accessed on 15 November 2024).

Disclaimer/Publisher's Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.

religions

MDPI

Article

Science as Divine Signs: Al-Sanūsī's Framework of Legal (*sharʿī*), Nomic (*ʿādī*), and Rational (*ʿaqlī*) Judgements

Shoaib Ahmed Malik

School of Divinity, University of Edinburgh, Edinburgh EH1 2LX, UK; shoaib.malik@ed.ac.uk

Abstract: This article examines the Ashʿarī theological framework of Imam Abū ʿAbd Allāh Muḥammad ibn Yūsuf al-Sanūsī (d. 1490) and its potential for shaping contemporary Muslim engagement with science. At the heart of al-Sanūsī's thought is a tripartite typology of judgements—legal (*ḥukm sharʿī*), nomic (*ḥukm ʿādī*), and rational (*ḥukm ʿaqlī*)—as articulated in *The Preliminaries of Theology* (*al-Muqaddimāt*). This classification distinguishes between rulings grounded in revelation, patterns observed in nature, and conclusions drawn from reason. Unlike other theological approaches, al-Sanūsī's model integrates core Ashʿarī doctrines such as radical contingency, occasionalism, and divine command theory, offering a coherent synthesis of metaphysics, empirical inquiry, and ethics. Building on recent scholarship that re-engages with Ashʿarī theology in the context of Islam and science, this article argues that al-Sanūsī's schema offers a meta-framework—one that positions science not merely as an object of analysis but as a locus for theology.

Keywords: science and theology; Islamic theology; al-Sanūsī; rational judgements (*ḥukm ʿaqlī*); nomic judgements (*ḥukm ʿādī*); legal judgements (*ḥukm sharʿī*); Islamic epistemology; philosophy of science; scientific and religious dialogue; theological reflection

1. Introduction

The relationship between science and theology remains one of the most compelling areas of inquiry in contemporary thought. In an age dominated by scientific advancement, questions concerning the metaphysical, ethical, and epistemological implications of the natural sciences are not only relevant but urgent. How do religious traditions engage with scientific paradigms? Can theological frameworks provide unique insights into the nature of scientific knowledge and its implications? These questions have gained prominence in discussions around science and religion, yet much of the scholarship has been shaped by Christian philosophical and theological paradigms (Koons et al. 2018; Silva 2021; Kopf 2023; Tabaczek 2023). There remains a pressing need to explore non-Christian traditions that offer alternative, yet equally rigorous, perspectives on these issues (Guessoum 2011a; Alkemade et al. 2024). Islamic theology, with its rich history of engagement with reason and revelation, presents a fertile ground for such inquiry (Griffel 2009; Jackson 2009; El-Tobgui 2020; Hassan 2020; Griffel 2021).

The field of Islam and Science is rapidly developing, with scholars exploring a range of inquiries such as quantum mechanics, evolution, psychology, artificial intelligence, and extraterrestrial life, to name a few (Jalajel 2009; Altaie 2016, 2023; Rassool 2018; Koca 2020; Malik 2021b, 2024a; Lazzari 2024). While some areas of investigation are marked by significant agreement, others are hotly contested, e.g., evolution (Malik 2023). A key point of contention lies in the methodological approach to understanding the relationship between Islamic theology and science. Some scholars engage with scientific ideas by drawing

directly from the Islamic intellectual tradition, either by adhering strictly to its classical frameworks or by adapting and modifying them to address contemporary issues (Jalajel 2009; Malik 2021b, 2024a, 2024b). Others argue that while tradition is a vital foundation, it is necessary to develop new frameworks that better address the epistemological and methodological challenges posed by modern scientific advancements (Taji-Farouki 2006; Guessoum 2011a).

This article aligns with the first approach, which seeks to engage with modern scientific ideas by drawing directly on the Islamic intellectual tradition. It explores the potential of an underutilised yet richly developed framework developed by Imam Abū ʿAbd Allāh Muḥammad ibn Yūsuf al-Sanūsī (d. 1490, a prominent post-classical theologian (the meaning of "post-classical" will be expanded upon shortly)).

1.1. Al-Sanūsī, Kalām, and His Legacy

Imam al-Sanūsī was a prominent Maghrebi Ashʿarī theologian and jurist of the post-classical Islamic period. Born in Tlemcen, in present-day Algeria, he became renowned for his contributions to the Islamic sciences, particularly *kalām*.

The term *kalām*—literally meaning "speech" or "discourse"—refers to a discipline that emerged in the early Islamic period as a means of defending and articulating Islamic beliefs through rational argumentation. *Kalām* developed in dialogue with the debate culture of Late Antiquity, particularly influenced by the Christological and philosophical discussions of the Arab Christian milieu in Syria and Iraq, as well as internal disagreements on various theological points (Wolfson 1976; Frank 2005, 2007, 2008). This historical and intellectual context gave *kalām* its distinctive character, blending Islamic theology with dialectical reasoning and, later, elements of Greek philosophy. While English terms like "theology", "philosophical theology", "scholastic theology", or "dialectical theology" offer partial parallels, they fail to fully capture the scope and methodology of *kalām*, which integrates metaphysics, logic, and scriptural interpretation in ways unique to the Islamic tradition (Frank 2007, 2008; Treiger 2014; Bulgen 2021). For this reason, the Arabic term *kalām* will be retained throughout this discussion.

Al-Sanūsī is best known for his prolific output in *kalām*, authoring a series of texts that are pedagogically structured to guide students through progressively advanced levels of theological learning (al-Sanūsī 2019a, 2019b, 2019c, 2019d, 2019e). His major works include the following (see the introductory notes in (al-Sanūsī 2019d, pp. 25–27; Olson 2020, p. 108):

1. *The Preliminaries of Theology (al-Muqaddimāt);*
2. *The Most Concise Theology (Ṣughrā al-Ṣughrā);*
3. *The Concise Theology (al-ʿAqīda al-Ṣughrā);*
4. *The Intermediate Theology (al-ʿAqīda al-Wusṭā);*
5. *The Advanced Theology (al-ʿAqīda al-Kubrā).*

Among these works, *The Concise Theology* is especially significant, often referred to as *The Mother of Proofs* (*Umm al-Barāhīn*), as it has received extensive attention over the centuries, inspiring numerous commentaries and super-commentaries that reflect its enduring significance in the Islamic tradition (Karagöz 2018). Designed to present core theological principles in a succinct and accessible manner, *The Mother of Proofs* has been a cornerstone of theological education in Muslim seminaries.

What makes these texts particularly interesting is that al-Sanūsī not only authored the texts (*mutūn*) himself, but he also wrote their accompanying commentaries (*shurūḥ*). This dual authorship ensured that each text was not only concise and precise but also thoroughly explained and contextualised for learners. These works were meticulously designed as a pedagogical series to guide students in building their theological understanding,

progressing from foundational concepts to more complex and advanced ideas. Al-Sanūsī's approach reflects a clear emphasis on systematic learning, ensuring clarity and accessibility at every stage of intellectual development (Olson 2020, pp. 107–8).

Al-Sanūsī is an especially significant figure for examining the relationship between Islamic theology and science in modern contexts. As mentioned earlier, *kalām* emerged as a discipline aimed at defending Islamic beliefs using reasoned arguments in response to internal and external philosophical and theological challenges. Over time, this tradition engaged with *falsafa* (Islamic philosophy), which was heavily shaped by the works of philosophers such as al-Kindī (d. 873), al-Fārābī (d. 950), Avicenna (Ibn Sīnā, d. 1037), and Ibn Rushd (Averroes, d. 1198). In particular, Avicenna's ideas profoundly impacted *kalām*. By the post-classical period (roughly spanning the 12th and onwards), *kalām* entered a new phase where Ashʿarī scholars, like Fakhr al-Dīn al-Rāzī (d. 1210), integrated Avicenna's philosophical insights into the theological discourse (Shihadeh 2005; Shihadeh 2006; Shihadeh 2015). This synthesis resulted in a more systematic and sophisticated approach within *kalām* to address theological, epistemic, and metaphysical questions (Hassan 2020; Griffel 2021; al-Rāzī 2024). Writing in the 15th century, al-Sanūsī's work reflects this advanced stage of *kalām*, marked by the intimate interactions and porosity between *kalām* and *falsafa*. This is what makes him a post-classical theologian.

Among al-Sanūsī's works, *The Preliminaries of Theology* (hereafter referred to as *The Preliminaries*) holds a significant position as an introduction to his broader theological system. This text provides a concise and systematic presentation of foundational concepts, making it particularly suited for this study (Al-Saraqusṭī 2019; Fawda 2019). A defining feature of al-Sanūsī's thought is his categorisation of judgements (*aḥkām*), which he classifies into the following three domains: legal (*sharʿī*), nomic (ʿ*ādī*), and rational (ʿ*aqlī*). These distinctions form the systematic presentation of his theological framework, offering a structured approach to understanding the relationship between reason, revelation, and the empirical world.

Although al-Sanūsī remains an underexplored figure in contemporary discussions, his structured model of judgements offers a distinctive and methodologically rigorous framework for engaging with the relationship between Islamic theology and science. Unlike the broader metaphysical approaches often found in Muʿtazilī or Thomistic traditions, al-Sanūsī's tripartite classification—legal, nomic, and rational—aligns theological, empirical, and logical dimensions in a systematic manner. By systematically analysing his presentation, this study shows how his framework provides a coherent and historically grounded approach to positioning science as a locus for Islamic theology. Furthermore, engaging with al-Sanūsī's insights presents an opportunity to advance discussions not only within Islam and science but also in the broader field of Islamic intellectual history.

1.2. Caveats and Qualifications

It is important to clarify that Islamic theology is not a unified or monolithic tradition. Rather, it comprises several theological schools, including the Atharī, Māturīdī, Muʿtazilī, Falāsifa, Ithnā ʿAsharī, Zaydī, and Ismāʿīlī traditions, each with its own metaphysical assumptions and internal logic regarding causality, divine action, and the role of reason and revelation (Ibn Qudāma 2012; Daftary 2007; Hoover 2007; Frank 1978, 2007, 2008; Winter 2008; El-Rouayheb and Schmidtke 2016; Schmidtke 2016; Abdulsater 2017; Harvey 2021; Price 2024; Suleiman 2024). These differences are not trivial: they shape how each tradition conceptualises the natural world, the structure of knowledge, and the very possibility of integrating science and theology.

This article focuses specifically on the Ashʿarī tradition. This is not merely due to its historical prominence but because Ashʿarism has become increasingly relevant in

recent conversations at the intersection of Islam and science. Recent scholarship has employed Ashʿarī theological principles to engage contemporary topics such as quantum indeterminacy, evolutionary contingency, divine command theory, and even discussions of extraterrestrial intelligence (Malik 2021a, 2021b, 2024a; Salim and Malik 2021). These discussions reflect a growing recognition that Ashʿarism offers conceptual tools that can address the epistemological and metaphysical challenges posed by modern science.

As we will come to see in the course of this article, what makes Ashʿarism distinct in this regard is its integration of three tightly interwoven commitments: the radical metaphysical contingency of creation based on divine, occasionalism, and divine command theory (Malik 2021a; Malik and Muhtaroglu 2022). Together, these allow the Ashʿarī tradition to affirm the full dependence of the natural world on God's will while still recognising empirical regularities as meaningful patterns sustained by divine volition. Natural laws are not understood as fixed necessities but as contingent habits, constantly upheld by God's choice. Within this worldview, miracles do not violate an inviolable order but rather reflect the same volitional freedom through which regularities are maintained.

This approach stands in marked contrast to that of the Falāsifa (Muslim Peripatetic philosophers), for instance, who operate within a necessitarian metaphysical scheme rooted in Neoplatonic emanationism. For them, God acts not through will but by necessity; creation flows in a hierarchical and immutable chain of being (Hassan 2020; Moad 2023). Divine action, in this model, is tightly constrained, and the natural world operates through intelligible causal laws that reflect this hierarchical necessity. Consequently, miracles, contingency, and the volitional disruption of natural processes are either reinterpreted or rendered problematic.

The sharp metaphysical divergence between just these two schools already makes it clear that it is untenable to speak of a single, unified Islamic theological framework for engaging with science. Each tradition offers a distinct conception of God, creation, and causality, resulting in fundamentally different ways of interpreting the natural world (Jackson 2009; Koca 2020). This article, therefore, does not aim to provide a universal Islamic perspective on science. Rather, it focuses specifically on the Ashʿarī tradition—not to dismiss others, but because of its growing relevance in contemporary discussions in Islam and science. Building on this emerging body of scholarship, the present study proposes a systematic meta-framework for theological engagement with science, using al-Sanūsī's tripartite categorisation of legal, nomic, and rational judgements as a basis for conceptual clarity and methodological coherence.

The remainder of this article is structured as follows: Section 2 elaborates on al-Sanūsī's tripartite framework and its internal logic. Section 3 explores how this model enables a principled theological engagement with contemporary science and why it offers a particularly coherent method for such dialogue within the Sunni tradition.

2. Judgements and Their Varieties

The *Preliminaries* is divided into eight sections, each addressing foundational concepts central to al-Sanūsī's framework. This article focuses on the first preliminary, which introduces and elaborates upon the different types of judgements briefly mentioned in the Introduction. To provide clarity and structure, the discussion of this preliminary is organised into four sections: the first explains the distinction between concept (*taṣawwur*; pl. *taṣawwurāt*) and judgement (*ḥukm* or *taṣdīq*; pl. *aḥkām* or *taṣdīqāt*); the second examines legal judgements (*ḥukm sharʿī*; pl. *aḥkām sharʿiyya*); the third explores nomic judgements (*ḥukm ʿādī*; pl. *aḥkām ʿādiyya*); and the fourth delves into rational judgements (*ḥukm ʿaqlī*; pl. *aḥkām ʿaqliyya*).

It should be noted that these ideas were developed prior to al-Sanūsī. For instance, al-Farābī wrote extensively on concepts and judgements (Forcada 2012). Additionally, earlier Ashʿarī scholars such as Abū Bakr al-Baqillānī (d. 1013), Abū al-Maʿālī al-Juwaynī (d. 1085), Abū Ḥāmid al-Ghazālī (d. 1111), and al-Rāzī also discussed various types of judgements. However, al-Sanūsī's organisation and use of these ideas as the introduction to *kalām* introduces a distinction that sets his *kalām* work apart from his predecessors.[1]

2.1. Concepts and Judgements

Al-Sanūsī begins the first preliminary by distinguishing between two foundational aspects of human cognition: concepts (*taṣawwurāt*) and judgements (*aḥkām* or *taṣdīqāt*). This distinction is critical for framing his subsequent categorisations of legal, nomic, and rational judgements, as it clarifies the cognitive processes underlying how humans engage with ideas and propositions (al-Sanūsī 2019d, pp. 111–12).

Concepts refer to the meaning or essence of an idea, independent of any assertion about its truth or existence. For example, the concept of "a cat" includes its characteristics as a small, furry animal with whiskers and a tail, while the concept of "a car" encompasses its function as a vehicle designed for transportation. Concepts define and encapsulate the essence of a thing, serving as foundational elements for further reasoning. However, they remain neutral in terms of truth, applicability, or existence—concepts do not assert whether the entity they describe exists or how it relates to other entities.

Judgements, by contrast, involve making a claim about the truth or falsehood of a proposition. This step builds on concepts by either affirming (*ithbāt*) or negating (*nafī*) a specific relationship or state of affairs. For instance, after forming the concept of a cat, one might make a judgement such as "My neighbour has a cat" (affirmation) or "My neighbour does not have a cat" (negation). Similarly, after grasping the concept of a car, one could judge, "This car is red" (affirmation) or "This car is not red" (negation). In this way, judgements extend beyond mere comprehension to evaluate and assert relationships or states of being, grounding rational and systematic thought.

Having distinguished between concepts and judgements—whether affirming or negating something—al-Sanūsī emphasises that judgements always pertain to specific domains. This observation serves as the foundation for his systematic exploration of the three types of judgements: legal, nomic, and rational.

2.2. Legal Judgement (Ḥukm Sharʿī)

In Islamic theology, revelation is understood to consist of two types of divine speech: declarative (*khabar*) and performative (*inshāʾ*). Declarative statements are truth-bearing, as they describe reality and can be evaluated as true or false. Examples include affirmations about God's attributes, historical events, or eschatological outcomes. Performative statements, by contrast, are non-truth-bearing; they do not describe what is or is not the case but instead enact obligations, prohibitions, and permissions. These performative statements provide prescriptive guidance for human behaviour and form the foundation for legal judgements (*ḥukm sharʿī*) (al-Sanūsī 2019d, pp. 115–16, 262–68).

Legal judgements derive their authority from performative statements in revelation, directly linking divine will to human responsibility. According to Ashʿarī theology, as articulated by Al-Sanūsī and others, morality and law are exclusively determined by God's will. Ashʿarīs uphold a divine command theory (DCT) framework, asserting that human reason alone is insufficient to determine the moral value of actions (Malik 2021a). Actions are not intrinsically good or bad but acquire their moral value solely through divine designation communicated in revelation. This understanding underscores the central role of God's speech as the basis for all moral and legal directives.

Al-Sanūsī categorises legal judgements into two primary types: defining law (*ḥukm taklīfī*) and declaratory law (*ḥukm waḍʿī*). Defining law prescribes specific moral and religious obligations. Declaratory law, on the other hand, identifies the contextual framework that determines when and how these obligations come into effect. The remainder of this section explores these two categories in detail.

2.2.1. Defining Law (Ḥukm Taklīfī)

This category focuses on prescriptive rulings that govern the moral and religious responsibilities of morally responsible individuals (*mukallaf*). There are five types, each reflecting a specific relationship between divine command and human action (al-Sanūsī 2019d, pp. 118–21). This category of law is organised around three overarching considerations: actions that are obligatory to perform or avoid, actions that are recommended but not mandatory, and actions that are neutral. Five specific types of declaratory law emerge from this arrangement: obligatory (*wājib*), prohibited (*ḥarām*), recommended (*mandūb*), discouraged (*makrūh*), and permissible (*mubāḥ*).

Obligatory actions (*wājib*) are those that must be performed, with rewards for compliance and punishment for neglect. For instance, performing the five daily prayers is a clear example of an obligatory act. In contrast, prohibited actions (*ḥarām*) are those that must be avoided, such as consuming alcohol, which is explicitly forbidden in Islam. Recommended actions (*mandūb*) are encouraged but not mandatory; performing them earns a reward while neglecting them carries no punishment. An example is giving extra charity (*ṣadaqah*) beyond the obligatory almsgiving (*zakāt*). Discouraged actions (*makrūh*) are better avoided but not sinful if performed, such as eating garlic before attending communal prayer, as it may cause discomfort to others. Finally, permissible actions (*mubāḥ*) are neutral, neither commanded nor prohibited, such as choosing to eat regular foods like apples or oranges. All five categories are summarised in Table 1.

Table 1. The spectrum of the defining law.

Obliged to Avoid (*ḥarām*)	**Recommended to Avoid (*makrūh*)**	**Neutral (*mubāḥ*)**	**Recommended to Perform (*mandūb*)**	**Obliged to Perform (*wājib*)**
Drinking alcohol	Eating garlic before prayer	Eating apples and oranges	Giving extra charity	Praying five times a day

2.2.2. Declaratory Law (Ḥukm Waḍʿī)

While defining law addresses direct moral and religious obligations, declaratory law focuses on the contextual framework that determines the applicability of these obligations and prohibitions. In other words, declaratory law identifies the conditions and circumstances under which the defining law comes into effect, ensuring that rulings are applied appropriately (al-Sanūsī 2019d, pp. 121–22).

The term "*waḍʿī*" in Arabic carries the meaning of being "placed" or "established", which is semantically significant in understanding this category of rulings. It reflects how these laws, though mandated by divine revelation, are inherently tied to the natural order and the observable patterns of creation. This alignment indicates the intentional design of Islamic rulings to function within the framework of the created universe. For instance, the timing of daily prayers is determined by the position of the sun, while the obligation to fast in Ramadan is linked to the sighting of the crescent moon. Such examples highlight the interplay between divine guidance and empirical realities, underscoring the harmony between revelation and creation that characterises declaratory law.

Declaratory law is further divided into three subcategories: cause (*sabab*), condition (*sharṭ*), and impediment (*māniʿ*) (al-Sanūsī 2019d, pp. 122–23). These divisions clarify the

various factors that dictate when and how obligations and prohibitions come into effect. Before delving into these subcategories, it is essential to first distinguish between *necessary* and *sufficient* conditions. This distinction is foundational to understanding the role of cause, condition, and impediment within declaratory law.

A necessary condition is something that must be in place for an outcome to occur, but on its own, it does not guarantee the outcome. For example, think about needing a passport to travel internationally. Having a passport is a necessary condition—you cannot board a flight to another country without it. However, simply possessing a passport does not guarantee that you will actually travel; you also need a plane ticket, a valid visa, and other factors. The passport is required for travel, but it is not enough by itself to ensure the trip happens.

A sufficient condition, by contrast, is something that, if met, guarantees the outcome. For example, consider a key for a locked door. In a scenario where the lock is functioning correctly, using the key to unlock the door is a sufficient condition for the door to open. As long as the key is the correct one, turning it in the lock will always result in the door opening, ensuring the outcome happens. The key guarantees the desired result.

Sometimes, multiple necessary conditions come together to form a sufficient condition for an outcome. For example, a meat patty is necessary for a burger, but it is not sufficient on its own. You also need burger buns, condiments, and other ingredients. When all of these necessary conditions are present together—the meat patty, buns, condiments, and vegetables—they become sufficient to create a burger. In this case, each individual ingredient is necessary to make a burger, but only when all of them are combined do you have something that fully satisfies the condition of being a burger. This illustrates how multiple necessary conditions can combine to ensure the desired outcome.

These distinctions between necessary and sufficient conditions are crucial for understanding how declaratory law operates, as it often relies on similar principles to define when and how specific rulings come into effect.

A cause (*sabab*) is a factor that directly and sufficiently brings a ruling into effect, acting as the definitive trigger for the application of a legal obligation or prohibition. It establishes a clear and direct link between a specific event or condition and the enactment of the ruling, ensuring that obligations or prohibitions are tied to observable realities (al-Sanūsī 2019d, pp. 123–24).

For instance, the arrival of the designated time for prayer (*ṣalāh*) serves as the cause for the obligation to perform it. When the sun reaches past its zenith, it becomes the cause that renders the noon (*ẓuhr*) prayer obligatory. Similarly, the sighting of the crescent moon marks the beginning of Ramadan and serves as the cause for the obligation to fast during the sacred month. In both cases, the presence of the cause directly initiates the relevant legal ruling, creating a systematic connection between divine command and the natural world.

Conversely, the absence of a cause negates the ruling entirely, as the sufficient trigger for its application is missing. For example, the obligation to pray the noon prayer does not arise until the sun has reached past its zenith, as the cause for the prayer has not yet occurred. Similarly, fasting during Ramadan does not become obligatory unless the crescent moon is sighted; without this cause, the ruling remains inapplicable.

A condition (*sharṭ*) is a factor that is necessary for a ruling to come into effect. Its presence is a prerequisite for the validity of the ruling, meaning that without it, the ruling cannot be enforced. However, a condition alone does not suffice to enforce the ruling; it is just one of several requirements that must align for the ruling to take effect. As seen with the earlier burger example, a condition sets the stage but does not, on its own, cause the ruling to be implemented (al-Sanūsī 2019d, pp. 123–27).

For example, consider ritual purity (*ṭahārah*) in the context of prayer. Ritual purity is a condition for the validity of prayer. If a person does not achieve ritual purity through ablution (*wuḍūʾ*), their prayer is invalid—this illustrates the necessity of the condition.

However, being in a state of ritual purity does not automatically validate a prayer, as it also depends on other factors, such as the arrival of the correct time of prayer, i.e., one cannot pray the morning prayer in the evening. This highlights that while ritual purity is necessary, it is insufficient by itself to enforce the prayer's validity.

The absence of a condition, on the other hand, is sufficient to prevent the ruling from being enforced. Returning to the example of ritual purity, if a person has not performed ablution, their prayer cannot be valid, regardless of other factors present. Thus, the absence of the condition (ritual purity) is sufficient to negate the ruling.

This distinction clarifies the dual role of a condition: it is a necessary prerequisite that enables a ruling but does not independently cause it, while its absence alone is sufficient to negate the ruling entirely.

An impediment (*māniʿ*) functions in contrast to a condition (*sharṭ*). While a condition enables a ruling by its presence, an impediment blocks a ruling from taking effect. In this sense, the presence of an impediment is sufficient to negate the ruling, regardless of the alignment of other factors. However, the absence of an impediment, although necessary for the ruling to be applied, is not sufficient on its own to enforce the ruling. For the ruling to take effect, the absence of the impediment must work in conjunction with the presence of the necessary conditions and the cause (al-Sanūsī 2019d, pp. 127–29).

For example, consider the case of debt in relation to *zakāt* (the obligatory almsgiving in Islam, which is typically a specific percentage of one's wealth given to the poor). Debt acts as an impediment to the obligation of *zakāt*. The presence of debt prevents the full ownership of wealth, which is the foundation for the *zakāt* obligation. Since *zakāt* is based on the principle of owning wealth in full, debt negates the requirement to give *zakāt*, even if other conditions—such as possessing the minimum taxable amount (*niṣāb*)—are met. The debt is sufficient to prevent the obligation, regardless of the amount of wealth one possesses.

On the other hand, the absence of debt does not automatically oblige *zakāt*. Other factors, such as the possession of the minimum taxable amount and the passage of one lunar year, must also be in place for the obligation of *zakāt* to be enforced. Thus, while the presence of an impediment like debt is sufficient to negate the ruling, its absence is merely a prerequisite that enables the possibility of the ruling when combined with other necessary elements.

This distinction highlights the dual role of an impediment: its presence is sufficient to block the enforcement of a ruling, ensuring that the circumstances that contradict the applicability of the ruling are accounted for. However, its absence is necessary for the ruling to take effect.

These three ideas in declaratory law—cause (*sabab*), condition (*sharṭ*), and impediment (*māniʿ*)—are summarised in Table 2.

Table 2. A summary of declaratory law.

Term	Its Presence Is . . .	Its Absence Is. . .	Example
Cause (*sabab*)	Sufficient for the ruling to take effect	Sufficient for the ruling to not take effect	A cause guarantees the ruling when present (e.g., prayer time obligates prayer); its absence ensures no ruling applies
Condition (*sharṭ*)	Necessary for the ruling to take effect	Sufficient for the ruling to not take effect	A condition must be present for the ruling to apply (e.g., ritual purity for the validity of prayer); its absence invalidates the ruling
Impediment (*māniʿ*)	Sufficient to prevent the ruling	Necessary for the ruling to take effect	An impediment blocks the ruling (e.g., debt prevents *zakāt*); its absence allows other factors to enable the ruling

2.3. Nomic Judgement (Ḥukm ʿĀdī)

To understand nomic judgements, it is helpful to begin with the divine action model that Ashʿarī theology espouses. Ashʿarīs adopts occasionalism, asserting that God is the sole and direct cause of all events in the universe (Malik and Muhtaroglu 2022). In this view, created entities do not possess any intrinsic causal powers. Instead, all causal relationships are directly created by God's will, which operates continuously in an ongoing manner (*ʿāda*). Observable phenomena, such as fire burning paper or water quenching thirst, are not outcomes of inherent properties within those entities but are contingent upon God's active will, created whenever these events occur.

In occasionalism, the regularities we observe in the natural world, often referred to as "laws of nature", are not the result of intrinsic qualities of objects. Rather, these regularities reflect the consistent will of God. For instance, when fire burns paper, it is not because fire inherently has the power to burn or because paper inherently has the vulnerability to be burned. Rather, God wills the outcome of burning whenever fire and paper are present on this specific occasion. These patterns, which we observe and label as natural laws, occur because God consistently chooses to create them in this manner, and their occurrence is entirely dependent on God's ongoing will.

The term "*ʿādī*" in *ḥukm ʿādī* is telling. Derived from *ʿāda*, meaning "custom" or "habit", it highlights the contingent and habitual nature of these patterns. Al-Sanūsī defines nomic judgements as affirmations of habitual connections (*takarrur*) between two phenomena, whether in their presence or absence (al-Sanūsī 2019d, pp. 130–33; these terms will be unpacked shortly—see Table 3). These connections form the observable regularities of the natural world and are identified through repeated experience. For example, the act of eating is habitually followed by satiety, while refraining from eating leads to hunger. Such patterns are not based on intrinsic necessity but on divine volition, which is discernible through consistent observation.

Table 3. All possible nomic relations.

Type	Description	Example
Presence–presence	The presence of one phenomenon habitually aligns with the presence of another	Eating (presence) is consistently followed by satiety (presence), establishing a regular pattern
Absence–absence	The absence of one phenomenon habitually coincides with the absence of another	The lack of rain (absence) habitually corresponds to no vegetation growth (absence)
Presence–absence	The presence of one phenomenon habitually coincides with the absence of another	Hunger (presence) aligns with a lack of satiety (absence) when no food is consumed
Absence–presence	The absence of one phenomenon aligns with the presence of another	The lack of rain (absence) coincides with the occurrence of drought (presence)

Importantly, nomic judgements encompass not only everyday observable patterns, like the association of eating with satiety, but also scientific laws, which can be broadly categorised as deterministic or probabilistic (Plantinga 2011, pp. 65–128; Koperski 2020, pp. 39–68, 109–28). While al-Sanūsī himself does not explicitly distinguish between these two categories, this study clarifies how his framework can accommodate both. Deterministic laws, such as Newton's laws of motion or the laws of thermodynamics, describe natural phenomena with fixed regularities, ensuring that under identical conditions, the same outcome always follows. These laws provide a structured, predictable understanding of the physical world, from planetary motion to energy conservation. In contrast, probabilistic

laws, particularly in quantum mechanics, statistical mechanics, and evolutionary biology, operate on tendencies rather than certainties. For example, while Newtonian physics allows precise predictions of macroscopic motion, quantum mechanics governs subatomic particles in terms of probability distributions rather than fixed trajectories. Likewise, natural selection in biology follows probabilistic patterns based on genetic variation and environmental pressures. Within al-Sanūsī's framework, both deterministic and probabilistic laws can be understood as expressions of divine will—regular patterns that God has established in creation, whether in fixed, predictable forms or through dynamic, statistically governed processes (Malik 2021b, pp. 179–211). This perspective accommodates the full spectrum of scientific inquiry, positioning both certainty and contingency within a God-centred metaphysical framework.

Al-Sanūsī exhausts all logical possibilities for habitual connections, framing them in terms of presence and absence and systematically exploring how the interplay between phenomena can be understood. Before delving into these possibilities, it is helpful to consider the nuanced relationship between presence and absence as it applies to the dualities observed in creation (al-Sanūsī 2019d, pp. 134–36).

Dualities—such as light and darkness, hunger and satiety, or life and death—are often understood in binary terms. However, the notions of presence and absence can be attributed to either side of these dualities, depending on perspective. For instance, darkness is commonly regarded as the absence of light, defined by a lack of illumination. Yet, it can also be framed as the presence of a distinct state characterised by qualities such as shadow or dimness. Similarly, hunger is frequently described as the absence of nourishment, but it can equally be understood as the presence of a physical sensation resulting from a lack of food. Recognising this flexibility is crucial for grasping the exhaustive logical possibilities that al-Sanūsī outlines, which are summarised in Table 3.

The concept of miracles finds a natural place within al-Sanūsī's framework of nomic judgements and habitual connections. Since regularities in the natural world are contingent expressions of divine will, they are not fixed or inviolable. What humans perceive as laws of nature are descriptive accounts of God's habitual actions, discerned through observation, but they do not constrain His omnipotence. This understanding provides a theological basis for miracles as extraordinary events that deviate from these regular patterns without contradicting them.

In this context, miracles are not violations of natural laws but temporary suspensions or alterations of divine custom (*ʿāda*). The same will that establishes the habitual associations governing the natural world can override or modify them at any moment. This flexibility underscores God's complete sovereignty over creation and His ability to intervene in ways that serve specific purposes, such as affirming prophethood or providing signs of His power.

Within the framework of occasionalism, miracles are particularly significant. Since occasionalism posits that God is the sole and direct cause of all events, what humans observe as regularities—such as fire burning paper—are entirely contingent on His will. This same principle explains how God can produce extraordinary events without contradicting His established patterns. In both nomic and miraculous occurrences, God remains the only true agent. Miracles, therefore, are not exceptions to a rule imposed by nature but expressions of the same divine volition that sustains the observed regularities. By suspending or altering the customary patterns, miracles highlight the ultimate contingency of the natural order and the unfettered power of the Creator.

2.4. Rational Judgement (Ḥukm ʿAqlī)

In al-Sanūsī's framework, rational judgements (*ḥukm ʿaqlī*) refer to conclusions reached solely through reason, without reliance on sensory experience or divine revelation. Fundamentally, these judgements are grounded in the law of non-contradiction (LNC), which serves as the basis for determining coherence and validity in rational thought. They are divided into three types: necessity (*wujūb*), impossibility (*istiḥāla*), and possibility (*jawāz*). This tripartite division provides a clear structure for understanding what must exist, what cannot exist, and what may exist, forming a key component of Islamic theological reasoning (al-Sanūsī 2019d, pp. 138–39).

Necessity (*wujūb*) is the judgement that refers to something that must exist or be true because its negation leads to a logical contradiction (al-Sanūsī 2019d, pp. 140–41). This necessity arises from the intrinsic nature of the thing itself, making it inconceivable for reason to conceive of it being otherwise. Necessary judgements form the foundation of rational thought, as they are principles that are either self-evident or derived through logical reasoning. For example, the mathematical proposition "1 + 1 = 2" is a necessary judgement. Its truth is intrinsic to the fundamental operations of arithmetic and denying it would render the entire framework of mathematics incoherent. Another example is the geometric assertion that "the internal angles of a triangle in Euclidean geometry always sum to 180 degrees". This judgement is necessary because it arises directly from the axioms of Euclidean space; to deny it would contradict those foundational principles. Similarly, the proposition that "a whole is greater than any of its parts" exemplifies necessity, as its denial would violate the basic logic underlying part–whole relationships. These examples illustrate that necessary judgements are those with negation that fundamentally disrupt rational coherence.

Impossibility (*istiḥāla*) is a judgement that refers to something that cannot exist or be true because its affirmation entails a logical contradiction (al-Sanūsī 2019d, p. 142). This impossibility is rooted in the intrinsic nature of the thing, and the thing's existence is rationally inconceivable. For instance, the concept of a "square circle" is impossible because the defining characteristics of a square (four equal sides and right angles) are fundamentally incompatible with those of a circle (a continuous curve with no angles). Affirming such an entity would violate the principle of non-contradiction. Another example is the claim that "a body can exist and not exist simultaneously." The notions of existence and non-existence are mutually exclusive, and their simultaneous affirmation would render reason incoherent. Similarly, the assertion that "a triangle can have four sides" is impossible because it directly contradicts the definition of a triangle, which inherently possesses three sides. Impossible judgements, therefore, are those with an affirmation that is not only rationally untenable but also irreconcilable with the logical structure of reality.

Possibility (*jawāz*) is a judgement that refers to something that can either exist or not exist without entailing a logical contradiction (al-Sanūsī 2019d, pp. 143–46). Unlike necessary or impossible judgements, which are fixed by their intrinsic nature, possibilities do not intrinsically entail a logical contradiction. Possibilities are fundamental to understanding the variability and contingency of the created world, allowing for a range of outcomes that reason deems conceivable.

For instance, the existence of a specific tree in a forest is possible because it lacks intrinsic necessity or impossibility. The tree could exist, or it might not, depending entirely on external factors such as whether it was planted, sustained, or cut down. Additionally, the tree's characteristics—its height, leaf colour, or even species—are not fixed by necessity. It could grow taller, remain stunted, or even fail to exist altogether, demonstrating that it is not bound by logical necessity. Similarly, extraterrestrials could exist or not exist, and if they

were to exist, they could have all kinds of possible features; there is nothing intrinsically contradictory in any of these options.

On a larger scale, the universe and its constituents exemplify the nature of possibility. The arrangement of stars and galaxies, the presence of particular elements, or the existence of specific planetary systems are all possible; they could have been different or simply not have existed at all. For instance, the composition of the Earth's atmosphere—primarily nitrogen and oxygen—could have been vastly different if external factors, such as the planet's formation and subsequent chemical processes, had varied. Similarly, the universe itself could have been structured differently or might not have existed at all, emphasising its lack of intrinsic necessity. Possibility, therefore, encompasses entities and phenomena that do not impose any logical contradiction, whether they exist or not.

Al-Sanūsī further categorises possibilities into three subcategories to provide a more nuanced understanding of their scope (al-Sanūsī 2019d, p. 143): established or actualised possibilities, negated or unactualised possibilities, and uncertain possibilities.

Established or actualised possibilities (*al-jāʾiz al-maqṭūʿ bi-wujūdihi*) are events or outcomes that have occurred or exist in the present, confirmed by reason or evidence. For instance, the development of vaccines or the widespread use of electricity as a power source are actualised possibilities. These were once possible ideas, but through specific actions, circumstances, and discoveries, they have been actualised. In a religious context, the resurrection of the dead in the eschaton and the existence of heaven and hell are established possibilities, affirmed through divine revelation, and are consistent with logical possibilities.

Negated or unactualised possibilities (*al-jāʾiz al-maqṭūʿ bi-ʿadamihi*) refer to things that are logically possible but did not occur, given what we know. For example, it was logically possible for Albert Einstein to win the Nobel Prize in biology, but in reality, this did not happen. This is an example of an unactualised possibility—something that could have happened but was not actualised due to the course of events or circumstances (in light of God's will). In a theological context, the salvation of Pharaoh and Abū Lahab, both of whom are historical figures mentioned in the Qurʾān, are examples of negated possibilities. Their eternal punishment in hell is explicitly affirmed in divine revelation, making their salvation impossible despite being theoretically conceivable. For example, Abū Lahab's fate is mentioned in Q. 111:3: "He will [enter to] burn in a Fire of [blazing] flame", while Pharaoh's condemnation is affirmed in Q. 28:41–42: "And We made them leaders inviting to the Fire, and on the Day of Resurrection, they will not be helped. And We caused a curse to follow them in this world, and on the Day of Resurrection, they will be of the despised."

Uncertain possibilities (*al-jāʾiz al-muḥtamal li-l-wujūd wa-l-ʿadam*) are scenarios with an outcome that remains unknown and contingent on future events or conditions. For instance, whether a new technology will succeed in the market or whether a scientific theory will be proven correct or not are uncertain possibilities. These outcomes depend on factors that have yet to unfold. In theology, the question of whether an individual will attain salvation or face punishment in the afterlife is an uncertain possibility, as it depends on the individual's choices and God's will. The outcome is not determined until the relevant conditions are fulfilled.

Building on this framework, we can now explore how it underpins the entire Ashʿarī theological system. Ashʿarī theologians articulated arguments for the existence of God that hinged on the necessity of a necessary being (*wājib al-wujūd*) to account for the contingent nature of creation. Central to this effort were two foundational arguments: the contingency argument (*dalīl al-imkān*) and the kalām cosmological argument (*dalīl al-ḥudūth*) (al-Rāzī 2024, vol. 1, pp. 65–328).[2] While these arguments differ in their methodological emphases,

both point to the same conclusion—that all contingent beings ultimately require a necessary being to explain their existence.

The contingency argument focuses on the inherent dependence of possible beings (*al-jāʾizāt*). As articulated in the framework of rational judgements, possible beings lack intrinsic necessity or impossibility; their existence or nonexistence depends entirely on external causes. For instance, the existence of a tree in a forest or the configuration of stars in the universe is contingent upon prior conditions, such as the processes that led to their formation. These contingent realities cannot explain their own existence; they demand an external cause. However, if this chain of contingent causes regresses infinitely, no ultimate explanation is possible. To resolve this, the contingency argument posits the existence of a necessary being whose existence is not contingent but self-sufficient, providing the ultimate foundation for all other beings (al-Rāzī 2024, vol. 1, pp. 65–172).

The kalām cosmological argument, by contrast, highlights the temporal nature of the universe. It begins with the premise that the universe had a beginning (*ḥudūth*), which is a state confirmed by the impossibility of an infinite regress of past events. Since everything that begins to exist must have a cause, the universe's existence points to an external cause beyond itself. This cause, Ashʿarī theologians argue, must be a necessary being—eternal, uncaused, and the originator of all contingent realities (al-Rāzī 2024, vol. 1, pp. 271–86).

In both arguments, the concepts of necessity (*wujūb*) and possibility (*jawāz*) play critical roles. The necessary being is defined as one whose existence is not dependent on anything else and whose negation would entail a logical contradiction. In contrast, the contingent beings that populate the universe—trees, stars, atoms, and even time itself—are marked by their dependence on external causes for their existence. The rational judgement of impossibility (*istiḥāla*) ensures that the concept of infinite regress occurs—whether ontological in the case of the contingency argument or temporal in the case of the kalām cosmological argument—where a self-caused contingent being is dismissed as logically incoherent, reinforcing the conclusion that a necessary being must exist (al-Rāzī 2024, vol. 1, pp. 181–200).

Thus, the rational judgements outlined by al-Sanūsī serve as the philosophical underpinnings for these theological arguments. They provide a systematic basis for distinguishing between what must exist (the necessary being), what cannot exist (logically impossible scenarios, such as a square circle), and what may exist (contingent realities that populate creation). Through these arguments, Ashʿarī theologians establish that rational thought leads inexorably to the affirmation of a necessary being who underpins all contingent realities. These logical judgements are summarised in Table 4.

Table 4. Logical categories.

Necessity (*wujūb*)	**Impossibility (*istiḥāla*)**	**Possiblity (*jawāz*)**
A judgement that something must exist or be true, as its negation leads to a logical contradiction	A judgement that something cannot exist or be true, as its affirmation would lead to a logical contradiction	A judgement that something can exist or not exist, without implying any logical contradiction

3. Reflecting on al-Sanūsī's Framework

This section is structured to provide a detailed reflection on al-Sanūsī's framework and its implications for Islamic theology and science. Section 3.1 explores the God-centric nature of the three types of judgements—legal (*ḥukm sharʿī*), nomic (*ḥukm ʿādī*), and rational (*ḥukm ʿaqlī*)—demonstrating how each is inherently grounded in divine authority and action. Section 3.2 examines the hierarchical relationship and scope of these judgements, illustrating how the rational sphere underpins the nomic and legal domains, forming a coherent

framework for understanding the world and human responsibility. Section 3.3 focuses on science as a locus for theological reflection and inquiry, showcasing how al-Sanūsī's framework integrates empirical observations with ethical and theological principles, making it highly relevant for contemporary discussions on Islam and science. Together, these sections offer a comprehensive analysis of how al-Sanūsī's insights can bridge traditional theology and modern scientific discourse.

3.1. God-Centric Framework

Al-Sanūsī's presentation makes it clear how each kind of judgement is inherently God-centric, with each type of judgement providing a distinct yet interconnected foundation for understanding the centrality of God in all aspects of existence and reasoning. This God-centric orientation is evident in how each category of judgement is ultimately grounded in divine authority, action, or necessity.

Within legal judgements, morality and law are exclusively derived from God's will, as revealed through divine commands. This reflects the principle of DCT, where actions are not intrinsically good or bad but acquire their moral value through God's explicit designation. The prescriptive nature of these judgements—whether obligations, prohibitions, or permissions—underscores the dependence of ethical and legal systems on divine authority. This approach ensures that all moral and legal obligations are tethered to divine will, highlighting God's role as the ultimate arbiter of human action (Malik 2021a).

In the realm of nomic judgements, observable regularities in the natural world are framed not as independent, inherent properties of objects but as manifestations of God's habitual will (*ʿāda*). The Ashʿarī doctrine of occasionalism denies the intrinsic causal power needed to create entities, asserting instead that all causes and effects are directly enacted by God. This view reinforces the idea that the cosmos operates through divine volition, with every event and natural regularity being a direct expression of God's continuous action. Thus, nomic judgements situate God as the sustaining force behind the natural order (Malik and Muhtaroglu 2022).

Rational judgements, which deal with necessity, impossibility, and possibility, provide a philosophical framework for understanding the contingent nature of creation. Through the principles of possibility and necessity, rational judgements lead inevitably to the affirmation of a necessary being (*wājib al-wujūd*). Ashʿarī theologians employ this framework to argue that all contingent realities ultimately depend on a self-sufficient, necessary being—God (Malik and Muhtaroglu 2022).

3.2. The Hierarchy and Scope of the Three Spheres

Al-Sanūsī's framework presents a systematic hierarchy of the rational, nomic, and legal spheres, each distinguished by its scope and epistemic basis. This structure reflects how pure reason, observable regularities in nature, and divine revelation interact to underpin the theological and practical dimensions of human understanding and action.

The rational sphere, grounded in pure reason, is the broadest in scope. It encompasses all conceivable possibilities within the bounds of logical coherence, establishing the parameters of necessity, impossibility, and possibility. This sphere forms the epistemic foundation for all other domains, as it determines what can or cannot exist or occur in principle. Without the rational sphere, neither the actualised patterns of the natural world nor the ethical and legal guidelines derived from revelation can be meaningfully conceptualised.

The nomic sphere, rooted in observable regularities, constitutes a subset of the rational sphere. It is defined by those possibilities that God has actualised in creation, forming the patterns and phenomena that are consistently observed in nature. These regularities provide stability and predictability, enabling humans to engage with their environment and

understand the world through empirical observation and scientific study. The nomic sphere links the broader rational domain with the tangible realities of existence. It serves as the foundation for practical human activity, including the ethical guidelines prescribed in the legal sphere. Without the regularities of the nomic domain, ethical and legal prescriptions would lack the stable framework necessary for their application (Malik 2021a).

The Ashʿarī framework's distinction between the rational and nomic spheres inherently allows for phenomena that fall outside of the boundaries of empirical science. Nomic irregularities, such as miracles, uphold divine omnipotence by suspending or altering the regular patterns of the natural world while maintaining logical coherence. This distinction highlights the limitations of scientism and materialism, which reduce reality to what can be empirically observed and measured. The Ashʿarī perspective rejects such reductionism, recognising that the natural laws governing the nomic sphere are contingent expressions of God's will and are not exhaustive of all that exists (Malik 2023). By affirming the broader scope of the rational sphere, the Ashʿarī framework integrates science into a more expansive theological worldview, where empirical observation is one pathway among many for understanding the complexities of creation.

The legal sphere, the narrowest in scope, derives its epistemic basis from divine revelation. It prescribes human behaviour within the constraints of the actualised nomic world, offering a framework for ethical and religious obligations. Legal rulings presuppose the stability and predictability provided by the nomic sphere; for example, obligations such as daily prayers or fasting rely on consistent natural phenomena, such as the movement of celestial bodies or the passage of time. Revelation guides human conduct in alignment with the established regularities of the natural world, ensuring that ethical imperatives are both grounded and actionable. It is important to note, however, that this alignment does not have to be inherent; it is solely due to God's grace that such an alignment exists in the first place (Malik 2021a, p. 568).

This connection to revelation also underscores the intelligibility and importance of prophethood within Ashʿarī theology. Prophets act as divinely appointed intermediaries between God and humanity, with their authority being validated through miracles. However, it is crucial to note that miracles in this context do not imply "divine intervention" in the common contemporary sense (Lazzari 2024). In Ashʿarī theology, particularly in the framework of occasionalism, God does not intervene in His own actions. Instead, miracles are understood as extraordinary events that manifest within the established natural regularities of the nomic sphere. These regularities provide a stable backdrop, allowing miracles to be perceived as exceptional precisely because they deviate from the norm. Without the predictability of the nomic world, miracles would lack the contrast necessary for them to be recognised as extraordinary, thus establishing an important solidifying link between the nomic and legal domains (Jalajel and Malik 2025).

In this sense, prophethood is the critical contact point between the natural order and divine guidance. Miracles validate the prophet's claim to convey revelation, acting as a definitive sign of divine endorsement and bridging the rational and nomic spheres with the legal domain. The prophetic message transforms the regularities of the natural world into actionable legal and ethical frameworks, ensuring that human conduct aligns with the rational order of creation and the ultimate purposes of divine will. Through this connection, natural theology, which discerns God's attributes through reason and observation, is seamlessly integrated with systematic theology, which incorporates the knowledge revealed to provide a comprehensive guide for human life (Feser 2017, pp. 238–46).

This hierarchical structure underscores a clear interdependence among the spheres. The rational sphere, which is the broadest, provides the foundation for all conceivable possibilities. The nomic sphere narrows this scope to the actualised patterns willed by

God, while the legal sphere is further refined and articulates specific divine prescriptions for human conduct. Each sphere builds on the broader domain that precedes it: the legal depends on the nomic, and the nomic relies on the rational. This is summarised in Figure 1.

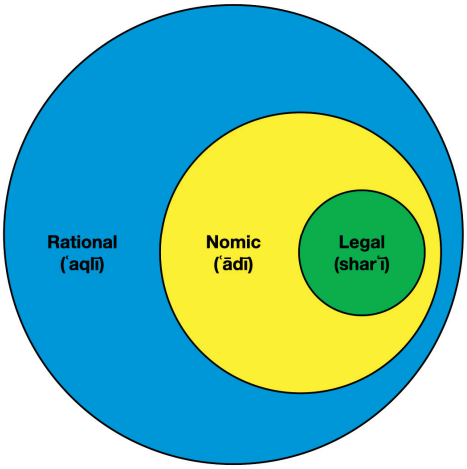

Figure 1. The interrelationships between rational, nomic, and legal domains.

Al-Sanūsī's prioritisation of the legal sphere in his presentation, despite its narrower scope, reflects the honour given to divine revelation in Islamic thought. Revelation, as the direct expression of divine will, holds a central place in guiding human conduct. By beginning with the legal sphere, al-Sanūsī underscores its practical importance while also acknowledging its dependence on the underlying rational and nomic structures. This integrated hierarchy illustrates how reason, natural regularities, and divine command converge to create a coherent framework for understanding existence and guiding human action.

3.3. Science as a Locus of Theological Reflection and Inquiry

Science, within the Ashʿarī framework, has historically been pursued as a means of exploring the manifestations of divine will, fulfilling ethical responsibilities, and reflecting upon the contingency of creation (Kara-Ali 2014; Brentjes 2018; Stearns 2021). This approach inherently ties scientific inquiry to theological ends, grounding it within the three domains of legal, nomic, and rational.

At its core, science, as the study of the laws of nature, aligns most directly with nomic judgements. It investigates the regularities and patterns that God has willed into existence through His customary actions. For Ashʿarī thinkers, these patterns are not intrinsic to the objects themselves but are expressions of divine volition. The pursuit of science, then, becomes an exploration of God's design, revealing His wisdom and the intricate systems He has placed into creation. Historically, this perspective has motivated Muslim scientists to seek knowledge of the natural world, not merely for its own sake but as a means of uncovering divine wisdom embedded in creation (Malik et al. 2022).

Science also intersects with legal judgements, particularly when defining law (*ḥukm waḍʿī*), by providing tools and insights to better fulfil ethical and religious obligations. Historically, this was evident during the Islamic Golden Age, when scientific pursuits were closely tied to religious practices and ethical mandates. For instance, astronomy was developed to refine the precision of prayer timings, fasting schedules, and the determination of the lunar calendar (King 1996; Morrison 2013). Similarly, medicine was advanced not merely as a pursuit of knowledge but as a practical means to preserve health and well-being, aligning with the ethical responsibility to protect life and alleviate suffering (Ullmann 1978; Pormann and Savage-Smith 2007; Stearns 2011; Ragab 2018).

It is also important to highlight that the relationship between legal reasoning and empirical knowledge in classical Islamic jurisprudence has not been one-sided. Legal scholars actively incorporated available empirical knowledge into their deliberations, reflecting the scientific understanding of their time. A notable example is found in classical Islamic law, where Shāfiʿī scholars ruled that using water heated by the sun in metal containers, such as copper or iron, was disliked (*makrūh*) because they believed exposure to sunlight could release harmful substances (*zuhūma*) that could cause leprosy (*baraṣ*). An exception was made for gold and silver containers, which were believed to be pure in substance and, thus, did not cause leprosy (al-Shirbīnī 1997, vol. 1, p. 47). While modern science shows that leprosy is caused by bacteria, not metals or sunlight, this ruling was based on the best scientific understanding available at the time, rooted in alchemy.

Another example is the classical Islamic legal debate on the maximum duration of pregnancy. Scholars debated this issue based on documented cases of extended pregnancies, with some considering the possibility of pregnancies lasting beyond the typical nine months. Influenced by theories such as the "sleeping foetus", some legal scholars even suggested that pregnancies could last for up to four years or longer (Serrano-Ruano 2023).

While they reveal the limitations of knowledge from a contemporary perspective, both examples highlight how classical scholars engaged with the empirical sciences of their time to make informed legal judgements. This practice has continued into the modern context, where the role of scientific knowledge in shaping legal deliberations has evolved. Biomedical scientists equipped with expertise in contemporary medical advancements are now increasingly participating in religious deliberations, especially when modern medical knowledge challenges traditional views. For instance, discussions around the plausibility of extremely prolonged pregnancies or the ethical considerations of organ transplants have become integral to Islamic legal reasoning. These scientists now play an essential role in "informing" and even "co-authoring" religious edicts, working alongside theologians in collective independent legal reasoning (*ijtihād*). This shift has transformed some biomedical scientists from mere informants into key contributors in the religious decision-making process, reflecting the growing integration of scientific input into Islamic jurisprudence (Ghaly 2022).

Medical research and biotechnology continue to challenge and shape ethical reasoning within Islamic law. Innovations such as ectogenesis, euthanasia, organ transplantation, and sex reassignment surgeries compel religious scholars to reconsider traditional legal frameworks (Ali 2020; Afifi and Padela 2021; Padela 2021; Jaffer et al. 2022; Ghaly 2024). These modern technologies test the boundaries of Islamic ethics, prompting nuanced legal rulings that account for the latest scientific realities. For example, ectogenesis raises questions about the sanctity of life and parental responsibility, while organ transplantation introduces ethical concerns regarding prioritisation and the permissibility of using human-derived materials. Similarly, advances in regenerative medicine challenge Islamic values concerning the sanctity of life and the body's integrity. All of these discussions require ongoing (re-)evaluations within Islamic jurisprudence (Padela 2024).

Alongside these medical advancements, the broader realm of environmental science also plays a critical role in shaping contemporary Islamic bioethics. The ethical mandate of stewardship over the Earth (*khilāfa*) is increasingly relevant in the context of climate change and environmental degradation (Salimi Turkamani 2023). Climate science, in particular, provides critical tools for understanding the ecological crises facing the world today, urging action to conserve resources and mitigate harm in accordance with Islamic ethical principles (Koehrsen 2021; Sobirin and Khasanah 2023).

This dynamic relationship between scientific discovery and ethical imperatives underscores the evolving nature of Islamic jurisprudence. As new challenges emerge, the

natural world—through its observable patterns and underlying complexities—acts as both a source of inquiry and a testing ground for ethical reasoning. Scientific inquiry, therefore, is not merely a tool for refining precision in established practices but a dynamic process that continually shapes and is shaped by Islamic jurisprudence. Through this interaction, modern science serves as a vital means for furthering ethical values, fostering a constant dialogue between the realities of the natural world and the divine objectives of Islamic law (*maqāṣid al-sharīʿa*) (Padela 2024).

Furthermore, rational judgement links scientific discovery to theological reflection by framing the natural world as a collection of contingent phenomena that point to the existence of a necessary being. For Ashʿarīs, every discovery—whether the fine-tuning of the cosmos, the complexity of ecosystems, or the intricacies of molecular biology—reinforces the contingent nature of creation, leading back to God as the ultimate cause. Thus, the study of science was never viewed as separate from theology but as a means of affirming divine existence and attributes and the contingency of the created order (Malik et al. 2022; Malik and Muhtaroglu 2022).

In light of this, new phenomena discovered by science should not be perceived as threatening to Islamic theology. So long as these discoveries do not contradict core principles derived from revelation, they are not only acceptable but also welcomed as extensions of human understanding (Malik et al. 2022).[3] The Ashʿarī framework, with its grounding in rationality and contingency, provides an epistemological basis for integrating new knowledge. For example, theories of the multiverse or the existence of extraterrestrial life raise fascinating questions about the scope and diversity of creation, yet they remain within the bounds of contingency and point to the creative power of God (Malik 2024b). Similarly, advancements in quantum mechanics or the discovery of new subatomic particles further illustrate the intricate systems that God has willed into existence (Salim and Malik 2021). By framing scientific inquiry as a process of uncovering God's will in creation, this perspective alleviates the fear of the unknown and encourages Muslims to approach new discoveries—whether terrestrial, cosmic, or even beyond the cosmos—with confidence and curiosity rather than suspicion or apprehension.

This integrated view of science within Ashʿarism offers modern Muslim scientists a foundation for approaching their fields with a sense of continuity and purpose. While the methods and contexts of contemporary science may differ, the core principle remains the same: science is a tool for uncovering what God has manifested in the natural world.

Thus, it is hoped that this presentation of al-Sanūsī's framework can provide a positive theological outlook, encouraging Muslims to view science not as a threat but as an opportunity to deepen their understanding of the Divine. Whether it serves to reveal divine wisdom, aid in fulfilling ethical and religious duties, or reflect upon the metaphysical realities of contingency and necessity, the scientific inquiry remains, and will never cease to be, a locus for (engaging with) Islamic theology (also see Abdelnour 2023, 2024).[4]

4. Conclusions

This article has examined how Imam al-Sanūsī's theological framework provides a structured model for understanding the relationship between Islam and science. His tripartite categorisation of judgements—legal (*ḥukm sharʿī*), nomic (*ḥukm ʿādī*), and rational (*ḥukm ʿaqlī*)—integrates revelation, reason, and empirical observation, offering a coherent way to engage with scientific inquiry while upholding core theological principles. At its core, al-Sanūsī's framework is deeply God-centric. Legal judgements establish morality based on divine command; nomic judgements explain natural laws as manifestations of the divine will; and rational judgements affirm the necessity of a transcendent Creator.

It is important to recognise, however, that Islamic theology is not monolithic. Across Islamic intellectual history, different traditions—including Muʿtazilī, Māturīdī, Atharī, and Falāsifa schools, among others—have developed distinct perspectives on reason, causality, and divine action. Against this broader landscape, this article presents one articulation of the Islamic perspective: Ashʿarism as developed by al-Sanūsī. It will be interesting to see how other theological models and expressions engage with contemporary discussions on Islam and science, highlighting areas of agreement and divergence in future scholarship.

More broadly, this study exhibits the continued relevance of classical Islamic theology in modern discussions of Islam and science. By illustrating how a structured theological framework can accommodate scientific advancements, this article underscores the enduring value of Ashʿarī *kalām* as a dynamic and evolving intellectual tradition. As new scientific discoveries raise complex questions—from the nature of causality in quantum mechanics to the theological implications of extraterrestrial life—al-Sanūsī's model will serve not merely as a historical construct but as a living methodology that allows for engagement with modern science without compromising theological integrity.

Ultimately, this framework challenges the perceived divide between science and theology. By recognising scientific discoveries as contingent expressions of God's will and spaces for ethical deliberations, theological engagement with the natural world is encouraged. This perspective positions science not merely as an empirical discipline but as a vital locus for theological reflection—one that deepens our understanding of divine wisdom, strengthens intellectual inquiry, and reaffirms the interconnectedness of knowledge, faith, and reason.

Funding: This research received no external funding.

Data Availability Statement: No new data were created or analyzed in this study. Data sharing is not applicable to this article.

Acknowledgments: I would like to express gratitude to my colleagues Nazif Muhtaroğlu, David Solomon Jalajel, Mohamed Gamal Abdelnour, Zaigham Junaid, and Tahseen Khan for their invaluable support and insightful discussions. I also extend my thanks to my students from the Academy of Divinity and Science for their dedication and engagement in the learning process. Their contributions have greatly enriched my work.

Conflicts of Interest: The author declares no conflicts of interest.

Notes

1 At the time of writing this article, Abū al-Ḥasan ʿAlī ibn ʿAbd al-Raḥmān al-Yafrīnī al-Tanjī (d. 1334), a North African theologian, was identified as a noteworthy precursor. Al-Yafrīnī presents an earlier iteration of nearly the same conceptual framework in his work, *Rational Investigations into the Explanation of the Meanings of the Burhānī Creed* (*Al-Mabāḥith al-ʿAqliyyah fī Sharḥ Maʿānī al-ʿAqīda al-Burhāniyya*). However, unlike al-Sanūsī—who establishes the discussion of judgements as the foundational framework for kalām at the very outset of his work—al-Yafrīnī introduces these same ideas much later in his text (al-Yafrīnī 2017, vol. 1, pp. 435–51). While the precise historical development of these ideas falls outside the scope of this article and is best explored by intellectual historians, it is worth noting this connection. Full credit goes to Tahseen Khan for bringing this to my attention.

2 To clarify, these arguments do not originate from Ashʿarī theologians. Instead, they inherited them from earlier and parallel intellectual traditions, including Muʿtazilī theology and Hellenic philosophy, and further developed within their own theological framework. Their engagement was not a simple adoption but involved refinement and critical elaboration, addressing both internal Islamic debates and broader philosophical discussions (Goodman 1971a, 1971b; Davidson 1987; İskenderoğlu 2002; F. a.-D. al-Rāzī 2012, pp. 49–52; Erlwein 2019; Mihirig 2022). The key point here is that both arguments became central to the Ashʿarī framework.

3 The question of what constitutes "core principles" in Islamic theology and how they are derived is beyond the scope of this article. However, the general theological principles relevant to this discussion have been outlined in Malik and Muhtaroglu (2022). Which principles are considered fundamental depends on the specific scientific claim being evaluated and its theological implications. Recall from Section 2.2 that declarative statements (*khabar*) in revelation are truth-bearing and serve as the foundation for

identifying key theological commitments. One such commitment within Ashʿarī theology is the belief in a historical Adam and his miraculous creation (Malik 2021b, 2024b). Since this belief is rooted in revelation, scholars have proposed various models to reconcile it with evolutionary theory without compromising theological integrity. One such model, Adamic exceptionalism, accepts the broader process of human evolution while maintaining that Adam was created through a distinct divine act. It is also important to clarify that miracles—such as Adam's creation—are fully affirmed within the Ashʿarī's framework. This remains a point of contention in Islam and science, particularly among scholars such as Guessoum (2011b), who argued that accepting miracles undermines a naturalistic scientific framework. However, Ashʿarī occasionalism does not adhere to strict naturalism; rather, it holds that all causal relations are contingent upon God's will. This means that both natural regularities and extraordinary divine acts—such as miracles—belong to the same ontological order. As a result, miracles are not seen as violations of nature but as expressions of divine will. Within this framework, science itself is understood as the study of patterns that God has willed into existence, ensuring that scientific inquiry and theological commitments remain compatible.

4 While this article highlights the potential of Ashʿarī theology to serve as a positive force for scientific engagement, it is important to recognise that intellectual frameworks alone do not determine how science develops within a society. Historical, political, and socio-economic conditions significantly influence how Muslims approach and integrate scientific inquiry. The lasting effects of colonisation, secularism, and orientalism have shaped the structures of knowledge production in many Muslim-majority societies, affecting both the perception and practice of science (Saliba 2007; Dallal 2010; Elshakry 2013; Hallaq 2018; Jackson 2024; Lumbard 2022, 2025; Faruque 2024; Siddiqui 2024). These broader forces have created intellectual and institutional challenges that continue to shape contemporary discourse on science and theology. A persistent narrative, particularly in Western and some internal Muslim critics, is that thinkers like al-Ghazālī, by critiquing certain philosophical positions, played a role in the decline of scientific progress in the Muslim world. This argument, often directed at the Ashʿarī tradition more broadly, assumes that theological commitments inherently stifle scientific inquiry. However, this claim has been increasingly challenged by scholars who have demonstrated that Ashʿarī theology historically accommodated and even encouraged scientific and philosophical exploration (Griffel 2009, 2021; Adamson 2016). Nevertheless, theological openness to scientific engagement does not automatically translate into a thriving scientific culture. The development of science depends on institutional, economic, and educational support structures, many of which have been shaped by modern geopolitical realities. While this article focuses on the epistemological contributions of Ashʿarī theology, a fuller picture requires the consideration of these broader material conditions. This issue, only briefly noted here, will be explored in future research.

References

Abdelnour, Mohammed Gamal. 2023. The Qurʾān and the Future of Islamic Analytic Theology. *Religions* 14: 556. [CrossRef]

Abdelnour, Mohammed Gamal. 2024. From 'How' to 'Why': Reinvigorating the Qur'ān as a Living Philosophy. *Journal of Islamic and Muslim Studies* 9: 116–25. [CrossRef]

Abdulsater, Hussein Ali. 2017. *Shi'i Doctrine, Mu'tazili Theology: Al-Sharīf al-Murtaḍā and Imami Discourse*. Albany: State University of New York Press.

Adamson, Peter. 2016. *Philosophy in the Islamic World: A History of Philosophy Without Any Gaps*. Oxford: Oxford University Press, vol. 3.

Afifi, Al-Akiti, and Aasim I. Padela, eds. 2021. *Islam and Biomedicine: The Interplay of Jurisprudence, Ethics, and Society*. Cham: Springer.

Ali, Mansur. 2020. Seven Faces of a Fatwa: Organ Transplantation and Islam. *Religions* 11: 99. [CrossRef]

Alkemade, Elise, Nils Deeg, Carles Guillén Almiñana, Samar Nasrullah Khan, Oriana Morales Hernández, Abigail Nieves Delgado, Elian Schure, Mark Whittle, and Hilbrand Wouters. 2024. Global Epistemologies and Philosophies of Science: Global Dialogues and New Directions for Philosophy of Science. *Journal of General Philosophy of Science* 55: 469–78. [CrossRef]

al-Rāzī, Fakhr al-Dīn. 2012. *Maʿālim Uṣūl al-Dīn [Landmarks of the Fundamentals of Religion]*. Edited by Nizār Ḥammādī. Kuwait: Dār al-Ḍiyāʾ.

al-Rāzī, Fakhr al-Dīn Muḥammad ibn ʿUmar ibn al-Ḥusayn. 2024. *Al-Maṭālib al-ʿĀliya min al-ʿIlm al-Ilāhī [The Sublime Objectives of Divine Knowledge]*. Edited by Abdullāh Muḥammad Ismāʿīl and Muḥammad Ḍargām. Kuwait: Dār al-Diyāʾ.

al-Sanūsī, Muḥammad ibn Yūsuf. 2019a. *Al-ʿAqīda al-Kubrā [The Advanced Theology]*. Damascus: Dār al-Taqwā.

al-Sanūsī, Muḥammad ibn Yūsuf. 2019b. *Al-ʿAqīda al-Ṣughrā [The Concise Theology]*. Damascus: Dār al-Taqwā.

al-Sanūsī, Muḥammad ibn Yūsuf. 2019c. *Al-ʿAqīda al-Wusṭā [The Intermediate Theology]*. Damascus: Dār al-Taqwā.

al-Sanūsī, Muḥammad ibn Yūsuf. 2019d. *Al-Muqaddimāt [The Preliminaries of Theology]*. Damascus: Dār al-Taqwā.

al-Sanūsī, Muḥammad ibn Yūsuf. 2019e. *Ṣughrā al-Ṣughrā [The Most Concise Theology]*. Damascus: Dār al-Taqwā.

Al-Saraqusṭī, Abū Isḥāq Ibrāhīm. 2019. *Sharḥ al-Muqaddimāt al-Sanūsiyyah [A Commentary on al-Sanūsī's Preliminaries]*. Cairo: Dār Kashīda.

al-Shirbīnī, Muḥammad ibn Aḥmad. 1997. *Mughnī al-Muḥtāj ilā Maʿrifat Maʿānī Alfāẓ al-Minhāj [The Sufficer's Need to Know the Meanings of the Words of the Guide]*. Beirut: Dār al-Maʿrifa.

Altaie, Basil. 2016. *God, Nature, and the Cause: Essays on Islam and Science*. Abu Dhabi: Kalam Research & Media.

Altaie, Basil. 2023. *Islam and Natural Philosophy: Principles of Daqīq al-Kalām*. London: Beacon Books.

al-Yafrīnī, Abū al-Ḥasan ʿAlī ibn ʿAbd al-Rahmān. 2017. *Al-Mabāḥith al-ʿAqliyyah fī Sharḥ Maʿānī al-ʿAqīda al-Burhāniyya [Rational Investigations into the Explanation of the Meanings of the Burhānī Creed]*. Edited by Jamāl ʿAllāl al-Bakhtī. Tunis: al-Mamlaka al-Maghribiyya.

Brentjes, Sonja. 2018. *Teaching and Learning the Sciences in Islamicate Societies (800–1700)*. Turnhout: Brepols Publishers.

Bulgen, Mehmet. 2021. Science and Philosophy in The Classical Period of Kalām: An Analysis Centered Upon the Daqīq and Laṭīf Matters of Kalām. *Kader* 19: 938–67. [CrossRef]

Daftary, Farhad. 2007. *The Ismāʿīlīs: Their History and Doctrines*, 2nd ed. Cambridge: Cambridge University Press.

Dallal, Ahmad. 2010. *Islam, Science, and the Challenge of History*. New Haven: Yale University Press.

Davidson, Herbert A. 1987. *Proofs for Eternity, Creation, and the Existence of God in Medieval Islamic and Jewish Philosophy*. New York: Oxford University Press.

El-Rouayheb, Khaled, and Sabine Schmidtke, eds. 2016. *The Oxford Handbook of Islamic Philosophy*. Oxford: Oxford University Press.

Elshakry, Marwa. 2013. *Reading Darwin in Arabic, 1860–1950*. Chicago: University of Chicago Press.

El-Tobgui, Carl Sharif. 2020. *Ibn Taymiyya on Reason and Revelation: A Study of Darʾ taʿāruḍ al-ʿaql wa-l-naql*. Leiden: Brill.

Erlwein, Hannah C. 2019. *Arguments for God's Existence in Classical Islamic Thought: A Reappraisal of the Discourse*. Berlin: De Gruyter.

Faruque, Muhammad U. 2024. Decolonizing the Muslim Mind: A Philosophical Critique. *Philosophy* 55: 353–75. [CrossRef]

Fawda, Saʿīd. 2019. *Al-Sharḥ al-Jadīd ʿalā Muqaddimāt al-Sanūsī [The New Commentary on al-Sanūsī's Preliminaries]*. Damascus: Dār al-Aṣlīn.

Feser, Edward. 2017. *Five Proofs for the Existence of God*. San Francisco: Ignatius Press.

Forcada, Miquel. 2012. Ibn Bājja on Taṣawwur and Taṣdīq: Science and Psychology. *Arabic Sciences and Philosophy* 22: 1–25.

Frank, Richard M. 1978. *Beings and Their Attributes: The Teaching of the Basrian School of the Muʿtazila in the Classical Period*. Albany: State University of New York Press.

Frank, Richard M. 2005. *Philosophy, Theology and Mysticism in Medieval Islam: Texts and Studies on the Development and History of Kalām*. Edited by Dimitri Gutas. Aldershot: Ashgate Variorum, vol. I.

Frank, Richard M. 2007. *Early Islamic Theology: The Muʿtazilites and al-Ashʿarī. Texts and Studies on the Development and History of Kalām*. Edited by Dimitri Gutas. Aldershot: Ashgate Variorum, vol. II.

Frank, Richard M. 2008. *Classical Islamic Theology: The Ashʿarites. Texts and Studies on the Development and History of Kalām*. Edited by Dimitri Gutas. Aldershot: Ashgate Variorum, vol. III.

Ghaly, Mohammed. 2022. Biomedical Scientists as Co-Muftis: Their Contribution to Contemporary Islamic Bioethics. *Islamic Bioethics* 29: 286–309. [CrossRef]

Ghaly, Mohammed. 2024. *Islamic Ethics and Incidental Findings: Genomic Morality Beyond the Secular Paradigm*. SpringerBriefs in Ethics. Cham: Springer.

Goodman, Lenn E. 1971a. Ghazâlî's Argument from Creation. (I). *International Journal of Middle East Studies* 2: 67–85. [CrossRef]

Goodman, Lenn E. 1971b. Ghazâlî's Argument from Creation. (II). *International Journal of Middle East Studies* 2: 168–88. [CrossRef]

Griffel, Frank. 2009. *Al-Ghazālī's Philosophical Theology*. New York: Oxford University Press.

Griffel, Frank. 2021. *The Formation of Post-Classical Philosophy in Islam*. New York: Oxford University Press.

Guessoum, Nidhal. 2011a. *Islam's Quantum Question: Reconciling Muslim Tradition and Modern Science*. New York: I.B. Tauris.

Guessoum, Nidhal. 2011b. Review of Islam and Biological Evolution: Exploring Classical Sources and Methodologies by David Solomon Jalajel. *Journal of Islamic Studies* 22: 476–79. [CrossRef]

Hallaq, Wael B. 2018. *Restating Orientalism: A Critique of Modern Knowledge*. New York: Columbia University Press.

Harvey, Ramon. 2021. *Transcendent God, Rational World: A Māturīdī Theology*. Edinburgh: Edinburgh University Press.

Hassan, Laura. 2020. *Ashʿarism Encounters Avicennism: Sayf al-Dīn al-Āmidī on Creation*. Piscataway: Gorgias Press.

Hoover, Jon. 2007. *Ibn Taymiyya's Theodicy of Perpetual Optimism*. Leiden: Brill.

Ibn Qudāma. 2012. The Censure of Speculative Theology (Taḥrīm al-Naẓar fī Kutub Ahl al-Kalām), 2nd ed.Edited and Translated by George Makdisi. Edinburgh: Gibb Memorial Trust.

İskenderoğlu, Muammer. 2002. *Fakhr al-Dīn al-Rāzī and Thomas Aquinas on the Question of the Eternity of the World*. Leiden: Brill.

Jackson, Sherman A. 2009. *Islam and the Problem of Black Suffering*. Oxford: Oxford University Press.

Jackson, Sherman A. 2024. *The Islamic Secular*. Oxford: Oxford University Press.

Jaffer, Mahdiyah, Aasim I. Padela, and Gurch Randhawa, eds. 2022. *Organ Donation in Islam: The Interplay of Jurisprudence, Ethics, and Society*. Lanham: Rowman & Littlefield.

Jalajel, David Solomon. 2009. *Islam and Biological Evolution: Exploring Classical Sources and Methodologies*. Cape Town: University of the Western Cape.

Jalajel, David Solomon, and Shoaib Ahmed Malik. 2025. The Role of Classical Sunnī Theology in Islam and Science: Responding to Nidhal Guessoum. *Zygon: Journal of Religion and Science*. Forthcoming.

Kara-Ali, Mustapha. 2014. Constructivism at the Birth of the Scientific Revolution: A Study of the Foundations of Qushjī's Fifteenth Century Astronomy. Ph.D. dissertation, International Islamic University Malaysia, Kuala Lumpur, Malaysia.

Karagöz, Nail. 2018. Argumentations in Proving Attributions of Prophets in Sanūsī's Treatise, Umm al-Barāhīn. *Kader* 16: 113–28. [CrossRef]
King, David A. 1996. Astronomy in Islamic Society, Qibla, Gnomonics, and Prayer-Times. In *Encyclopedia of the History of Arabic Science*. Edited by Roshdi Rashed. London: Routledge, vol. 1, pp. 132–57.
Koca, Özgür. 2020. *Islam, Causality, and Freedom: From the Medieval to the Modern Era*. Cambridge: Cambridge University Press.
Koehrsen, Jens. 2021. Muslims and Climate Change: How Islam, Muslim Organizations, and Religious Leaders Influence Climate Change Perceptions and Mitigation Activities. *WIREs Climate Change* 12: e702. [CrossRef]
Koons, Robert C., William M. R. Simpson, and Nicholas J. Teh, eds. 2018. *Neo-Aristotelian Perspectives on Contemporary Science*. London: Routledge.
Koperski, Jeffrey. 2020. *Divine Action, Determinism, and the Laws of Nature*. London: Routledge.
Kopf, Simon Maria. 2023. *Reframing Providence: New Perspectives from Aquinas on the Divine Action Debate*. Oxford: Oxford University Press.
Lazzari, Edmund Michael. 2024. *Miracles in Said Nursi and Thomas Aquinas: Non-Noninterventionist Approaches to Divine Action and the Sciences*. Abingdon: Routledge.
Lumbard, Joseph E. B. 2022. Decolonizing Qurʾanic Studies. *Religions* 13: 176. [CrossRef]
Lumbard, Joseph E. B. 2025. Islam, Coloniality, and the Pedagogy of Cognitive Liberation in Higher Education. *Teaching in Higher Education*, 1–11. [CrossRef]
Malik, Shoaib Ahmed. 2021a. Al-Ghazālī's Divine Command Theory: Biting the Bullet. *Journal of Religious Ethics* 49: 546–76. [CrossRef]
Malik, Shoaib Ahmed. 2021b. *Islam and Evolution: Al-Ghazālī and the Modern Evolutionary Paradigm*. Abingdon: Routledge.
Malik, Shoaib Ahmed. 2023. Adam, Eve, and Human Evolution: Is There a Conflict? In *Islamic Philosophy of Religion: Essays from Analytic Perspectives*. Edited by Mohammad Saleh Zarepour. London: Routledge, pp. 143–62.
Malik, Shoaib Ahmed. 2024a. Artificial Intelligence and Islamic Thought: Two Distinctive Challenges. *Journal of Islamic and Muslim Studies* 9: 123–45. [CrossRef]
Malik, Shoaib Ahmed. 2024b. Extraterrestrial Intelligent Life and Islamic Beliefs: Investigating Six Potential Conflicts. In *Islamic Theology and Extraterrestrial Life: New Frontiers in Science and Religion*. Edited by Shoaib Ahmed Malik and Jörg Matthias Determann. London: I.B. Tauris, pp. 139–57.
Malik, Shoaib Ahmed, and Nazif Muhtaroglu. 2022. How Much Should or Can Science Impact Theological Formulations? An Ashʿarī Perspective on Theology of Nature. *European Journal of Analytic Philosophy* 18: 5–36. [CrossRef]
Malik, Shoaib Ahmed, Hamza Karamali, and Moamer Yahia Ali Khalayleh. 2022. Does Criticizing Intelligent Design (ID) Undermine Design Discourse in the Qurʾān? A Kalāmic Response. *Zygon: Journal of Religion and Science* 57: 490–513. [CrossRef]
Mihirig, Abdurrahman Ali. 2022. The Existence of Arguments in Classical Islamic Thought: Reply to Hannah Erlwein. *Sophia* 61: 429–44. [CrossRef]
Moad, Edward Omar. 2023. *Coherence of the Incoherence: Between Al-Ghazālī and Ibn Rushd on Nature and the Cosmos*. Piscataway: Gorgias Press.
Morrison, Robert G. 2013. Astronomy in Islam. In *Encyclopedia of Sciences and Religions*. Edited by Anne L. C. Runehov and Lluis Oviedo. Dordrecht: Springer. [CrossRef]
Olson, Caitlyn. 2020. Beyond the Avicennian Turn: The Creeds of Muḥammad b. Yūsuf al-Sanūsī (d. 895/1490). *Studia Islamica* 115: 101–40. [CrossRef]
Padela, Aasim I. 2021. *Medicine and Shariah: A Dialogue in Islamic Bioethics*. Notre Dame: University of Notre Dame Press.
Padela, Aasim I. 2024. *Maqāṣid al-Sharīʿa and Biomedicine: Bridging Moral, Ethical, and Policy Discourses*. Herndon: The International Institute of Islamic Thought.
Plantinga, Alvin. 2011. *Where the Conflict Really Lies: Science, Religion, and Naturalism*. Oxford: Oxford University Press.
Pormann, Peter E., and Emilie Savage-Smith. 2007. *Medieval Islamic Medicine*. Edinburgh: Edinburgh University Press.
Price, Elizabeth G. 2024. *The Barāhima's Dilemma: Ibn al-Rāwandī's Kitāb al-Zumurrud and the Epistemological Turn in the Debate on Prophecy*. Berlin: De Gruyter.
Ragab, Ahmed. 2018. *The Medieval Islamic Hospital: Medicine, Religion, and Charity*. Cambridge: Cambridge University Press.
Rassool, G. Hussein. 2018. *Evil Eye, Jinn Possession, and Mental Health Issues: An Islamic Perspective*. Abingdon: Routledge.
Saliba, George. 2007. *Islamic Science and the Making of the European Renaissance*. Cambridge: The MIT Press.
Salim, Emil, and Shoaib Ahmed Malik. 2021. Creatio Continua and Quantum Randomness. In *Abrahamic Reflections on Randomness and Providence*. Edited by Kelly James Clark and Jeffrey Koperski. Cham: Springer Nature, pp. 243–64.
Salimi Turkamani, Hojjat. 2023. The Role of Islam in Realizing the Goals of Climate Change Law: From Theory to Practice? *Journal for European Environmental & Planning Law* 20: 24–50. [CrossRef]
Schmidtke, Sabine, ed. 2016. *The Oxford Handbook of Islamic Theology*. Oxford: Oxford University Press.
Serrano-Ruano, Delfina. 2023. The Duration of Pregnancy in Contemporary Islamic Jurisprudence (Fiqh) and Legislation: Tradition, Adaptation to Modern Medicine, and (In)consequences. *Muslim World* 113: 367–88. [CrossRef]

Shihadeh, Ayman. 2005. From al-Ghazālī to al-Rāzī: 6th/12th Century Developments in Muslim Philosophical Theology. *Arabic Sciences and Philosophy* 15: 141–79. [CrossRef]
Shihadeh, Ayman. 2006. *The Teleological Ethics of Fakhr al-Dīn al-Rāzī*. Leiden: Brill.
Shihadeh, Ayman. 2015. *Doubts on Avicenna: A Study and Edition of Sharaf al-Dīn al-Masʿūdī's Commentary on the Ishārāt*. Leiden: Brill.
Siddiqui, Sohaira. 2024. Anglo-Muhammadan Uṣūl al-Fiqh?: The Development of Colonial Legal Theory in British India. *The Muslim World* 114: 75–91. [CrossRef]
Silva, Ignacio. 2021. *Providence and Science in a World of Contingency: Thomas Aquinas' Metaphysics of Divine Action*. London: Routledge.
Sobirin, Mohamad, and Karimatul Khasanah. 2023. The Pesantren Scholars' Fatwa on Global Warming and Climate Change: An Integrative Analysis of Islamic Law, Theology, and Environmental Sciences on the Practice of Multidisciplinary Ijtihad. *Cogent Arts & Humanities* 10: 2193023. [CrossRef]
Stearns, Justin K. 2011. *Infectious Ideas: Contagion in Premodern Islamic and Christian Thought in the Western Mediterranean*. Baltimore: Johns Hopkins University Press.
Stearns, Justin K. 2021. *Revealed Sciences: The Natural Sciences in Islam in Seventeenth-Century Morocco*. Cambridge: Cambridge University Press.
Suleiman, Farid. 2024. *Ibn Taymiyya and the Attributes of God*. Leiden: Brill.
Tabaczek, Mariusz. 2023. *Theistic Evolution: A Contemporary Aristotelian-Thomistic Perspective*. Cambridge: Cambridge University Press.
Taji-Farouki, Suha, ed. 2006. *Modern Muslim Intellectuals and the Qur'an*. Oxford: Oxford University Press.
Treiger, Alexander. 2014. Origins of Kalām. In *The Oxford Handbook of Islamic Theology*. Edited by Sabine Schmidtke. Oxford: Oxford University Press, pp. 23–40.
Ullmann, Manfred. 1978. *Islamic Medicine*. Edinburgh: Edinburgh University Press.
Winter, Tim, ed. 2008. *The Cambridge Companion to Classical Islamic Theology*. Cambridge: Cambridge University Press.
Wolfson, Harry Austryn. 1976. *The Philosophy of the Kalam*. Cambridge, MA: Harvard University Press.

Disclaimer/Publisher's Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.

religions

MDPI

Article

Some Eastern Orthodox Perspectives on Science-Engaged Theology (and Their Relevance to Western Christians)

Christopher C. Knight

The Institute for Orthodox Christian Studies, Cambridge CB5 8BJ, UK; fatherxopher@gmail.com

Abstract: An Eastern Orthodox understanding of science—that of Christopher C. Knight—is presented as a contribution to science-engaged theology that has implications for western Christian reflection on science as a contemporary locus theologicus. Three areas of enquiry are discussed: natural theology, the human mind in its relationship to God, and divine action. It is suggested that in each of these areas, Orthodox perspectives can provide links between the differing perspectives to be found among western Christians and provide new pathways for theological exploration on an ecumenical basis.

Keywords: divine action; Eastern Orthodoxy; idealism; mind; natural theology; science-engaged theology

1. Science as a Locus Theologicus

Within Eastern Orthodox Christianity—with its characteristic stress on the thinking of eastern patristic writers[1]—there are still several competing approaches to the question of how the sciences of our time should be evaluated and used theologically. Of these approaches, my own is arguably the one that most fully attempts to develop the idea of science as a contemporary *locus theologicus*, since my attitude is that we can see the sciences of our time as providing an opportunity not only to deepen our theological understanding, but also to see in new ways how, as the psalmist puts it, "the heavens declare the glory of the Lord". It is on this approach that I shall focus in what follows.[2]

My work in this area does not suggest that scientists need in any way take theological perspectives into account, but rather that theological interpretation of robust scientific theories allows clarification of certain important theological questions. This clarification relates primarily to three issues: the character of natural theology, our understanding of the human mind in its relationship to God, and the question of how God acts in the world. Inevitably, in the present essay, there is insufficient space to address these issues adequately (although the references to my previous work will provide the reader with an indication of where I have addressed them more fully). My purpose here is not, however, to provide an exhaustive account of my approaches to these issues but to indicate the way in which they represent one of the ways in which theologians are now increasingly seeing science as an important resource for theological thinking. In what follows, I shall therefore simply outline my views on how Orthodox perspectives can illuminate these issues and indicate how this illumination may often be seen as providing links between the differing scholarly perspectives that predominate in the various western Christian communities.

2. Natural Theology

Those who speak about *natural theology* are often influenced in their understanding of that term by their ecclesiastical or academic background. In relation to ecclesiastical affiliation, Roman Catholics (and many Anglicans) tend to understand and defend natural theology in terms that reflect the definition of it upheld by many philosophers of religion: as the attempt to develop arguments for the certainty or probability of the reality of God on

the basis of "premises that neither are nor presuppose any religious beliefs" (Alston 1991, p. 289). Sometimes, these arguments have been purely philosophical in form, and they have sometimes related at least partly to aspects of the empirical world, so that scientific understanding has been incorporated into these philosophical arguments. However, as the editor of the *Oxford Handbook of Natural Theology* once put it, there has historically been a "rich diversity of approaches to, and definitions of, natural theology", partly because of "its inherently interdisciplinary character" (Manning 2013, p. 1). One aspect of the diversity of which he speaks is that some theologians—especially in certain Protestant traditions—either deny the validity of natural theology or else see the need for a more nuanced understanding of its character and role than has been usual.

This latter view has influenced many of those exploring science-engaged theology because of the way in which a natural theology argument that was at one time highly influential in the English-speaking world—William Paley's "watchmaker" version of the design argument—was demolished by the kind of evolutionary understanding pioneered by Charles Darwin in the mid-nineteenth century.[3] This demolition made many science-engaged theologians of the twentieth century more attentive to the way in which Protestant scholars had often become suspicious of natural theology because of the attack on it articulated by Karl Barth.

This attack was based on the way in which natural theology had often been presented—especially in the scholastic tradition—as something independent of any faith commitment, so that it could be seen as providing "preambles of faith" (*praeambula fidei*). This understanding seemed to Barth and his followers to have an insufficient sense of the importance of God's revelation of himself in historical acts, so that it became common in the Protestant world to argue that theologians should either shun natural theology arguments altogether or, at the very least, insist on integrating such arguments into a theology based on revelation in historical events. As Thomas Torrance (one of the leading proponents of this latter view) once put it, natural theology should not "be pursued in its traditional abstractive form, as a prior conceptual scheme on its own, but must be brought within the body of positive theology and be pursued in indissoluble unity with it" (Torrance 1985, p. 40).

Torrance's view may, I have argued (Knight 2021; 2022, pp. 5–16), be seen as reflecting an important strand of Orthodox, as well as of Protestant thinking. Not only did the Cappadocian Fathers, in the patristic era, modify the pre-Christian tradition of natural theology in a way that incorporated aspects of what Torrance calls "positive" theology.[4] In addition, we need to take into account the Orthodox understanding of the theological task, which—especially in the hesychastic strand of Orthodox thinking[5]—stresses the importance of the *noetic* perception that arises from the intuitive mental capacity that ancient Greek philosophers called the *nous*.

This approach is reflected in the Orthodox understanding of contemplation—*theoria* in Greek—which is not seen primarily as an activity based on discursive rationality but as the *direct* perception or vision of the *nous* (the common translation of *nous* into English as "intellect" is potentially misleading in this respect because the modern English notion of the intellect is focused more on discursive reasoning than on the essentially intuitive apprehension that was important for patristic understanding). This focus on direct perception is underlined by Vladimir Lossky's insistence that Orthodox theology is essentially an experiential or "mystical" pursuit and that, as such, it must be approached "in such a fashion that instead of assimilating the mystery to our mode of understanding we should, on the contrary, look for a profound change, an inner transformation of the spirit, enabling us to experience it mystically" (Lossky 1957, p. 8).

These understandings are reflected in the notion of the contemplation of nature—*theoria physike*—which was developed in the Christian east at least from the time of the fourth-century writer, Evagrius Ponticus (see, e.g., Lollar 2013). In this kind of contemplation, "the same kind of noetic, contemplative deportment that Plato had reserved solely for the eternal forms, denuded of any earthly encumbrance, is now directed towards the cosmos itself" (Foltz 2014, pp. 248–49). Evagrius saw this contemplation of nature as

involving two things: training in the use of both philosophical and scriptural insights, and also "a radically altered state in which the mystic is transformed" (Bradford 2012, p. 110). While this understanding was later often broadened so as to be applicable to all Christians, and not just to highly educated ones, the notion of the importance of noetic apprehension and of spiritual transformation was still maintained, at least to the extent that ascetical effort was seen as an essential component of the contemplative task.

There have, admittedly, been recent defenders of a kind of *preambula fidei* natural theology within Orthodoxy, often influenced by the work of the philosopher of religion, Richard Swinburne (a convert to Orthodoxy from Anglicanism), and by the fact that historians have been able to point to what seem to be straightforward natural theology arguments in the works of eastern patristic authors. These kinds of defence have been expressed most clearly, perhaps, in a recent book of essays (Bradshaw and Swinburne 2021), in which several of the contributors attempt to defend natural theology in its *praeambula fidei* form. It is noteworthy, however, that in this book, there are significant differences in emphasis to be found in these different contributions. In particular, while one of the book's editors, the philosopher of religion, Richard Swinburne, seems to defend a straightforward form of rationalistic natural theology, his fellow editor, David Bradshaw, offers a far more nuanced historical and theological understanding.

In his introduction to the book, Bradshaw notes not only that eminent Orthodox scholars—Sergius Bulgakov, Vladimir Lossky, Christos Yannaras, and John Zizioulas—have viewed natural theology "as at best religiously useless, in that it does not lead to a true knowledge of, or encounter with God; and at worst as positively harmful". In addition, he goes on to make the vital point that the Greek patristic writers "certainly recognized a distinction between faith and reason [but] tended to think of them as mutually supporting and interpenetrating. Faith begins as an innate orientation towards the good, and reason, which depends on faith, is the attempt to bring this innate orientation to its full realization. No point in this process is autonomous and self-directed, for God is the good, and he is constantly active presenting the good to us in various forms, so that every choice we make is in some sense a response to him. It is this doubly synergistic view—involving the synergy of human faith and reason and of both with God—which determines the definite but subordinate role that the Greek Fathers gave to natural theology" (Bradshaw 2021, p. 3). This is, for me, an insightful comment, but I have urged that we need to expand it in terms of the concept of noetic contemplation in order to distance Orthodox thinking even more from an autonomous, rationalistic natural theology of the kind that Swinburne seems to defend.

There are three ways in which theologians of Western Christian traditions can incorporate this focus on noetic apprehension into their own thinking about natural theology. One is through the way in which one of the most influential Western "spiritual writers" of the twentieth century, Thomas Merton, has expressed the need for contemplation of nature at least partly in terms of that concept's Eastern Christian lineage (see St. John 1998). The second is through the kind of focus on the Greek patristic tradition that has been characteristic of the twentieth-century *Resourcement* movement within the Roman Catholic community, which has often been critical of the developments in scholastic thinking that took place after the time of Thomas Aquinas (Boersma 2009). The third—which is linked to this *Resourcement* sensibility—arises from recognition that the scholastic *praeambula fidei* notion, as it developed after the time of Aquinas, may not correspond to Aquinas's own approach.

Roberto di Ceglie, for example, has noted that while the truths available only through faith cannot, for Aquinas, make a direct, evidential contribution to natural reasoning, God's influence on those who manifest revelation-based faith is such that they "take the truths of faith as *orientation* and *criterion* for their rational enquiry, *orientation* because they aim to confirm by reason what they already believe, *criterion* because in case of a contradiction, reason must be considered as surely mistaken and rational investigation must start anew from the beginning" (di Ceglie 2016, p. 143). Moreover, the natural theology of Aquinas—

usually thought of as the classic example of the *praeambula fidei* approach—is arguably only properly understood when we recognize that he not only practised both theology and natural theology, but did so—as James Brent (2020) has put it—"rather freely, and blended them into a unified architectonic wisdom. His architectonic contains both theology and natural theology (sometimes they are difficult to sort out)".

In light of all these considerations, I have suggested that Christians of both east and west can still see natural theology as valid provided that they modify the *praeambula fidei* notion of its character and recognize, with Torrance, that the relationship between its arguments and other kinds of religious knowing needs to be understood in a more complex way. I have also argued, however, that Torrance's own view of this complexity must be modified in a way that allows, as he does not, for the noetic aspect of this integration, so that we move closer to Alister McGrath's revision of his outlook, in which—in relation to the cosmos—the focus is on the way in which "the divine light of the logos allows us to 'see' the created order in the proper way, so that human limitations in discerning the divine might be overcome" (McGrath 2008, p. 173). Ultimately, however, I believe that this focus can be clarified adequately only through the Orthodox "mystical" understanding in which—as Lossky (1957, p. 43) has put it—"theology will never be abstract, working through concepts, but contemplative: raising the mind to those realities which pass all understanding".

3. The Human Mind and the Mind of God

When Christians think about what it is to be human, they sometimes have in mind an ancient Greek or more modern kind of dualism, in which body and mind are seen as distinct entities in some kind of loose association. In recent years, however, there has been a revival of a more traditional Christian understanding, in which body and mind are seen as components of a unified being. This revival has come about not only because many theologians have reacted against the dualism common in certain periods in the past, but also—especially among science-engaged theologians (see e.g., Brown et al. 1998; Murphy 2006)—because analyses of brain scanning data and of the effects of brain damage have increasingly led cognitive scientists to emphasize and elucidate the physical basis of human mental functioning, at least as this is usually understood.

However, in their exploration of the implications of scientific insights in this field, these science-engaged theologians have until recently given little or no consideration to unconscious processes, whether of the kind assumed in the notion of noetic apprehension or of the kind in which a few of them have recently begun to take an interest because of their recognition of differences between the functioning of the two hemispheres of the brain. These differences have been made known to many through the work of Iain McGilchrist (2019), whose perspectives have been influential well beyond the boundaries of the scientific and theological communities. This influence arises from the way in which he focuses not only on scientific insights into brain functioning, but also on the way in which it is becoming increasingly recognized that our present culture is one in which we have, for several centuries, attributed great value to the capacities that arise from the left hemisphere of the brain—our quantitative and analytical capacities—but little value to the capacities that arise from the right hemisphere, which are related to creativity, emotion and intuition. McGilchrist's analysis of this lack of balance has led, among other things, to a new appreciation, among science-engaged theologians, of the concept of *spiritual intelligence* and—among a few of them at least—to explorations linking this concept to the ancient concept of the *nous*.[6]

One way of exploring this link is through the strand of "disability theology" that focuses on the kind of cognitive impairment associated with conditions such as Alzheimer's disease. In relation to this, the Orthodox scholar, Petre Maican, has pointed out the relevance of the thinking of the Protestant theologian, John Swinton, who has argued, on Biblical grounds, that it is wrong to see human beings—as is often the case—primarily or only as the sum of their cognitive capacities and the web of social relationships that they establish throughout their lives. We are, Swinton argues, *persons* and—from a theological

perspective—the loss of cognitive capacities and social relationships in old age does not diminish what is most important about personhood (Swinton 2012). The important thing, he argues, is that our personhood arises from the "breath of God" (*nephesh*),[7] which is, according to the Book of Genesis (2:7; 6:17; 7:22), breathed into all living beings. Our true identity, he argues, is found in God, and it will be revealed to us fully only in the "world to come". The spiritual identity with which we are endowed by God is, he suggests, not lost in dementia. Rather, it continues to exist in God even when the sum of our cognitive abilities and our web of human relationships have been lost. Swinton's account may, Maican (2024) argues, be expanded in terms of the concept of the *nous*, and this reflects my own emphasis on the way in which that concept is still used within the Orthodox tradition, underlining the way in which the *nous* should be seen as in some sense what truly links the human mind directly to the "mind of God".

In general, however, most of those involved in science-engaged theology have not yet seen this Orthodox focus on the *nous* as relevant to their exploration of mental processes, partly because their focus has tended to be on attempting to refute the widespread reductionistic view that mental processes are nothing but epiphenomena of physical brain processes. This attempt at refutation has frequently used the philosophical notion of *emergence* to defend the ontological reality of mental experience, using this concept to insist that "bottom up" causality—the only causality acknowledged in reductionist analysis—must be seen as being supplemented by "top down" causal effects, so that the relationship between mind and brain is seen in terms of complex feedback loops. According to this view, the qualities often associated with the term *soul*—discursive thought, the sense of free will, and so on—are not simply to be dismissed as epiphenomena with no ultimate reality.[8]

This kind of analysis is not (as we shall see) without merit, but it has the disadvantage that, as it stands, it is difficult to reconcile with the notion that these "soulish" qualities can have any reality apart from the body, so that it has become fashionable among some science-engaged theologians to discard the word *soul* and replace it with Warren Brown's term, *embodied soulishness* (see Brown and Strawn 2012). Some, in this context, have suggested that it is helpful to think about the distinction between the body and the mind in terms of the distinction between hardware and software in an electronic computer. Without the software/mind, they say, the hardware/body has no real purpose; but without the hardware/body, the software/mind has no natural means of functioning. Just as, in a computer, software can operate only through appropriate hardware, so, according to this analogy, the human mind requires a body of some kind in order to function.

This hardware–software analogy may not, as we shall note, be as useful as it may initially seem to be. It has been helpful, nevertheless, in making many science-engaged theologians wary of the dualistic notion of the eschatological existence of disembodied souls, which is now often seen as untenable because it assumes software functioning without appropriate hardware. It has thus provided these theologians with a plausible argument for upholding the traditional Christian concept of the eschatological state, in which humans in the "age to come" are seen not as disembodied souls, but as possessing *resurrection bodies*. Our natural state—both in this world and the next—is not, they have argued, one in which our "software" alone can constitute our being. Moreover, since different types of computer hardware can be used to operate any particular software, this analogy has allowed these theologians to conceive of the resurrection body as significantly different to the earthly one (this notion is sometimes seen as a novel one, but in fact—albeit for different reasons—it was common in the Eastern part of the Christian world at least from the fourth century).[9]

It is observable that many science-engaged theologians now adopt this understanding of the body–mind relationship in a way that uncritically accepts an aspect of the materialist framework of our current scientific culture. They focus on how the human mind emerges from matter but very little on how, in a theological perspective, matter has its origin in the "mind of God". This means that they have rejected any form of philosophical *idealism*, in which mind is given ontological priority over matter. I have challenged this dismissal

of idealism elsewhere, partly on the basis of aspects of Keith Ward's defence of idealism (Ward 2012) and partly on the basis of the way in which Gregory of Nyssa's views—based on his understanding of the *nous*—exhibit interesting parallels not only with Berkeleyan idealism, but also with questions that arise from quantum mechanics about the role of the observer in "creating" reality.[10]

This argument in defence of idealism is, however, too complex to be dealt with adequately here, and the reader who is interested in that argument will need to look at what I have said elsewhere (Knight 2020, pp. 107–11; 2022, pp. 26–31). One corollary of this argument may, however, be summarized relatively briefly. This arises from the way in which I have criticized the way in which certain science-engaged theologians have assumed that our state in the "world to come" will be one in which, while the earthly body may be very significantly modified when it is transformed into a resurrection body, the earthly mind will continue much as it is in this life, differing only insofar as certain faculties, such as memory, may be made perfect rather than being (as at present) incomplete and fallible.

This assumption ignores two factors, one scientific and one theological. The scientific one is that most cognitive scientists no longer accept in any straightforward way the analogy in which mental processes constitute the functioning of "software" that will give the same results regardless of the hardware that enables it to function. Mental processes, they increasingly stress, are not only emergent from but also *conditioned by* the physical substrate with which they are associated. This seems to be true not only in relation to the very specific way in which the brain works, but also—if certain formulations of the notion of "embodied cognition" are accepted—in relation to the interactions between the mind and the rest of the body and between the mind and the world beyond the body.[11] If we accept these insights, then—unless the resurrection body and resurrection cosmos are assumed to be identical to those we experience in this life—the "resurrection mind" that will be associated with the resurrection body and its environment will inevitably be rather different from our earthly mind.

The related theological issue is that the Christian thinking of the early centuries did not always take the view that seems to be taken for granted in much recent theological discussion of this topic. The continuity of our mental faculties in their transition from this world to the next was not simply assumed. The eastern patristic tradition, in particular, often made a firm distinction between our present, biological state—in mythical terms, viewed as the result of "the Fall"[12]—and the embodied state for which we were originally made and are ultimately intended. In this kind of view, the "original" and eschatological human state is something that has, in some sense, been "covered up" by our present biological state—a view often expressed in the patristic period in terms of an allegorical interpretation of the way in which God is reported to have given "garments of skin" to those expelled from Eden (Genesis 3:21).[13]

A useful exploration of this aspect of eastern patristic thinking is that of Panayiotis Nellas, who makes the interesting point that the patristic interpretation of our "garments of skin" relates not only to the physical body—as some scholars have supposed—but also to the soul. What such scholars overlook, he notes, is that writers like Gregory of Nyssa use the term *garments of skin* to refer to "the entire postlapsarian psychosomatic clothing of the human person". For Gregory, he stresses, the Fall has brought about a situation in which the "functions of the soul . . . have also become 'corporeal' along with the body . . .. [they] form together with the body 'the veil of the heart . . . the fleshy covering of the old man'" (Nellas 1997, pp. 50–52). A corollary of this perspective would seem to be that both body and soul are to be transformed when the "garments of skin" are thrown off in our eternal life.

For many in our present era, the particular way in which this discontinuity between our present and eschatological states was perceived may seem unpersuasive. However, what I have called the "spiritual instinct" that lies behind early understandings may still be worthy of attention even when the particular way in which that instinct was expressed may now seem questionable. In this case, the need for attentiveness to that instinct

arises from the scientific insight that at least some human mental processes are not only inextricably linked to human bodies but also strongly conditioned by them. Given this strong conditioning, it seems to follow that a resurrection body that is significantly different from the earthly one implies precisely what Gregory of Nyssa seems to have envisaged: an associated mind that is also significantly different from that which we now possess.

This notion is, of course, incompatible with the widespread Christian hope that eternal life will mean the survival of our "personalities". However, we need to recognize that our usual focus on personality may be no more than a kind of egoism, a spiritual blindness and self-centeredness to be overcome.[14] Related to this perception is another important insight that may perhaps inform our thinking about eternal life. This is the notion that what we currently tend to think of as constitutive of our minds and personalities—things like our discursive rational faculty and our memories—may in fact be no more than servants, in this world, of something more central to our being: the *nous* (here, as we have seen, John Swinton's analysis of personhood in relation to dementia, as interpreted by Petre Maican, seems to point in a very similar direction).

The point here is that, in the kind of late antique and medieval Christian understanding that focused on the concept of the *nous*, our spiritual journey in this world was often seen as having as one of its prime aims the purification of that *nous*, the overcoming of the distortion or darkening of its functions in our present "fallen" state. Often, in Christian literature, the *nous* was described as the "eye" of the soul, and it was the full opening of this eye that was seen as making possible what is sometimes called, in Western Christian theology, the beatific vision.[15] In light of this understanding, it seems possible to understand the functioning of our "resurrection minds" largely, or even completely, in terms of the expanded and transformed functioning of the *nous*. This suggests that our transition to the "world to come" may in fact involve the shedding of all kinds of mental activity other than the direct intuitive knowing that arises from the perfected *nous* (something of this kind—albeit expressed in different terms—certainly seems to be hinted at in some of the most well-known New Testament passages that refer to our eschatological state).[16]

Might it be, then, that those of us who are believers in the eschatological state should recognize that, in that state, we may not know *about* anything, or even "think", in the sense in which we usually use that term? Rather—as Gregory of Nyssa puts it of our ascent to God in this life (Laird 2004, p. 127)—"every form of comprehension" should eventually be abandoned in that ascent. This suggests that, in the "world to come", we will simply *know*—directly and intuitively—in the way that mystics, in their most sublime moments in this life, are said to *know*. If this is valid, then continuity in our existence as unique *persons* will not necessarily involve continuity of much with which we tend to identify ourselves. Rather, it will involve a transformation of our whole being that will be far more radical than we usually appreciate: a casting aside of our "garments of skin" in both their physical and their mental dimensions.

A corollary of this kind of understanding relates to the concept of *emergence*. This corollary is that there would seem to be no theological problem in seeing most aspects of our present functioning—those not intrinsically associated with the *nous*—as emergent properties of our biological bodies, which will cease to function when we die and will not resume their functioning when we receive our resurrection bodies. This permanent cessation of functioning may be seen simply as an aspect of the way in which casting off our 'garments of skin' includes casting off all those 'functions of the soul' which [. . .] have become 'corporeal' along with the body.

4. Divine Action

Orthodox theology has a strong "spiritual instinct" that the world—*as part of the very nature given to it in the act of creation*—has a teleological character. As Doru Costache has rightly put it, science, "epitomized by Darwinian evolution, does not mention the purposefulness of natural movement, whereas [Orthodox] theology . . . considers teleology crucial" (Costache 2019, p. 54). This contrast between science and Orthodox theology is,

however, potentially misleading, even though Costache is correct in this observation that modern scientific insights arise through a methodology that precludes any mention of purpose. However, what he perhaps fails to emphasize sufficiently is that the methodology of modern science *necessarily* avoids the concept of purpose,[17] and that what is important is the way in which at least some scientific insights are susceptible to *theological interpretation* in terms of purpose. This interpretation enables a kind of teleology to be seen as compatible with current scientific understanding. There are two scientific insights that are open to teleological interpretation in this way. These are the "fine tuning" of the universe that is evident from astronomical evidence and the occurrence of "convergent evolution" in the biological world. Both point to the way in which the role of chance in the development of the cosmos is not inconsistent with a broadly predictable outcome (Knight 2020, pp. 146–56).

This way of using the notion of teleology does not involve the kind of teleology that is envisaged in Aristotelian philosophy, but is of a more distinctly theological kind, which, in the model of divine action I have proposed, focuses on eschatology in a way that arises from the Orthodox doctrine of creation developed by Maximus the Confessor (which has evoked much interest in the western Christian world in recent years). In Maximus's model, the fourth gospel's assertion that the *Logos* (Word) of God "became flesh" (John 1:14) is not seen simply as a statement about a historical event. Rather, he develops his understanding through a subtle and profound perception of how everything was, in the beginning, created through this *Logos* (John 1:1–4).

By moulding the philosophical categories available to him to the realities of the Christian revelation, Maximus expresses his faith in terms of the way in which the *Logos* of God is to be perceived, not only in the person of Jesus Christ, but also in the "words" (*logoi*) of all prophetic utterance and in the "words" (*logoi*) that represent the underlying principles by which all created things have their being and act as they do. The incarnation in Jesus Christ is thus seen, not simply as a historical event, to be interpreted—as so often in western Christian thinking—as a "supernatural" intrusion into the natural order. Rather, what occurs in the person of Jesus is, for this strand of theology, intimately linked to the whole history of the redemptive process and to the act of creation itself. It takes up the fourth gospel's insight that the incarnation does not involve "the sudden arrival of an otherwise absent Logos", but rather "the completion of a process already begun in God's act of creation" (Need 2003, p. 403).

It is precisely this Biblical insight that Maximus uses when he develops the *Logos* concept to describe a continuous process from the creation of the cosmos to the Christ event. Lars Thunberg's comment that Maximus envisages "almost a gradual incarnation" (Thunberg 1985, p. 75) may perhaps be imprecise in its terminology. Nevertheless, it points accurately to an important aspect of Maximus's thought, in which he could go as far as to say (in *Ambiguum* 7) that "the one Logos is the many logoi, and the many logoi are the one Logos". This linkage means, according to Andrew Louth (2013, p. 42), that everything in the universe "has its own meaning in its own *logos*, or principle, but . . . all these *logoi* form a coherent whole, because they all participate in the one *Logos* of God". As Kallistos Ware has put it, Maximus describes the *logoi* of created things "in two different ways, sometimes as created and sometimes as uncreated, depending upon the perspective in which they are viewed. They are created inasmuch as they inhere in the created world. But when regarded as God's presence in each thing—as divine 'predetermination' or 'preconception' concerning that thing—they are not created but uncreated". For Maximus, he goes on, the *logos* of each created thing is "God's intention for that thing, its inner essence, which makes it distinctively itself and at the same time draws it towards the divine realm" (K. Ware 2002, p. 160).

The important thing here is that the drawing "towards the divine realm" of which Ware speaks represents an essentially teleological understanding, in which the cosmos is—as Vladimir Lossky (1957, p. 101) has put it—"dynamic . . . tending always to its final end". Central to this understanding is the way in which the *logoi* of created things are, for Maximus, what Paul Blowers (2016, p. 113) has called "principles or signatures of

a creature's essence and nature, teleological 'codes' that project creatures towards their fulfilment in the divine plan". This means, for Maximus, that all things are drawn—by their very nature, and not by some external "force" or "lure"—not only towards the eschatological state but also, arguably, towards various intermediate goals associated with the journey towards that state, so that Maximus's framework may be seen as compatible with scientific evolutionary theory (see, especially, Jackson 2023, 2024). Indeed, as I have argued, anything that contributes towards the journey towards the eschatological state—including both events perceived as miraculous and "responses" to intercessory prayer—would seem to be possible in terms of my own extension of Maximus's model.[18]

The form of teleology envisaged in this extension points, I have argued, towards a model of divine action that is very different to the "causal joint" model that has—despite valid criticisms of its incoherence (Saunders 2002)—been dominant among science-engaged theologians (especially Protestant ones) in recent decades.[19] The model that I have developed not only rejects the causal joint model's concept of temporal "special divine action", which is seen as supplementing the "general divine action" arising from the way in which the world has been created. In addition, although my model may initially seem deistic because of its strong focus on a kind of naturalism, it actually avoids deism because it envisages a "single act" model of divine action in which there is no denial—as there is in classical deism—of the possibility of "miraculous" events or of "responses" to intercessory prayer. The resulting model of divine action is not only comparable to the scholastic *primary and secondary causes* model in certain respects,[20] but it also undermines many Protestant science-engaged theologians' rejection of that model, which is based on the belief it has little explanatory traction in relation to scientific understanding. This undermining comes about because Maximus's model is, as we have seen, not merely philosophical, since it has a strong theological component, which arguably expands the notion of secondary causes in an important way.

Sarah Lane Ritchie, in her analysis of the model I have articulated, has rightly noted that God's act of creation—incorporating the setting up of what I have called "fixed instructions' for all eventualities—is not, for my model, "to be thought of as occurring in the past; to do so is to presume an essentially erroneous relationship between God and time". One should not, she goes on, think of this setting up "as occurring in a far distant past—rather it is eternal and being subjectively experienced within temporal constraints" (Ritchie 2019, p. 286). What is envisaged here is in fact based on an expansion—incorporating "higher laws of nature" of the kind envisaged by Augustine of Hippo (see Pannenberg 2002)—of a very traditional Christian understanding of the origin of the laws of nature.[21] In terms of this very traditional understanding, as Ritchie explains, the model I propose is not one in which we are unable to speak of God's personal "responses" to events in the world. Rather, it is based on the argument that "responsiveness should not be conflated with temporality" (Ritchie 2019, p. 282).

In much of the literature on science-engaged theology, this kind of "single act" model of divine action is dismissed as inconsistent with basic theistic commitments. Often, this is because parallels with the thinking of profound and subtle theologians such as Karl Rahner on this topic are ignored,[22] and any kind of "single act" understanding is simplistically identified with the version of it developed by Maurice Wiles (1986), in which miraculous events are regarded as impossible because temporal divine intervention is denied. As I have argued, however, the notion of higher laws of nature—especially when expanded in terms of the scientific notion of regime change (Knight 2020, pp. 202–7)—makes it possible to question, on both philosophical and theological grounds, Wiles's assumption that the events usually called miraculous can only come about through such intervention. A single-act account, when rooted in a more traditional theological understanding of the kind I have outlined, can be of a quite different kind, in which the central Christian affirmation of the occurrence of events that seem "above nature" is not regarded as questionable but is actually reinforced.

This is especially the case because my model is further reinforced by the Orthodox sense that being "above nature" is not the same as being "supernatural" in the way that the latter term is often understood in the West. The point here is that, while Orthodoxy makes a strong distinction between the created and the uncreated, it does this in a way that denies the separation between the natural and the supernatural that has become quasi-instinctive in much western Christian thinking, and in this respect its approach is comparable to the critique of that separation to be found in the *Resourcement* movement in the Roman Catholic Church (see Boersma 2009). However, the Orthodox approach goes further because, I have suggested (Knight 2020, pp. 177–95), it has a distinctive understanding in which events that seem "above nature" may be seen as anticipations of the "natural" as it is to be experienced fully in the "world to come". Such events are, in this sense, only above the "subnatural" state in which we exist in a "fallen" cosmos, not above the "truly natural" world that is God's original and ultimate intention for the created order.

What is important in relation to our present study is not, however, the detailed reasoning behind my own proposed "naturalistic" model of divine action, or even its implications for issues such as miraculous events and the purpose of intercessory prayer. What is important is the fact that the model exhibits significant parallels with the two other components of what Sarah Lane Ritchie has described as a "theological turn" in 21st century discussions of divine action. These are the revision of scholastic understandings developed within the Roman Catholic world by Michael Dodds (2012) and the focus on the Holy Spirit developed within the Pentecostal/charismatic strand of Protestant thinking by James Smith (2010) and Amos Yong (2011).

In these parallel developments, Ritchie notes, the metaphysical basis of the causal joint model is radically challenged in much the same way as in my own model. All of the proponents of the theological turn—despite their different starting points—challenge the causal joint model's assumption of an essentially autonomous universe that God must influence from "outside". The challengers instead posit, in their various ways, a universe that is to be understood only in terms of God's presence within it, arguing "that standard causal joint proposals . . . are dependent upon question-begging metaphysical commitments, which in turn inadequately frame the entire divine action conversation. These presuppositions involve basic ontological questions about the God–nature relationship, and especially the question of what, exactly, it means to be properly 'natural'" (Ritchie 2017, p. 361).

Ritchie points to the way in which—as in the Thomistic approach of Dodds and in what she calls my own "panentheistic" framework—the "pneumatological naturalism" of Yong and Smith reverses the methodology of the causal joint divine action theory. Smith, she notes, labels his own version of this perspective as *enchanted naturalism*, and this is similar, she observes, to the understandings to be found in Dodds' approach and in my own work (it is surely significant that Smith's term, *enchanted naturalism*, and my own comparable use of the term *enhanced naturalism* represent independent choices of phraseology). The pneumatological framework for divine action developed by Smith and Yong is able, in Ritchie's judgment, to perform the same metaphysical function as that performed by panentheism in my own approach, so that to be natural is seen as being fundamentally involved with God at the most basic level.

One aspect of this parallelism relates to the basic understanding of nature. Just as, for the Eastern Orthodox framework, there is "no 'pure' nature to which grace is added as a supernatural gift" (Lossky 1957, p. 101), so also, says Ritchie, the pneumatologists "deny the implicit deism that would legitimize the notion of an autonomous natural world apart from the Spirit of God" (Ritchie 2017, p. 374). Another similarity lies in the understanding of miraculous events. Such events are, for my own approach, an aspect of the "natural" functioning of the world that may be spoken of in terms of regime change or higher laws of nature. In a comparable way, the pneumatological approach is, Ritchie observes, one in which, if "some events seem more supernatural than others, this is due to varying levels of creaturely response and openness to the Spirit". Such events are, she goes on (quoting Smith), "sped-up modes of the Spirit's more regular presences" (Ritchie 2017, p. 375).

5. Conclusions

What we have seen in relation to the three topics that I have addressed is that while Eastern Orthodox perspectives are in many respects distinctive, they nevertheless manifest significant parallels with views to be found in other parts of the Christian world and may well, as a result, have a part to play in Western Christians' exploration of science-engaged theology.

Pope John Paul II of Rome—paraphrasing an earlier statement by the Dominican theologian, Yves Congar—often said that Christianity needs to "breathe with her two lungs", meaning that the fullness of "faith seeking understanding" requires the theologian to take into account the distinctive insights of both the eastern and the western parts of the Christian world. One aspect of this insight is, for western Christians, the need to acknowledge the validity of the comment about theological methodologies that was once made by Timothy Ware (later Metropolitan Kallistos of Diokleia). Christians in the west, he said, "both Roman and reformed, generally start by asking the same questions, although they may disagree about the answers. In Orthodoxy, however, it is not merely the answers that are different—the questions themselves are not the same as in the west" (T. Ware 1963, p. 9).

As we have seen, this difference in the questions asked in the two main parts of the Christian world does not mean that Christians of east and west cannot learn from one another. In relation to science-engaged theology, in particular, it may well be that the specific perspectives to be found in Orthodoxy can be helpful in providing common ground between the differing opinions to be found among western Christians. This means that Orthodox perspectives on science-engaged theology may well have an important part to play in making science—as a *locus theologicus*—the focus of a truly ecumenical theological endeavour: one in which all strands of Christian thinking can potentially be integrated in a pan-Christian vision.

Funding: This research received no external funding.

Data Availability Statement: No new data were created or analyzed in this study. Data sharing is not applicable to this article.

Conflicts of Interest: The author declares no conflicts of interest.

Notes

1 This is not to say that patristic writers from the west are ignored. There is, however, a tendency among Orthodox scholars to judge much that they see as distorted in Western Christian theology as having its roots in the thinking of Augustine of Hippo, so that his work, together with that of Western patristic writers influenced by him, is often used only selectively.

2 I have previously described this approach as a contribution to the *science-theology dialogue*. In practice, however, the term *dialogue* suggests a reciprocity that is in practice usually absent from discussion, so that, although my approach falls into what Ian Barbour calls "dialogue" in its *theology of nature* component (Barbour 1990, p. 26), it may equally well be described in terms of another phrase that has recently become more commonly used, and that I use in this paper: *science-engaged theology.* This latter term has been popularized by Perry and Leidenhag (2023) and, in an Orthodox context, it has been explored in terms of patristic and neopatristic understandings by Costache (2023).

3 This "watchmaker" argument was in fact so influential that its demolition has become the basis of much atheist rhetoric; see, e.g., Dawkins (1986).

4 The most extended study of the Cappadocians' natural theology is the work by Pelikan (1993), in which the eschatological dimension of their natural theology is emphasized.

5 Hesychasm—a term derived from the Greek for silence or stillness—is the school of thinking and practice that has become dominant in Orthodoxy (and especially in its monastic practice), in part, in modern times, through the influence of the *Philokalia*, an anthology of writings from the fourth to the fifteenth centuries, compiled and edited by Nikodemos of the Holy Mountain and Makarios of Corinth in the eighteenth century.

6 This topic of spiritual intelligence is addressed in general terms by various authors in an edited volume by Dorobantu and Watts (2024). It is also the focus of a forthcoming (2024) special issue of the journal, *Christian Perspectives on Science and Theology*, guest-edited by the same two scholars and based on contributions to the 2023 conference of the International Society for Science

and Religion. The relevance of the *nous* concept is highlighted in the contributions to this latter collection by myself and by Petre Maican.

7 The Hebrew word, *nephesh*, correctly translated as "breath", is frequently mistranslated as "soul"—a term that has connotations in modern English that are not to be found in the Hebrew word (or, indeed, in patristic and medieval Christian thinking about the soul).

8 The current state of the debate about emergence is well represented in the essays in Clayton and Davies (2006).

9 This sense of novelty exists because early Western Christian perspectives on the resurrection body—based on the views of authors like Tertullian—are wrongly assumed to have been accepted throughout the Christian world until relatively recently. For a useful brief summary of the differences between Eastern and Western parts of the Christian world in this respect, see Sherrard (1976, p. 40).

10 In the dominant (Copenhagen) interpretation of quantum mechanics, reality consists of multiple potentialities, only one of which is actualized when an observer "collapses the wave function". This understanding leads, however, to a paradox that is highlighted by the "Schrödinger's Cat" thought experiment, devised by the physicist, Erwin Schrödinger, to illustrate the implications of this paradox, in which a hypothetical cat may be considered both alive and dead simultaneously because its fate is linked to a random event that may (or may not) occur. This paradox is one of the issues that led to the quasi-idealist metaphysics of the quantum physicist, David Bohm, which have been analysed in Orthodox theological terms by both Schooping (2015) and de Grijs and Costache (2023).

11 Embodied Cognition is a growing research program in cognitive science. It emphasizes the formative role the environment plays in the development of cognitive processes, based on a general theory that cognitive processes develop when a tightly coupled system emerges from real-time, goal-directed interactions between organisms and their environment. The nature of these interactions, it is believed, influences the formation and further specifies the nature of developing cognitive capacities. Since embodied accounts of cognition have been formulated in a variety of different ways in each of the sub-fields comprising cognitive science, a rich interdisciplinary research program is emerging. The different conceptions arising from different sub-fields are all based, however, on the belief that one necessary condition for cognition is embodiment, where the basic notion of embodiment is broadly understood as the unique way in which an organism's sensorimotor capacities enable it to successfully interact with its environmental niche. All share a quest for cognitive explanations that capture the manner in which mind, body, and world interact with and influence one another to promote an organism's adaptive success.

12 Patristic thinking did not, we should note, always understand the Genesis account of the Fall in straightforward historical terms. Especially for those strongly influenced by the Origenist tradition, it was often seen as meta-historical, with the Fall being a fall *into* our present space–time universe and biological state. In a comparable way, Maximus the Confessor seems to have seen creation and fall as simultaneous.

13 For an exploration of how this view has implications for science-engaged theology, see Knight (2008).

14 As Vladimir Lossky (1957, p. 121f) has put it, we need to make a distinction between being individuals and being what we are called to become: persons in relationship. He says that the one "who is governed by his nature and acts in the strength of his natural qualities, of his character, is the least personal. He sets himself up as an individual, proprietor of his own nature, which he pits against the nature of others and regards as his 'me'".

15 There are, we should note, significant differences between the ways in which the beatific vision is interpreted in Western and Eastern Christian traditions, with the latter, unlike the former, insisting that the essence of God remains forever unknowable.

16 In the Johannine literature, for example, there is a strong sense that eternal life is something that the believer can experience, not only in the future, but also now, in our knowledge of God. Indeed, in the fourth gospel there is the report that Jesus himself not only described but also *defined* eternal life as the state in which we "know . . . the only true God and Jesus Christ" (John 14:3). In the Pauline strand of New Testament teaching, the emphasis is admittedly, different, with a stronger sense of eternal life as belonging to the future. There is also, however, a sense that we are unable in this life to anticipate what our eschatological state will be, and that our knowledge in that state will not simply be an extension of the type of knowledge we have now, but that, in some sense, it will be knowledge in a mode akin to that of God's knowledge. What "God has prepared for those who love him", says Paul, is something that "no eye has seen, nor ear heard, nor the human heart conceived" (1 Cor. 2:9). In this life, "we see in a mirror dimly", but in eternal life "we will see face to face", knowing "fully" even as we "have been fully known" (1 Cor. 13:12).

17 Modern science arose historically from the insight that the teleological explanations of late medieval science—based on Aristotelian perspectives—provide less insight and predictive power than explanations based on mathematical laws of nature. It is for this reason that explanations would simply cease to be "scientific" if purpose were posited as the only way to understand certain phenomena (in practice, admittedly, certain phenomena can be understood scientifically in quasi-teleological ways, but these ways are seen by scientists simply as being a convenient kind of "shorthand" for laws that may be understood in a more conventional, mathematical way).

18 This "naturalistic" approach to miraculous events has roots, we might note, not only in Orthodox thinking, but in Augustine of Hippo's hints that there are, in addition to the laws of nature susceptible to scientific investigation, "higher" laws of nature that are not susceptible to this kind of investigation (see Pannenberg 2002). In the latter model, "miraculous" events are seen in terms that challenge the scholastic framework's assumption that "secondary" causes are not relevant to such events.

[19] The dominance of this causal joint model has, I have argued, arisen at least partly from reliance on the kind of modern, "personalistic theism" criticized by experts on philosophical theology such as the Roman Catholic, Brian Davies, and the Eastern Orthodox, David Bentley Hart. Hart, in particular, makes the interesting (and, in my view, valid) point that many contemporary philosophers of religion "have effectively broken with classical theistic tradition, adopting a style of thinking that the Dominican philosopher Brian Davies calls theistic personalism . . . [This seems] to involve a view of God not conspicuously different from the polytheistic picture of the gods as merely very powerful discrete entities who possess a variety of distinct attributes that lesser entities also possess, if in smaller measure [. . .] It is a way of thinking that suggests that God, since he is only a particular instantiation of various concepts and properties, is logically dependent on some more comprehensive reality embracing both him and other beings. For philosophers who think in this way, practically all the traditional metaphysical attempts to understand God as the source of all reality become impenetrable" (Hart 2013, pp. 127–28).

[20] My model is, however, different from the usual version of the primary and secondary causes one because it does not see miraculous events as "supernatural" in the sense that no secondary causes are involved.

[21] As Thomas Torrance (1989, p. 4) has said of Basil the Great's understanding: "though acts of divine creation took place timelessly, the creative commands of God gave rise to orderly sequences and enduring structures in the world of time and space. It was thus that the voice of God in creation gave rise to laws of nature".

[22] Rahner's thinking on this topic represents, for those in Rahner's Roman Catholic tradition, a good springboard for the exploration and development of my own proposals, especially when interpreted in the manner of Edwards (2006).

References

Alston, William. 1991. *Perceiving God: The Epistemology of Religious Experience*. Ithaca: Cornell University Press.

Barbour, Ian. 1990. *Religion in an Age of Science: The Gifford Lectures 1989–1991*. London: SCM, vol. 1.

Blowers, Paul. 2016. *Maximus the Confessor: Jesus Christ and the Transfiguration of the World*. Oxford: Oxford University Press.

Boersma, Hans. 2009. *Nouvelle Théologie and Sacramental Ontology: A Return to Mystery*. Oxford: Oxford University Press.

Bradford, David T. 2012. Evagrius Ponticus and the Psychology of Natural Contemplation. *Studies in Spirituality* 22: 109–25.

Bradshaw, David. 2021. Introduction. In *Natural Theology in the Eastern Orthodox Tradition*. Edited by David Bradshaw and Richard Swinburne. St. Paul: IOTA.

Bradshaw, David, and Richard Swinburne, eds. 2021. *Natural Theology in the Eastern Orthodox Tradition*. St. Paul: IOTA.

Brent, James. 2020. Natural Theology. Internet Encyclopedia of Philosophy. Available online: https://iep.utm.edu/theo-nat/ (accessed on 1 September 2024).

Brown, Warren S., and Brad D. Strawn. 2012. *The Physical Nature of Christian Life: Neuroscience, Psychology and the Church*. Cambridge: Cambridge University Press.

Brown, Warren S., Nancey Murphy, and H. Newton Malony. 1998. *Whatever Happened to the Soul?: Scientific and Theological Portraits of Human Nature*. Minneapolis: Fortress.

Clayton, Philip, and Paul Davies, eds. 2006. *The Re-Emergence of Emergence: The Emergentist Hypothesis from Science to Religion*. Oxford: Oxford University Press.

Costache, Doru. 2019. The Orthodox Doctrine of Creation in the Age of Science. *Journal of Orthodox Christian Studies* 2: 43–64. [CrossRef]

Costache, Doru. 2023. Patristic and Neopatristic Antecedents of Scientifically Engaged Theology. *St. Vladimir's Theological Quarterly* 67: 1–2, 115–45.

Dawkins, Richard. 1986. *The Blind Watchmaker: Why the Evidence of Evolution Reveals a Universe without Design*. London: Longman.

de Grijs, Richard, and Doru Costache. 2023. The Cosmology of David Bohm: Scientific and Theological Significance. *Theology and Science*. Available online: https://arxiv.org/abs/2303.04303 (accessed on 1 September 2024).

di Ceglie, Roberto. 2016. Faith and Charity in Thomas Aquinas's Thought. *International Journal for Philosophy of Religion* 79: 133–46. [CrossRef]

Dodds, Michael. 2012. *Unlocking Divine Action: Contemporary Science and Thomas Aquinas*. Washington, DC: Catholic University of America Press.

Dorobantu, Marius, and Fraser Watts. 2024. *Perspectives on Spiritual Intelligence*. London: Routledge.

Edwards, Denis. 2006. Resurrection and the Costs of Evolution: A Dialogue with Karl Rahner on Noninterventionist Theology. *Religious Studies* 67: 816–33. [CrossRef]

Foltz, Bruce. 2014. *The Noetics of Nature: Environmental Philosophy and the Holy Beauty of the Visible*. New York: Fordham University Press.

Hart, David Bentley. 2013. *The Experience of God: Being, Consciousness, Bliss*. Yale: Yale University Press.

Jackson, Andrew. 2023. Towards an Eastern Orthodox Contemplation of Evolution: Maximus the Confessor's Vision of the Phylogenetic Logoi. *Zygon: Journal of Religion and Science* 58: 789–805. [CrossRef]

Jackson, Andrew. 2024. *Maximus the Confessor and Evolutionary Biology: The Phylogenetic Logoi*. London: Routledge.

Knight, Christopher C. 2008. The Fallen Cosmos: An Aspect of Eastern Christian Thought and its Relevance to the Dialogue between Science and Theology. *Theology and Science* 6: 305–17. [CrossRef]

Knight, Christopher C. 2020. *Science and the Christian Faith: A Guide for the Perplexed*. Yonkers: St. Vladimir's Seminary Press.

Knight, Christopher C. 2021. Natural Theology: Complementary Perspectives from the Eastern Orthodox Tradition and the Science-Theology Dialogue. *Philosophy, Theology and the Sciences* 8: 259–84. [CrossRef]

Knight, Christopher C. 2022. *Eastern Orthodoxy and the Science-Theology Dialogue*. Cambridge: Cambridge University Press.
Laird, Martin. 2004. *Gregory of Nyssa and the Grasp of Faith: Union, Knowledge, and Divine Presence*. Oxford: Oxford University Press.
Lollar, Joshua. 2013. *To See into the Life Things: The Contemplation of Nature in Maximus the Confessor and his Predecessors*. Turnhout: Brepols.
Lossky, Vladimir. 1957. *The Mystical Theology of the Eastern Church*. Cambridge: James Clarke.
Louth, Andrew. 2013. *Introducing Eastern Orthodoxy*. London: SPCK.
Maican, Petre. 2024. Spiritual Intelligence and Dementia: A Theological Re-evaluation of the Nous. *Christian Perspectives on Science and Theology*. *forthcoming*.
Manning, Russell Re, ed. 2013. *The Oxford Handbook of Natural Theology*. Oxford: Oxford University Press.
McGilchrist, Iain. 2019. *The Master and His Emissary: The Divided Brain and the Making of the Modern World*, expanded ed. Yale: Yale University Press.
McGrath, Alister. 2008. *The Open Secret: A New Vision for Natural Theology*. Oxford: Blackwell.
Murphy, Nancey. 2006. *Bodies and Souls or Spirited Bodies?* Cambridge: Cambridge University Press.
Need, Stephen W. 2003. Re-reading the Prologue: Incarnation and Creation in John 1:1–18. *Theology* 106: 397–404. [CrossRef]
Nellas, Panayiotis. 1997. *Deification in Christ: The Nature of the Human Person*. Crestwood: St. Vladimir's Seminary Press.
Pannenberg, Wolfhart. 2002. The Concept of Miracle. *Zygon: Journal of Religion and Science* 37: 759–62. [CrossRef]
Pelikan, Jaroslav. 1993. *Christianity and Classical Culture: The Metamorphosis of Natural Theology in the Christian Encounter with Hellenism*. New Haven and London: Yale University Press.
Perry, John, and Joanna Leidenhag. 2023. *Science-Engaged Theology*. Cambridge: Cambridge University Press.
Ritchie, Sarah Lane. 2017. Dancing around the Causal Joint: Challenging the Theological Turn in Divine Action Theories. *Zygon: Journal of Religion and Science* 37: 362–79. [CrossRef]
Ritchie, Sarah Lane. 2019. *Divine Action and the Human Mind*. Cambridge: Cambridge University Press.
Saunders, Nicholas. 2002. *Divine Action and Modern Science*. Cambridge: Cambridge University Press.
Schooping, Joshua. 2015. Touching the Mind of God: Patristic Christian Thought on the Nature of Matter. *Zygon: Journal of Religion and Science* 50: 583–603. [CrossRef]
Sherrard, Philip. 1976. *Christianity and Eros: Essays on the Theme of Sexual Love*. London: SPCK.
Smith, James A. K. 2010. *Thinking in Tongues: Pentecostal Contributions to Christian Philosophy*. Grand Rapids: Eerdmans.
St. John, Donald P. 1998. The Flowering of Natural Contemplation: Some Notes on *Theoria Physike* in Thomas Merton's Unpublished *An Introduction to Christian Mysticism*. *Merton Seasonal* 23: 13–16. Available online: https://merton.org/ITMS/Seasonal/23/23-2StJohn.pdf (accessed on 1 September 2024).
Swinton, John. 2012. *Dementia: Living in the Memories of God*. Grand Rapids: Eerdmans.
Thunberg, Lars. 1985. *Man and the Cosmos: The Vision of St. Maximus the Confessor*. Crestwood: St. Vladimir's Seminary Press.
Torrance, Thomas F. 1985. *Reality and Scientific Theology*. Edinburgh: Scottish Academic Press.
Torrance, Thomas F. 1989. *The Christian Frame of Mind*. Colorado Springs: Helmers and Howard.
Ward, Keith. 2012. Bishop Berkeley's Castle: John Polkinghorne on the Soul. In *God and the Scientist: Exploring the Work of John Polkinghorne*. Edited by Fraser Watts and Christopher C. Knight. Farnham: Ashgate, pp. 127–37.
Ware, Kallistos. 2002. God Immanent yet Transcendent: The Divine Energies According to Saint Gregory Palamas. In *In Whom We Live and Move and Have our Being: Panentheistic Reflections on God's Presence in a Scientific World*. Edited by Philip Clayton and Arthur Peacocke. Grand Rapids: Eerdmans, pp. 157–68.
Ware, Timothy. 1963. *The Orthodox Church*. Harmondsworth: Pelican.
Wiles, Maurice. 1986. *God's Action in the World: The Bampton Lectures for 1986*. London: SCM.
Yong, Amos. 2011. *The Spirit of Creation: Modern Science and Divine Action in the Pentecostal-Charismatic Imagination*. Grand Rapids: Eerdmans.

Disclaimer/Publisher's Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.

religions

MDPI

Article

Scientific Imagination as *locus* of Theology

Robert J. Woźniak

Faculty of Theology, Pontifical University of John Paul II in Kraków, 31-004 Kraków, Poland; robert.wozniak@upjp2.edu.pl

Abstract: Christian theology is not an isolated system of knowledge. The theological phenomena of revelation and inspiration are related to human knowledge of self, community and the world, yet it would be insufficient to think that their conceptual content comes only from human natural experience. This truth is expressed in the doctrine of "theological places", which is most often associated with the Spanish Dominican Melchior Cano because of its systematic presentation. In this contribution, I present the hypothesis that science (in the modern sense) can be understood as a "theological place", not only from the perspective of direct assimilation of concrete and detailed scientific data, but also at the level of imagination. Imagination turns out to be one of the essential components of the scientific method, of course, differently at different stages of the history of science. At the same time, today, theology itself is increasingly appealing to the imagination. In this perspective, one of the main tasks facing theology is the reception of the scientific imagination at both levels of its functioning: as a paradigm of thinking and a specific set of information that makes up the modern scientific picture of the world. Scientific imagination, not only that which comes from art, literature and philosophy, can significantly stimulate the theological imagination.

Keywords: science; theology; mathematics; imagination; space; metaphysics; loci theologici; Cusanus; Heller; Torrance

Contemporary theology, following its turn to history and narrative, is harnessing the power of human imagination more than its neo-scholastic version.[1] It can be said that imagination is returning under the thatched roofs of theology departments. A major contributor to this is the increasingly popular, though not always easy, interdisciplinarity in the conduct of scientific research, including in the humanities and theology (Woźniak 2025). Imagination in theology usually draws its sources from poetry, literature, philosophy and art.[2] Strangely, there are still too few references to scientific research and its results inside theology itself. The theological imagination is still insufficiently stirred by the scientific imagination,[3] both with regard to the structures of thought themselves (the way of preceding) and the results of research in the empirical and exact sciences.

In this contribution, I would like to point out one of the fundamental ways in which the sciences can become a place (*locus*) for theological reflection.[4] It is precisely about imagination. My perspective here is at the same time theological and interdisciplinary. I claim that modern science provides the human imagination with a great deal of relevant data, which create a whole picture of reality, and that it can imprint the human consciousness of self and the world. Science can become a place for theological reflection precisely in the perspective of stimulating imagination of theologians.

In this perspective, the argument undertaken manages to significantly open new perspectives in the dialogue between theology and science. Although many theological studies have been devoted to this dialogue, there is still a clear lack of observing and appreciating the results of science at the level of basic theological imagination. We therefore

have quite a few interesting studies on imagination in science and theology, and at the same time there is a substantial lack of literature on the scientific aspect, the scientific moment of theological imagination. Theologians who accept the place of imagination in their work find it easier to seek inspiration in this regard in art, literature and poetry (cf. Milbank 2009, pp. 160–70) than in the sciences. The point is that in specific theological works, thinking in categories of the "image of the world"[5] proposed by scientists today can positively influence and shape the theological imagination. The category of the image of the world is very important here. It is in its perspective that I see the greatest possibilities for the influence of the scientific imagination on the theological imagination (both materially and formally). In both cases, of science and theology, imagination is much more than an uncritical jumble of images randomly fused into each other. In fact, both in the sciences and in theology it is a resultant derivative of the synthesis of a huge research body analyzed critically.

In order to sketch an argument for the thesis, I will make the following analyses: *firstly*, I will point to possible concrete points where the given sciences and their assimilation can contribute to the essential and homogeneous development of theology itself. At this stage, I will limit myself to the classic vision of the influence of the exact sciences on theology. Imagination is understood here in the colloquial sense of an image of the world, which consists of many data and procedures, and which can and should be assimilated into theology. Secondly I will outline, following Michael Heller, the role and place of imagination in the history of modern science—this moment of my reflection is essential for the entire argument presented here; thirdly, I will address Heller's hypothesis of mathematics as an approximation to pure rationality, asking the question of whether such an account can in any way be applied to theology. Finally, fourthly, in form of an appendix, I will present Torrance's intuition, according to which some theological solutions may precede their equivalents discovered much later by science, addressing, in this way, a question of theology as the place (*locus*) of the science.

It is necessary to add, tentatively, how I understand theology and science. In the most general terms, I understand theology as rational discourse, the subject of which is the form and content of Revelation. What is of essential importance here, is that theology conceived in such a manner proceeds according to the principle of analogy (cf. Mondin 2013; Przywara 2014), which admits to its formation not only the truths contained in Revelation, but also those resulting from the natural functioning of human cognitive abilities, based on scientific methodology (unity of empirical moment, theory and mathematical formalization). In this regard, I refer specifically to the biblical wisdom tradition, in which close observation of the world is an essential component not only of wise living, but also of theological thinking. Today, such wise observation of the world must consider the approach to the structures of reality proper to science. From this perspective we can assume, with David Tracy, that theological imagination is, basically and organically, an analogical one (Tracy 1998).

On the other hand, by sciences, I mean here those disciplines that are distinguished by empirical research and the use of mathematical formalizations. These are, therefore, a phenomenon that is today referred to as the "empirical sciences" (e.g., physics, biology, but also sociology) and "exact" science (mathematics). It should be noted here that providing a unified, unambiguous and global definition of science is largely impossible today. For now, we are left with a descriptive, functional approach (cf. more in Tyson 2022, pp. 24–26).

My contribution belongs to a long history of reflection on the so-called *locis theologicis*. The term is most closely associated with the Spanish theologian Melchior Cano and his posthumous work with a similar title *De loci theologici* published in Salamanca in 1563. This work, with a clear methodological tinge and characterized by Renaissance flair, is situated in a long line of reflection on theological cognition and its nature, structure, scope and possibilities. It perpetuates the openness of theology to data coming from outside its

own constitutive sources. In this respect, it is an expression of the search for the unity of knowledge, while preserving the differences and hierarchies that constitute it. Such an agenda remains relevant today, perhaps more so than before. It remains valid for theology as well. It is worth recalling in this regard an important statement by Thomas F. Torrance, which can serve as a motto for further reflection: "Certainly the task of Modern theology clearly lies in a unitary movement of thought in which the ontological and dynamic approaches are brought together. If so, we must set ourselves to the task of developing appropriate logical tools and an apposite theological language for this purpose—a task not altogether unlike that on which contemporary physicists and biologists are engaged. This will require us to work in close association with them, however, in clarifying the different metaphysical and logical levels of thought within each science and exploring how they are and must be coordinated within the same universe of knowledge" (Torrance 2005, p. 51).

1. Scientific Imagination in Theology: Classical Perspective

At the very beginning, one has to underline that imagination does not mean a hectic, smooth flow of emotions. The imagination that interests us here is not, as in the case of its general or artistic understanding, the ability to indulge in and create fiction. Understood in this way, it would mean intellectual error, *conversio ad phantasmata*, constant submission to Descartes' "malignant demon" or Bacon's "idols of the cave."[6] Such a possibility is ruled out by the history of science as we will see it in the next paragraph. On the contrary, imagination, as I understand it here, is a function of reliable cognition. Constantly fed by and referenced to data, it is a creative principle of association and synthesis.[7] Imagination is neither blind to reality nor arbitrarily free from it. It is the ability to create images, hypotheses, experiments, theories, and models of reality—the power "to integrate sensory data into forms or wholes that are not simply given" (Wolfe 2024, p. 97). There is a fairly general agreement among experts on its importance for the sciences (see Lakoff and Johnson 1980; Bachelard 1994; Einstein 1999; Popper 2002; Gould 2002; Penrose 2004; Lehrer 2012).

Imagination as the ability to create models and syntheses and images is not only an important moment of reflection in empirical and exact sciences, but also an important moment in humanities and theology. The latter contains a whole set of tools and ideas that allow us to imagine the world around us. Wolfe argues "that in experiencing the presence of God, people of faith often experience the world similarly as they would experience a work of art: as disclosive of an unseen depth. The faculty enabling them to do so is the imagination. This claim is more multifaceted than it may appear because the role of the viewer's, hearer's or reader's imagination in the interpretation of a work of art is endlessly complex. The active and unpredictable engagement of his or her imagination responds to the deliberate incompleteness or incoherence of the perceptual material presented. In the case of visual art (to which the following analysis restricts itself), this incompleteness and incoherence relate, above all, to the spatiality and materiality of the perceptual field that the artwork presents to the viewer" (Wolfe 2024, p. 103). Wolfe rightly connects imagination with the lack of knowledge, with the perception of the invisible, the unnoticed, perhaps even the unobservable. Such imagination turns out to be important both in the sciences and in theology. While Wolfe describes imagination in the relationship between theology and art, there is therefore a need to take scientific imagination into greater consideration in the formation of the theological imagination. Since theology, as Wolfe argues, offers "a potent way of imagining the world even as it brings us to the limits of our capacity to imagine", and on the other hand science itself also opens itself to the invisible and distant through imagination (McMullin 1996, pp. 240–48), a broader and stronger fusion of the theological data with the scientific data is needed today, and the issue of imagination can play a vital moment in such a fusion.

Let us assume that the important constitutive moments of the scientific imagination are, primo, certain rules of conduct that are supposed to lead to intersubjectively meaningful and communicable knowledge, and, secundo, a certain set of data that make up what could be called a scientific picture of the world. In both cases, we are dealing not so much with something definitively closed and defined, but with a kind of approximation, constituting a fixed object of reference. Neither in its methods nor in its results does science claim to be an absolute, sole and unchangeable way of knowing reality. Despite this, however, it seeks to discover and implement clear rules of thinking and research conduct, and to present a coherent set of beliefs in the form of simplified but adequate model (or a whole set of models) of reality, resulting from the application of these rules. In this view, by scientific imagination we would mean the combination of clear and reasonably unambiguous research procedures and their results in the form of a concrete picture of reality. I would argue that in both cases, the sciences have much to offer the theological imagination.

Primo, at the methodological level, and with the line of demarcation appropriate to that level, theology should constantly learn from the sciences in terms of transparency, clarity of argument, procedural order, calibration of the generally understood method to the specific object of research, accuracy and consistency, and, in general, accountability for its own methodology. Science and theology do not represent two types of rationality. Both strive for reliable rational cognition and transparent denunciation of their gains. If we consider that they both have different scopes of competence and assume that they both refer to reality (the world and Revelation as datum), and that at the same time they do not enter each other's spheres of competence, then it must also be assumed that they both use the same ability to know, the same reason, the same rationality. Truth and rationality, and reason itself in its unity, contain many forms, strategies and techniques of cognition. Recall, moreover, that the marriage of mathematical formalisms and empirical research is not indifferent or alien to theology but is an important point of reference for it. Today, moreover, theology itself uses versions of empirical-formalist methods, as evidenced, for example, by Lluís Oviedo Torró (2022), N. Murphy (2006), Alexandre Ganoczy (2008), Leonardo Paris (2012, 2017), Strzelczyk and Vetulani (2016) or Peterson et al. (2024). Thus, although the original object of theological research itself is not possible to study by means of an empirical method (Rahner 1975, pp. 95–97), a significant amount of theological content can already be subjected to such research, even if it cannot be thoroughly described by empirics alone. After all, theology deals with God and the world in relation to God. It therefore shares a common reason with the sciences. To the extent that theology deals with the world in its relation to God, data drawn from science will be an important point of reference for it. Science, although it cannot study the world in this respect (in relation to God), can study it in itself and additionally provide valuable information to theology.

Methodological inspiration drawn in theology from the way science conducts its research can be seen in an important document by John Paul II to the director of the Vatican observatory, George Coyne. There the pope expresses the important conviction that modern science can help theology by making a correction inside its view of the world: "science can purify religion from error and superstition" (John Paul II 1988). Such a papal opinion inscribes dialogue with the sciences into the very genetic code of theology.[8] While the latter has always been de facto an attempt to express the truth of Revelation in context, the changing context, including the scientific one, remains significantly important to it. It does not modify what is essential to Revelation and in some way supra-contextual or context-creating (for such is God's creative action itself) but allows better expression of God's truth in adequate language.

Scottish theologian Torrance (Torrance 1980), in a similar vein, expresses a strong conviction that, in the current cultural context, marked by the postmodern confusion

of truth, the contact of theology with what scientists do is indispensable. Theology, he believes, can, thanks to the sciences, become more grounded in reality, and more properly and radically pose the question of truth and objective order. In the context of the "weak rationality" inherent in postmodern critical thinkers, it is the sciences that maintain a constant reference to truth and reality. In their pursuit of them, already expressed in their very methodological foundations, they provide an incentive for theology to think in a manner reliably rooted in truth and reality. If their methodologies cannot be universal and directly applied in theology, at least in their methodological quest for objectivity they have much to say to other fields of knowledge.

Secundo, it is about the possible impact of scientific imagination on theology in a material perspective. The multiplicity of research, methodologies and results of scientists' explorations leads to a certain set of convictions, which can be described as the scientific picture of the world. Despite the multiplicity of data and research fields, there seems to be some consensus in science today about the basic features of reality. Denis Edwards (2010, pp. 1–11), following William Stoeger, enumerates four such characteristics that make up the picture of reality: (a) the cosmos evolves at all its levels and dimensions, (b) its constitutive element is relationship, (c) the natural processes occurring in it are characterized by their own integrity and (d) as a whole, the cosmos is a directional reality (a directional universe). There is no doubt that these four points reveal the cosmos as a dynamic reality. It is in the perspective of this dynamism that they have much to offer theology. Compounding the modern scientific imagination, they should inspire theologians who have classically preferred a rather static view of reality.

It is worth noting here the monograph by Sławomir Kołata on the subject of modeling in Trinitarian theology (Kołata 2017). Kołata divides possible models into two groups: impersonal and personal. From our point of view, the author's description of impersonal models constructed by reference to exact and empirical sciences (mathematics, geometry, theory of evolution, physics of light, quantum theory) is interesting (Kołata 2017, pp. 64–123). Kołata considers both the proposals of other authors and provides his own. The whole argument clearly indicates the creative role of imagination in extrapolation and modeling of theological theories. Extrapolation and application of scientific theories to theology is undoubtedly a factor of the activity of learned imagination, which skillfully crosses the demarcation boundaries of individual fields, striving for conceptual and imaginative interdisciplinary translation of data. What is more, Kołata ultimately seeks the unification of the discussed models on the basis of articulating their complementarity (Kołata 2017, pp. 183–203). The author thus performs a double task: he points to historical attempts to grasp theological problems using models resulting from observations of nature and then asks about their consolidation and coherence. His analyses clearly indicate the creative role of mathematical and natural imagination in theology. The very association of theological problems with solutions from exact and natural sciences determines an important moment of the role of scientific imagination in theology. Just as in this respect modeling in theology is based on scientific models, so too does scientific imagination stimulate theological imagination.

The assimilation of the indicated perspectives should enrich the imagination of theologians. To the extent that they create a general image of the world in becoming, in principle, on each of its dimensions of existence, they also become a specific and significant point of reference for all theological reflection, which should be permeated with them, just as once, during the editing of the narratives of creation scattered in various places in the Old Testament, the ancient imagination modeled, in a certain significant way, the imagination of the inspired authors. Such a relationship is becoming even more desirable today. This occurs, first of all, because there is an undeniable qualitative difference between the myth-

ical imagination of the ancients and the contemporary one formatted by data resulting from the methodological search for truth in the sciences. If, therefore, the ancient, inspired authors considered it beneficial and necessary to use whole sections of mythical narratives about beginnings and to incorporate them into the sacred text, how much more should the modern theologian consider it imperative to apply the data of science, its worldview, and its imagination in building a theological worldview, of course, in compliance with the rules of disciplinary demarcation. More so since these data seem to correspond more closely to the content of Revelation itself as interpreted in tradition.

As one can see, the sciences and their new imagination have much to say to theology, and the latter can learn much from science. According to the above intuitions, confirmed by the Church's Magisterium, theologians should look more closely at the very method of the sciences, as well as its material results. Such scrutiny by theologians of the new scientific imagination can contribute to a significant purification of theology and its normal way of proceeding, and perhaps even to the development of its renewed form. In such an interaction of theology with the sciences, I see the most interesting, fertile and necessary expression of the conviction of the status of science as a theological place.

This is the classical perspective of the interaction of theology and science at the level of imagination. It is primarily about the reception in theology of what could be roughly called the scientific image of the world, that is, a certain amount of data that determine and define today the understanding of reality studied by empirical and exact sciences. These data provide theology with analogous, imaginative models that allow for a better understanding and presentation of its own claims. Science thus becomes a reservoir, a place of theological knowledge (*locus theologicus*): scientific data carrying a certain image of reality in themselves significantly stimulate the theological imagination. Let us note that imagination is understood colloquially in this classical model: it means as much as a certain image of reality resulting from the connection of data and influencing research methods.

However, should not this classical, simple and colloquial understanding of imagination itself be subject to evolution? This question opens a new field of research for us. Our guide will be Michał Heller and his narrative about the history of modern science and the transformation of the understanding of imagination that has taken place in it.

2. Science and Imagination in Michał Heller's Historical Narration

In her enlightening and extravagant essay on science, its essence, methods and forms, and its place in society, Nancy Cartwright states that "science produces remarkable and reliable outputs. But not primarily by ingenious experiments and brilliant theory. Rather by learning, painstakingly, on each occasion, how to discover or create and then deploy together a panoply of different kinds of highly specific scientific products to get the job done. Every product of science—whether a piece of technology, a theory in physics, a model of the economy or a method for field research—depends on huge networks of other products to make sense of it and support it. Each takes imagination, finesse and attention to detail, and each must be done with care, to the very highest scientific standards, so that it can do the immediate job we expect of it and because so much else in science depends on it" (Cartwright 2022, p. 17). As can be seen, the author sees the phenomenon of science quite multidimensionally. In her narrative, science presupposes, what is of special interest to us here, the reference and use of imagination. It belongs to its domain and at the level of its essence and procedures.[9]

A valuable tool for a quick orientation on the issue of the meaning, role and place of imagination in science is Michael Heller's essay *Mathematics and Imagination in the Theory of Relativity* (Heller 1995, pp. 49–66). In its essence and scope, it is a kind of historic panorama

of the relationship between science and imagination at important moments in the history of science.

Heller, following Kuhn, notes two important moments of paradigm shifts in the practice of science (Kuhn 1977, pp. 31–65). The first is the shift from the causal model to the mechanistic model (or imaginary model, Heller 1995, p. 57), and the second from mechanics to mathematical formalism. The starting point of the entire development is Aristotelian theory, which accepts the explanation of the world of phenomena by means of four causes[10]: material, formal, efficient and final (Heller 1995, pp. 51–53). It was this theory that gave rise to the pre-modern understanding of science (cf. Lindberg 1999, p. 52). Heller maintains that, at least until Newton, science was linked to imagination. It is Newton who, in his advocacy of formal solutions, makes the important gesture of moving away from imaginative models to formal-mathematical models. What seemed to many of Newton's contemporaries to be the main weakness of his theory, that is, the lack of a mechanistic, causal, imaginative explanation, turned out to be the opening of a new path, the discovery that it is not so much imagination but mathematical formalism that expresses how reality functions. Newton managed to maintain and be faithful to his belief that gravity can be treated as a "mathematical force" (Heller 1995, p. 57). This is where Heller finds clear evidence of his brilliance. "The success of Newtonian theory meant that the genius ploy to treat attraction as a mathematical force soon became scientific canon' (Heller 1995, p. 59). This is all true, even if "in Newton's times mathematics was a discipline that was eminently service-oriented. It developed to a large extent only insofar as it was needed by physics. It was therefore treated as a tool, and no one asks about the reasons for tools, they just use them. In this situation, mathematics could only fulfill explanatory functions with great difficulty. And it is here that Newton's genius and courage (courage is always part of genius) are revealed: he despite everything, relied not on imagination, but on mathematics" (Heller 1995, p. 62).

What happened here Heller describes as follows: "Descartes appealed to the imagination, Newton told us to count and measure. Imagination undoubtedly remains a very useful feature in the study of Newtonian-type theories, but in the theory itself it ceases to play a significant role. [. . .] One could briefly say that the Newton-Einstein method consists in giving up any imaginary structures as elements of a scientific theory and in inventing such a mathematical structure that would include all the experimental results known so far in a given field and would be able to suggest projects of new experiments and correctly predict their results. It is surprising (above all to the creators of scientific theories themselves) that this method not only works but works so effectively. Every philosopher of science will admit that today it has completely displaced all its rivals" (Heller 1995, p. 61). As can be seen, Heller's historical study of the changing cognitive strategy over time leads him to conclude that for "theoretical physics there is no other way but the 'royal road of mathematics'" (Heller 1998, p. 13). Science practiced in the Newton-Einstein paradigm leaves behind mechanistic imaginary models and replaces them with mathematical explanations. Moreover, the world of mathematics today turns out to be not only larger and more adequate than the world of imagination, but also richer than the world of physics (Heller 1995, p. 64). That is ultimately why "the achievements of modern science are a constant victory of mathematics over imagination" (Heller 1995, p. 169).

Heller's historical narrative of imagination in science, however, does not end with the assertion that the Newton-Einstein model marks its transcendence in favor of explanation by mathematical structures. Heller reminds us that Einstein's important historical achievement was to note that time, space and gravity must not be treated as independent elements of mechanics and, therefore, must be combined so that "the whole can be identified with a certain mathematical structure" (Heller 1995, p. 64). Paradoxically, this structure turned

out to be a geometrical structure. At the same time, as the Polish philosopher and scientist reminds us, "geometry is one of the few mathematical disciplines that has largely retained its imaginative character" (Heller 1995, p. 65). Moreover, the development of geometry has contributed to and led to the development of human imagination, according to Heller. Thus, we are dealing here with a certain paradox and reinforcement. First of all, imagination, which seemed to have lost its importance in science, is returning to it with all its momentum. However, it is not the same imagination as in the case of mechanistic theory, but the mathematical imagination, the imagination of mathematical geometry, which is shaping more and more common human imagination. Heller draws the following and extremely important conclusion from this story: "It is not physics that returns to the imagination, but the imagination that evolves with the development of mathematical methods of physics. Mathematical structures are extremely rational. Imagination trained in the art of precision adapts to them easily. There is no better explanation than in terms of "pure rationality". At least that is what we think today. But the history of science continues. What other possibilities does it hold? We should learn one thing from history: never trust your imagination to make predictions. The future holds many a shock" (Heller 1995, p. 67).

With erudition and acerbity, Heller showed in a simple and convincing way how science gradually moved away from the popular imagination and replaced it with mathematics, only to return to it again, this time making significant changes and transformations within it. There is no doubt that the whole story told by Heller stimulates the imagination and directs it, including that of a theologian. Heller has shown that "instructed" imagination (what one could call a kind of "docta imaginatio"[11]) is fundamentally important in science. The adventurous history of developing science leads to the specialization of imagination, to its purification. Even from this perspective, the history of imagination in the sciences is an important point of reference for theology itself and the imagination proper to it. The new imagination of the sciences, obtained after many attempts, can indeed subtly stimulate the theological imagination at the very methodological level.

I'm thinking in particular of Heller's understanding of mathematics as a corrective and catalyst for a new imagination in science. From this perspective, it falls to note that in Heller's description, mathematics not only becomes the universal language of reality, but also a form of rationality itself. It is a certain version of the visibility of rationality. Reality can be viewed by mathematics, it is no longer just only one of many tools for viewing it. Heller stresses that such intuition contributed to both Newton's and Einstein's theories. Can the same be said of theology? We now need to consider this issue in more detail from the perspective of its possible application in theology.

3. *Qauestio Disputata*: Mathematics in Theology?

Let me formulate a question, referring to Heller's findings relating to mathematics and its role in understanding and doing science today. Can formalized explanations be proposed in theology? Heller boldly states that "it turns out that a specific physical problem always leads in a natural way to some mathematical structure. In this way, mathematics serves as a logical framework that allows us to distinguish those physical quantities that play an important role in a given problem from those that are irrelevant. Thanks to this, we can concentrate on physics" (Heller 1995, p. 62). Can a similar translation as the one observed by Heller between physics and theology take place between theology and mathematics? Would this relationship with mathematics be natural only in the case of physics? Do theological problems "lead to some mathematical structures"? If mathematics forms a new concept of scientific imagination, does this fact have any influence on the dialogue between theology and the sciences at the level of imagination? Does the new understanding

of imagination in the sciences, which Heller writes about, have any application in the perspective of theological research?

If Heller, who shows a constant tendency toward mathematical Platonism, is right, and mathematics is the purest form of rationality we know or "rationality in pure form" (Heller 1995, p. 63), then the answer should be positive.[12] However, if we took mathematics as the primary language of theology, wouldn't we risk reducing the world viewed through theology to what we today consider to be a pure form of rationality? Wouldn't that lead to a reduction of mystery? At the same time, on the other hand, wouldn't the adoption of mathematics as a possible language for theology lead to some existential impoverishment of theology itself, which must be rooted not only in the world of objective inferences, but also in the world of human subjective and communal experience? Besides, some believe that theology today should take refuge in the world of poetry, that it is the poem that can save its essence from the horrors of history (Lipszyc 2015) and the insensitive objectivity of the cold logic of the sciences. Arguably, a lot of prudence and a firm rejection of all extremes are needed here. Theology needs poetry, narrative, but also strict definitions and a language capable of coherently expressing its beliefs. In learning about the world, it would be a mistake to separate, or forcibly reduce, the richness of the multitude of languages by which the one and only rationality given to us is expressed in many ways. If only because there are very important genetic links between the sciences and the humanities (Heller and Krajewski 2014).

While I understand that Heller is not postulating some absolutization of mathematics, he is puzzled by why it is so useful for describing reality, and still prior to any empirical experience. It is interesting that in his argument Heller does not consider the explanation of this fact that underlies Kant's critical philosophy although he refers to it indirectly when writing about "a pure form of rationality". As is well known, the philosopher from Königsberg fastened the possibility of "pure mathematics" (Kant 2004, pp. 32–45) and "pure natural science" on the principle of embedding its structures in the cognitive subject itself. The forms of pure natural mathematics were, in his view, to be universal and common to all human beings. Such an approach disabsolutizes mathematics by relativizing it, i.e., linking it to the subject. And while it is not a definitive explanation and trumpets reductionism and presuppositionalism, it points to an important clue in understanding mathematics as a Hellerian form of "pure rationality," namely, that it is always already somehow linked to the subject. In turn, the subject itself is part of the reality it comes to know.

Either way, the necessary condition for applying mathematics, as a "pure form of rationality", to theology is the awareness that mathematical explanations are not absolute. Heller himself remembers that mathematical structures "only approximately correspond to the structure of the world" (Heller 1995, p. 63). Thus, the rational exposition of the data of theology by means of useful mathematical formulas should not claim exclusiveness.

Keeping this in mind, a question parallel to the questions posed by Heller in the space of physics arises in theology: which known mathematical structures, theories and systems could help express the truths of faith, such as the Trinitarian nature of God (the relationship of unity and multiplicity), creation, incarnation (the relationship of otherness and identity), the eucharist (the essence of transformation, the link between essence and phenomenon) and its meaningful and essentials parts?

In answering these questions, one must always keep in mind that while mathematics can be considered a system richer than physical reality itself, the case is different for theology. Theologically speaking, rationality is not something above God, but, as Christian tradition maintains, it expresses His own way of existence, which is analogously and contingently reflected in the created order. Mathematics can be richer than physical reality because it is a certain way of capturing the inner logic (Logos) of the life of the Triune

God.[13] Precisely for this reason, it can be applied to theology, although its "predictive power" (see Krajewski 2016a, pp. 111–14) may be limited and narrowed in its case due to the primary object of theology, which is the Triune God as the source of rationality. Hence, in answering the theological questions cited above, theo-mathematics will have to be vigilant not to at any point subordinate what theology sees to what mathematics sees today. Arguably, mathematics itself could gain something from attempting to answer the above questions.[14] Be that as it may, the above questions remain legitimate and interesting, especially on the subject of seeking, in mathematics, certain structures, perhaps not obvious to empirical experience, by means of which theological experience based on the set of data called Revelation could be better described.

Let me emphasize again: the application of mathematics to theology cannot mean narrowing the perspective of the supernaturality of theological claims. Theological truths (especially such as the Trinity, the incarnation, and grace) cannot be deduced from pure reason[15] or from a pure form of rationality, which as we know, Heller contemplates in mathematics, conceived as a set of mathematical structures. The possible application of mathematics to theology must not be about explanation, especially when one understands it as giving the ultimate *raison d'être* or as "reducing of a fragment of the physical world to a fragment of the world of mathematics" (Heller 1995, p. 63). Closer to theology and its requirements, however, exists, already, another "definition" of explanation offered by Heller as a "translation of a given problem into a mathematical structure".

Viewed in this way, mathematics could serve theology to expose, express or bring to light the logical coherence of the truths of faith. No theory of mathematics or physics or any other science explains existence. Mathematics, at least in its formality, is not the ground of being. The truths of faith are not deducible from pure rationality (Thomas Aquinas), which does not mean that they are not rational. Once revealed, they can be rationally investigated and, at least, expressed, if only by means of paradox (cf. Wołowski 2021; 2023, p. 313). The question of the possibility of using mathematics in theology, therefore, is not so much about laying a rational foundation for the truths of faith, but about rational expression of their essence and cognitive content.

Such possibility of rational expression is necessary for the act of faith by its nature, and is therefore also necessary for theology itself. If the complex history of science leads us today to occlude, in and through mathematics, the pure form of rationality, then should it not be included in theology, just as Aristotelian theory once was, perhaps with less success, mechanistic theory? Mechanistic vision of reality and its version of theology failed perhaps for the same reason that in Heller's story Newton brilliantly transcends it, just as Einstein transcends Newton while nevertheless retaining the same formal–mathematical paradigm. Theology cannot remain blind to the fundamental discovery of modern science which articulates mathematics as a "pure form of rationality". Just as it once entered into an alliance with Aristotelianism and was able—less successfully—to leave that alliance for the sake of entering into another one, this time with a more modern explanation in the form of mechanistic theory, so today it should think deeply about some implementation of the mathematical–formal paradigm. I write about some implementation because it cannot be about establishing mathematics as the only language for theology.

The history of theology has already known moments when some form of mathematical thinking was discovered, and attempts were made to apply it to theology. Three such moments come to mind.

The figure and work of Nicholas of Cusa, in particular, should be recalled here. Indirectly, I have already referred creatively to his thought when writing about "instructed imagination", a notion that copies his understanding of knowledge and transfers it to the issue of interest here. Nicholas, as is well known, is one of those philosophers and

theologians who realized the limitations of the human cognitive adventure. Apophatic awareness, however, is not his last word. The work that continues the discoveries from the *Docta ignorantia* is the philosophical–theological–mathematical treatise *De coniecturis*. Its content, de facto, is a description of the benefits of mathematical thinking in the space of philosophy and theology. Cusanus does not engage in it with biblical exegesis or considerations from the history of doctrine but seeks mathematical structures that open the way to God in terms of pure reason. His program is largely based on a marriage of the themes and intuitions of Pythagorism and Neoplatonism, a mathematical and geometrical exposition of the content of the convictions of reason and faith. Cusanus does not deduce the truths of faith from mathematics; rather, he uses it to point out their logical, mathematical, and geometrical consistency.

The second moment is an interesting, though little known, program of practicing and presenting theology by means of the "graphographic method" (*metoda wykresograficzna*) proposed by the Polish patrologist Franciszek Drączkowski. The systematic vision of theological research is born in his thought under the influence of detailed study of the Church Fathers and their language. Drączkowski defines his method as "a way of presenting the truths of faith by means of parallel approaches, that is, verbal and graphic-image approaches" (Drączkowski 2017, p. 119). His theology in geometric–mathematical terms assumes that "individual diagrams, composed of geometric figures, show the truths of faith under discussion in a clear, simple and understandable way. A further advantage of visual forms, operating with a drawing composed of geometric figures, is the graphic shorthand, which also facilitates memorization. A drawing visually imagines what takes up several pages in a book. The introduction of diagrams to denote spiritual realities makes perceptible what is abstract and difficult to imagine" (Drączkowski 2017, p. 127). Drączkowski's method relates to mathematics and geometry only rudimentarily. It is not so much concerned with the application of mathematics or geometry to theology as with depicting theological themes with geometric figures. Assuming this significant methodological deficit, it should be noted that Drączkowski's intuition about the possibility of presenting theological data with geometric figures remains valid and interesting. However, it requires further work and significant mathematical deepening.

The third moment is linked to the current rise and exuberant development of analytic theology. It seems that analytic theology and its firm reliance on formalizations may prove to be the bridge leading to the stronger alliance of theology and mathematics and logics today. Rea characterizes the style as including the following points: "P1. Write as if philosophical positions and conclusions can be adequately formulated in sentences that can be formalized and logically manipulated. P2. Prioritize precision, clarity, and logical coherence. P3. Avoid substantive (non-decorative) use of metaphor and other tropes whose semantic content outstrips their propositional content. P4. Work as much as possible with well-understood primitive concepts, and concepts that can be analyzed in terms of those. P5. Treat conceptual analysis (insofar as possible) as a source of evidence" (Rea 2009, pp. 5–6). P1 is important here. The analytical method in theology presupposes the possibility of using formalizations of reality. Although Rea does not specify exactly which formalizations he means, it is mathematical formalism itself that comes to mind. Such an approach is ultimately based on a certain, classical understanding of mathematics: "Just as universal-kind concepts can yield cognition of relevant necessary truths in virtue of the God-given immaterial abstractive power of the human mind, so mathematical concepts can yield cognition of relevant necessary truths" (Cleveland 2021, p. 176; cf. Maurer 1993, pp. 43–61). It should be remembered that analytic philosophy and theology are not a branch of mathematics. What they have in common with mathematics is an attempt to formalize issues. Despite this, there is no doubt at all that it is analytic theology, based

on the achievements of analytic philosophy, which will be crucial in developing bridges between theology and mathematics.

Furthermore, one must conclude, following Heller, that even if the use of mathematics in theology turns out to be possible only in part, one thing remains certain; mathematics can indeed help to purify and shape theology. It is precisely for this reason that theology needs a reliable dialogue with it.

4. *Excursus*: Possible and Important *vice versa*: Theological Imagination in Science?

What was said until now raises the question of reciprocity. Since theology can and should enter into fruitful cooperation with science, can it also be the case that science can benefit from a relationship with theology? It seems that, with all methodological boundaries and subject demarcations preserved, the sciences can gain, in the space inherent in theology, some new and interesting fields of research. Just as the scientific imagination should shape theology, theology too has many relevant places that may prove to be interesting representations of reality for the sciences themselves. Such truths of the faith as creation from nothingness, the incarnation, and especially the Trinity provide, both in their dogmatic formulations and their tumultuous history of emergence, much data for reflection.

The history of theology provides examples of the creative influence of the truths of faith on the philosophical and scientific imagination. It is appropriate to mention here two that have already been fairly well researched and described. These are the history of the concepts of time and space in early philosophical and theological reflection, and the concept of relation and its increasingly decisive role in understanding the mysteries of the world.

The first case has been the subject of research and inquiry by Scottish scientist and theologian Thomas F. Torrance on many occasions. It is about the significant change that took place in the fourth century in the scientific imagination of antiquity for the sake of and inspired by the dogmas of creation and (especially) the incarnation. Torrance sees in Nicean theology (this is the theology created for the purpose of elaborating and clarifying the content of the Creed from the so-called Council of Nicaea I in 325), a great creative potential in taking up old issues related to the classical understanding of reality anew.

Christian theologians proclaiming the descent of the second person of the Trinity into the world and its incarnation had to, in his opinion, quickly realize that such a belief meant, de facto, a whole set of problems linked to issues of time and space as the ancients understood them. Both creation and, especially, incarnation imply God's being in the temporal and spatial world. The very act of incarnation, captured in the Creed by the verb "descend," even evokes a kind of odyssey, God's journey from eternity and spacelessness into the temporal and spatial world. If such events were somehow reconcilable with ancient mentality, especially that mythical, pre-philosophical version of it, such reconciliation was already impossible from the perspective of gospel-based theology, and for two interrelated reasons: the ancient concept of time and space and the Christian concept of God. The ancients imagined that space was a kind of container for things that had to be in certain specific places that bounded them. "On the whole Greek science and philosophy had come to concentrate upon the determinate and finite, for that alone was conceivable, and so operated with a notion of space as delimited place defined in terms of a containing vessel. If there were an actual (as distinct from a mathematical) infinite it could only be the limitless, empty void beyond the cosmos, but although some such notion was advocated by Pythagoreans and Atomists alike, Platonic, Aristotelian and Stoic thought deemed it unthinkable and unintelligible. Thus the finite, the intelligible and the limits of the container were all bound up together in their thought" (Torrance 2005, p. 23). At the same

time, Christian theologians already knew that God is infinite, and that He is not immersed in the container of time and space, which—thanks to His free creation of the world ex nihilo—also comes from Him.

According to Torrance, Nicene theology, especially St. Athanasius, whose achievements are preserved and developed by Damscius and Philoponus and forgotten in late Byzantine theology and in the West (Torrance 2005, p. 25), solves this problem on the basis of rejecting the ancient concept of time and space, and their new articulation, one in which they could express the truth of the Christian faith, namely, that both time and space come from God on the basis of the creative act, and that God can act in them without losing his transcendence. "The essential key"—affirms Torrance—"was found in the relation of the homoousion to the creation, that is, in the fact that the Lord Jesus Christ, who shares with us our creaturely existence in this world and is of one substance with the Father, is He through whom all things, including space and time, came to be. That is to say, Nicene theology rejected an approach to the questions of space and time from any point of absolute rest, but adopted an exclusive approach from the living and active Self-Word through whom all things, visible and invisible, were created out of nothing, who leaves nothing void of Himself, and who orders and holds the entire universe together by binding it into such a relation to God that it is preserved from breaking up into nothingness or dropping out of existence, while at the same time imparting to it light and rationality. He it is who by Incarnation has come into our spatial realm although He was not far off before. He is fully present with us in space and time and yet remains present with the Father. He was certainly 'outside' all things in respect of His essence, but 'in' all things and events in respect of His power. Yet He did not activate the body He assumed from us in such a way as to cease to deploy Himself actively throughout the universe in all its dimensions. Since He shared with us our physical space, while remaining what He ever was, the spatial ingredient in the concept of the Incarnation must be interpreted from the side of His active and controlling occupation of bodily existence and place. Space is here a predicate of the Occupant, is determined by His agency, and is to be understood in accordance with His nature. He cannot, therefore, have the same space-relation with the Father as we creatures have, otherwise He would be quite incapable of God" (Torrance 2005, pp. 14–15).

Such an approach leads Torrance to draw important conclusions about the transformation of the meaning of the concept of space in Athanasius. The Scottish theologian argues that the event of the incarnation leads to the rejection of the classical concept of space and the development of a new view of it. The dominant emphasis of this new account is its relationality, built on the role and place of Christ in natural history and sacred history, which can no longer, because of the Incarnation, be completely separated. Torrance affirms that "the concept of space in terms of the ultimate immobile limit of the container independent of time, all fall away, and instead there emerges a concept of space in terms of the ontological and dynamic relations between God and the physical universe established in creation and incarnation. Space is here a differential concept that is essentially open-ended, for it is defined in accordance with the interaction between God and man, eternal and contingent happening. It is treated as a sort of coordinate system (to use a later expression) between two horizontal dimensions, space and time, and one vertical dimension, relation to God. In this kind of coordination, space and time are given a sort of trans-worldly aspect in which they are open to the transcendent ground of the order they bear within nature. This means that the concept of space which we use in the Nicene Creed is one that is relatively closed, so to speak, on our side where it has to do with physical existence but is one which is infinitely open on God's side" (Torrance 2005, p. 18, cf. p. 24[16]). Let us just note that Torrance (2005, p. 17) sees in the Nicaean thought of Athanasius a kind of new approach, a paradigm (*paradeigma*), whose essential feature is the fusion of the dimensions of reality by

analogy. The focal point of such fusion, its condition of possibility, is the incarnation, in which "heaven and earth merge" human affairs with the divine, the sensual order with the rational order.

All this historical argument about Nicene theology is needed by Torrance to demonstrate that proper theology never separates Revealed knowledge from natural knowledge. An example of the fruitfulness of combining two visions of reality is precisely the history of the understanding of space and time. In this regard, Torrance's narrative allows us to conclude that Athanasius' theological imagination led him to a critical and in-depth reflection on space, the fruits of which anticipate the later development of its understanding in modern science (cf. Torrance 2005, p. 58), for this is what Torrance's claim boils down to—that Athanasius abandoned the ancient understanding of space as a container in favor of understanding it in relational terms. A good and critical theological imagination, which consists of various truths of faith and methodological rules of reading Scripture, can thus offer vital data to science itself, and even anticipate its later development. It is important to realize that Torrance's description that his historical narrative of events in the history of ideas is approximate and to some extent intuitive. Torrance does not claim that Athanasius preceded Einstein, but that theological data enabled him to propose a new understanding of reality that proved, centuries later, to be quite consistent with the foundations of modern physics. And while Torrance's arguments should be critically examined by specialists in patristic theology, it is difficult to admit that this author does not provide us with valuable insight.

This brings us naturally to the second of the issues mentioned, which is the concept of relationships. Torrance argued that the Nicene faith led to a new concept of time and space. This novelty consisted of a relational view of them. Recent research in the field of fourth-century Trinitarian theology, especially Cappadocian pro-nicaeanism, reveals that the relational revolution took place not only at the level of understanding the basic physical dimensions of the world, but also, and above all, at a much deeper level because, within metaphysics itself, the basic theory of being as being.

Speaking of such a situation, Giulio Maspero notes that "Christian thought has in stages come to acknowledge that the one and only God in three Persons not only has relations but is also three eternal Relations. Greek metaphysics has thus been extended through this sense of who, that is, in the personal sense, becoming a relational and Trinitarian ontology and a relational ontology precisely because it is a Trinitarian one" (Maspero 2023, p. 7). A little further on, the Italian theologian gives a definition of what he calls Trinitarian ontology concluding that: "what is meant by the expression Trinitarian ontology is precisely the ontology of relation as it is conceived through Trinitarian revelation. Indeed, an analysis of the Greek tradition shows that the dogmatic development of the fourth century could actually be reread as the history of the birth of a new ontology of relation, one that surpasses classical Greek metaphysics" (Maspero 2023, p. 9).

Maspero bases his theses on careful analyses of Greek theologians of the fourth century, which lead him to believe that the Cappadocians, especially Basil and Gregory of Nyssa, incorporated the reality of relation in divine, Trinitarian immanence itself, thus making breakthroughs in the perspective of classical metaphysics, in which relation had only the status of accidentality (Maspero 2023, p. 161). In their Trinitarian theology, relation ceases to be accidental (Maspero 2023, p. 162), which ultimately means that "in speaking of the unity of the one and triune God we cannot set the personal dimension in opposition to that of substance" (Maspero 2023, p. 163). At the same time, Maspero stresses that this new ontology is not a rejection of the classical metaphysics of substance, by replacing it with the category of relation, but a kind of extension of its classical form (Maspero 2023,

p. 164). Instead, the novelty lies in the fact that relation does not so much replace substance so much as it becomes an internal and essential dimension of it.

Having made these important discoveries and observations, Maspero moves on to sketch the epistemological implications of the Cappadocian metaphysical breakthrough. The new metaphysics leads, in his view, to the formation of a new epistemology. "Key to this new epistemological perspective is relation, which had been metaphysically reshaped by the Cappadocians. In fact, the fundamental aporia of the Greek world consisted in affirming the relationality of the epistêmê, which is the authentic path to truth insofar as it sought the metaphysical foundation of the world but in denying the relational dimension of the first principle. This left science itself suspended in the void, a path taken by the Sophists and the Skeptics, or introduced a separation between divine and human thought, which ended up making the human equivocal with respect to its divine foundation, as Plato, Aristotle and the Neo-Platonists did. In order to reach the fullness of truth, the human being had to renounce being human, as the path from Aristotelian nous to Plotinian mysticism illustrates" (Maspero 2023, p. 213). The Trinitarian ontology of relations was capable of transcending the pointed aporia. Moreover, it turns out that the Cappadocian discoveries within the ontology of relations apply not only to the realm of the divine, but also to the space of created entities (Maspero 2023, p. 220; cf. Maspero 2016, 2018). Trinitarian ontology offers a perspective not so much beyond physics (meta-physical) but rather as 'ana-physical' (Maspero 2023, p. 221).

From this epistemological perspective, one can see how important the metaphysical breakthrough operated by Cappadocians was. What they discovered within the framework of their Trinitarian theology, faithful to the message of the Gospel, turned out to be the key to solving the ancient metaphysical and epistemological aporias. At the same time, relation's ideological position being changed from the space of accidentality to the category of substance begins to conceptually concern the grasp of the totality of reality. In his work, Maspero has provided convincing historical evidence in this regard under the claims of authors such as Ratzinger and Zizioulas, and the aforementioned Torrance. Relation becomes the chief category of metaphysics, but also of science. The Cappadocian metaphysical breakthrough thus anticipates a development that will take place in modern science, whose vision of reality is increasingly based on the role and importance of the category of relation.

Greatly instructive and critical material in this regard is provided by the collective study of the common points of theology and science in the perspective of the concept of relations. The very editor of the aforementioned collection of essays states meaningfully at the beginning of the book that "The history of twentieth-century physics can be read as the story of the discovery of many levels of intrinsic relationality present in the structure of the universe" (Polkinghorne 210, p. vii). It is hard not to see, in light of the arguments presented above, that there is some golden thread—even if it is a very fine one—connecting the theological imagination of fourth-century authors and modern scholars. Are these examples not enough to hypothesize a possible contribution of the theological imagination to the scientific imagination? Could the optional—for obvious reasons—reading of classical theological texts and scientists' familiarity with the lines of doctrinal development not point them imaginatively to certain models of understanding reality that could prove relevant in solving contemporary problems? The provided examples indicate that the answer to both questions is positive.

5. Conclusions: Toward Mutual Locality Between Theology and Science

The above reflections lead us to draw general conclusions that could contribute to further discussion.

Firstly, imagination, as Heller shows, has its own history and its own place inside the phenomenon of science. Heller has allowed us to see not only the changing history of the understanding of imagination, but also the very basic fact that it permanently accompanies scientific reflection.

Secondly, the evolution of imagination in science has led to its refinement and methodological specialization. As a result of it, imagination can no longer be understood as arbitrary fantasizing. Imagination in modern science, Heller argues, is indeed combined with geometry and mathematics, and is thus based on reliable knowledge. The evolution of imagination has thus proceeded from thinking in mechanistic terms to reasoning in geometrical terms. The specialization of methods and their calibration has led to a purification of imagination in science.

Thirdly, the evolution of imagination in science, noted by Heller, which is, de facto, its elaboration and shaping according to the principles of mathematical thinking, has great significance for theology. Although science is not its own source for theology it remains an important point of reference for it. Referring to Melchior Cano's terminology, it is one of the new "theological places".

Fourthly, the scientific imagination, refined by mathematics and geometry, is indeed important for theology, and this on two parallel and interrelated levels: methodological and material. If the scientific imagination consists of rudimental methodological rules calibrated to adequately learning the truth and concrete data resulting from research, data that form a certain picture of reality, then theology can benefit from the appropriation of both moments to its own reflection. The first of these moments, the methodological one, may be particularly important. It is not a matter of direct importation of methods, forbidden by the principle of demarcation, but a constant striving for ever greater clarity and transparency in theological procedures and claims.

Fifthly, it should be noted that there is a possibility of a positive influence of theology on the scientific imagination. The interdisciplinary locality, such as that described by Cano in his *loci alieni*, should be mutual and reciprocal. History shows that theology, in its theoretical form, can anticipate later developments in science. Hence, the development of doctrine can provide scientists with important material in planning their own research. The fact that theology can also be a place of inspiration for sciences is ultimately based on the fundamental conviction of the unity of the world and the intellect which discovers and knows it.

Sound theology has always looked at God with one eye and the world with the other. The subject of theological development has always been the relationship between God and the world. Precisely because of this, it can ultimately draw on the reliable maturity of the sciences and can itself contribute to its development. In this regard, the fact is that the relationship between the emergence of modern sciences and specific developments within theology itself is not indifferent. But this is already a story for another study (cf. Jaki 1988; Funkenstein 1989).

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: No new data were created or analyzed in this study. Data sharing is not applicable to this article.

Conflicts of Interest: The authors declare no conflict of interest.

Notes

1 Evidence of this can be found in the systematic elaboration of the subject of imagination in the perspective of its place and role in the systematics of fundamental theology in (Steeves 2016). Unfortunately, the author does not address the issue of the importance of imagination in the dialogue between theology and science. Instead, he focuses on the importance of imagination for theology in the area of spirituality, liturgy and ethics. Despite this lack, one can find interesting observations in the book on the connections between the concepts of Revelation and faith and imagination.

2 See, on this perspective, two recent and paradigmatical works by Sander (2019) and Wolfe (2025). Sander's theological theory and the place of heterotopia in it refers directly to the basic assumptions of Michel Foucault's philosophy and methodology and may, thus, be described as an attempt at postmodern theology/dogmatics. Wolfe's work is more classic in this regard.

3 Amos Funkenstein's now classic work *Theology and the Scientific Imagination From the Middle Ages to the 17th Century* (Funkenstein 1989) can serve here as an important example of the desired state of affairs. Funkenstein's work is paradigmatic in our topic, especially in the perspective of the history of the relationship between theology and science. It is also worth referring to this author's earlier work on the Middle Ages (Funkenstein 1965).

4 I adopt the understanding of the concept of *locus* after Bernhard Körner (2014, pp. 21–62). His approach is based on the doctrine of Melchior Cano, which is deepened and modernized. The Austrian theologian draws attention first and foremost to the 'locality' of the essence of Christianity, which happens in a specific place and a specific time. For faith and for reflection on it, this 'phenomenon of locality' is fundamentally important. Körner's approach is interesting primarily because, instead of talking about the contextuality of faith and theology, he points to their locality.

5 More on the category of the scientific "world image" as an essential dimension of a possible dialogue between theology and science cf. (Heller et al. 1996).

6 For the comprehensive early history of imagination cf. (McMullin 1996, pp. 228–40).

7 This is precisely how Kant understands imagination in his *Critique of Pure Reason*, A78/B104: "The imagination (*Einbildungskraft*) is the faculty that allows the synthesis of the manifold, which is the precondition for all empirical knowledge" (Kant 1999).

8 John Paul II 1988: "Theology has been defined as an effort of faith to achieve understanding, as *fides quaerens intellectum*. As such, it must be in vital interchange today with science just as it always has been with philosophy and other forms of learning. Theology will have to call on the findings of science to one degree or another as it pursues its primary concern for the human person, the reaches of freedom, the possibilities of Christian community, the nature of belief and the intelligibility of nature and history. The vitality and significance of theology for humanity will in a profound way be reflected in its ability to incorporate these findings". Such dialogue requires discernment on side of theology: "Theology is not to incorporate indifferently each new philosophical or scientific theory. As these findings become part of the intellectual culture of the time, however, theologians must understand them and test their value in bringing out from Christian belief some of the possibilities which have not yet been realized".

9 The current status of the question of the place of imagination in science can be found in (A. Murphy 2021).

10 Aristotle, *Physics* 194 b17–20; see also *Posterior Analytics* 71 b9–11; 94 a20.

11 McMullin distinguishes, in a very similar way, between "first and second imagination", cf. (McMullin 1996, pp. 252–58).

12 In a similar vein, Adam Olszewski demonstrates the existence of certain analogies and connections between theology and mathematics using the problem of formalism in Hilbert and Gordon as an example, cf. (Olszewski 2012, p. 144).

13 The connections between the Trinitarian doctrine and the concept of rationality are obvious and date back in Christianity to the considerations of John the Evangelist, who refers to Christ as the Logos in the Prologue of his Gospel narrative. A description of the historical, dizzying career of this Johannine expression exceeds the scope of this article. However, it should be noted that there is no doubt that it forms the hard core of the development of the Trinitarian concept of God in early Christianity. Cf. (Enders and Kühn 2011).

14 Such a gain of mathematics itself may be, according to Plantinga's intuitions, to explain why mathematics actually, adequately and predictively learns about the structures of reality. "Plantinga also argues that Christian theism is a better fit with science than naturalism, since it offers superior explanations of the preambles of science. The naturalist has no good explanation for why the natural world functions in a law-like way and can be understood by the human mind. Similarly, theism explains why abstract creations of the human mind, like mathematics, are fit to describe and produce predictions of the natural world. These facts can be explained by invoking a rational God that has created humans as rational creatures" (Visala 2021, p. 416). Cf. as well (Krajewski 2016b).

15 See Vatican I, Dei Filius 4: "Hoc quoque perpetuus Ecclesiae catholicae consensus tenuit et tenet, duplicem esse ordinem cognitionis, non solum principio, sed obiecto etiam distinctum: principio quidem, quia in altero naturali ratione, in altero fide divina cognoscimus; obiecto autem, quia praeter ea, ad quae naturalis ratio pertingere potest, credenda nobis proponuntur mysteria in Deo abscondita, quae nisi revelata divinitus, innotescere non possunt [...] Divina enim mysteria suapte natura intellectum creatum sic excedunt, ut etiam revelatione tradita et fide suscepta ipsius tamen fidei velamine contecta et quadam

quasi caligine obvoluta maneant, quamdiu in hac mortali vita peregrinamur a Domino: per fidem enim ambulamus, et non per speciem (2 Cor. V, 7)".

16 "Thus it came about that in seeking to articulate its understanding of God's activity in creation and Incarnation, Patristic theology rejected a notion of space as that which receives and contains material bodies, and developed instead a notion of space as the seat of relations or the place of meeting and activity in the interaction between God and the world. It was brought to its sharpest focus in Jesus Christ as the place where God has made room for Himself in the midst of our human existence and as the place where man on earth and in history may meet and have communion with the heavenly Father".

References

Bachelard, Gaston. 1994. *The Poetics of Space*. Boston: Beacon Press.

Cartwright, Nancy. 2022. *A Philosopher Looks at Science*. Cambridge: Cambridge University Press.

Cleveland, Lindsay K. 2021. Divine Aseity and Abstract Objects. In *T&t Clark Handbook of Analytic Theology*. Edited by James M. Arcadi and James T. Turner. London and New York: T&t Clark, pp. 165–79.

Drączkowski, Franciszek. 2017. Metoda wykresograficzna (wykresografia) w służbie teologii. *Vox Patrum* 67: 115–31. [CrossRef]

Edwards, Denis. 2010. *How God Acts. Creation, Redemption, and Special Divine Action*. Minneapolis: Fortress Press.

Einstein, Albert. 1999. *The World As I See It*. Chicago: The Open Court Publishing.

Enders, Markus, and Rolf Kühn, eds. 2011. *"Im Anfang war der Logos . . .": Studien zur Rezeptionsgeschichte des Johannesprologs von der Antike bis zur Gegenwart*. Freiburg-Basel-Wien: Herder.

Funkenstein, Amos. 1965. *Heilsplan und natürliche Entwicklung: Formen der Gegenwartsbestimmung im Geschichtsdenken des hohen Mittelalters*. München: Nymphenburger Verlanshandlung.

Funkenstein, Amos. 1989. *Theology and the Scientific Imagination from the Middle Ages to the 17th Century*. Princeton: Princeton University Press.

Ganoczy, Alexandre. 2008. *Christianisme et Neurosciences: Pour une théologie de l'animal humain*. Paris: Odile Jacob.

Gould, Stephen Jay. 2002. *The Structure of Evolutionary Theory*. Cambridge, MA: Belknap Press of Harvard University Press.

Heller, Michał. 1995. *Nauka i wyobraźnia*. Kraków: Znak.

Heller, Michał. 1998. Czas i historia. *Philosophical Problems in Science (Zagadnienia Filozoficzne w Nauce)* 23: 37–52.

Heller, Michał, and Stanisław Krajewski. 2014. *Czy fizyka i matematyka to nauki humanistyczne?* Kraków: CCPress.

Heller, Michał, Stanisław Budzik, and Stanisław Wszołek, eds. 1996. *Obrazy świata w teologii i naukach przyrodniczych*. Tarnów: Biblos.

Jaki, Stanley. 1988. *The Savior of Science*. Grand Rapids: Eerdmans.

Kant, Immanuel. 1999. *Critique of Pure Reason*. Cambridge: Cambridge University Press.

Kant, Immanuel. 2004. *Prolegomena to Any Future Metaphysics That Will Be Able to Come Forward as Science*. Cambridge: Cambridge University Press.

Kołata, Sławomir. 2017. *Komplementarność modeli w teologii trynitarnej*. Kraków: WAM.

Körner, Bernhard. 2014. *Orte des Glaubens—Loci theologici: Studien zur theologischen Erkenntnislehre*. Würzburg: Echter Verlag.

Krajewski, Stanisław. 2016a. Matematyka w teologii, teologia w matematyce. *Philosophical Problems in Science (Zagadnienia Filozoficzne w Nauce)* 60: 99–118.

Krajewski, Stanisław. 2016b. Theological Metaphors in Mathematics. *Studies in Logic, Grammar and Rhetoric* 44: 13–30. [CrossRef]

Kuhn, Thomas. 1977. *The Essential Tension: Selected Studies in Scientific Tradition and Change*. Chicago and London: University of Chicago Press.

Lakoff, George, and Mark Johnson. 1980. *Metaphors We Live By*. Chicago: University of Chicago Press.

Lehrer, Jonah. 2012. *Imagine: How Creativity Works*. Boston: Houghton Mifflin Harcourt.

Lindberg, David C. 1999. *The Beginnings of Western Science: The European Scientific Tradition in Philosophical, Religious, and Institutional Context, Prehistory to A.D. 1450*. Chicago: The University of Chicago Press.

Lipszyc, Adam. 2015. *Czas wiersza. Paul Celan i teologie poetyckie*. Kraków: Austeria.

Maspero, Giulio. 2016. La fisica contemporanea e la teologia trinitaria possono avere qualcosa in comune? Un suggerimento dall'ontologia relazionale. *Rivista di Filosofia Neo-Scolastica* 2: 319–31.

Maspero, Giulio. 2018. Redes y relaciones: Lo cósmico y lo humano en diálogo. in Sociedad Argentina de Teología. In *¿Dónde estás? Ser humanos en este mundo. Teología, humanidad y cosmos. XXXVI Semana Argentina de Teología*. Buenos Aires: Agape Libros, pp. 25–53.

Maspero, Giulio. 2023. *The Cappadocian Reshaping of Metaphysics: Relational Being*. Cambridge: Cambridge University Press.

Maurer, Armand. 1993. Thomists and Thomas Aquinas on the Foundation of Mathematics. *Review of Metaphysics* 47: 43–61.

McMullin, Ernan. 1996. Enlarging Imagination. *Tijdschrift vor Filosoofie* 58: 227–60.

Milbank, John. 2009. *The Future of Love*. Eugene: Cascade Books.

Mondin, Battista. 2013. *The Principle of Analogy in Protestant and Catholic Theology*. Berlin: Springer.

Murphy, Alice. 2021. Imagination in Science. *Philosophy Compass* 17: e12836. [CrossRef]

Murphy, Nancey. 2006. *Bodies and Souls, or Spirited Bodies?* Cambridge: Cambridge University Press.

Olszewski, Adam. 2012. Matematyka czy teologia? Hilbert, Gordan i początki formalizmu. *Philosophical Problems in Science (Zagadnienia Filozoficzne w Nauce)* 51: 131–49.
Oviedo Torró, Lluís. 2022. *La credibilidad de la propuesta cristiana*. Santander: Sal Terrae.
Paris, Leonardo. 2012. *Sulla libertà. Prospettive di teologia trinitaria tra neuroscienze e filosofía*. Roma: Città Nuova.
Paris, Leonardo. 2017. *Teologia e neuroscienze. Una sfida possibile*. Roma: Città Nuova.
Penrose, Roger. 2004. *The Road to Reality: A Complete Guide to the Laws of the Universe*. New York: Alfred A. Knopf.
Peterson, Michael L., Timothy J. Pawl, and Ben F. Brammelli. 2024. *Jesus and the Genome: The Intersection of Christology and Biology*. Cambridge: Cambridge University Press.
Popper, Karl Raymund. 2002. *The Logic of Scientific Discovery*. London and New York: Routledge.
Przywara, Erich. 2014. *Analogia Entis: Metaphysics. Original Structure and Universal Rhythm*. Grand Rapids: Eerdmans.
Rahner, Karl. 1975. On the Relationship Between Theology and Contemporary Sciences. In *Theological Investigation*. Edited by Karl Rahner. New York: The Seabury Press, vol. 13.
Rea, Michael C. 2009. Introduction. In *Analytic Theology. New Essays in the Philosophy of Theology*. Edited by Oliver D. Crisp and Michael Rea. Oxford: Oxford University Press.
Sander, Hans-Joachim. 2019. *Glaubensräume—Topologische Dogmatik. Glaubensräumen nachgehen*. Grünewald: Ostfildern.
Steeves, Nicolas. 2016. *Grâce à l'imagination. Intégrer l'imagination en théologie fondamentale*. Paris: Cerf.
Strzelczyk, Grzegorz, and Jerzy Vetulani. 2016. *Ćwiczenia duszy, rozciąganie mózgu*. Kraków: Znak.
Torrance, Thomas F. 1980. *Ground And Grammar of Theology: Consonance Between Theology and Science*. Charlottesville: The University of Virginia Press.
Torrance, Thomas F. 2005. *Space, Time and Incarnation*. London and New York: T&t Clark.
Tracy, David. 1998. *The Analogical Imagination: Christian Theology and the Culture of Pluralism*. New York: Crossroad Publication.
Tyson, Paul. 2022. *A Christian Theology of Science. Reimagining a Theological Vision of Natural Knowledge*. Grand Rapids: Baker Academic.
Visala, Aku. 2021. Analytic Theology and the Sciences. In *T&t Clark Handbook of Analytic Theology*. Edited by James M. Arcadi. London and New York: T&t Clark, pp. 407–21.
Wolfe, Judith. 2024. Imagining God. *Modern Theology* 40: 97–109. [CrossRef]
Wolfe, Judith. 2025. *The Theological Imagination: Perception and Interpretation in Life, Art, and Faith*. Cambridge: Cambridge University Press.
Wołowski, Lech. 2021. Od Cantora do Balthasara, czyli słowo o roli paradoksu w naukach ścisłych i w dogmatyce. In *Dogmat i metoda. Wprowadzenie do badań interdyscyplinarnych w teologii dogmatycznej*. Edited by Robert Józef Woźniak. Kraków: WAM, pp. 415–35.
Wołowski, Lech. 2023. *Problematyka paradoksu w myśli Henriego de Lubaca i Hansa Ursa von Balthasara*. Kraków: Wydawnictwo Uniwersytetu Papieskiego Jana Pawła II w Krakowie.
Woźniak, Robert Józef, ed. 2025. *Dogma and Method Toward Interdisciplinarity in Dogmatic Theology*. Tübingen: Mohr Siebeck.

Disclaimer/Publisher's Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.

religions

MDPI

Article

The Idea of Mathematicity of the Universe as a *Locus Theologicus*: Michael Heller and Representatives of "The Kraków School of Philosophy in Science"

Kamil Trombik

Faculty of Philosophy, The Pontifical University of John Paul II in Kraków, 31-002 Kraków, Poland; kamil.trombik@upjp2.edu.pl

Abstract: In this paper, I focus on the analysis of the concept of the mathematicity of the Universe developed by Heller and his colleagues from the Kraków School of Philosophy in Science [KSPS]. For the representatives of this School, the mathematicity of nature was one of the most frequently discussed issues. Based on these philosophical discussions, several proposals were formulated with clear theological references, and these also constitute an area for a broader discussion at the interface between science and religion. From a philosophical point of view, the question of the mathematicity of nature remains an open metaphysical problem. The image of the world formulated on the basis of this idea can be an inspiration for theologians seeking common ground with the sciences. An example of this are the views of Heller himself and some representatives of the KSPS, which are analyzed in this paper, taking into account critical positions and indicating possible research perspectives.

Keywords: mathematicity of the universe; mathematical universe; Michael Heller; Kraków School of Philosophy in Science; science–religion

1. Introduction

"The miracle of the appropriateness of the language of mathematics for the formulation of the laws of physics is a wonderful gift which we neither understand nor deserve". These words were used by Eugene Wigner—a famous 20th-century physicist, one of the co-founders of quantum mechanics and a Nobel Prize winner—in his paper with the meaningful title "The Unreasonable Effectiveness of Mathematics in the Natural Sciences" (Wigner 1960, p. 14). Wigner and many like-minded scientists expressed their amazement at the fact that scientists are increasingly better able to explore and understand reality through the use of mathematics[1].

The possibility of investigating and understanding nature through mathematics raises some philosophical questions about the relationship between mathematics and reality itself (i.e., physical objects and physical states). This problem was one of the key issues addressed by Michael Heller and his colleagues from the Kraków School of Philosophy in Science [KSPS][2]. In this paper, I will reconstruct and analyze their views and show how the idea of the mathematicity of the Universe led them from epistemology (the world is able to be known thanks to mathematics) to a certain ontological concept (the idea of the mathematical character of the Universe[3]). This ontological conviction provides an area for certain theological considerations, including for Heller and his colleagues. If mathematics reveals the rational nature of the Universe, can the mathematicity of the world be considered a sign left by a rational Creator? (Sections 3 and 4).

I will also show in this paper how an image of the world formulated on the basis of the idea of the mathematicity of the Universe could inspire theologians looking to find common ground with the sciences, and it could even be considered a kind of *locus theologicus* (Sections 5 and 6). The views of Heller himself and some representatives of the KSPS are analyzed in this paper, taking into account critical positions and indicating possible research perspectives. I will precede the main portion of the considerations with a few historical remarks, showing the origins of the idea of the mathematicity of the world in the views of philosophers of earlier eras (Section 2).

2. Historical Roots of the Idea of the Mathematicity of the World (A Very Brief Outline)

The idea of the mathematicity of nature in its primary form already existed in the philosophy of the ancient Greeks. According to many philosophers of that period, the world shows signs of order and harmony. This is reflected in the term "*cosmos*", which can be translated as meaning "order" or "harmony". Some, such as the Pythagoreans and Plato (and his successors in the Platonic Academy), believed that the path to understanding the nature of the cosmos went through mathematics[4]. Mathematics was believed to be the key to understanding reality, including its ultimate causes. According to them, the world was organized according to "number and measure" by a divine being. The connections between mathematics and physics therefore have their extension in theological matters (Dembiński 2015, 2017).

The emphasis on order and harmony prevailing in the world featured very commonly in ancient Greek philosophy[5]. The Ionian thinkers of the 7th and 6th centuries BC were the first to ask questions about the elementary principle of the world (*arché*), and the idea that nature is rational was widespread. In the Middle Ages, an important issue for philosophers was the intelligibility of nature (*intelligibilitas entis*), which was in fact a question about the fundamental intelligibility of being. In the modern era, following the successes of Newtonian physics, there were attempts to answer the question about the effectiveness of mathematics for investigating the world (see Heller 2011). The method of modern physics became a combination of the theoretical element (i.e., mathematics) and the empirical element[6]. The phenomenon of the rationality of nature was closely related to the question of the relationship between mathematics and the world.

Nowadays, many scientists (e.g., Schrödinger 1996; Wilson 1998) emphasize the significant importance of the first philosophers of nature in the development of science. This significance is supposed to consist, among other things, of the fact that the first Greek philosophers treated nature as something that could be understood using appropriate research methods. The supposed comprehensibility of nature combined with the idea of the elementary nature and unity of the world caused some (e.g., Alfred N. Whitehead, Werner Heisenberg, Roger Penrose) to start tackling metaphysical questions about the nature of reality. In this field, a question emerged from the noticeable connections between mathematics (as the language of science) and the world itself: Does the Universe have a mathematical nature?

Over the past century, several approaches to tackling the question of the mathematicity of nature have been proposed. Here are some of them (see Życiński 1987, p. 173):

1. The neo-positivist tradition omitted considerations of the mathematicity of nature, treating the possibility of investigating nature using mathematics as a natural fact that did not require further philosophical interpretations.
2. The Kantian approach explains the effectiveness of mathematics by referring to the mental activity of the subject who attributes mathematicity to the world. In other

words, we can cognize the world not as it really is (*noumenon*) but as it presents itself to our minds (*phenomenon*).

3. The Platonizing approach assumes the real existence of a mathematical reality as objects or structures prior to human beings. Mathematics is effective for investigating the world because the world is mathematical in nature (in the metaphysical sense).

Heller's views on the mathematicity of nature are situated within the Platonic interpretation.

3. Michael Heller's Views: From Physics and Cosmology to Theology

Heller's views on the mathematicity of the Universe have developed over many years. They took on a more mature form in the 1980s and 1990s and inspired many other scientists, especially physicists, and philosophers who collaborated with Heller in the Kraków milieu. The problem of the mathematicity of nature could be considered one of the key issues that Heller and the KSPS took up (Trombik 2021, p. 225). This is reflected in the number of publications on this topic and the many discussions held in the KSPS milieu, as well as local scientific events (e.g., conferences, seminars) devoted to the idea of a mathematical Universe, that have been organized since the 1980s. Initially, philosophers of science (e.g., Heller's long-time collaborator, Józef Życiński) and physicists from the Jagiellonian University in Kraków (e.g., Andrzej Fuliński, Leszek M. Sokołowski) took part in discussions about this issue (see, e.g., Trombik 2023). Over time, this idea spread even more, and the idea of the mathematicity of nature was also taken up by a new generation of KSPS representatives with an interest in the philosophy of mathematics (e.g., Janusz Mączka, Jerzy Dadaczyński), the history and philosophy of science (e.g., Jacek Rodzeń), science–religion relationships (e.g., Wojciech Grygiel), or the philosophy of computer science (e.g., Paweł Polak, Roman Krzanowski).

3.1. Basics of the Concept of the Mathematicity of the Universe

In his programmatic paper titled "How is philosophy in science possible?" Heller writes about several philosophical assumptions of empirical sciences: (a) the assumption of the mathematicity of nature, (b) the assumption of the idealizability of nature, (c) the assumptions of an elementary character, and (d) the unity of nature. According to Heller, these assumptions are accepted by contemporary science and can be especially noticed in methodologically advanced sciences like physics. From the point of view of my considerations here, point (a) is particularly important, although it is worth adding that the mathematicity of the Universe is also closely related to the other assumptions mentioned by Heller (see Heller 2019, pp. 243, 245).

What does Heller mean by the mathematicity of nature? He writes as follows: "From the most general point of view, the mathematicity of nature boils down to the fact that nature can be described mathematically. It may be considered a fact since it is 'empirically' confirmed by the development of the sciences from the times of Galileo and Newton. Moreover, this development is extremely efficient, documented with a sequence of successes, both theoretical and pertaining to the 'technical' conquest of nature" (Heller 2019, p. 241).

Heller treats the concept of the mathematicity of nature as a modern equivalent of the idea of *intelligibilitas entis*, which already has some ontological references. The assumption of the mathematicity of nature, as indicated by Heller, can be primarily considered an epistemological assumption. The world is knowable through the use of mathematics, as a result of which we obtain a mathematical description of natural phenomena. Empirical research provides knowledge about physical phenomena, while mathematics provides rigorous methods for formally describing phenomena using appropriate symbols and formulas and allows for the formulation of new empirical predictions and research hypotheses.

Mathematics is a language used to formulate scientific theories, and it also indicates what follows from these theories. Regardless of how one understands "objective reality" ontologically, mathematical formulas correspond to the structures of natural phenomena; there is a certain correspondence between mathematical creations and the scientific models in physics. From a philosophical point of view, it is worth reflecting on the question of why this agreement occurs at all.

3.2. Ontological Reference Points

The mathematization of nature generates many questions, including one about the property of the world in an ontological sense. The idea of the mathematicity of nature is therefore founded on epistemology, but the consequences flowing from this idea may also include ontology. In the context of this issue, Heller formulated the hypothesis that the world has a specific property that allows it to be effectively investigated. The starting point of Heller's ontological considerations is the following problematic question: Why is mathematics so effective at describing nature?

According to Heller, it is doubtful that this effectiveness of mathematics can be explained solely by subjective factors, i.e., through the role of the active rational human subject constituting knowledge through the functioning of the mind (in light of this view, mathematics could be considered an invention of the human mind)[7]. The relationship between mathematics and cognition is an inverse one; mathematical models describing reality are closely related to reality itself, and they fit so well because reality itself is mathematical (in the ontological sense). This concept is closely related to a moderate version of mathematical Platonism, which assumes the existence of mathematical objects or structures, independent of the mind.

In the context of this view, mathematics constitutes reality (as a network of structures) prior to the human being and its cognitive possibilities. Heller's views are basically closest to Platonism in its structuralist version[8]. The world can be understood as a mathematical structure, the nature of which is approximated by the mathematical structures used in science. Heller poses a strong ontological hypothesis: the Universe has a mathematical nature. This Mathematics (written with a capital letter) serves as a fundamental ontology and is essentially broader than the mathematics (written in the lowercase) used by humans. The language of mathematics used by scientists is an approximation of certain fragments of objectively existing Mathematics. Mathematics—as the ontology of the world—is primary in relation to the human mind. The human mind does not "create" mathematics (and in any case the creative aspect is not fundamental here), which it then projects onto the world, but the world has a mathematical nature, and the mathematics we use is only a reflection of Mathematics as such.

The ontic property of the world is described by Heller through the concept of the mathematical character of the Universe (in this case, Heller sometimes talks about the "Structure of the World", see e.g., Heller 2006). This ontological, speculative statement begs many questions and opens a series of discussions that often go beyond the framework of ontology. For Heller and some representatives of the KSPS, the idea of a mathematical character of the Universe is interesting and inspiring from a theological point of view. If we accept, following Heller, that Mathematics reveals the rational nature of the universe, then can we say that this is a sign of the creation of reality by a rational Creator?

3.3. Theological Aspects of the Mathematicity of the World

Epistemological and ontological considerations on the mathematicity of nature constitute a foundation for theological reflection. Heller connected the mathematical property of the world with the broader idea of rationality: The mathematical world is a realization of the

rationality of a mathematical type. Therefore, we can use the phrases "Mathematical character of the Universe" or "rational world" interchangeably (in this case, we can speak of the ontological rationality of the world hypothesis; see Heller 1997; Coyne and Heller 2008).

Ontic rationality manifested in the stability of physical structures is, according to Heller, a manifestation of God's immanence in the world. The mathematicity of the world can be considered in two ways: (1) as a sign left by a rational Creator (through the act of creation that has been accomplished) and (2) the manifestation of God's continuous presence in the world, which is knowable thanks to mathematics. Heller considers this double creative action in the context of the traditional theological ideas of *creatio ex nihilo* (point 1) and *creatio continua* (point 2).

According to Heller, God uses mathematics to create the world. He creates and sustains the existence of the Mathematical Universe. The tool for understanding the "book of nature" (i.e., the Universe) is the language of mathematics. Divine rationality is known (at least to some extent) by man who investigates reality through mathematics. In Heller's view, practicing natural sciences is a way of studying God's plan for the world, and this way is no less valid than traditional theological models for describing God's action that use the much less precise language of philosophy, such as Aristotelian (Thomism) or Platonic (e.g., the main trends in Patristic Theology). Heller stated that "science is but a collective effort of the Human Mind to read the Mind of God from the question marks out of which we and the world around us seem to be made" (Heller 2008, p. 17; see also Heller 1994b).

These theological interpretations of the mathematicity of nature led Heller to the view that physicists are in fact engaged in discovering the effects of God's creation in their research. However, Heller's conception of the Universe does not match with the popular idea of "Intelligent Design". He also does not exploit the gaps in our knowledge of the world to propose the God hypothesis there. Indeed, Heller is very critical of the idea of "God of the gaps" and "physicotheologies" projects. He fully accepts the scientific image of the evolution of the Universe that has emerged from contemporary sciences, both cosmology and modern synthesis in evolutionary biology (see, e.g., Heller 2010). He also notes that the theistic vision of the world is often argued against on the basis of the idea of chance, which is supposed to undermine the concept of a rational (implicitly created by God) world. According to Heller, however, the idea of chance does not rule out the theological perspective. It is worth discussing this thread briefly, because his approach is relatively original and goes beyond the common views in this area, formulated on the basis of the science–religion relationship.

Taking up the issue of the structure of the Universe, Heller points out the elements of necessity (i.e., laws of nature) and the elements of chance. He indicates that chance does not breach the rationality of nature but is an integral part of it, with it being the effect of various laws of nature. Chance does not violate the structure of the Universe but is its integral component. It has a mathematical character and is an aspect of the mathematicity of nature. According to Heller, chance does not oppose God's plan but is a part of it (see Heller 2013). At this point, it is worth giving a voice to Heller himself, who expressed the theological message on the relationship between chance and necessity in the evolution of the Universe as follows: "Is chance a rival force of God's creative Mind, a sort of manicheistic principle fighting against goals of creation? But what is chance? It is an event of low probability which happens in spite of the fact that it is of low probability. If one wants to determine whether an event is of low or high probability, one must use the calculus of probability, and the calculus of probability is a mathematical theory as good as any other mathematical theory. Chance and random processes are elements of the mathematical blueprint of the universe in the same way as other aspects of the world architecture. Mathematical structures that are parts of the composition determining the

functioning of the universe are called laws of physics. It is a very subtle composition indeed. Like in any masterly symphony, elements of chance and necessity are interwoven with each other and together span the structure of the whole. Elements of necessity determine the pattern of possibilities and dynamical paths of becoming, but they leave enough room for chancy events to make this becoming rich and individual" (Heller 2008, p. 16).

According to Heller, chance is an essential element of the structure of nature. It is necessary for harmonizing this structure, and it also enables development within it, constituting the basis of processes that lead to increased complexity. Heller does not oppose chance and necessity but believes that they complement each other.

4. The Idea of the Mathematicity of Nature in the Kraków School of Philosophy in Science

Heller was one of the main supporters of the idea of the mathematicity of nature in the Polish philosophical milieu. His views had a local influence, especially in the Kraków circle. Hence, the hypothesis of the mathematicity of the world was one of the key issues undertaken at the KSPS. Simultaneously with Heller, this idea was at the center of Joseph Życiński's philosophical interests. Życiński's views were close to Heller's position. Życiński identifies the mathematicity of the Universe with the rationality of being (rationality in the ontological sense). In the context of the problem of the mathematical character of the Universe, he develops the hypothesis of the "field of rationality". This philosophical proposition explains the mathematicity of nature by assuming that formal structures are ontologically prior to physical phenomena. Życiński claims that a field of structures is the basis of the rational structure of the world. He called this field the "field of rationality" or, interchangeably, the "field of potentiality", but he also refers to other names, such as formal field, nomic structure, or even Logos and "the Mind of God". According to Życiński, the field of rationality is necessary to explain the mathematicity of the Universe (see Życiński 1987, 2006; Grygiel 2022).

Życiński's concept is a development of Plato's philosophy of ideas, and it is also close to the supporters of Platonism in the contemporary philosophy of mathematics (one of the main inspirations for Życiński's philosophy were Whitehead's views). Życiński's views are close to Platonism in structuralism form (which can be considered a kind of Platonism); mathematical objects constitute a network of structures that is prior to the entity investigated in science. Like Heller, Życiński interprets the phenomenon of the mathematicity of nature ontologically, and on the basis of ontology he formulates propositions of a theological nature.

The basis of the rationality of the Universe is a rational God who makes himself present in the world, mainly through the laws of nature. Życiński's theology, which is based on the idea of the mathematicity of nature, is extensive and touches upon, among other things, the issue of God's action in the world. Życiński propagates the panentheistic model of God's presence in nature. God ontologically transcends the world, but the Creator also acts through natural processes and reveals his presence in the rational structure of nature. God acts in the world, constituting the rational basis of nature from which new qualities emerge over the course of evolution (*creatio continua*). According to Życiński, panentheism is the most mature form of the doctrine combining theses on God's immanence and transcendence (Życiński 1988, p. 150) and at the same time allowing for the interpretation of Christian theism as being consistent with the theory of evolution.

The philosophical and theological ideas of Heller and Życiński found fertile ground in the KSPS. The philosophical aspects of the issue of mathematicity were taken up by collaborators, such as Janusz Mączka, Jerzy Dadaczyński, Jacek Rodzeń Jacek Dębiec, Bartosz Brożek, Mateusz Hohol, and others (e.g., Rodzeń 2005, 2011; Brożek and Hohol

2014). In turn, the theological significance of the concept of the mathematicity of nature was noticed by, among others, Tadeusz Pabjan, Wojciech Grygiel, and Paweł Polak. Polak reinterpreted Heller's idea by referring to the contemporary philosophy of computer science and the concept of pancomputationalism (e.g., Polak 2017). Pancomputationalism views nature as the product of computational processes (or, directly, nature as a computational process). A stronger version of this concept treats the Universe as an equivalent of a computer program[9]—a program that could be programmed by God the Mathematician (or the Programmer). Although these ideas are inspired by the development of the philosophy of new technologies, they have historical roots, e.g., in the views of the Pythagoreans or the philosophy of Leibniz. According to Leibniz, the best of all possible worlds is organized in accordance with the principles of mathematics, which he expressed in the famous sentence "*cum Deus calculat et cogitationem exercet, fit mundus*". God thinks mathematically (calculates), as a result of which a mathematical world emerges. The mathematicity of the Universe is considered a manifestation of God's mathematical thought.

It is worth noting that although the issue of the mathematicity of nature was widely discussed in the KSPS milieu, not all the members of this School fully accepted Heller's ontological and theological views. Some, such as physicists Andrzej Fuliński and Lech Sokołowski, pointed out difficulties with this concept, especially its Platonic version. In the context "of the question of whether a scientific theory discovers objectively existing laws or just constructs a description of the world, Fuliński answered that the problem was apparent and that the two claims should not be considered to be contradictory. A scientific theory can be a reflection of reality as well as its reconstruction, structuring, and even a kind of 'creation'" (Trombik 2023, p. 247). Sokołowski also showed some caution in formulating an unequivocal position on the issue of the mathematicity of nature. Although he believed that the hypothesis of the mathematical nature of the world was worthy of serious consideration, he also followed Einstein in believing that in the ontological sense the nature of the Universe is more complex than the possible philosophical positions adopted in the dispute (Sokołowski 2015, p. 67). In this regard, Sokołowski expresses doubts about modern Platonism, e.g., in the Penrose style (Sokołowski 2011, p. 218). Nevertheless, it is worth noting that Sokołowski was willing to accept the milder ontic position that nature is rational. However, this view is not equivalent to the stronger position that the Universe is mathematical in terms given to this view by the supporters of radical Platonism (see Sokołowski 2001, p. 215).

Representatives of the KSPS also addressed the issue of "the surplus of mathematics". They point out that a specific property of mathematics is noticeable in the fact that its formulas, derived independently of any physical interpretation, correspond to the structures of phenomena in nature (see, e.g., Życiński 1992). The boundaries between so-called pure mathematics, developed independently of research on nature, and applied mathematics are often blurred. The blurring of these boundaries occurs especially when the sciences assimilate the results of mathematics. However, it has been historically confirmed that mathematics develops faster than the process of assimilation of its results in natural sciences. There are many examples of this. Probability theory developed much earlier before it was used in quantum mechanics, and non-Euclidean geometries found application in Einstein's physics after several decades.

Because so-called pure mathematics develops faster than sciences such as physics, and the process of accumulating mathematical knowledge is more dynamic than the process of its "absorption" into empirical sciences, some are inclined to recognize a specific "surplus of mathematics" in relation to physics, and consequently perhaps in relation to nature itself (Sokołowski 1992). From the point of view of ontological considerations, this is of significant importance. As Sokołowski writes: "The entire world is a realization of one specific

mathematical structure, some fragments of which we already know, and others await to discovery. Mathematics contains and allows for the existence of many different structures, which, at least conceptually, could be assigned to various worlds [. . .] Mathematics has many more possibilities than can be realized in a world that, although astonishing in its diversity of phenomena, has a uniform character. Mathematics is enormously surplus in relation to nature" (Sokołowski 1992, p. 69). "The surplus of mathematics" is undoubtedly one of the interesting problematic issues emerging in the context of the mathematicity of nature.

It should be added that some doubts about the views of Heller and Życiński were also expressed by other members of the School, such as Łukasz Lamża (Lamża 2019). According to Lamża, Heller and other supporters of his concept made a mistake by ontologically interpreting a certain phenomenon of an epistemological nature. The fact that one can investigate the world using mathematical equations and models does not mean that the objects occurring in the world have a mathematical structure. In the context of the question about the mathematicity of nature, Lamża suggests agnosticism: "The only honest answer to the question of what the world is like is the good old Buddhist answer: silence. In other words, no matter what feature I 'really' attribute to the world, I will be wrong. This is the Śūnyatā doctrine, a specific version of which we also studied in Europe when wondering what God 'really' is like" (Lamża 2019). This criticism of the ontological interpretation of mathematics also negates its theological significance.

The nature of all these doubts, and especially the scope and specificity of the discussions held within the School on the mathematicity of nature, testify to the importance of this issue among the Kraków milieu[10]. Discussions about the mathematicity of nature have been occurring within the KSPS for several decades. Indeed, this part of the paper discusses just certain selected aspects of these discussions, leaving the more detailed issues to be examined and discussed in a more extensive work.

5. Selected Areas of Influence for the Concept of the Mathematicity of Nature

The views of Heller and his colleagues show how reflection on the effectiveness of mathematics in science can lead from epistemology through ontology to theological considerations. The philosophical idea of the mathematicity of the Universe can serve as a bridge for discussions on many questions, e.g., on the existence and nature of God, God's action in the world, and even certain issues in the area of the "Science and Religion" debate. These remarks require more detailed commentary.

The problem of the existence and nature of God, considered in a philosophical way (without any apologetic purposes), has been discussed in Western tradition since ancient Greece. The fact is that the value of the traditional arguments for the existence of God (i.e., ontological, cosmological, moral, and others) has long been rightly questioned. Natural theology has been in crisis since at least the Enlightenment, and it is now at an impasse due to the development of the sciences. Based on the results of science, philosophical positions are often formulated in contrast to Christian doctrine, which is expressed in theological (not always clear) conceptual forms. The argument for a theism based on the idea of the mathematical Universe is currently being discussed in the philosophical literature (e.g., Hołda 2014). It is treated as a variant of the epistemological argument because it makes investigating the world the starting point of reasoning. This argument is of course susceptible to criticism. The fact that scientists effectively investigate reality using mathematical methods does not in any way follow that the world can be attributed with the property of mathematicality, or even that it is a mathematical structure created by God.

On the other hand, for philosophers who do not exclude the theological perspective, the concept of God as the source of the mathematicity of nature can provide an interesting point of reference for reflection on God's action in the world. It is worth adding that the idea of the mathematicity of the world can encompass a wide range of views in this regard. The concept of Heller and other like-minded philosophers opens up various interpretative perspectives. Therefore, it can be stated that the traditional questions about the value of various models of God's relationship to the world (including deism, pantheism, and panentheism) have gained renewed importance.

The theological interpretation of the mathematicity of nature can take various forms. The idea of a mathematical character of the world does not determine the nature of the Absolute. Some who follow Leibniz or contemporary pancomputationalism may be inclined to claim that God thinks mathematically (the idea of God the Mathematician) or acts like a programmer (the idea of God the Programmer), and the world is the result of this mathematical thinking or programming. As Heller wrote: "In the work of creation, God's rational plan was realized (. . .) God's creative plan is mathematically precise, because God, in creating the world, thinks mathematically" (Heller 1994a, p. 256). Heller interpreted the theological remarks on creation in close connection with Christian beliefs[11]. However, it seems that this is not the only way of interpretation. The above statements can be interpreted in the context of both deism and pantheism or panentheism:

(a) The deistic position limits the role of the Absolute to creating (programming) the world. Thus, the world is permeated by divine, mathematical thought. However, this is where divine action in the world ends. God can be understood here as an impersonal being that does not enter into any additional interactions with nature and humanity.
(b) The pantheistic position, on the other hand, extends divinity to all of nature, identifying the rationality of God with the rationality of nature. In this approach, the boundaries between mathematics and Mathematics are blurred (for comparison, see Section 3.2).
(c) The panentheistic model of God's action in the world is based on the belief that God is the rational basis of reality. His immanence in the world consists of the fact that he constantly permeates reality through the process of its development (this view can be understood in the context of the idea of *creatio continua*), making himself present, for example, in the laws of nature, as the ontological condition of the cosmic order.

The position of panentheism, as understood in this way, is relatively close to the views of Heller and Życiński. I believe that from a theological point of view, one of the advantages of the idea of the mathematicity of nature is the potential to discuss different models of God's action in nature. This concept can also serve as a platform for discussion with more subtle ideas, not necessarily traditional ones. The phenomenon of the mathematical rationality of the world could be interpreted here even within the context of Einstein's idea of a "cosmic religion" (see, e.g., Einstein 1954). Einstein rejected the anthropomorphic representations of gods in monotheistic religions but shared the belief that the rational order of nature refers to something metaphysical that cannot be expressed by means of language (speaking in the language of "early Wittgenstein", it is what is "mystical") but whose nature can be explored through scientific research. In this context, the idea of the mathematicity of nature seems to be—at least to some extent—compatible with the idea of a "cosmic religion", which, although far from traditional theism and the concept of a personal God, is at the same time distant from extreme scientistic philosophies convincing that the world does not constitute any metaphysical mystery to man.

It is worth adding here that the idea of the mathematicity of nature may constitute, as a philosophical concept, an important *locus theologicus* for theologians, considering the issue

of God's action in the world. This concept could open up new avenues for interpreting many theological ideas. The foundation for the concept of the mathematicity of nature is the scientific image of the world, interpreted philosophically in a way that allows for the formulation of more metaphysical theoretical constructs.

The historical perspective shows that, in past eras, theological trends (or even theological models) were formed on the basis of intellectual currents that prevailed in culture. The dependence of theological trends (the theological image of the world) on philosophy, and often science as well (i.e., on philosophical and scientific images of the world), has been historically confirmed. We could mention, for example, popular trends in patristic theology rooted in Neoplatonism, medieval scholastic theology based on Aristotelian philosophy, or contemporary process theology inspired by an evolving vision of the world built on the foundations of the modern sciences. Currently, the idea of the mathematicity of nature can fulfill a similar function as a source of inspiration for a new way of thinking in theology. This is a philosophical idea that has theological potential. This potential was noticed by both Heller and his colleagues in the KSPS (e.g., Polak 2017).

It is worth adding that the idea of the mathematicity of nature in its theological interpretation is a construct that may prove helpful for breaking down barriers in the science–religion relationship. Thinkers like Heller reject the view that there is a conflict between these two spheres (i.e., the "conflict model" in Ian Barbour's views), and they also critically evaluate the "independence model". They recognize that science and religion have certain important points of reference. At the same time, in their opinion, these references are not mutually contradictory but can be harmonized.

Heller and his colleagues proposed a theology that is open to the achievements of science and accepts its latest findings, and they also believe that scientific knowledge allows theological concepts to be enriched with new perspectives. The project of this "new theology" is, in the case of Heller and his colleagues, a departure from the Thomistic tradition. Heller's theology is developed on the basis of philosophy, which in turn is based on a scientific image of the world (see Heller 1996). This philosophy has a serious ontological commitment, especially in the conception of the mathematical character of the Universe. According to Heller, a theology built on the idea of the mathematicity of nature, where nature is understood as a manifestation of the divine *Logos*, coexists in harmony with scientific theories, e.g., with the theory of evolution. He also considers the conflict between science and religion to be an alleged one. This thread would undoubtedly require a more extensive commentary and examination of whether this is really the case; this problem is worth considering in a later publication.

6. Summary and Some Research Perspectives

The concept of the mathematicity of nature is a very debatable one. In the epistemological sense, it seems obvious, but its ontological interpretation poses many difficulties (some of which have even been pointed out by members of the KSPS)[12]. The interpretation of ontological propositions in the context of theology is even more debatable. In this paper, I tried to show that the image of the world formulated on the basis of this idea is interpreted theologically (Heller and his collaborators) and can also be an inspiration for other theologians seeking common ground with the sciences.

Therefore, the concept of the mathematicity of nature can even be considered a kind of *locus theologicus*, i.e., an idea that can provide a basis for a theological vision of the world, which, instead of traditional models of theological thinking (e.g., Aristotelianism), proposes a concept that is closer to contemporary discussions at the interface of science and philosophy. In this context, the views of Heller and his colleagues deserve attention as an example of a theologically and philosophically fertile concept, built on a scientific

view of the world[13]. The ideas of Heller and the KSPS deserve further research because they represent an interesting example of the mutual influence of philosophy, as inspired by the achievements of modern science, and theology, which is open to new proposals for reinterpreting old convictions about God and his action in nature[14]. They also constitute an interesting discussion platform for thinkers who are critical of the idea of God rooted in Christianity. For example, God the Mathematician could be considered an impersonal being that permeates mathematical reality. Perhaps this is where the perspectives of theists and more unorthodox thinkers could come closer.

The above remarks lead us to the thought that the idea of the mathematicity of nature could in fact serve to rethink many fundamental issues that touch upon the borders between science, philosophy, and theology, including, for example, the problem of evil and suffering in relation to the idea of God the Mathematician (in a deistic interpretation or some version of the "cosmic religion", this issue does not have to be a riddle, because an impersonal Absolute does not have to establish any moral order, while it constitutes a serious challenge to traditional theism and panentheism). Although the concept of the mathematicity of nature seems to be a highly abstract idea, separated from the "existential problems of man", it could in fact creatively influence the understanding of existential issues, i.e., the understanding of man and his place in the world. Just like with Stoicism or Epicureanism, for example, considerations of the fate of man were undertaken in close connection with, or rather depending on, the vision of the world, so these days, the concept of the mathematicity of the Universe, understood both ontologically and theologically, constitute an interesting plane for a philosophical discussion about humanity. This issue has already been reported in some of Heller's works (see e.g., Heller 2010), but it has not yet been developed in more detail and comprehensively discussed by other thinkers.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: No new data were created or analyzed in this study. Data sharing is not applicable to this article.

Conflicts of Interest: The author declares no conflict of interest.

Notes

1 The success of modern sciences (starting with Newton's physics in the 17th century) began with the consistent use of mathematical methods to describe phenomena occurring in the world, both on a macro and micro scale. Quantitative physics proved more effective than qualitative physics. The mathematical language—in close connection with the empirical research method—proved to be much more effective at exploring nature than the previous attempts made by earlier generations of scholars who were accustomed to more speculative philosophies; the aim of them was to develop a holistic vision of the world based on theoretical foundations (as basic beliefs, see "foundationalism") and intended to constitute a reference system for all knowledge (see, e.g., the image of the world in the Aristotelian–Thomist tradition).

2 Michael Heller is one of the most famous contemporary Polish philosophers and theologians. His works in the field of the philosophy of science (especially the philosophy of physics) and the science–religion relationship are well known around the world. He was awarded the prestigious Templeton Prize in 2008 for his contribution to breaking down the barriers between science and religion. Heller's achievements include over a thousand works, some of which are available in English. It should be added that since the turn of the 1970s and 1980s, Heller organized an interdisciplinary milieu in Krakow and became the creator of the so-called Kraków School of Philosophy in Science. The School has been developing for several decades, engaging many Polish scholars in work at the interface of science, philosophy, and theology. For more on the history of this milieu, see (Brożek and Heller 2015; Trombik 2019; Polak and Rodzeń 2021; Polak and Trombik 2022).

3 In this article, I refer to the idea of the "mathematical character of the Universe" with synonymous phrases, such as the "mathematicity of nature", the "mathematicity of the world", and "the mathematicity of the Universe".

4 I assume—following Dembiński (e.g., Dembiński 2010, p. 46)—that the Pythagorean tradition had a significant contribution to the shaping of the philosophical profile of Platonism. The connections between Platonic philosophy and Pythagorean philosophy were very deep—to such an extent that it can even be understood as a continuity between Pythagoreanism and Platonism in relation to the issue of understanding mathematics and its connections with the world.

5 On the idea of order in ancient (and medieval) thought, see, e.g., (Heller 2007; Wildiers 1982). It is also worth comparing the philosophy of the ancient Greeks with other traditions of antiquity, represented, for example, by Indian thinkers (see, e.g., Hamilton 2001).

6 This issue deserves more extensive commentary. In this paper, I will only indicate that historical aspects of the development of the modern scientific method were undertaken by Heller (e.g., Heller 1992, p. 73), as well as by members of the KSPS (e.g., Życiński 2000) and scholars cooperating with the Kraków milieu, such as Olaf Pedersen (see, e.g., the metaphor of the "Book of Nature" in Pedersen 1997, p. 218).

7 In his works, Heller discusses views critical of the idea of the mathematicity of nature (see, e.g., Heller 1997).

8 It is worth pointing out here that for over 20 years there have been numerous discussions about the structural realism (see, e.g., Ladyman 1998, 2002; Krzanowski 2017).

9 The "Computing Universe" concept.

10 It is worth adding that in Kraków, in parallel with KSPS, a group of Józef Tischner's students and collaborators was developing and gaining importance. Tischner was the author of an original philosophy called the "philosophy of drama" (see, e.g., Tischner 2024). There were discussions between Heller (and his students) and Tischner's collaborators on their philosophical proposals. In recent years, some papers have been published that highlight certain connections between these two ways of practicing the philosophy (e.g., Sierotowicz 2018, 2023).

11 For example, one could mention the connection of the idea of ontic mathematicity of the world with the Christian concept of the *Logos*, which is identified by Heller as Christ; e.g., "Christ is the Logos implies that God's immanence in the world is its rationality" (Heller 2003, p. 57).

12 The context for many discussions in contemporary philosophy of mathematics is the traditional dispute between realism and antirealism. In recent decades, many concepts have emerged on the basis of earlier views shared by, for example, Gödel, Quine, or Putnam (see, e.g., the views of Penelope Maddy). It is worth mentioning here the development of several varieties of structuralism in the philosophy of mathematics, for example, in the views of Michael Resnik, Geoffrey Hellman, or Stewart Shapiro. A certain form of structuralism has also been adopted in recent years by James Franklin (see e.g., Franklin 2014). The views of these several thinkers show that structuralism can have different faces. It is important to note that some of them support Platonism, while others serve to criticize Platonism. I think that in later publications it would be worthwhile to compare the views of Heller and the representatives of the KSPS with the views of other representatives of structuralism, placing them in the context of broader discussions among representatives of different varieties of structuralism (e.g., by comparing the views of Heller and Franklin).

13 Some contemporary theologians, e.g., Peter Hünermann, explicitly include a contemporary image of the world, shaped on the basis of the sciences, among the "*modern loci alieni*" (Hünermann 2003).

14 It is worth emphasizing here that the research tradition developed in the KSPS milieu was present in the international area. Heller published many works in English, often in collaboration with esteemed scholars such as Derek Jeffrey Raine, Odon Godart, and George Coyne. Over the course of several decades, Heller collaborated with many research centers in Europe and the USA. He was, among others, a member of the Vatican Observatory and also headed the Georges Lemaître Chair at the Université catholique de Louvain. He regularly participated in interdisciplinary seminars organized in Castel Gandolfo during the pontificate of John Paul II. He also developed the "philosophy in science" project in the USA in collaboration with A. Pacholczyk from the Steward Observatory of the University of Arizona in Tucson and William R. Stoeger from the Vatican Observatory Research Group in Tucson. It should be added that many of Heller's students and collaborators have published numerous works that are recognizable in the international area among philosophers and scientists (see, e.g., Polak and Trombik 2022).

References

Brożek, Bartosz, and Mateusz Hohol. 2014. *Umysł matematyczny*. Kraków: Copernicus Center Press.

Brożek, Bartosz, and Michael Heller. 2015. Science and Religion in the Kraków School. *Zygon* 50: 194–208. [CrossRef]

Coyne, George, and Michael Heller. 2008. A Comprehensible Universe. In *The Interplay of Science and Theology*. New York: Springer.

Dembiński, Bogdan. 2010. *Późny Platon i Stara Akademia*. Kęty: Marek Derewiecki.

Dembiński, Bogdan. 2015. Pitagorejsko-platoński projekt teologii matematycznej. In *Teologia Nauki*. Edited by Janusz Mączka and Piotr Urbańczyk. Kraków: Copernicus Center Press, pp. 229–46.

Dembiński, Bogdan. 2017. U źródeł pytania o matematyczność świata. Pitagorejczycy, Platon i Arystoteles. In *Oblicza filozofii w nauce. Księga pamiątkowa z okazji 80. urodzin Michała Hellera*. Edited by Paweł Polak, Janusz Mączka and Wojciech Grygiel. Kraków: Copernicus Center Press, pp. 11–27.

Einstein, Albert. 1954. *Ideas and Opinions*. New York: Crown Publishers.

Franklin, James. 2014. *An Aristotelian Realist Philosophy of Mathematics: Mathematics as the Science of Quantity and Structure*. Basingstoke: Palgrave Macmillan.

Grygiel, Wojciech. 2022. A critical analysis of the philosophical motivations and development of the concept of the field of rationality as a representation of the fundamental ontology of the physical reality. *Philosophical Problems in Science (Zagadnienia Filozoficzne w Nauce)* 72: 87–108.

Hamilton, Sue. 2001. *Indian Philosophy: A Very Short Introduction*. Oxford: Oxford University Press.

Heller, Michael. 1992. *Nowa fizyka i nowa teologia*. Tarnów: Biblos.

Heller, Michael. 1994a. *Kosmiczna przygoda Człowieka Mądrego*. Kraków: Znak.

Heller, Michael. 1994b. On Creation without Anthropomorphisms. In *The Philosophy of Person: Solidarity and Cultural Creativity Polish Philosophical Studies. Vol. I*. Edited by Józef Tischner, Józef Zycinski and George F. Mclean. Washington, DC: Gibbons Hall.

Heller, Michael. 1996. *The New Physics and a New Theology*. Vatican: Vatican Observatory.

Heller, Michael. 1997. Czy świat jest racjonalny? *Philosophical Problems in Science (Zgadnienia Filozoficzne w Nauce)* 20: 66–78.

Heller, Michael. 2003. Scientific Rationality and Christian Logos. In *Creative Tension: Essays on Science and Religion*. Edited by Michael Heller. Philadelphia and London: Templeton Foundation Press.

Heller, Michael. 2006. Discovering the World Structure as a Goal of Physics. In *Paths of Discovery (Plenary Session, 5–8 November 2004)*. Vatican City: The Pontifical Academy of Sciences, pp. 154–67.

Heller, Michael. 2007. *Filozofia przyrody. Zarys historyczny*. Kraków: Znak.

Heller, Michael. 2008. Statement by Professor Michał Heller at the Templeton Prize News Conference, March 12th, 2008. *Philosophical Problems in Science (Zagadnienia Filozoficzne w Nauce)* 43: 13–17.

Heller, Michael. 2010. *The Sense of Life and the Sense of the Universe. Studies in Contemporary Theology*. Kraków: Copernicus Center Press.

Heller, Michael. 2011. *Philosophy in Science. An Historical Introduction*. Heidelberg: Springer.

Heller, Michael. 2013. *Philosophy of Chance: A Cosmic Fuge with a Prelude and a Coda*. Kraków: Copernicus Center Press.

Heller, Michael. 2019. How is philosophy in science possible? *Philosophical Problems in Science (Zagadnienia Filozoficzne w Nauce)* 66: 231–49.

Hołda, Miłosz. 2014. *Teistyczne podstawy nauki. Epistemologiczne argumenty za istnieniem Boga*. Tarnów: Biblos.

Hünermann, Peter. 2003. Neue Loci Theologici. Ein Beitrag zur methodischen Erneuerung der Theologie. *Cristianesimo Nella Storia* 24: 1–24.

Krzanowski, Roman. 2017. Minimal Information Structural Realism. *Philosophical Problems in Science (Zagadnienia Filozoficzne w Nauce)* 63: 59–75.

Ladyman, James. 1998. What is structural realism? *Studies in History and Philosophy of Science* 29: 409–24. [CrossRef]

Ladyman, James. 2002. *Understanding Philosophy of Science*. London and New York: Routledge.

Lamża, Łukasz. 2019. Świat nie jest matematyczny. *Tygodnik Powszechny*. Available online: https://wielkiepytania.pl/article/swiat-nie-jest-matematyczny/ (accessed on 20 December 2024).

Pedersen, Olaf. 1997. *Konflikt czy symbioza? Z dziejów relacji między nauką a teologią*. Kraków and Tarnów: OBI-Biblos.

Polak, Paweł, and Jacek Rodzeń. 2021. The Science-Religion Relationship in the Academic Debate in Poland (1945–1998). *European Journal of Science and Theology* 17: 1–17.

Polak, Paweł, and Kamil Trombik. 2022. The Kraków School of Philosophy in Science: Profiting from two traditions. *Edukacja Filozoficzna* 74: 205–29.

Polak, Paweł. 2017. Current perspectives on the development of the philosophy of informatics (with a special regard to some Polish philosophers). *Philosophical Problems in Science (Zagadnienia Filozoficzne w Nauce)* 63: 77–100.

Rodzeń, Jacek. 2005. *Czy sukcesy nauki są cudem? Studium filozoficzno-metodologiczne argumentacji z sukcesu nauki na rzecz realizmu naukowego*. Kraków and Tarnów: OBI-Biblos.

Rodzeń, Jacek. 2011. Ewolucja dokładności przyrządów naukowych–w świetle obserwacji spektroskopowych Josepha Fraunhofera (1787–1826). In *Oblicza racjonalności. Wokół myśli Michała Hellera*. Edited by Bartosz Brożek, Janusz Mączka, Wojciech P. Grygiel and Mateusz Hohol. Kraków: Copernicus Center Press, pp. 117–41.

Schrödinger, Erwin. 1996. *Nature and Greeks and Science and Humanism*. Cambridge: Cambridge University Press.

Sierotowicz, Tadeusz. 2018. Filozofia dramatu jako filozoficzna tradycja badawcza. *Philosophical Problems in Science (Zagadnienia Filozoficzne w Nauce)* 64: 59–94.

Sierotowicz, Tadeusz. 2023. Theology of science: Its collocation and critical role for understanding of limits of theological and scientific investigations. *Philosophical Problems in Science (Zagadnienia Filozoficzne w Nauce)* 75: 211–31. [CrossRef]

Sokołowski, Leszek. 1992. Nadwyżkowość matematyki. In *Matematyczność przyrody*. Edited by Michael Heller, Józef Życiński and Alicja Michalik. Kraków: OBI, pp. 56–71.

Sokołowski, Leszek. 2001. Współczesne zagrożenia racjonalizmu. *Analecta Cracoviensia* 33: 213–32.

Sokołowski, Leszek. 2011. Parę uwag o matematyczności przyrody. In *Nauka w filozofii. Oblicza obecności*. Edited by Stanisław Burtyn, Małgorzata Czarnocka, Włodzimierz Ługowski and Anna Michalska. Warszawa: Wydawnictwo IFiS PAN, pp. 209–20.

Sokołowski, Leszek. 2015. Co nowego w filozoficznym problemie matematyczności przyrody? *Philosophical Problems in Science (Zagadnienia Filozoficzne w Nauce)* 58: 63–88.

Tischner, Józef. 2024. *The Philosophy of Drama*. Notre Dame: University of Notre Dame Press.

Trombik, Kamil. 2019. The origin and development of the Center for Interdisciplinary Studies. A historical outline by 1993. *Philosophical Problems in Science (Zagadnienia Filozoficzne w Nauce)* 66: 271–95.

Trombik, Kamil. 2021. *Koncepcje filozofii przyrody w Papieskiej Akademii Teologicznej w Krakowie w latach 1978–1993. Studium historyczno-filozoficzne*. Kraków: Scriptum.

Trombik, Kamil. 2023. Andrzej Fuliński as a representative of the concept of philosophy in science. *Philosophical Problems in Science (Zagadnienia Filozoficzne w Nauce)* 75: 233–56. [CrossRef]

Wigner, Eugene. 1960. The Unreasonable Effectiveness of Mathematics in the Natural Sciences. *Communications on Pure and Applied Mathematics* 13: 1–14. [CrossRef]

Wildiers, Norbert Max. 1982. *The Theologian and His Universe. Theology and Cosmology From the Middle Ages to the Present*. New York: The Seabury Press.

Wilson, Edward Osborne. 1998. *Consilience: The Unity of Knowledge*. New York: Random House.

Życiński, Józef. 1987. Filozoficzne aspekty matematyczności przyrody. In *Filozofować w kontekście nauki*. Edited by Michael Heller, Alicja Michalik and Józef Życiński. Kraków: Polskie Towarzystwo Teologiczne, pp. 170–85.

Życiński, Józef. 1988. *Teizm i filozofia analityczna*. Tom 2. Kraków: Znak.

Życiński, Józef. 1992. Jak rozumieć matematyczność przyrody? In *Matematyczność przyrody*. Edited by Michael Heller, Józef Życiński and Alicja Michalik. Kraków: OBI, pp. 23–42.

Życiński, Józef. 2000. *Inspiracje chrześcijańskie w powstaniu nauki nowożytnej*. Lublin: RW KUL.

Życiński, Józef. 2006. The Rationality Field and the Laws of Nature. In *Wyzwania racjonalności. Księdzu Michałowi Hellerowi współpracownicy i uczniowie*. Kraków: OBI-WAM, pp. 87–101.

Disclaimer/Publisher's Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.

religions

MDPI

Article

The Agencies of God's Word and Spirit: Modern Science as a "Sacred Reminder"

Christopher Barina Kaiser

Historical and Systematic Theology, Western Theological Seminary, Holland, MI 49423, USA; chrisk@westernsem.edu

Abstract: In this essay, I argue that modern science can function as a source of "sacred reminders" for aspects of Christian theology, like the doctrine of the Trinity, that are not normally engaged with in the empirical world. This approach is an alternative to the usual ways of relating scientific and theological endeavors in terms of conflict, separation, or consonance. I demonstrate this by beginning with the thoughts of two representative physicists (John Archibald Wheeler and Steven Hawking), particularly focusing on a fundamental distinction they make about the underlying ideal of the physical sciences. Noting a striking similarity of this distinction with some of the biblical imagery of God's Word and Spirit, I review biblical texts along these lines to show partial continuity with the groundbreaking ideas of our physicists, and to show how they can be generalized to include (a) levels of organization beyond those of physics; (b) intensive, localized agencies of Word and Spirit as well as the more extensive agencies suggested their ideas; and (c) the commissioning agency of God the Father. A review of the theology of Irenaeus shows that these distinctions in biblical imagery were developed in the early Church and played an important role in early Trinitarian theology.

Keywords: goals of scientific endeavor; John Archibald Wheeler; Stephen Hawking; laws of nature; Donald Walhout; God's Word and Spirit; economic Trinity; levels of organization; image and likeness of God; divine revelation; theophanies; Incarnation; sanctification; Irenaeus of Lyons

1. Introduction

Biblical texts are rich with imagery surrounding the divine Word and Spirit,[1] their relations to God, and their agencies in the created order.[2] They exhibit a variety of images that defy neat systematization. Any attempt to do justice to this variety must approach the subject from a particular viewpoint or question, theological or otherwise. My purpose in this essay will be to review those verbal images in a way that resonates with the understanding of the natural order, as proposed by two well-known modern physicists. In theological terms, these hints of an immaterial presence and agency in the physical world may be seen as a fresh way of framing the classical idea of the *vestigia Trinitatis*—the worldly vestiges or imprints of the triune God.[3] In this way, the thoughts of physicists about their own endeavors can serve as a "sacred reminder" to Christians for aspects of biblical theology that are not normally engaged with the empirical world. So, my main objective here will be to include the thinking of physicists in our conversations about theology. The result will contribute to our understanding of the distinctive ways in which members of the divine Triad function in the created order.

Over fifty years ago, Donald Walhout published a seminal article on "Other Religions as Sacred Reminders", in which he showed that the beliefs and practices of other religions can remind us of features that are currently forgotten or neglected in accounts of our own religious tradition.[4] This relationship is, therefore, a "self-reflective" one between religions rather than a theological assessment of other religions from the perspective of one's own (p. 201). For example, learning about the idea of *ahimsa*, the mandate to avoid causing harm to other beings in the indigenous religions of India, can remind us, particularly in

Euro-American societies, of the reverence for life found in the biblical wisdom literature and the teachings of Jesus (which Walhout refers to as a "subdominant theme" in present-day Christianity, pp. 204–5). For other cases, Walhout states, "when in another religion, we come across a more specific utterance, a more definite stance, on a subject than we are accustomed to find in our own thought, we are reminded of unfinished business and the need for more reflection" (which Walhout refers to as a "unclarified butter", pp. 205–6).

I suggest that the same relationship may hold true for Christian theology and the beliefs and practices of other disciplines like modern physics that are usually regarded as being completely secular.[5] Thinking about scientific endeavors can not only remind us of theological issues that need clarification, but it can also provide us with a fresh way of addressing them. In this case, the attribute of "sacredness" is based on the beliefs underpinning modern scientific endeavors[6] that were inspired by the historic Judeo–Christian creationist tradition, rather than overtly religious content.[7]

The work of modern physicists is certainly not the only vantage point from which to think about theology.[8] Most people find writings about physics challenging in the abstract austerity of its concepts and their distance from everyday life as we experience it. However, physics is one of the truly creative endeavors of our time, and its main ideas lie just beneath the surface of the technologies that we rely on day by day. Moreover, physics gives us an in-depth view of the natural world that our God has created. Even though no one-to-one correlation is feasible between the ideas of modern physicists and those of the Bible, approaching theology from this angle enables us to use the categories of scientific endeavor in our understanding of biblical theology, and vice versa.[9]

2. Guiding Insights from Two Modern Physicists

In thinking about the vestiges—or vestigial agencies[10]—of the triune God (the holy Trinity)[11] in our world, I have been inspired by ideas that come from two of the theoretical physicists of the previous generation: John Archibald Wheeler (1911–2008) and Stephen William Hawking (1942–2018). Both made intriguing statements about the ultimate goal of their work that point to a shared understanding in the community of physicists. These ideas will serve as a recurring reference point in our discussion of biblical and early Christian theology.

One of the main desiderata that motivate physicists is the formulation of a "final theory" that would unify all fundamental physical phenomena in a small set of mathematical laws (equations) and principles, or even in one single law. Whether that goal is attainable in the long run or not, it is the ideal that motivates physicists to find ways of unifying all the forces of nature and those forces with all the fundamental particles in a way that accounts for phenomena like neutrino oscillations, black holes, dark matter, and dark energy. In the words of physicist–cosmologist Stephen Hawking, finding that final theory would mean that "we would know the mind of God", at least as far as the physical level of creation is concerned.[12]

Although Hawking was an avowed "unbeliever" in conventional Christian terms, he was articulating a biblical insight better than many theologians do. In biblical terms, the "mind of God" that governs the organization and the evolution of the physical cosmos is usually called the Word (or Wisdom) of God,[13] which is designated the second member[14] of the divine Triad, the "Son of God", in Christian theology.[15] The creative Mind or Word of God is first manifested in the laws and principles that determine the form of the natural world and inform its evolution.[16] So, if we want to find vestiges of the triune God in the world governed by physics, we can do no better than to begin with the very laws of nature that Christians sometimes fear will exclude God (i.e., a "God-of-the-gaps") from the world around us. These laws manifest at the sensible, empirical level, but they are not in themselves empirical, spacetime entities like the phenomena they govern—they are not encoded in a software program hidden in the interior of fundamental particles or in the vastness of cosmic fields of force.

Consider the Pauli "exclusion principle", for example. It governs all the fermions (subatomic particles having spins in odd-numbered multiples of one half), and it explains why ordinary matter does not instantaneously collapse. Yet the exclusion principle does not exert a force on the particles that it governs, and it is not inscribed anywhere in space or time. Mathematical laws like these constitute the agency that governs the form of the empirical realm and informs its emergence and evolution.[17]

This association of physical laws with the divine Mind, Intelligence, or Word is not a new idea. It has often been noted by biblical writers, philosophers, and theologians before.[18] By itself, moreover, it is clearly incomplete from the standpoint of Christian theology. The vestigial agency here relates only to God as the Creative Mind or Creator Word. From the trinitarian perspective of traditional Christianity, it misses the complementary work of the Holy Spirit. There is more to God than a cosmic Intellect—more to be said about creation than God pronouncing a master equation.

I find another example of this idea in the words of a leading theoretical physicist of the postwar period, John Archibald Wheeler. When he was asked about finding a final theory to explain the existence and evolution of the material world, Wheeler began by saying: "There must be at the bottom of it all an utterly simple, if not an equation, an idea".[19]

This much agrees with what, with Hawking's help, we have associated theologically with the vestigial agency of the divine Word. What caught my attention was what Wheeler went on to say: "There is nothing deader than an equation. . .. Yet the universe flies. It has a life in it that no equation has".[20] Mathematical laws and equations are one part of what brings our world into being; whatever it is that actualizes the laws, gives them a life of their own, is another.[21]

By using the word "life", Wheeler suggested a meaningful connection to "giver of life", which is one of the main attributes of the Holy Spirit in trinitarian theology (Greek *zōopoión* in the third article of the Niceno–Constantinopolitan Creed). We normally associate that quality with organic life, or even with our own individual lives. But it can also apply, as Wheeler suggested for the foundational, physical level, to whatever it is that makes the mathematical formalism, or foundational "idea" of the universe, get up and "fly".

Stephen Hawking was also aware that something like this was assumed in scientific cosmology, and he raised questions that provide us with two further verbal images that suggest the vestigial agency of the Spirit. Like Wheeler, he argued that even if the mathematical equations may be complete, a rational explanation in natural philosophy requires a way of making the equations operative so that they actually do something:

> "Even if there is only one possible unified theory, it is just a set of rules and equations. What is it that breathes fire into the equations and makes a universe for them to describe? . . . Why does the universe go to all the bother of existing?"[22]

Our two physicists have highlighted the need for an actualizing agency, a "life", "breath", or "fire", without which the mathematical laws would be sterile.[23] We might add that such actualizing "fire" would be aimless without some kind of laws to channel it. The former is required to make things happen, but the latter is needed to provide creative direction to the "fire".[24]

The task of the physicist is to formulate and test equations, not to pursue the more metaphysical questions of actuality and existence. But the short, pithy statements of Wheeler and Hawking provide some clues of theological value. The terms they offer were intended to be metaphorical (as is much of theological language). They do not refer to physical forces or physical energy, but to the immaterial laws governing the physics of force and energy and an immaterial agency that actualizes them.[25] My point is that they can serve as "sacred reminders" of biblical imagery regarding the roles of God's Word and Spirit and make that imagery more relevant to the empirical world in which we live.

For those already familiar with biblical imagery, the words "life", "breath", and "fire" suggest the agency of the Spirit of God,[26] an agency that complements the formative, governing agency of the divine Word.[27] At the very beginning of the biblical narrative, when God began to create heaven and earth,[28] the wind or spirit of God (Hebrew, *ruach*

elohim) was already sweeping over the primordial items of creation (Gen. 1:2c), and it was accompanied by ten creational decrees,[29] with which God formed and informed the primordial elements[30] (unformed earth, darkness, waters) to produce the ordered, fruitful cosmos.[31] In a Christian reading of Genesis One, the Spirit and the Word of God worked together to accomplish the will of God.[32] For readers of the New Testament, something very similar occurred at the baptism of Jesus, when the hovering/anointing of the Spirit was accompanied by the declaration of God, "This is my Son", thus initiating a renewal of creation (Mark 1:10–12; cf. Luke 4:14, 18–19; Acts 10:38). Jesus' commissioning words to his disciples were similarly accompanied by his Spirit-granting breath (John 20:21–22; cf. Luke 24:46–49). In passages such as these, we have a recurring combination of an enabling, actualizing spirit[33] and defining word.[34]

As we shall see in the following sections of this essay, this dialectic of the governing word and actualizing breath/spirit can be traced through the various stages of the scriptural narrative: creation, (universal) providence, revelation, and personal transformation (renewal and sanctification), thereby organizing the imagery of biblical texts in accordance with the ideas suggested by our two physicists. This approach will coordinate the many ways in which God's Word and Spirit play active roles in our world at a range of levels, both physical and spiritual.

3. Generalizing the Agencies of God's Word and Spirit

Based on this analysis of the cosmos at the physical level, we may first discern the vestigial agencies of the divine Word and Spirit using the dialectic of lawfulness and actuality suggested by our physicists. In other words, there is in the natural world a synergy and coordination between the agencies of the second and third members of the divine Triad, which is termed the "economic Trinity".[35] These vestigial agencies of Word and Spirit are extensive (distributive) and everlasting—they permeate every aspect of our world, including humanity, and persist, wherever applicable, throughout time.[36]

This natural-science-based interpretation of *vestigia Trinitatis* can be generalized, however, to include biblical descriptions of the Word and Spirit in relation to select human beings. In contrast to the extensive, cosmic agencies of Word and Spirit, these agencies are intensive, locative, personalized, and episodic.[37] They manifest themselves as divine encounters with receptive humans at specific times and places. Such divine–human encounters occur both in revelations ("special revelation") and in transformations (renewal and sanctification); two areas of theology that are even more frequently the focus of attention in Scripture than the extensive laws of nature are.[38]

In extending our investigation to the intensive agencies of Word and Spirit, I am expanding the analysis along a second dimension. In addition to the distinction between Word and Spirit (an intra-trinitarian dyad), we have the differentiation between their agencies in creation and universal providence, on the one hand, and their roles in revelation and the transformation of humanity (an extensive–intensive dyad), on the other.

The first of these intensive roles is that of divine revelation. Here, the Word manifests itself in finite, generally anthropic (humanlike), forms[39] and in discrete events like spoken words and/or a theophany.[40] According to the Gospel of John, for example, the divine Word had manifested itself to the patriarchs and prophets in both spoken words and visualizable, anthropic forms long before assuming the concrete form of human flesh (John 5:37–40; 12:41; cf. Isa. 6:1–13 on Isaiah's vision of the Lord[41]). The agency of the Spirit is described as elevating the minds and imaginations[42] of receptive human beings to behold these forms (John 14:26; 15:26).[43] In some biblical texts, the Spirit is also credited with actualizing the theophanic forms of the Word.[44] Throughout the New Testament, the Spirit was operative in enabling the visions and auditions of apostles and prophets.[45] Here, again, there is a synergy between the vestigial agencies of the second and third members of the divine Triad—only here they are more direct and personal than in the extensive manifestations discussed earlier.[46] The coordination of an anthropic form with prophetic visualization,

like that of cosmic formation with actualization, reflects the synergy of the Word and Spirit within the created order.

A second intensive role of the Word and Spirit to consider is that of human transformation. According to the Gospel of John, those who believe the words of the incarnate Son/Word of God have eternal life (John 5:24; 6:63b, 68b; 15:3; 17:6–8). According to the Apostle Paul, the Son of God is the divine template in accordance with which believers are transformed in accordance with the original divine image (Rom. 8:29; 1 Cor. 15:49; 2 Cor. 3:18; Col. 3:10).[47] But there is an important twist here. This process of image formation (or renewal) in humanity was only made possible by the Cross and Resurrection. In order for humanity to be restored in the image of God, the incarnate form of God had first to be broken and disfigured (John 19:30–37; Phil. 2:6–8; 1 Cor. 11:24 $\aleph^{c}$ C^{3} $D^{b,c}$) and then restored by God's Spirit (Rom. 1:4; 8:11).

This transformation into the image of the risen Christ is actualized by the Spirit (1 Cor. 12:4, 7–11; 2 Tim. 1:6–7; cf. Rom. 12:6–8; 1 Tim. 4:14). Like the synergy of anthropic form and prophetic inspiration, this coordination of a formative image and actualizing gift reflects the synergy of the Word and Spirit.

These are the vestigial agencies of the second and third members of the divine Triad, both extensive and intensive. An analogy to the different parts of a musical composition may be helpful here. The extensive agencies of Word and Spirit (creation/providence) are continuous through time like the *cantus firmus* ("fixed song") in medieval polyphony or like the base guitar in rock music. The intensive agencies (revelation and transformation) improvise on that foundation in contrapuntal voices and more melodic figures.

4. The Agency of God the Father in the New Testament

Thus far, our procedure of beginning with the outlook of modern physics has provided us only with vestigial agencies for the Word and Spirit, not of the triune God. The reason is that our representative physicists provided us with two guidelines in thinking about the material cosmos explored by natural scientists, and, by extension, about the spiritual realm accessed by the prophets. This leads us to wonder whether the very first member of the divine Triad, God the Father, has a distinctive agency in the created order, and, if so, in what way. Here, biblical theology may further supplement the insights suggested by our two physicists.

In fact, the agency of God the Father within the created order is not clearly defined in the New Testament in either an extensive or intensive sense. With respect to extensive phenomena, we have the teachings of Jesus, according to which the Father makes the sun to rise, the rain to fall, the earth to bring forth bread, and the birds to be fed (Matt. 5:45; 6:11, 26, 30; cf. Ps. 104:2b–30), all without specifying any means or manner of operation. Paul adds that God arranged the diverse organs of the human body (1 Cor. 12:18, 24b). Texts like these provide us with stated facts or results without any information about their implementation. The first member of the divine Triad appears to be present and active somewhere in the background, decreeing and commissioning such events (cf. Col. 4:2–6), as in the imagery of Word and Spirit in Old Testament texts like Isaiah 55:11 ("my word that goes out from my mouth") and Psalm 104:30 ("you send forth your spirit").

There are some New Testament texts that indicate agency for God the Father in the intensive work of revelation. We occasionally hear the Father's voice (Mark 1:11; 9:7 and parallels; John 1:33; 12:28), but we only find vague indications of an anthropic form of the Father like that of the divine Word. While being tried before the high priest, for example, Jesus prophesied the coming of the Son of man "seated at the right hand of Power", referring obliquely to his heavenly Father (Mark 14:62 and parallels; cf. Acts 7:55–56).[48] The focus here was on the celestial status of the Son of man, not on God himself (partly reflecting Ps. 110:1).

The heavenly vision of "one seated on the throne" in the Revelation to John (the Book of Revelation) comes closest to a visual description of God the Father.[49] He looked "like jasper and carnelian", and he held a sealed scroll in his right hand (Rev. 4:2–3a; 5:1).

Without any description of the face or form of the Father, however, our gaze is immediately diverted to the Lion–Lamb who is "worthy to open the scroll and . . . look into it" (Rev. 5:2–10). The contrast between the stationary position of God ("seated on the throne")[50] and the detailed activity of the Lion–Lamb ("has conquered", "standing", "went and took the scroll", "worthy to take the scroll and open its seven seals", "ransomed saints for God", "made them to be a kingdom", Rev. 5:5–10) emphasizes the idea that the Lion–Lamb executes the will of the one seated on the throne.[51]

As a rule, therefore, God's Son, or the divine Word is the means through which God's revelations were assumed to take place,[52] and so was God's Spirit. This observation holds up even in cases that may appear to state the contrary. In Gospel accounts of Jesus' baptism, the Father designates Jesus as his beloved Son, but only after either Jesus or John the Baptist sees the Spirit descending upon him (Mark 1:1 and parallels; cf. Isa. 42:1). In the Gospel of John, God tells John the Baptist how he will recognize the pre-existent Lamb of God, and the Spirit is the means that God uses to direct John's attention to Jesus, the Son of God (John. 1:30–33). In the early source used by Matthew and Luke (Q for the German *Quelle*), the Father is said to reveal hidden truths to his children, but the text goes on to say that they can only know the Father through the Son (Matt. 11:25–27; Luke 10:21–22). A partial exception may be Matthew's account of Peter professing Jesus to be the Messiah, the Son of God. Jesus credited this revelation to the "Father in heaven" (Matt. 16:16–17). Yet, the sense of distance from earth that this celestial location suggests may reflect the fact that Jesus had previously attributed his disciples' ability to confess and defend their faith to the Spirit of their Father (Matt. 10:20; cf. Mark 13:11).[53]

The only agency impinging on the empirical realm that is frequently attributed directly to God the Father is the Resurrection. At least twenty passages in the New Testament state that God raised Jesus from the dead.[54] The raising of the beloved Son apparently elicited the immediate agency of the Father in a way that no other space–time situation called for. This striking exception to the general rule may be connected literally with the fact that seven of these passages associate the Resurrection with the postmortem agency of Jesus.[55] In theological terms, Jesus could not be said to restore himself to life without calling into question the reality of his death on the Cross [56] So, the long-term mission that God had mandated for his Son could not be completed without Jesus' being restored to life by the direct action of the Father.[57]

This relative ineffability of God the Father is made explicit in the Gospel of John, where we are informed that no one had ever before seen God himself (John 1:18; cf. 1 John 4:12). "You have never heard his voice or seen his form" (John 5:37b; cf. 6:46a): John's Jesus says these words to his fellow Jews, who certainly knew of the anthropic divine appearances to their patriarchs and prophets (which John assigns to the pre-incarnate Word; John 8:56–58; 12:37–41). As elsewhere in the New Testament, God the Father operates somewhere in the background as far as the affairs on earth are concerned. John's emphasis on the ineffability of the Father was not meant to deny the possibility of knowing God, however. The distancing of the Father here is compensated by the fact that he is now known and seen through his Son, the incarnate Word (John 1:18b; 5:38b; 6:46b; 14:7, 9b; cf. Matt. 11:27c), or at least is seen by those who are enlightened through the Spirit (John 16:13–15; cf. Rom. 8:13–16; Gal. 4:6).

In terms of Old Testament imagery, the role of the Father in New Testament texts is modeled on that of the presiding figure of the divine council. This council was a deliberative assembly in heaven that oversaw and managed affairs on earth.[58] In 1 Kings 22, for example, the prophet Micaiah reported a vison of "the Lord [*YHWH*/*Adonai*] sitting on his throne, with all the host of heaven standing beside him to the right and to the left of him" (1 Kgs 22:19 = 2 Chron. 18:18). The Lord asked for a volunteer from his attendant angels (here called "spirits") who would entice Ahab, the King of Israel. When one of the angels came forward, the Lord commissioned it, promised it success, and sent it out (1 Kgs 22:20–22 = 2 Chron. 18:19–21).[59] This is clearly an intensive (locative, temporal) action of God.[60]

Another example is the throne–room vision of the prophet Isaiah. Here, also, the Lord (*YHWH*/*Adonai*) was seen by the prophet on a majestic throne ("high and lofty") with angels (seraphim) in attendance (Isa. 6:1–2). The Lord called for a messenger to deliver a message to his people, and when Isaiah volunteered, he was sent out with detailed instructions (Isa. 6:9–13).

Both of these Old Testament narratives set events on earth in the context of a larger cosmic order (a celestial courtroom in 1 Kings 22 and a cosmic temple in Isaiah 6[61]). Like the revelatory events described earlier, they are locative and temporal, but they occur in the spiritual realm ("host of heaven", "high and lofty") which transcends our empirical realm, and to which inspired seers like the prophets were granted access.

The heavenly court is clearly the context of the throne–room vision of Revelation 4–5 that was discussed above. This passage gives us only a minimal description of the one seated on the heavenly throne with twenty-four elders in attendance (Rev. 4:2–4). John was invited to ascend by the trumpet-like voice of the risen Lord, the "Word of God", whom he had already seen in anthropic, theophanic form (Rev. 4:1b; cf. 1:10; 19:13). His visionary capabilities were then elevated "in the Spirit" (*en pneumati*)[62] so that he could behold the celestial throne and see that God was seated there (Rev. 4:2). This formative/informative agency of the Word and actualizing/transformative agency of the Spirit are the intensive kind experienced by the prophets and apocalypticists rather than the extensive ones that apply to the whole of creation. Here, the role of God the Father, like that of the conciliar Lord seen by Micaiah and Isaiah, is limited to commissioning someone to execute his plan. In fact, the Enthroned One is even more passive here than in our Old Testament texts. He does not ask for volunteers or give any verbal instructions. He merely holds a sealed scroll and leaves it to an attendant angel to look for someone worthy of opening the seals and thereby controlling future history. The crucified Lion–Lamb then steps forward to receive the scroll and open it (Rev.5:1–6:1). The role of the Enthroned One is again one of deliberating and decreeing.[63]

In fact, the New Testament is replete with texts that refer to Christ, the Son of God, being commissioned by God the Father to administer justice and open the way to salvation[64] and also to his obeying the Father's instructions.[65] There are also texts that speak of the Holy Spirit being sent by the Father to carry out his will.[66] Although the Father is somewhere in the background as far as the empirical realm is concerned, he is the central figure in the celestial, spiritual realm, the one who ordains the agencies of his Word and Spirit within that realm. This triadic arrangement is compactly stated by Paul in Galatians 4 in relation to the incarnation of the Son and the outpouring of Spirit:

> "But when the fullness of time came, God sent his Son, born of a woman, born under the law, so that we might receive adoption as children. And because you are children, God has sent the Spirt of his Son into our hearts, crying 'Abba! Father!'" (Gal. 4:4–6)

In short, the vestigial agencies of the members of the divine Triad are: (1) commissioning/sending for the Father in heaven; (2) forming/informing for the Word; and (3) actualizing/elevating for the Spirit. Commissioning takes place in the celestial realm, while formation and actualization occur in concert with each other either in the empirical realm or at the interface between the two realms.[67]

Thus far, I have surveyed biblical descriptions of God, God's Word, and God's Spirit rather selectively, being guided by the two fundamental ideas, two "sacred reminders", from modern physics: that the physical realm is governed by formative laws and principles, which are associated in Scripture with the agency of the Word, and that those laws are actualized by some kind of immaterial "life" or "fire" that is biblically associated with the agency of the Spirit. Although the functioning of laws and whatever actualizes them is a necessary assumption for scientific endeavor, neither of them is empirical in itself. Although they govern the entire realm of the finite form and discrete events, neither is located anywhere in space or placed in the temporal sequence of events. They operate

at the interface of the divine and human worlds and make the existence of space and time possible.

For further understanding of these vestigial agencies of God's Word and Spirit and the way in which they were nuanced in the early Church, I turn to Irenaeus, the bishop of Lyons. In the following discussion, it will be useful for comparison to keep in mind the main points already noted in biblical texts:

- Within the world of finite forms and discrete events, both empirical and spiritual, the members of the divine Triad are described in terms of their vestigial agencies.
- The vestigial agency of God's Word is expressed:
    - Extensively (universally, continuously) in the laws and principles that govern the form of the created order and inform its evolution. We were reminded of this point by one of the ideas of our two physicists, John Archibald Wheeler and Stephen Hawking, but we have generalized it to include the agency of the Word at each of the empirical and spiritual levels of the created order.
    - Intensively (episodically) in informative revelations, theophanic forms, assumption of a human form in Jesus, the disfiguration of the incarnate form on the Cross, and the image or template according to which humans are transformed. This point was one aspect of our second generalization of the ideas of physicists Wheeler and Hawking.
- The vestigial agency of God's Spirit is expressed:
    - Extensively in the actualization of the possibilities implicit in the laws that govern the created order, not only at the level of physics, but at each of its various levels, thereby effecting the evolutionary transformation of creatures from one level of organization and functioning to another.
    - Intensively (episodically) in actualizing informative revelations, opening the spiritual realm to prophets and apostles, the conception/animation and anointing of Jesus, revivifying the incarnate form of the Word, and actualizing the transformation of believers into the image of the risen Christ. This was the complementary aspect of our second generalization of the ideas of physicists Wheeler and Hawking.
- There is synergy and coordination between the vestigial agencies of Word and Spirit, both extensive and intensive.
- The extensive, continual agencies of Word and Spirit in the created order provide the infrastructure for their more intensive, episodic agencies in revelation and transformation. An analogy to the coordinated parts of a musical composition was helpful here.
- On the empirical plane, manifestations of the vestigial agencies of the triune God are generally accorded to God's Word and Spirit. The agency of God the Father occurs in the celestial background and is most often seen by prophets in the commissioning and sending of his Word and Spirit (also in the resurrection of Jesus). This point was our third generalization of the scientific ideas of Wheeler and Hawking.

5. Irenaeus in His Second-Century Context

Irenaeus's writings date from the last two decades of the second century, roughly a century after the composition of the New Testament documents. He is of particular interest for this essay, in that he was the first comprehensive (though not systematic) theologian of the Church. He drew on biblical traditions, both written and oral, and he provided us with new language concerning the vestigial agencies of the Word and Spirit and the synergy between them. The biblical material summarized above is nicely illustrated in one of his best-known metaphors: the Word and Spirit as "two hands" through which God functions in the created order. In what follows, I shall detail the way Irenaeus differentiated and coordinated the work of these two hands of God along lines similar to our physicists' differentiation of the laws of physics and the immaterial agency that actualizes them. His

various comments give greater clarity to the scattered references in Scripture and further illustrates the notion of scientists' ideas as sacred reminders.

In discussing Irenaeus of Lyons, there are several things to keep in mind. He was one of the last theologians (Hippolytus being another) who ministered in the Latin West, yet he still wrote, and he no doubt knew the apostolic writings, in Greek.

Irenaeus was conversant with the writings of some earlier theologians (e.g., Justin Martyr[68]). He was also keenly aware of oral traditions and interpretations that he had received as the very words of the Apostles, especially the Apostle John, via Polycarp and the Elders of the Church.[69]

Ante-Nicene theologians like Irenaeus thought largely in terms of verbal associations and correlations. They often developed those associations in ways so diverse that modern readers might see disparities or even verbal contradictions, some of which will be noted below.[70] As various heresies were identified and combatted over the centuries, conciliar theologians would regularize some of the language they used, particularly with regard to the triune God, and give us the standards of faith that have guided the Church ever since. However, there is still value in revisiting earlier (ante-Nicene) theologians like Irenaeus in order to discern the rationale underlying the language of those creeds.

Irenaeus was keenly aware of adaptations that needed to be made in communicating the gospel to gentile audiences, particularly to those in southern France, who were relatively recent converts from pagan polytheism.

Irenaeus was commissioned to investigate various dissident groups that he disparagingly labeled "pretended gnostics"—what we would call "know-it-alls".[71] As he explained at length in his treatise, *Against Heresies* (*Adversus Haereses*, dating from the 170s-180s CE),[72] there were three main problems that occurred in one gnostic theology or another:[73]

1. A hierarchy of as many as thirty divine and semi-divine entities (the *plērōma* or pantheon), each having a different grade of stability and knowledge, thereby mediating between the ultimate, immutable reality and the ephemeral, material world;
2. Denigration of the material world, in general, and the human body, in particular;
3. A Christology in which the deity of Jesus required that he not experience the messier aspects of human life like natural birth and death.

Finally, Irenaeus sometimes appealed to selected traditions he claimed to have received as a way of combatting these ideas. His writing was expository and polemical, not organized systemically according to the topics of later theology.

In countering the gnostic idea of a *plērōma* of hypostases, Irenaeus stressed the biblical belief that there is a single divine being, "one God", especially in his use of credal statements (*AH* I.10.1; III.4.1; IV.20.2; 33.7). The divine being is integral and therefore not subject to an emanation or gradation of hypostases, as some gnostics had portrayed it (*AH* II.13.3; 17.7; 28.4, 5).[74] On the positive side, Irenaeus portrayed the triune God—God the Father, God's Word (also titled Son and Lord[75]), and God's Spirit (also titled Wisdom[76])—as a single entity of which the second and third members were the agents through which God operated in the world of finite form. To make this idea more accessible, he used a simple metaphor: the Word and Spirit function like two hands with which God operates in the world of finite form.[77] What did this striking image mean?

Irenaeus's view of God the Father was not anthropomorphite. He did not view God the Father as having a bodily form with literal hands and feet. To do so would have subjected the Christian God to the ridicule of gnostics who portrayed the Old Testament deity as a demiurgic remnant of the divine *plērōma* (e.g., *AH* I.11.1). In keeping with the apostle Paul and the Evangelist John, therefore, Irenaeus referred the finite manifestations of the Deity in Scripture to the agency of God's Son/Word: "for the Father is the invisible of the Son [*invisibile Filii*], but the Son is the visible [form] of the Father [*visibile Patris*]" (*AH* IV.6.6; cf. Col. 1:15–17; John 1:14).[78] Here, Irenaeus used the image of hands as a metaphor to describe the agencies of God's Word and Spirit in visualizable terms,[79] terms that his gentile audience would more readily understand.[80]

6. Irenaeus on the Extensive Agencies of God's Word and Spirit

To illustrate this approach and see how it exemplifies the formation–actualization dyad suggested by our physicists, let us begin with the agencies of God's Word and Spirit in the extensive work of creation. Later, we shall look at the more intensive agencies of the Word and Spirit in original sanctification, revelation, the Incarnation, and human transformation. Our findings will then be summed up in a table at the conclusion of the following section.

First, we consider the agency of God's Word and Spirit in creation—that of the cosmos and that of the human species, which Irenaeus usually treated together because humanity was the climactic step in the two accounts of creation in Genesis One and Two. This set of ideas is well described in *Against Heresies*, Book IV:

> ". . .we do always learn that there is so great a God, and that it is he who by himself has established and made and adorned and contains all things [*per semetipsum constituit et fecit et adornavit et continet omnia*] and among all things both ourselves and this our world. . .. And this is he of whom the Scripture says, *And God formed man [plasmavit Deus hominem], taking clay of the earth, and breathed into his face the breath of life* [*flatum vitae*; cf. Gen. 2:7[81]] . . .. For God did not stand in need of these [angels] in order to accomplish what he himself had determined within himself [*apud se*] . . .as if he did not possess his own hands [*suas manus*]. For with him were always present the Word and Wisdom, the Son and Spirit, by whom and in whom . . .he made all things, and to whom also he speaks, saying, *Let us make man after our image and likeness* [Gen. 1:26a] . . .". (*AH* IV.20.1; SC 100:624–6; ANF 1:487–8 adapted)

This typically dense statement includes the Word/Son and Wisdom/Spirit within the identity of God ("within himself", "his own hands"). It begins by saying that God accomplished the work of creation ("established and made and adorned and contains all things"[82]) all by himself. He did not need angels to accomplish this task.[83] Instead, he used "his own hands", that is, his Word and Spirit in "making all things",[84] and it was to them, rather than to angels, that he addressed the words, *Let us make man after our image and likeness* (Gen. 1:26a).[85]

Irenaeus has carefully established the unity of God here, while at the same time allowing for a conversation to take place within the Godhead itself.[86] The process of creation was initiated by God (identified as "God the Father"[87]), but it was carried out through the agency of his Word and Spirit, the two acting in conjunction with each other.[88] The role of God the Father is assumed to be in the celestial background. The agency of the Godhead on the empirical plane (here the creation of humanity), is accorded to God's Word and Spirit as if they were two hands that reach the earth.

The cited passage dealt with the extensive agencies of God's Word and Spirit, those that pertain to all created things (including all human beings[89]). But it did not differentiate the agencies of the Word and Spirit in any way. For further explanation, we may begin with the section of *Against Heresies* that immediately follows the one quoted above (*AH* IV.20.2). Here, again, Irenaeus stressed the unity of God and the universal scope of God's creation. The task of governing [*principatus*] and judging all things is then delegated by God the Father to the Lord (Jesus) and his Word, and the role of the Spirit is further defined. In the midst of his intricately woven discourse, Irenaeus then described God as the one "who made all things by the Word [John 1:3][90] and adorned them by Wisdom [*qui omnia fecit Verbo et Sapientia adornavit*]" (*AH* IV.20.2; SC 100:630; ANF 1:488a). In the previous section (IV.20.1), Irenaeus had assigned the role of making and adorning all things to God ("who has established and made and adorned and contains all things"), operating through both Word and Spirit. In this second text, however, he brings out the dialectic of the Word and Spirit by assigning the role of making all things to the Word and the role of adorning them to Wisdom/Spirit. This passing mention suggests that Irenaeus associated the Spirit of God with the completion or perfection of the creative work that God accomplished through his Word.[91] It also provides some support for my thesis about scientific endeavor as a sacred

reminder of this dialectic. It is not clear, however, whether the relation of adorning to making is proportional to that of actualization to law-giving that we discussed earlier.

Some help regarding the Spirit's adorning work comes from Irenaeus's discussion of horticulture, which was of particular interest for its relevance to the production of bread and wine for the Eucharist. Cuttings from a grapevine, he noted, once planted in the earth, will spontaneously grow and bear fruit (thereby adorning the vine) and kernels of wheat, once planted in the ground, will germinate to produce grain (cf. Gen. 1:11–12; Pss. 104:13–15; 147:8, 14; 1 Cor. 15:37–38). Irenaeus attributed these life-giving, transformative wonders of the natural world to the work of the Spirit who "contains all things" (*continet omnia*, *AH* V.2.3). As we saw above, Irenaeus spoke of God "containing all things" (*continet omnia*, IV.20.1). Elsewhere, he attributes this containing work to the Lord Jesus (*AH* V.18.3, *continent . . .omnia*). But for Irenaeus, the growth of fruit from detached cuttings and the growth of seemingly inert seeds perfectly illustrated the transformative, lifegiving agency of God's Spirit throughout the vegetable kingdom. In the view of Irenaeus's contention that God had established the laws that govern all things through the agency of his Word (*Dem.* 10) however, we must conclude that the Spirit's contribution was not to displace the biological laws of growth (as for a God-of-the-gaps) but rather to actualize them at various levels of organization.[92]

Irenaeus further distinguished the transformative, lifegiving work of the Spirit from the formative agency of the Word in other places where he discussed the creation of humanity in Genesis One and Two. In the case of Genesis 2:7a, he accorded the formation of the human body to the Word ("God formed man from the dust of the ground"), and he assigned the divine breath that animated it to the Spirit ("and breathed into his nostrils the breath of life"). One of his clearest statements occurs in his later treatise, *Demonstration of the Apostolic Preaching* (c. 200 CE).[93]

> "But man he [God] fashioned with his own hands, taking of the purest and finest of earth, mingling his own power [breath][94] with the earth in a measured manner [cf. Gen. 2:7ab]. He gave man's frame the outline of his own form [i.e., that of the anthropic Word; cf. Phil. 2:6], so that its visible appearance should be godlike [lit. 'deiform']—for it was as a [material] image of God that man was fashioned and set on earth [Gen. 1:27]. And in order that he might come to life, *he breathed into his face the breath of life* [*and man became a living being*, Gen. 2:7bc]. So, man became like God in inspiration [by the Spirit] as well as in frame [modeled after the form of God's Word]". (Dem. 11[95])

Here, again, we see the Word and Spirit described as the two "hands" with which God created all things, including all human beings. Following the account in Genesis 2, Irenaeus described the creation of humanity here in two ways:[96] (1) formation of the upright human body,[97] for which God's Word served as the template (Gen. 2:7b; cf. Gen. 1:27);[98] and (2) animation or ensoulment[99] of that deiform body by the "breath of life" (Gen. 2:7b),[100] which he has assigned to God's Spirit.[101]

These associations help to clarify the intra-trinitarian dimension of the vestigial agencies of Word and Spirit that we described earlier in terms of scriptural imagery, thereby providing further support for my thesis about science as a sacred reminder. The dialectic of Word and Spirit is proportional to the dialectic of cosmos-governing laws and actualizing the breath/fire that guided our investigation from the outset.[102] For Irenaeus, in this case, the archetype impressed upon the human body is the intensive agency of the Word, as the anthropic image or form of the Deity,[103] rather than its extensive manifestation in laws that govern the biological world (e.g., the growth of grapes and wheat). However, Irenaeus extended the formative effect of this intensive agency to all human beings (note above). So, it is both intensive and extensive; intensive in its archetype and extensive in its effects. In that case, it provides a segue to the discussion of the intensive agencies of the Word and Spirit in the following section of this essay.

The reader will notice that Irenaeus's description of Word and Spirit as God's hands, with which we began, is incommensurate with his subsequent description of the distinct

agencies of the Word and Spirit: formation, image, prototype, on one hand and actualization, breath, animation, on the other. These latter phrases, of course, were dictated by the twofold process, bodily form, and life-giving breath in the foundational text, Genesis 2:7. However, both ways of interrelating the members of the divine Triad served Irenaeus's purpose of countering gnostic denigration of the human body and its Creator. Irenaeus's two-hands metaphor adapted biblical language to ensure the unity of the Godhead together with its agency in the "hands-on" work of creation, while his use of phrases from Genesis 2:7 asserted the godlike form and divine animation of the human body—all this while using everyday language that was comprehensible to his gentile parishioners. The completion of God's work in creating human beings requires the agencies of both formation (from earthly matter) and transformation (animation/ensoulment). Moreover, there is synergy between these two agencies just as there is every day human tasks that require the coordinated use of two hands, each in its own way, for their successful completion.

7. Irenaeus on the Intensive Agencies of God's Word and Spirit

We have seen that the words of Genesis 2:7 were taken by Irenaeus to describe God's deploying of the agencies of his Word and Spirit in the creation of humanity. The task was carried out by the Word in the formation of the human body from elemental material and by the Spirit in animating this finite portion of matter, thereby actualizing its operation at the biological level ("became a living being"). In addition to these operations concerning human anatomy and physiology in Genesis 2:7, Irenaeus saw two distinct agencies of the Word and Spirit in the paired phrases of Genesis 1:26 "in our image, according to our likeness". His most detailed explanation of this text occurs in *Against Heresies*, of Book V, chapter 6:

> "Now God shall be glorified in his handiwork [*in suo plasmate*, the human body[104]], conforming it and modeling it after his Son [*conforme illud et consequens suo puero adaptans*]. For by the hands of the Father, that is, by the Son and the Holy Spirit, man, and not [merely] a part of man, was [originally] made in the likeness of God [*secundum similitudinem Dei*, Gen. 1:26a]. . .. for the perfect [spiritual[105]] man consists in the commingling and the union of the soul [*adunitio animae*], receiving the Spirit of the Father [*assumentis Spiritum Patris*], and the admixture of that fleshly being which was molded after the Image of God [*plasmata secundum imaginem Dei*, Gen. 1:26a; cf. 2 Cor. 4:4; Col. 1:15] . . .". (*AH* V.6.1; SC 153:72; ANF 1:531b adapted)

Much of the wording here is familiar to us from Irenaeus's treatment of Genesis 2:7—specifically the molding of Adam's body (God's "handiwork"), with God's Son/Word) serving as the prototypical image (assuming a visualizable, anthropic form of the Word[106]); the Word and Spirit serving as the two "hands" that God used in the operation; and Adam becoming an embodied soul or ensouled body ("the commingling and the union of the soul").[107]

But there are two further ideas in this passage, one regarding the creation of humanity, and the other about its redemption.[108] With regard to the work of creation, the first humans were not only molded after the image of God, but they were also perfected (temporarily) by "receiving the Spirit" in their souls and so becoming God's "likeness" (*similitudo*) as well as reflecting God's image.[109] In other words, Irenaeus assigned a dual role to the Spirit of God in creating humanity, animating (ensouling) the human form—an extensive agency based on Genesis 2:7b that was discussed in the previous section—and elevating that embodied soul to the divine "likeness"—an intensive agency based on Genesis 1:26.[110]

Ancient anthropology differentiated several levels of human existence: physical, biological, rational, and spiritual (angel-like), the latter level being the "likeness of God" as Irenaeus understood it.[111] At the biological level, the Word's modeling and the Spirit's actualizing are extensive in the sense that they apply to all human beings to the present day. In the case of spirituality, however, the actualization turned out to be intensive. It applied to the original pair of humans, and it would subsequently apply to those who would be

restored to the divine likeness, but it would not be extended to the entire human species, due to the original sin in the Garden of Eden.[112]

Irenaeus's stress on the original perfection of humanity, including the human body (and all of creation), was clearly designed to counter the gnostic denigration of the created world, but it was also the basis for his main point, that the salvation of humans would include their bodies as well as "that which is purely spirit" (*solum spiritus*, *AH* V.6.1). Therefore, gnostics who denied the goodness of the human body not only blasphemed the Creator of all things, but they even "disallowed the salvation of the Creator's workmanship [*plasmatis Dei*], which the flesh truly is, on behalf of which . . . the Son of God accomplished the whole dispensation [*omnem dispositionem fecisse*]" (*AH* IV.pref.4; SC 100:390; ANF 1:463a).

The second idea to notice in the previously cited passage (*AH* V.6.1) is that the agency of the Word will also operate in the future restoration of the divine likeness to humanity, "conforming it and modeling it after his Son". This step would require the Word assuming a human form and likeness (cf. Phil. 2:6–7), his deformation on the cross, and his resurrection, all of which would involve the agency of God's Spirit.

Before proceeding to Irenaeus's treatment of the Incarnation, however, we should pause to note the ways in which he described the role of God the Father in creation and the roles of the Word and Spirit in prophetic revelations.

Because God the Father always operates through the agency of his two "hands", he appears to function in the celestial background for Irenaeus as was the case in the New Testament. He is the one who plans and commands all things, including the creation of the first human as described in Genesis 1:26:

> ". . . man, a created and organized being, is rendered 'after the image and likeness' of the uncreated God [Gen. 1:26a]—the Father planning everything well and giving his commands, the Son carrying these into execution and performing the work of creating, and the Spirit nourishing and increasing it". (*AH* IV.38.3; SC 294–96; ANF 1:521–22)

Here, Irenaeus correlated the paired phrases of Genesis 1:26 ("image and likeness") with the agencies of God's Son and Spirit, yielding a description of the roles of all three members of the divine Triad in an ordered sequence. For the Son and Spirit, it is only a summary statement, with emphasis on the forming agency of the Son ("make man in the image of God") and the increasing, perfecting work of the Spirit (in the likeness of God). Irenaeus made it clear, however, that the initiator of these actions, the mind behind the "hands", as it were, was God the Father.

The intensive agency of God's Word and Spirit also occurred in revelations to the Old Testament prophets. In *Against Heresies* IV.36.8, Irenaeus described them rather succinctly (while discussing another topic): "He who chose the patriarchs and those [people of Israel; cf. Deut. 7:6; 14:2] is the same Word of God who visited them by [means of] the prophetic Spirit . . ." (SC 100:916; ANF 1:518b). Here, we find the agencies of the Word and Spirit coordinated in prophetic revelations: the one visiting the prophets and revealing himself to them (in an anthropic form and prophetic words), and the other actualizing those revelations and heightening the prophets' faculties to see him and to hear his words.

In *Demonstration of the Apostolic Preaching*, Section 5, Irenaeus described the reciprocity of these two agencies in more detail and applied it to prophecies of the Incarnation.

> "Thus, the Spirit demonstrates [or 'manifests'] the Word, and, because of this, the prophets announced the Son of God, while the Word articulates[113] the Spirit, and therefore it is he [the Word made flesh] himself who interprets [or 'gives their message to'] the prophets and brings humans to the Father". (SVSP trans., 43 adapted, with note d; cf. ACW 16:51)

Here, again, the role of the Spirit was one of inspiring the words of the Old Testament prophets, in this case words announcing the advent of the Son of God. As in the Gospel of Luke, however, some of the prophets' words about the crucifixion and resurrection were not

understood before the Word became flesh and interpreted their message to his followers [Luke 24:25–27, 44–49, which credits the Spirit, sent by the Son, for the power to bear witness]. Even if the wording here could have been clearer,[114] it shows Irenaeus's concern to coordinate the agencies of Word and Spirit along the lines we have discussed, revealing the future Incarnation to the prophets, on the one hand, and making those prophecies about the incarnate Word manifest to chosen humans, like the Apostles.

Proceeding to Irenaeus's treatment of the agencies of Word and Spirit in the Incarnation itself, we may turn to two passages in book V of *Against Heresies*. I begin with section V.18.3, which is the shorter of the two passages and focuses our attention on the extensive and intensive agencies of the Word:[115]

> "For the Creator of the world [*mundi factor*] is truly the Word of God. And this is our Lord, who in the last times was made man [*homo factus est*], existing in this world [that he created; cf. John 1:10, 14a], and who in an invisible manner [*secundum invisibilitatem*] contains all things created [*continent quae facta omnia*; cf. Col. 1:16a] and universally pervades [*in universa conditione influxus*], since the Word of God governs and arranges all things [*gubernans et disposens omnia*].[116] And therefore, he came to his own [John 1:11a] in an invisible manner [*invisibiliter*[117]], and was made flesh [*caro factum est*, John 1:14a], and was 'hung upon the tree' [Acts 5:30; 10:39b; Gal. 3:13b], so that he might sum up all things in himself [*universa in semetipsum recapituletur*, Eph. 1:10]". (*AH* V.18.3; SC 153:244; ANF 1:546–7 adapted)

The first point of this passage is the extensive agency of the Word as maker and governor of the cosmos. Here, Irenaeus followed the traditional idea that the Godhead pervades (*influxus*, literally "flows into") all things,[118] while it also contains all things and therefore cannot be contained (1 Kgs. 8:27; Wis. 1:7).[119]

Irenaeus then built on these ideas to explain (and defend) the divine Word's being made human flesh (John 1:14a). The Word who made all things (*mundi factor*) and contains all things (*continent quae facta omnia*), including the form of the human body, is also "our Lord" who was "made man" (*homo factus est*) and "made flesh" (*caro factum est*). By this quadruple use of the Latin verb *facio*, "to do or make", Irenaeus showed that the agency of the Word/Lord has to do with forming and imaging, not only extensively in the creation of the cosmos and of human beings in general, but also intensively in the in vivo formation of the man Jesus, who is the perfect embodiment of the Word of God.[120] In other words, the incarnation of the Word involved its self-formation as a flesh-and-blood human being speaking audible human words (rather than a theophanic form as in the Old Testament narratives).[121]

Irenaeus also describes the Cross of Jesus along these lines. The Word made flesh was "hung upon the tree that he might sum up all things in himself". In Irenaeus's well-known typology of recapitulation, the obedience of Christ on the "tree" of the Cross (to the point of death) atoned for the disobedience of Adam regarding the Tree of Knowledge (for which death was the prescribed penalty). However, Irenaeus seems to have a role of the Word in mind here that is more active ("sum up") and more extensive ("all things") than just the sin of the first humans.[122] Could the Cross also be a "summing up" of the Word's extensive agency in the entire cosmos?

The answer, I believe, comes from Irenaeus's later treatment of the Cross in Section 34 of *Demonstration of the Apostolic Preaching*:

> "And because he is himself the Word of God Almighty, who in the invisible [preincarnate] form pervades us universally in the whole world [cf. Wis. 7:24] and encompasses both its *length* and *breadth* and *height* and *depth* [cf. Eph. 3:18]—for by God's Word everything is disposed and administered—[so] the Son of God was also crucified in these [four dimensions] imprinted on the universe in the form of a cross. For, in becoming visible, he had necessarily to bring to light his cross-sharing with the universe, in order to show openly through his visible form [on the Cross] that [cosmic] activity of his: that it is he who illumines the *height* (that is, what is in heaven), and holds the *deep*, and stretches forth and extends the

> *length* from east to west, navigating also the northern parts and the *breadth* of the south, and calling in all the dispersed [people] from all sides to the knowledge of the Father". (*Dem.* 34; ACW 16:69–70 with 172n.172 and italics added; cf. SVSP, trans., 62)

Instead of using the Word's formation of the cosmos as a way of explaining the form of the Cross, as he did in the case of the Incarnation as previously discussed, Irenaeus retroactively portrayed the four-dimensional design of the Cross as "imprinted on the universe" in its "length and breadth and height and depth". Based on the pattern of the Cross, the Word illuminates the heavens and holds back the deep (cf. Pss. 74:16; 104:2; Pr. Man. 2–3).

In discussing Irenaeus's theology of the Incarnation thus far, we have focused on the agency of the divine Word, largely based on the Gospel of John, chapter one. We still need to see how he coordinated the agency of the Word with that of the Holy Spirit in effecting the Incarnation. Irenaeus's most extensive discussion of the role of the Spirit occurs in in *Against Heresies*, book V, and is based on the Gospel of Luke, chapter one. I divide the relevant passage into three parts: the first of which relates the Spirit to the need for holiness; the second part establishes a parallel to the formative–animating dyad of Genesis 2:7; and the third returns to the idea of the Word and Spirit as the hands of God in the image-likeness dyad of Genesis 1:26:

> "... the Holy Spirit came upon Mary, and the power of the Most High overshadowed her [Luke 1:35a]. Therefore, what was generated is holy [*quod generatum est sanctum est*] and the Son of the Most High God, the Father of all [Luke 1:35b], who effected the incarnation of this being [the Son] and showed forth a new [kind of] generation [*novam ostendit generationem*]". (*AH* V.1.3; SC 153:24–26; ANF 1:527b adapted)

In this first part of this passage, Irenaeus focused on the agency of the Spirit. Evidently, noticing the AB–AB parallelism in Luke 1:35—"Holy Spirit ... power of the Most High",[123] followed by "holy thing ... Son of the Most High"—he explained that the incarnate Son of God was holy (*sanctus est*) by virtue of the Holy Spirit's sanctifying Mary. In actualizing the conception of Jesus, the Spirit thereby effected "a new generation", that is, one untainted by natural intercourse (cf. John 1:13; Justin, *Dial.* 54.2). In other words, the agency of the Spirit elevated the process of reproduction above the normal physiological level, thereby making human gestation, with all its frailties, a fit vehicle for the incarnation of the divine Word and thereby countering the common gnostic assertion that the holiness of Jesus required that he not be tainted by gross matter as in natural birth. Irenaeus also saw a parallel between the Spirit's agency in the conception of Jesus and the agency of the Spirit in the original animation of humanity, as the sequel to the passage above explains:

> "... as at the beginning of our formation [*ab initio plasmationis nostrae*] in Adam [Gen. 2:7a], that breath of life from God [*a Deo adspiratio vitae*], having been united to what had been fashioned [*unita plasmati*], animated [or 'endowed with soul,' *animavit*] the man and manifested him as being endowed with reason [*rationabile ostendit*]; so also, in the last times, the Word of the Father and the Spirit of God, being united with the ancient substance of Adam's formation [*adunitus antiquae substantiae plasmationis Adae*; cf. Gen. 2:7], rendered man living and perfected [*viventem et perfectum effecit hominem*], receptive of the perfect Father [*capientem perfectum Patrem*] ...". (*AH* V.1.3; SC 153:26; ANF 1:527b adapted)

This part of the passage begins by revisiting the creation story of Genesis 2:7. The first human was fashioned from earth (according to the image/form of the Word) and united with the "breath of life" (by the animating agency of the Spirit). In addition, we hear that humanity was endowed by the Spirit with reason,[124] evidently, in coordination with the "Word of the Father", and this synergy would also bring about the Incarnation "in the last times". As the conclusion of this passage indicates, the function of human "reason" was to enable humans to respond to the teachings of the incarnate Word (the Greek term *logos*

means both "word" and "reason")[125] and, once perfected, to receive the perfect Father (cf. Matt. 5:48).

In short, Irenaeus completely reframed the creation story here to match the Incarnation and the sanctification of humanity. As humans had been deprived of their original, spiritual perfection (the divine "likeness" of Gen. 1:26), the Word had to be directly united to human nature (the "ancient substance of Adam's formation"), in conjunction with the Spirit's new work (the "new generation") in order to restore its God-given life and bestow the primordial perfection that made it "receptive of the perfect Father".[126] As in the first part of the longer passage, the Word provided the ideal form for the humanity of Jesus, but the Spirit's agency was required to actualize it.

In the third part of this passage, Irenaeus returned to his favorite metaphor, that of Word and Spirit as the two "hands" that God used in the creation of humanity, and he extended it (along the extensive–intensive dimension) to that of the perfection of humanity in the Incarnation:

> "For never at any time did Adam escape the hands of God [the Word and Spirit] to whom the Father said, *Let us make man in our image, after our likeness* [Gen. 1:26a]. And for this reason, in the last times, his hands perfected a living man [*vivum perfecerunt hominem*, i.e., Jesus] 'not by the will of the flesh, nor by the will of man, but by the good pleasure of the Father' [John 1:13], in order that Adam [the human species] might be made [once again] after the image and likeness of God". (*AH* V.1.3; SC 153:26–28; ANF 1:527b adapted)

Like the first human created in the image and likeness of God, Jesus was perfected (in the image and likeness of God) by the two hands of God. He was conceived (by the Spirit), formed (by the Word[127]), and born (of the Virgin Mary) in accordance with the will of God (the Father), rather than not the will of man (cf. John 1:13),[128] thereby renewing both "image and likeness of God" in humanity (Gen. 1:26a). The Word made flesh was the perfect human (as well as divine) image of God and, by virtue of his union with God the Father, he serves as a model for the restoration of humanity in the image and likeness of God as in the original creation.[129]

So, the Incarnation was made possible by the same synergy of the Word and Spirit that occasioned the original creation of humanity, and it re-established the likeness to God that humanity had previously lost (cf. *AH* V.6.1discussed above). The passage above has added, therefore, a further step along the extensive–intensive dimension: the sanctification of humanity by the restoration of the divine likeness. For clarification on this point, we may turn to a text in *Against Heresies* Book III, in which Irenaeus explained this step in relation to the Church and its spiritual gifts:

> "For this gift of God [*Dei munus*, i.e., the Spirit[130]], has been entrusted to the Church, as breath [*aspiratio*] was to the first created man [Gen. 2:7], so that all members receiving it may be vivified [*vivificentur*]. And [the means of] communion with Christ [*communicatio Christi*] has been distributed in it, that is, the Holy Spirit, [which is] the earnest of incorruption [*arrha incorruptelae*; cf. 2 Cor. 5:5; Eph.1:14], the confirmation of our faith [*confirmatio fidei*],[131] and the ladder of ascent to God [*scala ascensionis ad Deum*]. 'For in the Church,' it is said, 'God has set apostles, prophets, teachers' [1 Cor. 12:28], and all the other means through means through which the Spirit works …". (*AH* III.24.1; SC 211:472; ANF 1:458b adapted)

Once again, Irenaeus built on his earlier treatment of the creation of humanity. The work of the Spirit in creation was the bestowal of breath on the first human being (Gen. 2:7b) and its perfection in the divine likeness (Gen. 1:26a). In the new dispensation, the Church is granted the gift of the Spirit in order to vivify all its members[132] and to distribute to them the means of communion with Christ—the latter presumably referring to the transformative work of the Spirit in the Eucharist. The Spirit has advanced its members toward incorruption, confirmation of their faith (in the Lord Jesus Christ), and ascent

into the very presence of God.[133] Among the gifts of the Spirit to the Church are apostles, prophets, teachers, and miracle workers (1 Cor. 12:28; cf. 12:4–11).[134] In short, the agencies of the incarnate Word and the gifted Spirit ensure the sanctification of believers along the lines of the creation of humanity (both image and likeness; form and breath) and the Incarnation of the Lord Jesus (the perfect embodied image and likeness of God).

8. Summarizing and Assessing Irenaeus's Theology of Word and Spirit

We have discussed Irenaeus's views of creation, revelation, the Incarnation, and the transformation of fallen humans. The specific agencies that Irenaeus attributed to God's Word and Spirit in these areas are summarized in Table 1. Irenaeus on the agencies of Word and Spirit. The first five entries (rows) are about extensive (distributive) agencies and the last four are about intensive agencies (personalized and episodic):

Table 1. Irenaeus on the agencies of Word and Spirit.

Level/Stage of the Created Order	Word's Agency	Spirit's Agency
Empirical cosmos in general	Made all things (undifferentiated) Gave laws and set bounds Contains all things, yet embedded in all in an invisible manner Governs and arranges all things Imprints the form of a cross in the dimensions of the universe Illuminates the heavens and holds back the depths	Made all things (undifferentiated) Adorned all things Contains all things
Vegetation	Same as for the empirical cosmos.	Fructifies and multiplies vegetation
Creation and animation of human beings (Gen. 1:26a; 2:7a)	Prototypical image for formation of the human body (godlike in form) Carries out the Father's plan and commandments	Animates what was formed Produces a living soul (godlike in breath)
Humanity endowed with reason		Endows humanity with reason (in coordination with the Word)
Humanity formed in the divine Image and elevated to the divine likeness (Gen. 1:26a)	Prototypical image for the human body (godlike in form as above)	Perfected the first human (Adam) in the divine likeness (godlike in spirit)
Revelation	Coming to prophets in words and theophanic forms	Inspiring chosen humans to perceive those words and forms
Incarnation (perfect divine Image and likeness)	Was made man/flesh, visible Recapitulated the formation of Adam in Mary United the Spirit of God with humanity Hung upon the Cross that he might sum up all things in himself	Enabled Mary to produce a holy child, "Son of the Most High" Anointed the Word made flesh for service with the seven charismata of Isa. 11:2 LXX Raised the Word made flesh to glorified life
Humanity restored in the divine likeness	Re-established the divine likeness in humanity by becoming a perfect human in the image and likeness of God Raised from the dead as the prototype for restoration of humanity in union with God the Father	Vivifies us from a fallen, sinful life Renews the divine likeness in us Elevates us to union with Christ Confirms us in our faith
The life of the Church, present and future	Invites us to partake of his theanthropic life (esp. in the Eucharist) The ladder of our ascent to God the Father	Distributes the means of communion with Christ (esp. in the Eucharist) Works through apostles, prophets, and teachers The earnest/guarantee of our future resurrection and final union with Christ

This table shows that Irenaeus balanced the complementary agencies of the Word and Spirit along the lines suggested by our physicists for each of seven topics:

> The creation and development of the natural world: the Spirit's adorning all things and fructifying vegetation, complementing the Word's forming all things.
>
> The bodily creation of humanity: the Spirit's animation of virgin earth, complementing its bodily formation with the anthropic Word as its prototype.
>
> The elevation of humanity to the spiritual likeness of God, complementing its formation in the divine image.
>
> Divine revelations with the elevation of human minds and imaginations to perceive the forms and hear words of the divine Word.
>
> The Incarnation: conception, anointing, crucifixion, and resurrection of Jesus.
>
> The restoration in the divine likeness in humanity: spiritual rebirth and union with God with Christ as the prototypical Image.
>
> The Church, its spiritual gifts, the Eucharist, and its future hope.

The general outline of Irenaeus's treatment of the agencies of the Word and Spirit is comprehensive, spanning five major levels of the created order: physical, vegetable, physiological (animated body), mind (reason), and divine likeness (bestowed, lost and, restored). Irenaeus never systematized his ideas in this way. As seen in the passages cited above, they are entangled in such a way that you are never too far from one idea when reading about another. However, differentiating them as distinct topics can help us to describe the overall contours of his theology.

Most importantly, Irenaeus maintained the unity of the Godhead while including the Word and Spirit as integral members of the divine identity, on the one hand, and as potentialities for coordinated agency in the created world, on the other.

Recalling the ideas of our two physicists, however, one can see that Irenaeus's treatment of the extensive agency of the Spirit in the creation of the physical cosmos is not clearly differentiated from that of the Word. Based on our physicists' insights and our brief survey of the imagery of Scripture, I conclude that the Word's formative, ordering, lawful agency in the physical realm needs to be complemented with the actualizing "breath" or "fire" of God's Spirit to bring our world into existence, as stated in several biblical texts (e.g., Gen. 1:2; Ps. 33:6[135]). For Irenaeus, such actualization by the Spirit would not compete with the lawful evolution of the natural world.[136] So, our two physicists' ideas about scientific endeavors have not only given us an entry into the complex imagery concerning the agencies of God's Word and Spirit found in Scripture and in Irenaeus, but they also remind us of aspects of those agencies that might otherwise escape our notice.

9. Conclusions

The purpose of this essay has been to use the idea of two representative modern physicists (John Archibald Wheeler and Stephen Hawking) concerning the goal of scientific endeavor as a template for rethinking the complex imagery for God's Word and Spirit as described in Scripture and as further developed by Irenaeus of Lyons. The basic idea by which we were guided was a cooperative dialectic between a propensity for lawfulness and form, on the one hand, and the actualization of that propensity in all the many levels of the created order. It follows from our physicists' idea that any description of a Deity capable of creating a lawful world of finite form must include the potential for formation/information and the potential for the actualization/elevation of such a world. In biblical terms, these potentials are manifested in the formative agency of God's Word and the actualizing agency of God's Spirit.

These two divine agencies operate in unison at a variety of empirical levels, and also at spiritual, supramundane ones, like the world seen in prophetic visions. Divine agencies that operate at empirical levels (physical and organic) are generally extensive in that they function in the formation and information of all members of every class of creatures. At

least some human beings also function at a higher, supramundane level that may have formative laws of its own but are also subject to the intensive agencies of God's Word and Spirit, ones like those involved in theophanies and personal transformations that apply to specific individuals at specific times.

Whether or not there is any significant harmony between the current theories of modern physics and those of Scripture, there is an overlap between their underlying dialectics of formation and actualization as far as the natural world is concerned. To offer full justice to biblical imagery for God's Word and Spirit, however, this shared dialectic must be supplemented in several ways. It must allow for levels of the created order beyond the purely physical in order to do justice to the biblical tradition and avoid reductionism. It also must include the intensive, personal agencies of God's Word and Spirit in the context of revelation, Incarnation, and personal transformation. In these contexts, the biblical tradition reveals the agency of God the Father as the source and commissioner of the Word and Spirit. Despite these important supplements, the basic pattern offered by our modern physicists suggests that there is a much deeper relationship between scientific endeavor and historical theology than we normally assume. As theologians, we can benefit by being reminded of aspects of our traditions that have been appropriated by modern scientists and are often neglected by the Church as being too secular.

Funding: This research received no external funding.

Data Availability Statement: No new data were created or analyzed in this study. Data sharing is not applicable to this article.

Conflicts of Interest: The author declares no conflict of interest.

Notes

1 The ontological status of the Word and Spirit is not clearly addressed in the Hebrew Bible. Are they hypostatized attributes or angelic beings? In either case, the descriptor, "divine", serves to distinguish them from human words and spirits. Our primary concern here will be with the economic Trinity rather than the "immanent" Godhead that transcends all space and time.

2 I am using the term "agencies" to describe what traditional theology has called the "operations" (Greek, *energeia*) or "powers" (*dynameis*) of the deity e.g., Philo, *Cherubim* 27; *Special Laws* 1.45–47. On the proper use of this etic term, in discussing Irenaeus's understanding of Word and Spirit, see Lashier (2014, 176, 179, 181), passim. Lashier identifies a "two-agent theology of creation" (ibid. 177, 180), that supports the findings of the analysis of Irenaeus's writings here below.

3 In keeping with modern systems theory, I assume a multi-level model of the created order. I use the term "world" to indicate the created order in all its levels, spiritual as well as material. I shall use the terms "cosmos", "realm", and "plane", with various modifiers (physical, spacetime, material, empirical, mundane, spiritual, heavenly, celestial, angelic), as a way of differentiating those levels. I have previously reviewed two helpful ways of constructing such a stratified model in Kaiser (2013, 11–25).

4 Walhout (1970, 201–8). Walhout was then a professor at Rockford College (now Rockford University) in the state of Illinois. He proposed that other religions can be "sacred reminders" in the sense that they can function as "reminders of the truth or potentiality one affirms in one's own religion" but do not receive so much attention (ibid., 202).

5 On the role of beliefs in modern scientific endeavors in relation to creational theology, see Kaiser (2007, 130–45).

6 I make a case for relating theology to the study of scientific endeavor, rather than to current (provisional) scientific theories, in Kaiser (2007, 2–4).

7 I have discussed this heritage in detail in Kaiser (1997).

8 One alternative understanding of *vestigia trinitatis* is based on Augustine's psychological analogy to human memory, intellect, and will (summarized in his *On the Trinity* XV.3.5).

9 To be clear, I do not equate the teachings of Scripture with theories of modern-day scientists. I view the relationship rather as an analogy of proportionality (A is to B as C is to D): the ideas of modern-day scientists can be seen in relation to the modern worldview of what the teachings of Scripture were to their own view of the created order. This analogy will be exemplified in our discussion of the various levels of the created order in Irenaeus's writings.

10 The traditional idea of *vestigia Trinitatis*, literally "footprints" or "traces" of the Trinity, are more accurately termed "vestigial agencies" in the context of present-day English (where vestiges are traces of something that is disappearing or no longer exists). They are operations of the Deity that are most often accorded to God's Word and Spirit in Scripture, but operations carried out in the world of finite forms and discrete events; e.g., Isa. 55:11; Pss. 33:6; 147:15, 18; Wis. 9:1–2; Sir. 42:15; 43:26; 48:3; Heb. 1:3. In traditional Latin theology, the external operations of the Trinity are said to be shared by all three members (*opera ad extra indivisa*

sunt), yet "the distinction and order of the persons are preserved" (*servato discrimine et ordine personarum*). Typically, the mandate of creation is attributed to God the Father; lordship and redemption to the Son; communion and sanctification to the Spirit; see Blocher (1997, 120–22).

11 For the purposes of this essay, I generally use the term "triune God" and "Triad" rather than Trinity. The latter term was introduced by Tertullian to combat modalism (*Against Praxeas* 2, 3, passim), in the early third century; cf. Kaiser (2001, 64).

12 Hawking (1988, 175) (concluding words). Hawking was perhaps echoing Albert Einstein, who had stated that the laws of nature revealed "a superior mind" half a century earlier; Einstein (1935, 28, 131).

13 The association of the laws that govern creation with the Word (or command or covenant) of God is implicit in Pss. 119:89–91 (Hebrew, *devarka*); 148:8 (Hebrew, *osah divaro*) and Jer. 33:25 (*berit*), and it is made explicit in Second Temple texts like Sir. 16:26–28 (Greek, *to hrēma autou*); 39:31 (*lógos*), and 1 Enoch 5:2–3; 18:15; 41:5–7, 69:16–21; 72:35–36 (Ethiopic, *tezāz*); 79:1–2 (*sherāt*); 80:4–7 (*sherāt* and *tezāz*); on the meaning of the Ethiopic terms, see Orlov (2022, 307nn.207, 208). This association of the divine word and law was firmly established in Christian theology by Basil of Caesarea, *Hexameron* IX.2.

14 I speak here of "members" of the Trinity in order to not become entangled in the problematic idea of individual "persons", another term that was introduced by Tertullian in response to modalism (*Against Praxeas*); Kaiser (2001, 75–77).

15 The Word's cosmic agency is analogous to the way the Word is manifest in the Torah (Law) that governs and informs the lives of God's children. In rabbinic texts, the study of the laws received on Mount Sinai is called *halakhah* (plural *halakhot*), which derives from the verb *halakh*, meaning "to go". So, *halakhot* are meant to direct human behavior (Exod. 18:20) as much as the laws of nature direct the processes of the physical world as in Ps. 19:1–9 (knowledge, words, course, circuit, law, decrees, precepts, commandment, ordinances of the Lord); Ps. 147:16–20 (his word governing weather, his statutes and ordinances); cf. Theophilus of Antioch, *To Autolycus* (hereafter *Autol*.) II.15 (disposition of the stars, laws and commandments of God). An analogy between the Torah and the cosmic agency of the Word is also found in classic rabbinic writings, where Torah/Wisdom is seen as the blueprint for the created order (*Mishnah Avot* 3:14; *Genesis Rabbah* 1:1).

16 From the perspective of modern science, information about a system must include, not only its observed form, but the program that governs its formation and evolution. Hence, the agency of the Word is more expansive than the traditional Platonic world of ideas that give permanent form to material things, e.g., Philo of Alexandria's notion of divine powers or ideas that delimit, order, and define material objects (*Special Laws* I.46–48) and are themselves embedded in the divine Logos (*Creation* 20).

17 According to many physicists, mathematical laws like those of quantum theory govern the origin of our universe as well as its subsequent evolution. If so, they transcend space and time much like cosmic decrees of God in Scripture.

18 One could go back as far as Aristotle's assignment of a "separate intelligence" to each of the cosmic spheres. Each of these intelligences conceived an idea or law of perfect motion that governed its assigned (albeit animate) sphere. So, the separate intelligences functioned something like the laws of motion, principles, and geometries of modern physics, and they all emerged from the one single Unmoved Mover. Another unitary scheme was found in Philo of Alexandria's Mind of the universe, which is the divine Word (Philo, *Creation* 8, 20, 69).

19 John Archibald Wheeler was interviewed in Ferris (1985), at 28–29 min of the program.

20 John Archibald Wheeler in "The Creation of the Universe" at 1 h, 18–19 min of the program. The "life" that Wheeler attributed to the universe is not the same as energy in the physical sense. It is what actualizes the equations that govern all physical matter and energy.

21 William Whewell made a similar distinction from a theistic perspective in his Bridgewater Treatise (the first): "Hence we infer that the intelligence by which the law is ordained, [and] the power by which it is put into action, must be present at all times and in all places where the effects of the law occur", Whewell (1834, 361–62); cf. Kaiser (1997, 366–69). Whewell's "intelligence" and "power" correspond to the agencies of God's Word and Spirit as described below.

22 Hawking (1988, 174). On Hawking and the actualization of the laws of theoretical physics, cf. Kaiser (2007, 28–29). Kitty Ferguson quoted this passage and took the idea as the title of her book, Ferguson (1995, 84). Michael Heller refers to this issue in philosophical cosmology as the "ontological gap" between nonexistence and existence, in contrast to the "epistemological gap" that grants intelligibility to the universe; Heller, "Chaos, Probability, and the Comprehensibility of the World", in Heller (1995, 121). Heller states that, from a theological perspective, "the ontological gap and the epistemological one coincide". The theological rationale for this coincidence, according to our findings here, is the coordination of the agencies of the Spirit (actualized existence) and the Word (intelligibility).

23 This actualizing agency is not the same as physical energy, the latter being interchangeable with rest mass and all such mass energy having been generated by the laws of quantum theory and relativity. Here, we are concerned with the actualization of those laws.

24 The dialectic of transformative, sometimes chaotic novelty ("spirit"), on one hand, and limiting, harnessing order ("word"), on the other hand, is a common theme in the Old Testament wisdom literature; e.g., Job 38:8–11; Ps. 148:6–8; Prov. 8:29; Pr. Man. 3. In the New Testament, the Lord Jesus is portrayed as the channel for the outpouring of the transformative Spirit of the Church (John 20:22; Acts 2:38). For an ecclesial parallel to this dialectic in the New Testament, see Paul's treatment of the gifts of the Spirit in 1 Cor. 14:2–6, 13–19.

25 When speaking of laws that govern the cosmos, physicists generally assume a "nomological realist" view of those laws, rather than the descriptive, non-causal view taken by most of today's philosophers of science. According to such nomological realists, what we term "laws of nature" are progressive approximations to the phenomena at hand, depending on the current state of experimental technology and degree of computing power.

26 The Greek terms *penuma* (spirit) and *pnoē* (breath) are closely related in the LXX (Septuagint) of biblical texts like Job 32:8; 33:4 and Isa. 42:5. For the purposes of this essay, we assume their rough equivalence.

27 Divine light is another of the biblical images for the agency that forms and informs the created order, including humanity; cf. Pss. 36:9/10; 43:3; John 1:4, 9; 2 Cor. 4:6. In fact, the Word (Aramaic *Memra*) of the Lord is equated with primordial light in *Targum Neofiti* to Exod. 12:42; McNamara (1972, 103).

28 The Masoretic Hebrew text of Gen. 1:1 is best translated as "When God began to create heaven and earth—the earth being unformed and void . . ." (*Jewish Publication Society Tanakh Translation*, (Berlin and Bretler 1999)). It is described as if we were in a theatre waiting for the play to begin, and when the curtain rises, God is already at work on the primordial elements of earth, darkness, and water. In modern cosmology the primordial elements would be different, and the creative process would include the origin of those elements.

29 The exact phrase, "and God said" (*vayyomer elohim*) occurs only nine times in Gen. 1:3–29. However, a total of ten such words (*ma'amarot*) is asserted in *Mishna Avot* 5:1 (early third century) in order to match the number of commandments or words (*devarim*) of the "ten words" in Exod. 34:28; Deut. 4:13; 10:4.

30 The early rabbinic Sages saw a parallel to the ten creational decrees in God's delivery of the ten commandments at Mount Sinai. Each commandment (*davar*, word), issuing from the mouth of God, was activated by a blast of spirit/wind (*ruah*, from God's treasury of winds) so that the people of Israel could hear it distinctly and even see it; *Babylonian Talmud Shabbat* 88b (cf. Exod. 20:18a = 20:15a in Hebrew), as translated in Wollenberg (2023, 182–85).

31 In keeping with the usage of modern science, I shall use the simple term "cosmos" to designate the physical, spacetime level of the created order, which includes everything that is perceptible to the senses or with the aid of technologies. Our "cosmos" is comparable to the sensible world (*kosmos aisthētos*) of Platonic philosophy), but not the Platonic "world of ideas" (*ho ek tōn ideōn kosmos*).

32 E.g., Theophilus, *Autol.* II.13; Irenaeus, *Against Heresies* (hereafter *AH*) IV.32.1 (which aligns Gen. 1:3 with John 1:3); cf. Steenberg (2008, 70–71 with n.24).

33 Old Testament and Second Temple texts detail the agency of the Spirit empowering the prophets (Num. 11:25–26; 1 Sam. 10:6, 10–11; Mic. 3:8; Isa. 42:1–7; 61:1–3; Hos. 9:7b) and the Messiah (Isa. 11:2; Psalms of Solomon 17:37). In keeping with modern systems theory, I understand this empowering as the actualization of a higher, more complex level of functioning rather than power in the physical or biological sense (as in the empowerment of Samson in Judg. 14:6, 19; 15:14).

34 Similar combinations occur in 2 Sam. 23:1–2 (the Spirit anoints David and inspires him to speak God's words and rule justly); Isa. 11:1–4 (the Spirit inspires Jesse's descendant to judge and establish a just order); 42:1–4 (the Spirit identifies God's servant and enables him to establish a just order); Isa. 61:1 = Luke 4:18 (the Spirit inspires words of restoration); Luke 1:35 (the Spirit enables the conception and holy birth of Jesus, followed by his designation as "the Son of God"); John 14:26 (the Spirit inspires the Apostles to "remember" the words of Jesus).

35 Our primary concern here is with the "economic" Trinity rather than the "immanent" Trinity. The latter inheres within the divine being that transcends all finite forms and discrete events and for which the contingencies involved in creation and cosmic evolution are not directly applicable. This distinction was already made by early Apologists, who distinguished the *Logos prophorikos* (the spoken Word active in creation) from the *Logos endiathetos* (the eternal Word immanent within the Godhead); cf. the note below on Theophilus of Antioch and Kaiser (2007, 43). To avoid confusion, I refer to the former as the "vestigial agency" of the Word.

36 Given the multi-level world model assumed here, humans are embedded in the agencies of the Word and Spirit at the physical, chemical, biochemical, biological, social–psychological, and spiritual (even celestial) levels. Even though biological, social–psychological, and spiritual creatures are not ubiquitous, they constitute classes of beings. So, the agencies of the Word and Spirit are extensive at each level in the sense that they are distributive throughout the corresponding class of beings. In other words, the extensive vestigial agencies of Word and Spirit consistently apply to all members of those classes, but are not omnipresent or ubiquitous at all levels.

37 My distinction between "intensive" vestiges (effective at particular times and specific places) and "extensive" ones (affecting all of creation) is adapted from the thermodynamic distinction between intensive variables like temperature and extensive quantities like heat. Biblical texts make a similar distinction regarding the agency of divine Wisdom (Sir. 24:3–12; Bar. 3:24–37) and regarding Christ (Col. 1:15–20: Heb. 1:3–4; cf. Luke 2:9b, 11). In patristic texts, this differentiation was codified in the idea of the threefold presence of the divine Word: eternally present with God the Father, extensively and permanently present in all of creation, and intensively present in the Lord Jesus Christ as well as in biblical theophanies (Origen, *On First Principles* I.2.8; IV.4.3; *Against Celsus* IV.5; VII.17; Athanasius, *On the Incarnation* 14.8, 17.5). The latter two modes of presence are the vestigial agencies of the eternal Word, pertaining to the economic Trinity, that concern us here.

[38] As noted above, present-day scientific endeavor is based on beliefs inherited from the historic creationist tradition, three of which are intelligibility, unity, and relative autonomy of the natural world. These beliefs relate to the extensive agencies of God's Word and Spirit. Since the nineteenth century, the focus of the ecumenical Church's discourse has largely shifted to the Incarnation, Atonement, ecclesiology, and sacraments, all of which relate to the intensive agencies of Word and Spirit.

[39] The background reference to the revelation of *YHWH/Adonai* in a finite, anthropic (humanlike) form is explicitly stated in biblical texts like Num. 12:8 (*temunah*, apparently contradicting Deut. 4:12, 15–18); Jer. 1:9 (*yoshlah YHWH et-yado*); Ezek. 1:26b (*demut . . .adam*); 1:28b (*demut kavod YHWH*, both contradicting Isa. 40:18); Hos. 12:10/11 (*edameh*); cf. Gen. 32:30–31 LXX (*eidos theou*); Phil. 2:6 (*morphē theou*). An anthropic form modeled on that of *YHWH/Adonai* was also assigned to the divine Word in Wis. 18:15–16; Rev. 19:11–16; cf. Pss. 9:8; 96:13; 98:9; Isa. 11:4; 63:1–3; 64:1–2, 7a; Lam. 1:15; 1 Enoch 9:4). The variety of revelatory forms of the Deity was highlighted in the third/fourth-century midrash, *Mekhilta de-Rabbi Yishma'el*, Shirata 4; Bahodesh 5: at the Red Sea, the Lord was "a man of war", young enough to engage in battle (Exod. 15:3–4), but on Mount Sinai, he appeared as "an old man full of mercy"; Lauterbach (1961, 2:31, 231). For an overview of the homology between the anthropic form assumed by the deity and the human (male) body, see Altmann (1963, 213–22, Reprinted 1969, 19–28).

[40] The Word's assumption of a finite form is a reflexive instance of its intensive formative agency, hence, an autoformation. As with all formations governed by the Word, the Spirit is the agent of actualization; see below on the Irenaeus's treatment of the Incarnation in *AH* V.16.2. I refer to these finite forms of the Deity as "anthropic" rather than "anthropoid". The latter term is equally valid, but in scientific discourse it refers to a class of primates that includes monkeys and apes as well as humans.

[41] In most cases, Scripture writers used the Tetragrammaton (*YHWH/Adonai*) rather than God (*Elohim*) as the divine name when describing concrete manifestations and the worldly actions of the Deity; e.g., Exod. 19:11; 33:11; Num. 12:5, 8; Deut. 31:15; 2 Sam. 22:10–18 (=Ps. 8:9–17); 1 Kgs. 19:11; 22:19; Isa. 6:1–5; Ezek. 1:26–28; 43:4–7; Amos 7:7; Zech. 9:14; 14:3–4; Mal. 3:1b. John's correlation of Logos theology with Kyrios traditions was facilitated by the fact that both were associated with the governance of world affairs in first-century sources like Philo, *Cherubim* 27. According to Richard A. Horsley, this association was also assumed the Apostle Paul, for whom the extensive agency of the "one Lord" in 1 Cor. 8:6b (*di' ou ta panta*) was based on the Middle Platonic identification of the Word as the instrument through which God made all things; Horsley (1978, 134).

[42] Elliot Wolfson describes the intermediate realm of spiritual forms as an "imaginal world" (*mundus imaginalis*) and explains that it "is not the imaginary world of subjective fantasy or psychotic hallucination, but is instead a realm where invisible realities become visible and [where] corporeal entities are spiritualized"; Wolfson (1994, 61–62).

[43] The Spirit's agency in opening the realm of spiritual forms to Old Testament prophets and sages is indicated in texts like Num. 24:2–4 (Balaam); Job 32:8 (Elihu); Jer. 1:9; Ezek. 1:3b; 2:2; 8:1–4; 37:1, 4; 43:5–6; Joel 2:28–29; 4 Ezra 14:22; Philo, *Planting* 24–26 (Moses); idem, *Life of Moses* 2.291; Pseudo-Philo, *Biblical Antiquities* 28:6–7, 10 (Kenaz); 1 Pet. 1:11–12 (the Old Testament prophets); cf. Wis. 7:27; 10:21 on the illuminating agency of divine Wisdom (associated with the Spirit in 7:7b, 22b). Some biblical narratives portray visionary theophanies as occurring in a quasi-material way (e.g., Gen. 15:17; Amos 9:1), but I attribute this fact to the absence of the later apocalyptic distinction between visionary–spiritual and visible–empirical worlds, together with the tendency of dramatic narrative forms to flatten out the multileveled complexity of prophetic phenomena. Esther J. Hamori makes a helpful distinction between "concrete anthropomorphisms" and "envisioned anthropomorphisms" (two of her five categories) in biblical texts; Hamori (2008, ch. 2). Note, however, Hamori includes the concretely crafted theophany in Amos 9:1 ("I saw the Lord standing on/beside the altar") in the "envisioned anthropomorphism", rather than the "concrete anthropomorphisms", category (p. 29).

[44] The role of God's *ruah/pneuma* (spirit, breath) in actualizing anthropic forms (including those of the Word made flesh) is indicated in texts like Ezek. 1:4–5 (living creatures, cherubim); Rev. 1:10–16 (a Christophany); cf. Matt. 1:18–21 (virginal conception of Jesus); Luke 1:34–35 (virginal conception of the Son of God). Only in rare cases is the Spirit accorded a voice like that of the Lord (Acts 21:11; cf. Ezek. 2:4) or even a finite form like that of angels (possibly Acts 8:26, 29); cf. Martyrdom of Isaiah 9:27–36 on the "angel of the Holy Spirit"; Origen, *On First Principles* IV.3.14 on the two seraphim of Isa. 6:2 representing the Word and Spirit; Aphrahat, *Demonstration* VI.15 on the Holy Spirit standing before God like an attending angel). All four Gospels describe visions of the Spirit descending like a dove upon Jesus at his baptism (Matt. 3:16; Mark 1:10; Luke 3:33; John 1:32), and the two of these versions indicate that the Spirit alighted on him (Matthew) and remained on him (John), recalling the imagery of the dove that Noah released, finding a resting place after the Great Flood (Gen 8:9–12); compare this with Rabbi Ben Zoma's interpretation of Gen. 1:2c in *Genesis Rabbah* 2:4. However, only the Lukan version of the baptismal narrative states that it descended "in bodily form like a dove" (Luke 3:22a), and none of the Gospel accounts say that the Sprit was seen in the form of a dove, or that it was heard to speak the declarative words from heaven (Matt. 3:17; Mark 1:11; Luke 3:22b; John 1:32).

[45] On visions and auditions of the apostles and prophets, see Matt. 10:20; John 3:3–6; Acts 7:55–56; 1 Cor. 2:9–13; 12:3–11; 14:29–32; Gal. 4:6; Acts 2:17–21; Rev. 1:10–13; 4:2; 21:10; Odes of Solomon 36:1–3. In 1 Cor. 12:6, Paul stated that spiritual gifts were inspired by God (the Father). In the following verses (12:7–11), however, he repeatedly stated that the Spirit was the agency through which God bestowed those gifts. It should be kept in mind that visons and auditions (theophanic forms and words) often occurred together in biblical times; see e.g., 1 Sam. 3:1; 1 Kgs 22:19–22; Isa. 6:1–13; Amos 9:1.

[46] The idea of synergy between agencies of the Word/Christ and Spirit is indicated in texts like Rom. 1:3–4; 1 Cor. 12:3–5; 1 Tim. 3:16; and (arguably) 2 Cor. 3:16–18 ("The Lord is the Spirit").

47 The word "image" (Hebrew *selem*; Greek *eikon*, Latin *imago*) has various meanings. The two that we encounter in this project are: (1) the visible form of something that would otherwise be formless and invisible, as in the cases of God's Son, the Lord Jesus, in relation to God the Father (Col. 1:15; cf. 1:3, 10) and Philo's Word/Son of God in relation to the invisible, ineffable Deity (e.g., Confusion 62–63, 97, 146); and (2) the reflection or reproduction of a pre-existing, prototypical form, an exemplar, as in the case of Adam in relation to God and Seth in relation to Adam (Gen. 1:26–27; 5:3). The latter is in effect an image (sense 2) of an image (sense 1). It is common in rabbinic Judaism and has been termed "corporeal isomorphism" by Idel (2013, 113).

48 The reference to God as "Power" in Mark 14:62 (Greek *dymanis* for the Hebrew *gevurah*) is unique in canonical Scripture, but it later occurs in the talmudic and midrashic literature; see Idel (1988, 157–9).

49 The Lord Jesus was also envisioned as enthroned in New Testament texts like Matt. 19:28; 25:31 (on the Son of man); and John 12:41; Rev. 1:10–14a (with echoes of the enthroned deity in Isa. 6:1–3; Ezek. 1:26, 28; Dan. 7:9). When the risen Christ is described alongside God the Father, however, the throne is ascribed either to the Father or to both together (Rev. 7:15–17; 22:3).

50 The relative amorphousness and repose of God the Father in the New Testament suggests that the formative/informative agency of the Word could not apply to God the Father, of which supposition is consistent with the patristic idea of the "monarchy" of the Father (Athanasius, *To the Antiochenes* 5–6; Gregory of Nazianzus, *Oration* 42.15).

51 The detailed description of the Lamb, compared with that of the "one seated on the throne", in Rev. 4 reflects the greater accessibility and mediating role of the former. In the background are similar biblical throne–room scenes in which the enthroned one is less visible and more exalted than more accessible figures like seraphim and cherubim (Isa. 6:1–7; Ezek. 1:22–26; 1 Enoch 14:8–23 [Book of Watchers]; cf. Martyrdom of Isaiah 9:37–10:6; Testament of Levi 3:4–8, 2 Enoch 22:1–4; *Babylonian Talmud Hagigah* 12b–13a). One exception to this generalization is Dan. 7:9–10, where the enthroned "Ancient of Days" is described in some detail. In the Book of Revelation, however, these attributes were accorded to the risen Christ (Rev. 1:13–14).

52 The Gospels clearly identify the Son of man with Christ, the Son/Word of God (Mark 14:21, 41; John 3:13, 14; passim), and Revelation equates the Lion–Lamb with Jesus, the crucified and risen one (Rev. 3:1; 5:6, 9; cf. John 1:29, 36).

53 Similar ambiguity occurs in the Gospel of John. On one hand, Jesus states that the Father draws believers to Jesus; on the other, no one besides Jesus has seen the Father directly (John. 6:44–46; cf. 1:18; 14:8–9).

54 Jesus was raised by God the Father according to Acts 2:24, 32; 3:15, 26a; 4:10; 5:30; 10:40; 13:30; 17:31b; Rom. 4:24; 6:4b; 10:9b; 1 Cor. 6:14a; 2 Cor. 4:14; Gal. 1:1; Eph. 1:20; Phil. 2:9; Col. 2:12c; 1 Thess. 1:10b; Heb. 11:19; 13:20; 1 Pet. 1:21. Two of these passages also assign the future resurrection to God: 1 Cor. 6:14b; 2 Cor. 4:14 ("with Jesus"). However, the focus is on the relation of God to his unique Son.

55 On the postmortem agency of Jesus (and the renewed agency of his disciples), see Acts 3:26b ("he sent him to you first"); 10:40–42 ("and he commanded us to preach"); 13:30–31 ("and he appeared to those who came up with him"); 17:31a (he appointed him to judge the world); Rom. 4:24–25 ("for our justification"); 1 Thess. 1:10c ("he delivers us from the wrath to come"); John 10:16 ("And I have other sheep . . . I must bring them also").

56 The major exception to God's direct agency in the Resurrection is the Gospel of John, where Jesus repeatedly states that he will raise himself after his crucifixion, John 2:19; 10:17, 18 (in obedience to a command from his Father), and will raise his followers (John 5:21b; 6:39–54). Perhaps this postmortem self-formation or re-formation was the climax of the signs that John's Gospel intended to trace (John 2:11; 4:54; passim; cf. Matt. 12:39–40). Nonetheless, the patricentric rule that we find in Acts and Paul (see above) might still be reflected in the glorification language of John 13:32; 17:1, 5.

57 The fact that Paul consistently attributed the Resurrection to God the Father may also be due to its association in his mind with our justification (Rom. 4:25; 10:9c–10a). If the Lord Jesus had to rely on God for his renewed life, how much more must we rely on God, rather than ourselves, for ours.

58 In terms of his external operations, the Lord God of the Old Testament is Chief Executive or First Commissioner, rather than "First Cause" or "Prime Mover", as God would be portrayed in the Middle Ages under the influence of Aristotelian metaphysics (e.g., *Metaphysics* 1072b). The executive aspect of these external operations is seen, for example, in the Lord God's issuing decrees or laws for the natural world (Job 28:26 MT; 38:10, 33; Ps. 148:6; Prov. 8:27–30; Jer. 5:22; 31:35–36; cf. 1 Clem. 20:1–11). Unlike commissionings that generally last for a limited time, these cosmic decrees are said to be extensive in that they last for all of time (Ps. 148:6; Prov. 8:29; Jer. 5:22b; 31:35–36; 1 Enoch [Similitudes] 69:20; 1 Clem. 20:3–4). In the terms of the present essay, the execution of these decrees is part of the extensive agency of God's Word and Spirit.

59 Similar commissioning scenes are described in Job 1:6–12; 2:1–6. In other Old Testament texts, God is said to send out his Word (Ps. 147:15, 18; Isa. 55:11; 147:15) or his Holy Spirit (Wis. 9:17; cf. 9:9–10).

60 There are a few Old Testament examples of God's commissioning that extend to all creatures (at any given level). Isaiah 55:10–11 compares the Lord sending out his word (to redeem his people) to his sending rain to earth to bring forth vegetation from the earth. Psalm 104:27–30 blesses the Lord for sending out his spirit/breath to renew the earth and all its inhabitants—an example of agency that is spatially extensive and temporally cyclical. In general, however, such commissionings have to do with intensive divine–human relationships.

61 As scholars of Ancient Near Eastern cultures like Tryggve Mettinger have shown, the local temple was viewed as the primary conduit between our world and that of God (e.g., Pss. 11:4; 20:7; Isa. 66:1; Jer. 25:30; Zech. 3:7); cf. Mettinger (1982, 29–32).

62 The "spirit" that opened John the Apocalypticist's mind and imagination evidently came to him from the heaven above (Rev. 4:1–2). In the pseudepigraphal Epistle of Enoch, the patriarch similarly hears a voice and has a spirit poured out on him that enables him to foretell future events (1 Enoch 91:1).

63 The same may be said for God's receiving and answering of human prayers (e.g., Mark 11:22–25), and making various declarations from heaven (e.g., Mark 1:11; 9:8). As Brittany Wilson (2021) has pointed out, the Synoptic Gospels locate God (the Father) in the heavenly realm, but they do not describe God as having an anthropic form (e.g., Mark 6:41; 7:34; 14:62; 16:[19]); Wilson (2023, 144–45, 149); cf. Wilson (2021, 780, 789f., 791)) An exception may be the "face of the Father in heaven" as seen by angels in Matt. 18:10. Early theologians like Clement of Alexandria dealt with this anomaly by identifying this "face" of God with the divine Word; Clement, *Instructor* I.7.57; *Excerpts from Theodotus* 11.1–2; 12:1; cf. Bucur (2014, 70n.18; 2007, 221n). A Valentinian origin of this idea is suggested by Clement's *Excerpts* and by the occurrence of the same motif in the *Tripartite Tractate* (Nag Hammadi Codex I,5), 65.35–66.18; 110.37–111.4, which also stresses the formlessness and invisibility of God the Father; see James M. Robinson, ed., *The Nag Hammadi Library in English*, 3rd edition (San Francisco: Harper & Row, Robinson (1988, 67, 90)).

64 Jesus is said to be commissioned by God the Father in Mark 12:6 (a parable); John 3:17, 34; 5:30, 36–37; 8:26–28; 10:36a; 12:45, 49–50; 14:24b; 17:2–4, 8; 20:21; Rom. 8:3; 1 John 4:9–10, 14; cf. Rev. 1:1.

65 Christ's obedience to the Father's instructions and commands is described in John 9:4; 10:17; 15:10b; Phil. 2:8–9.

66 The Holy Spirit is sent by the Father in Rom. 8:27; Luke 11:13; Acts 2:17–18; 5:32; 15:8; John 14:26a; Acts 1 Pet. 1:12; cf. Rev. 5:6.

67 In the New Testament, God the Father is identified with "heaven", particularly in the Gospel of Matthew (Matt. 3:17; 5:16, 34, 45; 6:1, 9, 10; 7:11, 21; 10:32, 33; 12:40; 16:17; 18:10, 14, 19; 23:21–22). The biblical "heaven" is ontologically "higher" than the empirical world, even higher than the supracelestial waters (Ps. 29:10; Ezek. 1:22–28 using the Hebrew word *qerah*, meaning crystal or frozen water), but it is still part of the created order. It is everlasting, but not the eternal locus of the triune God, "Creator of heaven and earth, and of all things visible and invisible" (Nicene Creed). In other words, the biblical "heaven" is an intermediate realm in which the Deity can manifest itself through various self-projections and agencies, and to which biblical prophets and priests had access (1 Kgs. 22:19; Jer. 23:18–22; Zech. 3:1–7); cf. Kaiser (2007, 38–45). Like the empirical realm, the heavenly one could be described as having several levels or discrete "heavens", the highest of which was the throne or abode of the Lord God (e.g., 2 Cor. 12:2; Martyrdom of Isaiah 7–9; Irenaeus, *Dem.* 9; *Fathers According to Rabbi Natan* A 37; *Babylonian Talmud Hagigah* 12b–13a). From that perspective, the relationship between the empirical and spiritual levels of creation is a continuum with an interface and some overlap between the two.

68 For Irenaeus's debt to Justin Martyr, see, e.g., *AH* III.2.3 and cf. Justin, *1 Apol.* 12.

69 John's teachings had been passed down orally to Irenaeus by Polycarp and by the Elders, who were disciples of the Apostles; Irenaeus, *AH* III.3.4; V.5.1; 33.3; 36.1, 2, and his *Epistle to Florinus: On Unique Sovereignty* (*apud* Eusebius, *Ecclesiastical History* V.20.4–8). On his receiving and preserving the tenets of the faith handed down by his other predecessors, see *AH* I.10.1; III.4.1–2, 3.3; 24.1.

70 Matthew Steenberg has carefully noted the lack of tidy conceptual consistency in Irenaeus's writing; Steenberg (2008, 63, 70, 106), passim. As a result of the variation in Irenaeus's verbal associations, no scholarly attempt to organize them will do justice to every statement he made. As noted in the Introduction to this essay, the vantage point adopted here is one option based on the ideals that motivate scientific endeavor.

71 The recipient to whom Irenaeus addressed his treatise *Against Heresies* had requested him to provide detailed information about the heresies described (I.pref.2; III.pref.1; cf. IV.pref.1; V.pref.1).

72 *Against Heresies* was written in Greek in the late 170s and early 180s. The only complete extant version is the Latin translation, *Adversus Haereses*, which is thought to date from the third or fourth century. Comparison with the Greek fragments that survive indicate that this translation was fair. The best critical edition is found in Rousseau et al. (1965).

73 There was no such thing as "Gnosticism" as a unified group or single ideology. Of the many different varieties, Irenaeus concentrated on several versions classified as "Valentinian".

74 Irenaeus never spoke of a "Trinity" consisting of distinct hypostases or *personae* (usually translated as "persons" in English); cf., Lashier (2014, 11, 54n.1, 209). Those terms would be adapted for theological discourse early in the following century by Origen and Tertullian, respectively, as a way of combating a very different kind of heresy, that of modalism; cf. Kaiser (2001, 75–77).

75 In keeping with the salutations and confessional formulas of the New Testament world, Irenaeus used the divine titles "God" and "Lord" for the Father and Jesus Christ, respectively, whenever the two were mentioned together; cf. Kaiser (2001, 41, 53).

76 The association of the Spirit with divine Wisdom was already present in Wis. 1:6; 7:22, 27; 9:17; 1 Cor. 2:13. Theophilus of Antioch had assumed a Spirit–Wisdom identification; e.g., *Autol.* I.7; II.15, 18 (late 170s?). Ireneus may have learned this association from Theophilus, as argued by Lashier (2014, 166, 179, 182). On the other hand, such sapiential traditions were still shared between Jews and Christians in the second century; so, Irenaeus could just as well have inherited it from the same oral tradition that Theophilus did; cf. Briggman (2012, 126–28).

77 Theophilus had also written about God creating the first man, Adam, using his Word and Wisdom (Spirit) as his two hands; *Autol.* II.18 (citing Gen. 1:26; 2:7). He used this metaphor in describing the "spoken Word" (*Logos prophorikos*) that is active in creation, as distinct from the "immanent Word" (*Logos endiathetos*), as it eternally existed like a thought in the mind of the Godhead. Neither

here nor in the parallel text in *Autol.* I.17, however, did Theophilus clearly differentiate the roles of the Word and Spirit the way Irenaeus did (see below).

78 The English translation of Roberts and Donaldson (1965) (hereafter ANF), 1:469a. For the Latin text, see SC 100/2:450.

79 As a result of his concern to protect God the Father from gnostic ridicule, Irenaeus tended to attribute all such agency in the empirical world to the Word and Spirit. Even in his few citations of some of the New Testament texts that attribute the resurrection of Jesus to God the Father (see the listing above), Irenaeus included the reference to God (the Father) only once (*AH* III.18.2, citing the confessional formula in Rom. 10:9).

80 See *AH* III.24.2, where Irenaeus differentiates the finite manifestations and agencies of God, "within the reach of human knowledge", from his "substance" (*substantia*). The Greek term most often used for these agencies is *oikomomia* ("economy"), which is usually translated in Latin as *disposition* ("dispensation", e.g., *AH* IV.pref.4).

81 The first two parts of Gen. 2:7 follow the same sequence of words in both Hebrew and Greek: action (formed/breathed); object (man/his nostrils); source (clay of earth/breath of life). The parallelism suggests that the two events are coordinated, even simultaneous, rather than separate stages.

82 The idea of the Lord "containing all things" was based on is the divine function of setting boundaries to the different parts of creation and thereby limiting chaos and maintaining a degree of order; e.g., Job. 38:4–12 ("shut the sea with doors", "prescribed bounds", knows its place"); Ps. 104:8–9 ("set a boundary"); 148:6–8 ("fixed their bounds", "fulfilling his command"); Prov. 8:27–29 ("drew a circle", "assigned its limit"); Wis. 11:20 ("arranged all things by measure and number and weight"); Sir. 16:26–28 ("determined their boundaries", "never disobey his word"); 43:6–10 ("governing the times", "stand in their appointed places"); Prayer of Manasseh 3 ("shackled the sea . . .confined the deep"); Mark 4:39 (Jesus restrains wind and waves); Epistle to Diognetus 7:2 ("enclosed the sea", "the measure of the courses of the day").

83 The idea that God needed no external help because he used the Word and Spirit as his very own hands is also found in one of Irenaeus's versions of the rule of faith (*AH* I.22.1). The idea may have come from Theophilus, *Autol.* II.18, as argued in detail by Briggman (2012, 107–19). However, it may also have come from a common oral tradition. In contrast, some early Jewish sources held that God was conversing with his angels (e.g., Philo, *Creation* 75; idem, *Confusion* 179; *Genesis Rabbah* 8:4).

84 Irenaeus also described the Word and Spirit as the "hands of God" in *AH* IV.pref.4; 7.4 (Armenian text); V.1.3, 5.1, 6.1, 28.4; *Dem.* 11. The image of God using his "hands" to create was common in Judaism. According to Gen. 2:6–7, God formed the first human body from the dust of earth (often assumed to be moistened clay that could be molded). Job 10:8–9 adds that God's hands had made and fashioned the body of Job (Vulgate, *manus tuae fecerunt me et plasmaverunt me*). Psalm 119:73a (118:73 LXX) states that God's hands had made and fashioned the psalmist (Vulgate, *manus tuae fecerunt me et formaverunt me*). Later Rabbinic texts explicitly cited this verse to show that God formed Adam with his two hands (e.g., *Fathers According to Rabbi Nathan* 1 ad finem). Philo understood Gen. 2:7 to say that, when the first man was fashioned (*diaplasas*), he was made by divine hands (*chersi theiais genomenos*) and instructed by Wisdom herself. According to 2 Esdras (4 Ezra) 8:7b, all of God's people are the work of his hands.

85 As noted above, this exclusion of angels from the work of creating humanity contradicts the major Hellenistic Jewish theologian of the previous century, Philo of Alexandria, who held that the blame for the misdeeds of humans should not be assigned to God himself (*Creation* 75; *Confusion* 179).

86 Irenaeus's idea of a conversation of within the Godhead in Gen. 1:26 also occurs in *AH* IV.pref.4; V.1.3; 15.4; Dem. 55; cf. Barnabas 5:5; 6:12; Justin, *Dial.* 62; Theophilus, *Autol.* II.18. Irenaeus's idea differs from modern-day social models of the Trinity in that it was a simple imperative from the Father, not a reciprocal, social conversation. As noted above, Irenaeus stressed the unity of the Godhead and did not differentiate Word and Spirit as hypostases or persons.

87 Irenaeus identified the "God" (Greek *Theos*) of Gen. 1 as the Father in *AH* IV.20.1; V.1.3, 6.1; *Dem.* 97.

88 Irenaeus's stress on the oneness of the Godhead and the coordination of God's Word and his Spirit may also have been intended to avoid the idea of multiple divine powers in heaven. The latter idea was being challenged as heresy by rabbinic Sages by the third century CE, as highlighted for modern scholarship by Segal (1977), and recently reframed by Grossberg (2022, esp. 419–22, 430–31, and bibliography on pp. 432–36).

89 Irenaeus seems to have understood the manner of formation and animation of Adam in Gen. 2:7 as extending to all human beings (cf. Gen. 1:26–27; Wis. 2:23). In *AH* V.1.3, he described "the beginning of our formation [*ab initio plasmationis nostrae*] in Adam [Gen. 2:7a]" (ANF 1:527b, discussed below). In *AH* V.5.1, we are told that Enoch and Elijah were translated to heaven by the very same hands with which they were formed in the beginning (*di' ōn cheirōn eplasthēsan tēn archēn*; Greek fragment): "For in Adam the hands of God had become accustomed to set in order, to rule, and to sustain his own workmanship and to bring it and place it where they pleased" (SC 153:62–64; ANF 1:530–31). Irenaeus further argued that "throughout all time, man being molded at the beginning by the hands of God . . .is made after the image and likeness of God" (*AH* V.28.4, ANF 1:557b); cf. Briggman (2012, 124–25) with notes 67, 69 on the creation and vivification of human beings.

90 Irenaeus held that God's Word established the boundaries and laws that govern the cosmos, and assigned a particular function to every single creature, including the angels: e.g., *Dem.* 10: "He [God] has established by the Word the whole world, and the angels too are included in that world. And to the whole world he [the Word] has given laws, that each one keep to its place and not overstep the boundary laid down by God, each accomplishing the work marked out for it"; Smith (1952, 51, adapted); cf. Behr

(1997, hereafter SVSP trans.), 46. For the background of this idea, see Job 38:5–11; Sir. 16:26; 1 Enoch 2:1–2 (Book of Watchers); 41:5 (Similitudes).

91 The meaning of the Wisdom/Spirit's "adorning all things" is partially clarified in *AH* II.30.9, where Irenaeus states that God "founded and made all things (*condens et faciens omnia*), visible and invisible", by his Word and fitted and arranged all things (*omnia aptavit et disposuit*) by his Wisdom" (SC 294:318–20; ANF 1:406a; cf. Dem. 5). Another such passage is *AH* III.24.2, where Irenaeus cites Gen. 2:7 and then describes God as establishing (*confirmans*) all things by his Word and binding them all together (*compingens omnia*) by his Wisdom (ANF 1:459a). Noting the variety of verbs that were used to describe the creative agency of God's Wisdom, Anthony Briggman concluded that Irenaeus's intent was not to define the agency of God's Wisdom so much as to demonstrate the purposefulness and coherence of creation itself ("the wise activity of God"); Briggman (2012, 136–7, 140–42). Jackson Lashier takes *AH* III.24.2 as the basis for his differentiating the agencies of Word and Wisdom and concludes that Wisdom's role was one of completing or perfecting the work of the Word; Lashier (2014, 176, 179).

92 Irenaeus's differentiation of the actualizing agency of the Spirit from the governing, formative agency of the Word is missed by Matthew Steenberg when he describes the role of the Son as "formative actualization" and "the means of actualization" of the Father's creative will; Steenberg (2008, 79, 80) (but see his clear distinction of these roles in the creation of humanity, ibid., 106).

93 Irenaeus's *Demonstration of the Apostolic Preaching* was written in Greek, but the only extant version is a later, Armenian translation. In any case, Irenaeus also used Gen. 2:7 to differentiate the agencies of Word and Spirit in *AH* III.24.2 (forming/establishing and inbreathing/uniting); V.1.3 (fashioning and animating/endowing with reason).

94 Irenaeus's mention of God's two hands (the Word and Spirit), together with his correlation of "purest earth" with the "measured power" that is mingled with earth, indicates that the "power" in this sentence must here represent the divine "breath of life" (cited from Gen. 2:7b) that animated the earthly form.

95 *Demonstration* 11, adapted from ACW 16:54; 148n.65; cf. SVSP trans., 46–47. Other early Christian writers located the image of God (Gen. 1:26–27) in the rational human mind; e.g., Clement of Alexandria, *Exhortation to the Greeks* 10. Like Irenaeus, however, others interpreted it quite literally: the human body is isomorphic with the form of God; e.g., *Pseudo-Clementine Homilies* XVI.19; XVII.7 (ANF 8:316–17; 319–20). The early rabbinic Sages also viewed the anthropic form of *YHWH/Adonai* as the prototype for the human (male) body, e.g., *Genesis Rabbah* 8:8, 10; cf. Gottstein (1994, 171–95); Fossum (1996, 1:529–39).

96 Anthony Briggman comments that, for Irenaeus, "The activities of the Word and Wisdom in creation are, at least logically, sequential. Both are required for a complete and meaningful created order"; Briggman (2012, 146); cf. Lashier (2014, 203), on Theophilus's understanding of Gen. 2:7.

97 Like the biblical account (Gen. 2:7), Irenaeus regarded formation of the human body as unique, unlike that of the animals, due to its upright, heaven-oriented form.

98 For Irenaeus, as noted above, all things were formed by the divine Word, including humanity; cf. *AH* III.21.10, citing John 1:3; cf. Briggman (2012, 111).

99 The words used here for "life" and "soul" are the same in both Greek (*psychē*) and Latin (*anima*). So, Irenaeus associated the "breath of life" with the first man's "living soul".

100 In this respect, Irenaeus's understanding of the formation of the divine image in humanity is comparable to the ancient Near Eastern procedure for manufacturing images of the gods. As described in Neo-Assyrian and Neo-Babylonian sources, the statue of a god was sculpted—with the aid of the god himself—in his own image. Then it was animated by that god and deified by of washing the mouth of the statue with water; Jacobsen (1987, 120–28). Irenaeus seems to have been aware of this tradition, but he followed the biblical text in substituting terrestrial soil for wood and divine breath for water (which is similar to the Greek myth of the creation of humanity by the Titans, Prometheus and Epimetheus).

101 Irenaeus also associated the "breath of life" with God's Spirit by parallel constructions in *AH* III.24.1; V.1.3. As he made clear in passages like *AH* II.25.3, however, the physiological breath that was infused by God's Wisdom/Spirit is not the same as the Spirit itself. It is best described as an agency of God's Spirit.

102 Life giving in the physiological sense is not the same as the physicists' idea of breath/fire in the mathematical equations, but there is an analogy of proportionality between the two pairings (A is to B as C is to D), ancient and modern. The animation of human beings plays a role in the context of ancient physiology that is analogous to the actualizing breath/fire assumed in the context of modern mathematical physics.

103 Irenaeus discussed the Word's assumption of an anthropic form in Old Testament theophanies in texts like *AH* IV.7.4, 10.1, 20.8; *Dem.* 12, 44, 45. These theophanies literally pre-figured the Incarnation; e.g., *AH* IV.26.1; *Dem.* 12; see Ochagavia (1964, 90–95); Bucur (2018, 256, 273–74).

104 The Latin nouns *plasmatio* (workmanship) and *plasma* (image, figure) stem from the Septuagint of Gen. 2:7a, 15a, in which the Greek verb for "form" is *plassō*.

105 Irenaeus used the words "perfect" (*perfectus*) and "spiritual" (*spiritalis*) as synonyms in the sequel to this passage (*AH* V.6.1; SC 153:72; ANF 1:531–2). His knowledge of Paul's First Letter to the Corinthians is evidenced by his contrasting of this perfect state with that of being carnal (*carnalis*) or animallike (*animalis*) due to lack of the gifts of God's Spirit (1 Cor. 2:6a, 14a; 3:1). Elsewhere,

Irenaeus reserved the attribute of perfection to the uncreated, unbegotten God and those humans for whom the redeeming work of God's Word and Spirit had been effective (*AH* IV.38.1–3).

106 In *AH* IV.7.4, for example, the Word/Son of God appeared in humanlike form and spoke to Abraham and Moses (citing Gen. 18:1; Exod. 3:7–8); cf. Bucur (2018, 283)). The traditional idea of the Word/Lord assuming an anthropic form was not functionally at variance with Irenaeus's idea of the Word as one of the hands of God, because the former was rooted in Old Testament theophanies (as well as in the wording of Gen. 1:26–27), while the latter was a metaphor designed to protect the unity of the Godhead. In other words, Irenaeus was anthropomorphite regarding the divine Word, but not for the Godhead as a whole. Theophilus also stressed the formless nature of God the Father and attributed the Old Testament theophanies to God's Word, e.g., in *Autol.* II.22.

107 As Irenaeus stated in *AH* IV.pref.4, the man who was "formed" (*formatus*) and "molded" (*plasmatus*; cf. Gen. 2:7 LXX) by God's hands was a "mixed organization of soul and flesh" (*temperatio animae et carnis*; SC 100/2:390; ANF 1:463a).

108 The homology between the creation and redemption of humanity in Irenaeus is a major theme of Matthew Steenberg's book: "for Irenaeus the protology speaks from, and in turn to, the Christological testimony of salvation"; Steenberg (2008, 72; cf. 62, 76, 81, 83, 105, passim).

109 The Latin translation of *AH* IV.7.4 depicts the Word/Son and Wisdom/Spirit as God's "offspring and likeness" (*sua progenies et figuratio sua*), respectively (SC 100/2:462; ANF 1:470b), using the word *figuratio*, rather than *similitudo*, for the Spirit as "likeness". The wording is ambiguous here: the Spirit might be the likeness of the Offspring/Son (*figuratio sua*), who is himself the image of the Father. However, the Armenian translation of the same passage describes Word and Spirit as God's "offspring and hands", apparently applying both terms to each of the two. It is difficult to know which of the translations best reflects the original Greek; cf. Briggman (2012, 122–23 with n.61).

110 Irenaeus also assigns the likeness of God to the Spirit in *Dem.* 5; cf. Steenberg (2008, 105–6).

111 Like other early Greek theologians, Irenaeus differentiated the "likeness" of God in Gen. 1:26 from the "image" of God in Gen. 1:26; see, e.g., Clement of Alexandria, *Exhortation* 12 (albeit identifying both with the Word); see the summary of the issue in Smith (1952, 126n.70).

112 See *Dem.* 97, according to which the transformation of "those who are far from God" (i.e., gentiles; cf. Eph. 2:17) into the "likeness of God" was made possible by the one who had dominion over all of life; the Son of God made that transformation available to all people (reflecting John 1:4; 3:36; 5:26; 6:47; cf. Gal. 4:19, "Christ is formed in you"). The Son accomplished this by coming down to earth (citing Bar. 3:38) and "uniting the Spirit of God the Father with what God had fashioned", viz., the human nature assumed by the Word/Son of God (ACW 16:107–8; cf. SVSP trans., 100).

113 The Armenian word for "to articulate" can be taken in either of two senses: (1) to link or connect (the primary sense), or (2) to utter clearly (secondary sense). The older translation by J. Armitage Robinson preferred the latter; Robinson (1920, 74). Joseph P. Smith and John Behr both prefer the former, primary sense; ACW 16:141n.37; SVSP trans., 103.n.24.

114 My interpretation follows the SVSP translation (p. 43) here: the Word-made-flesh "interprets the prophets", thereby reciprocating the forward-looking annunciations of the prophets by looking back to their original message (which were, if fact, given to them by the pre-incarnate Word). The alternative translation, stating that the Word "gives their message to the prophets" (ACW 16:51) only credits the Word with the original annunciation ("their message") itself.

115 While not using the language of extensive and intensive (borrowed here from physics as explained above), Irenaeus clearly made the same conceptual distinction in passages like *AH* IV.20.7: "For, if the manifestation of God which is made by means of *creation* affords life to *all living* in the earth, much more does that *revelation* of the Father which comes through the Word give life to *those who see God*" (SC 100:648; ANF 1:490a, italics added for emphasis).

116 Irenaeus attributed the governing and arrangement of all things to both the Word and Spirit in *AH* I.22.1, but his focus in that section, as here in *AH* V.18.3, was clearly on the agency of the Word, as his citation of John 1:3 indicates.

117 The Latin *invisibiliter* is sometimes emended to *visibiliter*, based on the assumption that Irenaeus was thinking of the Word's "coming to his own" in the visible, tangible body of Jesus (as in *Dem.* 34, for example). But Irenaeus was probably thinking of the Word "coming" to the prophets in Old Testament theophanies, which are apparent to the eyes of the mind (as opened by the Spirit), but not to the eyes of flesh; cf. *AH* V.16.2; Eph. 4:8–10; Rev. 4:1–3; Philo, *Special Laws* I.46; Martyrdom of Isaiah 6:10–15; 10:17–31. On the "non-physical visibility" of Old Testament theophanies in a multi-storied spiritual universe, see Bogdan Bucur (2018, 275–77).

118 See *Dem.* 34: "the Word of God Almighty, who in the invisible form pervades us universally in the whole world and encompasses both its length and breadth and height and depth" (ACW 16:69–70, cited more fully below).

119 This paradox of the Deity containing and pervading was a commonplace in early Jewish and Christian literature: e.g., Philo, *Posterity* 14; *Confusion* 136; *Migration* 192–93; Preaching of Peter, frag. 2a; Hermas, Mandate 1. Irenaeus also stated the paradox in *AH* I.15.5; II.1.2, 30.9; IV.3.1; 20.2 (where Hermas is quoted as Scripture).

120 Compare *AH* V.16.2: "When, however, the Word of God became flesh [John 1: 14a], he confirmed both of these [image and likeness, Gen. 1:26], for he showed forth the [human] image truly [*tēn eikona edeixen alēthōs*], since he became himself what was his image [a human being], and he re-established the similitude after a sure manner by assimilating man to the invisible Father through means of the visible Word [assimilating man to himself]" (ANF 1:544ab; Greek text in SC 153:216). In other words, the

Word made flesh was the "image of God" in a double sense: as the divine Image of the invisible God (cf. Col. 1:15), according to which humans are formed (Gen. 1:26–27), and as a human being perfectly formed in that image.

121 In Irenaeus's Christology, the paradoxical combination of the divine Form and the formed human being in one and the same person, Jesus Christ, may be seen as an early version of the Chalcedonian combination of the divine and human natures in one *hypostasis*.

122 As Irenaeus stated in *AH* V.23.2, the Lord was "summing up in himself the whole of human existence [*recapitulans universum hominem in se*] from the beginning [of its life] to the end [in death]"; SC 153:290–92; ANF 1:551b. For a summary of the idea of recapitulation in Irenaeus, see Smith, 30.

123 The association of the power of God with the Spirit has precedent in Luke 1:17a; 4:14a, 49; 5:17b; 24:49; Acts 1:8; 10:38.

124 The association of reason with God-given breath goes back to Philo of Alexandria, e.g., *Creation* 139; *Planting* 18–19.

125 Irenaeus stressed the role of the Word made flesh, conceived/animated by the Spirit, as the formative model for rendering humans "living and perfected". According to *Dem.* 9, the seven charismata of the Spirit (Isa. 11:2 LXX) were the source of the wisdom and counsel of the Word made flesh (ACW 16:53; cf. SVSP trans., 45); cf., Luke 4:14, 18–19; John 16:12–15.

126 For a similar statement, see *Dem.* 97, where the Son of God bestowed new life on "what God had fashioned" (Gen. 2:7a) by assuming it and uniting it with the Spirit, thereby restoring the likeness of God in humanity that the Spirit had bestowed in the beginning (Gen. 1:26a).

127 Compare *AH* III.21.10, where Irenaeus drew a parallel between the Word's forming the body of Adam from virgin earth and the formation of the Word as a human body in the womb of the Virgin Mary.

128 Like several other early Latin texts, *AH* V.1.3 read John 1:13 as referring to Jesus himself (cf. AH III.16.2; 19.2).

129 In *AH* IV.38.3, Irenaeus stated that man is "made according to the image and likeness of the uncreated God [*tou agenētou theou*], of the Father who plans and commands, of the Son who assists and accomplishes, and of the Spirit who nourished and completes, but with the man . . . ascending toward the perfect, becoming near to the uncreated One"; Greek fragment from *Sacra Parallella*, attributed to John of Damascus (SC 100/2:294, 296); ET by Lashier (2014, 210 with n.67) (cf. ANF 1:521–2). Lashier assumes that Irenaeus redefined "God" here to include all three members of the divine triad. In the immediate context, however, Irenaeus described God as "unbegotten" (*agennētō hyparchonti*) as well as "uncreated" (*AH* IV.38.1; ANF 1:521a); the terms "God" and "Father" may be understood in apposition to each other. In the previous section of his work, moreover, Irenaeus stated that the Church was fashioned "after the image of his Son" (IV.37.7; ANF 1:521a). I conclude that the "image and likeness" of God in IV.38.3 are attributed to the agencies of God's Son and Spirit, respectively, here as elsewhere in Irenaeus's writings.

130 The Latin grammar of this part of *AH* III.24.1 is difficult. Dominic Unger understands the "gift" here to be the faith of the Church; Unger (2012, 110). In *AH* III.17.2 (ad finem; SC 211:334; ANF 1:445a), however, Irenaeus had just described the Spirit as the "living water" and "gift from the Father" (*aqua viva . . .quam Dominus acceptians munus a Patre*) that Christ bestowed on all the people on earth (cf. John 3:34; 4:10; 15:26). In the passage from *AH* III.24.1 cited above, moreover, this "gift" is associated with the inbreathing of the first human (Gen. 2:7b; cf. John 20:22), the vivification of members of the Church (cf. John 3:6, 8; 6:63; Rom. 8:1), the "earnest/guarantee of incorruption" (cf. 2 Cor. 1:22; 5:5; Eph.1:14, cited in *AH* V.8.1), and various "means through means through which the Spirit works", including apostles, prophets, and teachers (cf. 1 Cor. 12:4–11, 28).

131 In one of his versions of the rule of faith, Tertullian would refer to the Holy Spirit as *sanctificator fidei* ("sanctifier of the faith", *Against Praxeas* 2.1 ad finem). This phrase is not found in the New Testament, so I assume that Tertullian received it from his own teachers.

132 The vivification of living believers is the deliverance from the "death" of a sinful life (Eph. 2:1; Col. 2:13). It might be taken as a reference to the future resurrection, but the very next words describe the "communion with Christ" that has been distributed in the Church, presumably in the celebration of the Eucharist.

133 Irenaeus's "the ladder of ascent to God" is probably the God-man, Jesus himself, as described in John 1:51. Based on *Dem.* 45, it might also be understood as the Cross, "for by it, believers in him ascend to heaven, since his passion is our ascension on high"; cf. Eph. 2:5–6; Col. 3:1–3 (ACW 16:77; SVSP trans., 70; cf. Ignatius, *Eph.* 9:1). However, the one who raises us to union with Christ is the Spirit, as Irenaeus would explain in his discussion of eschatology in *AH* V.36.2: "they ascend by the Spirit to the Son, and by the Son to the Father" (SC 153:458–60; ANF 1:567a)—here, a tradition passed down from the Apostles by their disciples, the Elders of the Church; cf. *AH* IV.20.5; *Dem.* 5, 7.

134 In *AH* III.24.1, Irenaeus gave a short list of "apostles, prophets, teachers" and omitted the following reference to workers of miracles, healers, etc., in 1 Cor. 12:28. He had already argued (against the gnostics) that the miracles of exorcism and healing were among the many gifts that the Church had received by invoking the name of Jesus Christ in order to minister to the needs of gentiles (II.32.5); cf. Kaiser (1997, 66–67).

135 Irenaeus cited Ps. 33:6 (LXX 32:6) several times (*AH* I.22.1; III.8.3; *Dem.* 5). Following Theophilus (*Autol.* I.7), or else a common tradition, he understood the Psalm verse to assign the creation of the heavens to God's Word and the creation of their "powers" (*virtutes*, i.e., their angelic hosts; cf. *Dem.* 10) to the Spirit (the divine "breath"). As noted earlier, his focus was clearly on the agency of the Word, as his repeated citation of John 1:3 indicates. For Irenaeus, the main function of the celestial powers in *Dem.* 10 was to glorify God; cf. Briggman (2010, 593–4). While assigning the structure and motion of the heavens to the Word, Irenaeus apparently reserved the inspiration of this higher, angelic function to the Spirit.

136 As noted above, Irenaeus held that God's Word established the boundaries and laws that govern the cosmos and assigned a particular function to every single creature (*Dem.* 10).

References

Altmann, Alexander. 1963. The Delphic Maxim in Medieval Islam and Judaism. In *Idem, Biblical and Other Studies*. Cambridge: Harvard University Press, pp. 196–232, Reprinted in *Idem, Studies in Religious Philosophy and Mysticism.* Ithaca: Cornell University Press, 1969, pp. 1–40. Available online: https://www.google.com/books/edition/Studies_in_Religious_Philosophy_and_Myst/x-T5AAAAIAAJ?hl=en&gbpv=1&bsq=Studies+in+Religious+Philosophy+and+Mysticism&dq=Studies+in+Religious+Philosophy+and+Mysticism&printsec=frontcover (accessed on 5 March 2024).

Behr, John, trans. 1997. *St Irenaeus of Lyons, On the Apostolic Preaching*. Crestwood: St Vladimir's Seminary Press. Available online: https://www.google.com/books/edition/On_the_Apostolic_Preaching/c69z7MKHaYMC?hl=en&gbpv=1&dq=St+Irenaeus+of+Lyons,+On+the+Apostolic+Preaching&printsec=frontcover (accessed on 5 March 2024).

Berlin, Adele, and Marc Zvi Bretler. 1999. *Jewish Publication Society Tanakh Translation*, 2nd ed. Oxford: Oxford University Press. Available online: https://www.google.com/books/edition/The_Jewish_Study_Bible/yErYBAAAQBAJ?hl=en&gbpv=1&dq=Jewish+Publication+Society+Tanakh&printsec=frontcover (accessed on 5 March 2024).

Blocher, Henri. 1997. Immanence and Transcendence in Trinitarian Theology. In *The Trinity in a Pluralistic Age: Theological Essays on Culture and Religion*. Edited by Kevin J. Vanhoozer. Grand Rapids: Eerdmans, pp. 104–23. Available online: https://www.google.com/books/edition/The_Trinity_in_a_Pluralistic_Age/RSeIGeCLkWIC?hl=en&gbpv=1&dq=Trinity+in+a+Pluralistic+Age:+Theological+Essays+on+Culture+and+Religion&printsec=frontcover (accessed on 5 March 2024).

Briggman, Anthony. 2010. Re-Evaluating Angelomorphism in Irenaeus. *JTS* 61: 584–95. Available online: https://www.jstor.org/stable/43665334 (accessed on 5 March 2024).

Briggman, Anthony. 2012. *Irenaeus of Lyons and the Theology of the Holy Spirit*; Oxford Early Christian Studies. Oxford: Oxford University Press. Available online: https://books.google.com/books?hl=en&lr=&id=TQNREAAAQBAJ&oi=fnd&pg=PP1&dq=Irenaeus+of+Lyons+and+the+Theology+of+the+Holy+Spirit&ots=KJ7WvcErjF&sig=h_9iKOLSNdH1jLaNVtgLUEVYwvI#v=onepage&q=Irenaeus%20of%20Lyons%20and%20the%20Theology%20of%20the%20Holy%20Spirit&f=false (accessed on 5 March 2024).

Bucur, Bogdan G. 2007. Matt. 18:10 in Early Christology and Pneumatology: A Contribution to the Study of Matthean *Wirkungsgeschichte*. *NT* 49: 209–31. Available online: https://www.academia.edu/4996249/Matt_18_10_in_Early_Christology_and_Pneumatology_A_Contribution_to_the_Study_of_Matthean_Wirkungsgeschichte (accessed on 5 March 2024). [CrossRef]

Bucur, Bogdan G. 2014. Clement of Alexandria's Exegesis of Old Testament Theophanies. *Phronema* 29: 61–79. Available online: https://www.academia.edu/6912577/Clement_of_Alexandrias_Exegesis_of_Old_Testament_Theophanies (accessed on 5 March 2024).

Bucur, Bogdan G. 2018. Scholarly Frameworks for Reading Irenaeus: The Question of Theophanies. *VC* 72: 255–82. Available online: https://brill.com/view/journals/vc/72/3/article-p255_2.xml (accessed on 5 March 2024). [CrossRef]

Einstein, Albert. 1935. *The World as I See It*. Translated by Alan Harris. London: John Lane. Available online: https://www.google.com/books/edition/The_World_as_I_See_it_Translated_by_Alan/5WsLMwEACAAJ?hl=en (accessed on 5 March 2024).

Ferguson, Kitty. 1995. *Fire in the Equations: Science, Religion, and the Search for God*. Grand Rapids: Eerdmans. Available online: https://www.google.com/books/edition/The_Fire_in_the_Equations/9bR7PwAACAAJ?hl=en (accessed on 5 March 2024).

Ferris, Timothy. 1985. *The Creation of the Universe (Video)*. Blaine: Northstar Associates, Inc. Available online: https://nsainc.ca (accessed on 5 March 2024).

Fossum, Jarl E. 1996. The Adorable Adam of the Mystics and the Rebuttals of the Rabbis. In *Geschichte—Tradition—Reflexion: Festschrift für Martin Hengel zum 70. Geburtstag*. Edited by Hubert Cancik, Hermann Lichtenberger and Peter Schäfer. 3 vols. Tübingen: Mohr Siebeck, pp. 529–39. Available online: https://www.google.com/books/edition/Geschichte_Tradition_Reflexion/rEQd6OYf9akC?hl=en (accessed on 5 March 2024).

Gottstein, Alon G. Goshen. 1994. The Body as Image of God in Rabbinic Literature. *HTR* 87: 171–95. [CrossRef]

Grossberg, David Michael. 2022. One God, Two Powers, and the Rabbinic Rejection of Subordinationism. *JSJ* 53: 405–36. Available online: https://www.academia.edu/43122769/Alon_Goshen_Gottstein_The_Body_as_Image_of_God_in_Rabbinic_Literature_Harvard_Theological_Review_87_2_April_1994_171_195 (accessed on 5 March 2024). [CrossRef]

Hamori, Esther J. 2008. *"When Gods Were Men": The Embodied God in Biblical and Near Eastern Literature*. BZAW 384. Berlin: De Gruyter. Available online: https://www.google.com/books/edition/When_Gods_Were_Men/0gePQro0CSIC?hl=en&gbpv=1&dq=When+Gods+Were+Men%E2%80%9D:+The+Embodied+God+in+Biblical+and+Near+Eastern+Literature&printsec=frontcover (accessed on 5 March 2024).

Hawking, Stephen. 1988. *A Brief History of Time from the Big Bang to Black Holes*. Toronto: Bantam Books. Available online: https://www.google.com/books/edition/A_Brief_History_of_Time/u5daSQAACAAJ?hl=en (accessed on 5 March 2024).

Heller, Michael. 1995. Chaos, Probability, and the Comprehensibility of the World. In *Chaos and Complexity: Scientific Perspectives on Divine Action*. Edited by Robert John Russell, Nancey Murphy and Arthur R. Peacocke. Albano laziale: Vatican Observatory, pp. 107–21. Available online: https://www.google.com/books/edition/Chaos_and_Complexity/bd4pAAAACAAJ?hl=en (accessed on 5 March 2024).

Horsley, Richard A. 1978. The Background of the Confessional Formula in 1 Kor. 8:6. *ZNW* 69: 130–35.

Idel, Moshe. 1988. *Kabbalah: New Perspectives*. New Haven: Yale University Press. Available online: https://www.google.com/books/edition/Kabbalah/utWy5kz5K7IC?hl=en&gbpv=1&dq=Kabbalah:+New+Perspectives&printsec=frontcover (accessed on 5 March 2024).

Idel, Moshe. 2013. The Pearl, the Son and the Servants in Abraham Abulafia's Parable. *Quaderni di Studi Indo-Mediterranei* 6: 103–35. Available online: https://www.academia.edu/8792259/_The_Pearl_the_Son_and_the_Servants_in_Abraham_Abulafia_s_Parable_ (accessed on 5 March 2024).

Jacobsen, Thorkild. 1987. The Graven Image. In *Ancient Israelite Religion: Essays in Honor of Frank Moore Cross*. Edited by Patrick D. Miller, Paul D. Hanson and S. Dean McBride. Philadelphia: Fortress Press, pp. 15–32. Available online: https://www.google.com/books/edition/Ancient_Israelite_Religion/4lvbAAAAMAAJ?hl=en&gbpv=1&bsq=Ancient+Israelite+Religion:+Essays+in+Honor+of+Frank+Moore+Cross&dq=Ancient+Israelite+Religion:+Essays+in+Honor+of+Frank+Moore+Cross&printsec=frontcover (accessed on 5 March 2024).

Kaiser, Christopher B. 1997. *Creational Theology and the History of Physical Science: The Creationist Tradition from Basil to Bohr*. Studies in the History of Christian Thought 78. Leiden: Brill. Available online: https://www.google.com/books/edition/Creational_Theology_and_the_History_of_P/BBgXuy_D8WEC?hl=en&gbpv=1&dq=Creational+Theology+and+the+History+of+Physical+Science&printsec=frontcover (accessed on 5 March 2024).

Kaiser, Christopher B. 2001. *The Doctrine of God: A Historical Survey*, Revised ed. Eugene: Wipf and Stock. Available online: https://www.google.com/books/edition/The_Doctrine_of_God/L1r7DwAAQBAJ?hl=en&gbpv=1&dq=Doctrine+of+God:+A+Historical+Survey&printsec=frontcover (accessed on 5 March 2024).

Kaiser, Christopher B. 2007. *Toward a Theology of Scientific Endeavour: The Descent of Science*. Ashgate Science and Religion Series; London: Ashgate. Available online: https://www.google.com/books/edition/Toward_a_Theology_of_Scientific_Endeavou/CXgeEAAAQBAJ?hl=en&gbpv=1&dq=Toward+a+Theology+of+Scientific+Endeavour&printsec=frontcover (accessed on 5 March 2024).

Kaiser, Christopher B. 2013. The Phenomenology of Knowing in Everyday Life and in Natural Science: Reviewing the Contributions of Niels Bohr and Michael Polanyi. In *Rivers of Living Water: Essays in Honor of James V. Brownson*. Edited by James Hart Brumm. The Historical Series of the Reformed Church in America; Grand Rapids: Reformed Church Press, pp. 11–25. Available online: https://www.academia.edu/104564143/Phenomenology_of_Knowing_in_Everyday_Life_and_in_Natural_Science (accessed on 5 March 2024).

Lashier, Jackson. 2014. *Irenaeus on the Trinity*. VCSup 127. Leiden: Brill. Available online: https://www.google.com/books/edition/Irenaeus_on_the_Trinity/D56XCgAAQBAJ?hl=en&gbpv=1&dq=Irenaeus+on+the+Trinity&printsec=frontcover (accessed on 5 March 2024).

Lauterbach, Jacob Z., trans. 1961. *Mekhilta de-Rabbi Ishmael: A Critical Edition on the Basis of the Manuscripts and Early Editions*, 2nd ed. 3 vols. Philadelphia: Jewish Publication Society of America. Available online: https://www.google.com/books/edition/Mekhilta_De_Rabbi_Ishmael_JPS_Classic_Re/eaymyOWLPoQC?hl=en&gbpv=1&dq=Mekhilta+de-Rabbi+Ishmael&printsec=frontcover (accessed on 5 March 2024).

McNamara, Martin. 1972. *Targum and Testament: Aramaic Paraphrases of the Hebrew Bible: A Light on the New Testament*. Grand Rapids: Eerdmans. Available online: https://www.google.com/books/edition/Targum_and_Testament/LejYAAAAMAAJ?hl=en&gbpv=1&bsq=Targum+and+Testament:+Aramaic+Paraphrases+of+the+Hebrew+Bible&dq=Targum+and+Testament:+Aramaic+Paraphrases+of+the+Hebrew+Bible&printsec=frontcover (accessed on 5 March 2024).

Mettinger, Tryggve N. D. 1982. *The Dethronement of Sabaoth: Studies in the Shem and Kabod Theologies*. Coniectanea Biblica, Old Testament Series 18; Lund: Gleerup. Available online: https://www.google.com/books/edition/The_Dethronement_of_Sabaoth/4s3YAAAAMAAJ?hl=en&gbpv=0&bsq=Dethronement%20of%20Sabaoth (accessed on 5 March 2024).

Ochagavia, Juan. 1964. *Visibile Patris Filius: A Study of Irenaeus's Teaching on Revelation and Tradition*. Rome: Institute of Oriental Studies. Available online: https://www.google.com/books/edition/Visible_Patris_Filius/n5VizwEACAAJ?hl=en (accessed on 5 March 2024).

Orlov, Andrei. 2022. Worthless Secrets: Corruption of Cosmological Knowledge in the Enochic Tradition. *Scrinium: Journal of Patrology, Critical Hagiography, and Ecclesiastical History* 18: 244–314. [CrossRef]

Roberts, Alexander, and James Donaldson, eds. 1965. *Ante-Nicene Fathers*. 10 vols. Buffalo and New York, 1885–87, 1896. Reprinted. Grand Rapids: Eerdmans. Available online: https://www.google.com/books/edition/The_Ante_Nicene_Fathers/288czQEACAAJ?hl=en (accessed on 5 March 2024).

Robinson, J. Armitage. 1920. *St Irenaeus: The Demonstration of the Apostolic Preaching*. London: Society for Promoting Christian Knowledge.

Robinson, James M., ed. 1988. *The Nag Hammadi Library in English*, 3rd ed. San Francisco: Harper & Row. Available online: https://www.google.com/books/edition/The_Nag_Hammadi_Library_in_English/WI9Hnm8I_qwC?hl=en&gbpv=0&bsq=Nag%20Hammadi%20Library%20in%20English (accessed on 5 March 2024).

Rousseau, Adelin, Louis Doutreleau, and Charles Mercier, eds. 1965. Contre les hérésies [par] Irénée de Lyon: Edition critique d'après les versions arménienne et latine. In *Sources chrétiennes*. Paris: Editions du Cerf.

Segal, Alan. 1977. *Two Powers in Heaven: Early Rabbinic Reports about Christianity and Gnosticism*. Leiden: Brill.

Smith, Joseph P., trans. 1952. *St. Irenaeus, Proof of the Apostolic Preaching*. Ancient Christian Writers 16. New York: Newman Press.

Steenberg, Matthew C. 2008. *Irenaeus on the Trinity: The Cosmic Christ and the Saga of Redemption*. VCSup 91. Leiden: Brill. Available online: https://ebookcentral.proquest.com/lib/westernsem-ebooks/detail.action?docID=4003983&pq-origsite=primo (accessed on 5 March 2024).

Unger, Dominic. 2012. *St. Irenaeus of Lyons, Against the Heresies, Book 3*. ACW 64. New York: Newman Press.

Walhout, Donald. 1970. Other Religions as Sacred Reminders. *Religious Studies* 6: 201–08. [CrossRef]

Whewell, William. 1834. *Astronomy and General Physics Considered with Reference to Natural Theology*. London: Pickering.

Wilson, Britttany. 2021. Forming God: Divine Anthropomorphism in Luke-Acts. *JBL* 140: 775–95. Available online: https://muse.jhu.edu/article/845891/pdf (accessed on 5 March 2024).

Wilson, Britttany. 2023. The Scriptural Shape of God: Divine Anthropomorphisms in Synoptic Perspective. *NTS* 69: 138–53. Available online: https://www-cambridge-org.westernsem.idm.oclc.org/core/journals/new-testament-studies/article/scriptural-shape-of-god-divine-anthropomorphisms-in-synoptic-perspective/46588ACC0120E6076B742068B405331A (accessed on 5 March 2024). [CrossRef]

Wolfson, Elliot R. 1994. *Through a Speculum that Shines: Vision and Imagination in Medieval Jewish Mysticism*. Princeton: Princeton University Press. Available online: https://www.google.com/books/edition/Through_a_Speculum_That_Shines/19LgDwAAQBAJ?hl=en&gbpv=1&dq=Through+a+Speculum+that+Shines&printsec=frontcover (accessed on 5 March 2024).

Wollenberg, Rebecca Scharbach. 2023. *The Closed Book: How the Rabbis Taught the Jews (Not) to Read the Bible*. Princeton: Princeton University Press. Available online: https://www.google.com/books/edition/The_Closed_Book/F0uWEAAAQBAJ?hl=en&gbpv=1&dq=Closed+Book:+How+the+Rabbis+Taught+the+Jews+(Not)+to+Read+the+Bible&printsec=frontcover (accessed on 5 March 2024).

Disclaimer/Publisher's Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.

religions

MDPI

Article

The Quest for Intelligibility as Mediation Between Science and Theology

Dominique Lambert [1] and Michał Oleksowicz [2,*]

[1] Department of Philosophy, University of Namur, 61 Rue de Bruxelles, B-5000 Namur, Belgium; dominique.lambert@unamur.be
[2] Institute of Philosophy, Nicolaus Copernicus University in Toruń, Fosa Staromiejska 1a, 87-100 Toruń, Poland
* Correspondence: michaloleksowicz@umk.pl

Abstract: In this article, we explore how natural sciences can serve as sources of theological reflection. We do this by clarifying the notion of the intelligibility of the world and showing how it may work as the mediator between science and theology. In contrast to the celebrated classification of the relationship between science and religion provided by I. Barbour, we elaborate our approach within the threefold division: concordism, discordism, and articulation (mediation). We opt for the articulation mode of relationship, arguing that the link between science and theology can be articulated by raising the issue of intelligibility from the epistemic and ontic points of view. From the epistemic perspective, it results that both science and theology are operating according to proper principles and are aimed at unifying their domains of discourse and giving proper understanding. From the ontic point of view, both are related to reality: science applies its own principles to the universe and works under empirical commitments, whereas theology discusses God himself, the relationship between God and all things (creatures), and God's action in created reality. We emphasize how the articulation mode contributes to the formulation of a worldview, and we problematize the articulation by asking whether it is a convergent or divergent strategy. For this purpose, Kazimierz Ajdukiewicz's philosophical approach is applied. Finally, we show that Georges Lemaître and Pierre Teilhard de Chardin, who used two very different scientific and theological approaches, can come together if we consider them from the point of view of the intelligibility of the universe.

Keywords: science–religion; intelligibility; scientific worldview; theological worldview; Ajdukiewicz; Lemaître; de Chardin; articulation

1. Introduction

The relationship between religion and science has, in fact, been the subject of continued debate since the beginning of Christianity. However, since the 1960s, the interdisciplinary field of "science and religion", also referred to as "theology and science", has increasingly been recognized as a distinctive field of study. This is due to the extensive work of different scholars (including, for instance, I. Barbour, Th. Torrance, P. Davies, J. Haught, J. Polkinghorne, W. Stoeger, A. McGrath, F. Tipler, R. Russell, N. Murphy, A. Peacocke, W. Drees, M. Heller, and M. Artigas) who have explored the subject in a very systematic manner. Currently, the relationship between theology and science is a recognized field of study with dedicated journals (e.g., *Scientia et Fides*, *Theology and Science*, or *Zygon*) and institutions engaged in its pursuit (such as the European Society for the Study of Science and Theology, the International Society for Science and Religion, the Center for Theology and Natural Sciences in Berkeley, the Grupo Ciencia, Razón y Fe at Universidad de Navarra,

the Copernicus Center for Interdisciplinary Studies in Krakow, the Ian Ramsey Centre at Oxford, and more). Their scope of research mainly consists of studying historical and contemporary interactions between science and theology and providing philosophical analyses of how they interrelate.

In this introductory part, we recall that there are several typologies that probe the interaction between science and theology. Although the relationship between the two could (and should) be analyzed from a systematic and/or historical point of view, for reasons of space, we do not focus on the complexity of its history (e.g., Harrison 2015). While there are a variety of models describing this relationship, only a small subclass within this plurality refers to the warfare narratives. For instance, in his celebrated proposal, Ian Barbour (1997, pp. 77–105) distinguished four types of relationships, namely conflict, independence, dialogue, and integration. More recently, Ted Peters (2018) classified ten models. While four are confrontational (scientism, scientific imperialism, theological authoritarianism, and evolutionary controversy), the remaining ones emphasize cooperation (two languages, two books, ethical alliance, dialogue, naturalism, and theology of nature). What we want to emphasize from the beginning is that the historically-laden *and* systematically-laden views on the science–theology relationship are broader than just conflict or separation. Quite the contrary, it proves to be rather a dialogical perspective, assuming instances of greater or lesser agreement between the two sides (Tanzella-Nitti 2024).

For the remainder of our article, we adopt the approach proposed by one of us, which is to analyze the science–theology relationship while raising the issue of intelligibility. It is indeed possible (Lambert 1999) to individuate three main modes of interaction between theology and science. The first mode is concordism, according to which both disciplines are put at the same level, and the differences between them are blurred. The second one is discordism, according to which there is a clear delineation between the two. As a result, neither can make any contribution to the other since they remain separated. Finally, the third mode is articulation, which assumes that while the methodological differences between science and religion are to be respected, mediation and dialogue between the two are possible. Dominique Lambert has shown how each of these modes may operate at the ontological, epistemological, and ethical levels of the relationship. What mediation or dialogue adds is the assumption that science and theology are speaking about the same reality, but of course, through different perspectives. While they may be focused on different limit questions or methodologies, the possibility of consonance between them is nevertheless assumed within articulation mode. The main aim of this article is twofold. On the one hand, we intend to show that the relationship between science and theology can be articulated in an insightful manner by raising the issue of intelligibility from the epistemic and ontic points of view. On the other hand, we argue that within the articulation mode, one can fruitfully approach the differences between the scientific and theological worldviews.

The text is structured as follows. Section 2 introduces the notion of the intelligibility of the world. In Section 2.1, we discuss it from the epistemic and ontic points of view, and in Section 2.2, we clarify the philosophical and theological rationale for such a formulation of this term and discuss a variety of possible perspectives on the problem of intelligibility. In Section 3, we discuss the articulation mode of the science–theology relationship by taking important theoretical stimuli from the works of Pierre Teilhard de Chardin and Georges Lemaître. In Section 4, we explore Kazimierz Ajdukiewicz's philosophical approach in order to address the problem of intelligibility in reference to the conceptual framework and formulation of the worldview. In Section 4.1, we provide a set of important definitions needed to analyze the constitutive aspects of worldviews. In Section 4.2, we confront the scientific and theological worldviews in reference to the problem of intelligibility. In Section 5, we problematize the articulation mode by characterizing it as convergent strategy

à la de Chardin and Pierre Duhem (with his relatively unknown concept of "forme idéale de la science") aimed at formulating a unified worldview. We conclude the article by pointing out the open problems.

2. The Intelligibility of the World

In this section, we introduce and explain the notion of the intelligibility of the world from the ontic and epistemic points of view. Here, we develop several ideas that were discussed in a preliminary manner in previous articles by one of the authors (Marcacci and Oleksowicz 2023; Oleksowicz and Kłosowski 2023).

2.1. Terminological Clarifications

Terms such as intelligibility, rationality, or comprehensibility are very often used as synonyms and employed to define one another. For instance, according to Michał Heller (2008, pp. 38–40), the intelligibility of the world can be conceived of as a pre-assumption of science, that is, as a certain working philosophical hypothesis about the world that science tacitly assumes. Heller argues that if we witness the successful development of science, this means that science has comprehended some aspect of the world that has been investigated. Briefly put, "intelligibility of the world" means that the world can be known and that we manage to know it quite effectively. Firstly, let us note that Heller uses other synonyms to describe the intelligibility of the world, such as rationality, comprehensibility, realism, etc. Secondly, although these different concepts are connected by a series of overlapping similarities, it is not settled a priori that they can be merely interchanged in any context. Probably, they can be best seen as "family resemblance" concepts, as Ludwig Wittgenstein suggested (Wittgenstein [1953] 1973).

To better grasp this notion, we think that it should be analyzed from both an ontic and an epistemic point of view. The world (reality) as we know it is one in which being and knowing are mutually related and conditioned. By the term world or reality, we refer to everything that exists, that is, the set of all things in general. God, of course, is real, but not a thing, a reality *of* or *in* the world. All our knowledge is of things, events, processes, etc., that partake of being. Hence, every concept of reality that we have carries with it a relation to being. More specifically, reality as such makes itself accessible to us in such a way that it admits our intellectual activity (e.g., signification, description, knowing, explanation, modeling, intention, etc.), the results of which we will denote by the term *conceptual framework*. At the same time, it should be noted that the reality that is grasped via a certain conceptual framework remains something that we cannot fully master. When we speak truly about the world, there is more than we can express through our conceptual framework. In other words, the notions of conceptual framework and the concepts used to describe reality are related but are not identical. In what follows, we will interchangeably use two concepts, world and reality, although we are aware that each of them has a very heavy semantic content and that their semantic fields do not always coincide.

Therefore, *ontic intelligibility* means that there is a reality that can be known, whereas *epistemic intelligibility* means that there is a conceptual framework that partially grasps that reality. Briefly put, while the former means that there is some intelligibility inherent in the objective reality, the latter stands for the intelligibility inherent in the human conceptual framework. Let us note that our proposal to define intelligibility is mainly based on the distinction between reality and subject (human agent) and on the employment of the term *conceptual framework*, which we will define more precisely in Section 4. By the terms "to know" or "to grasp reality", we understand classically both certain cognitive acts and cognitive results. By the former, we refer to certain activities, for example, perception, recollection, or judgment, but also reasoning, inference, and so on. By cognitive results,

we understand properly formulated scientific statements, for instance, the Pythagorean law, the law of gravity, and so on. Moreover, in contrast to broadly understood idealistic philosophical approaches, we assume that such a thing as objective reality does exist. Finally, we are aware that the distinction between reality and subject is contextually sensitive. One can think about problems linked with this distinction in the realm of the quantum measurement process. However, for reasons of space, we do not deal more specifically with these issues here.

2.2. Philosophical and Theological Rationale

As we have noted, the notion of intelligibility indicates that ontic intelligibility and epistemic intelligibility are related. What is the relationship between them? Answers to this question may vary since they depend on the conception of truth that lurks in the background. The notion of truth in this context denotes a state of affairs that is ontologically prior to the truth of the conceptual framework, that is, of human cognition. The truth of being (the ontic necessity) would mean that the thing is what it is. Thus, ontic intelligibility is a necessary condition for epistemic intelligibility. In other words, the former is something that is independent of the human cognizer and without which the latter is not possible.

One can find a rationale for the above statements in the works of various prominent philosophers of nature. For instance, Aristotle, in his *Physics* (II, ch. 1, 191b21–23), proposed to define nature as "a principle and cause of being moved or of rest in the thing to which it belongs primarily and in virtue of that thing, but not accidentally". For him, nature possessed the sort of an intrinsic intelligibility that was self-evident. However, he was at the same time well aware that the acquisition of scientific knowledge about the physical or biological reality required laborious methodological and empirical effort (Oleksowicz 2018, 2019). In medieval times, Thomas Aquinas was clearly optimistic about the ability of the human mind to penetrate nature's secrets since, according to him, natural entities were objects proportioned to man's intellect (*Summa Theologiae* I, qq. 84–87) and, thus, it was also possible for humans to talk about God on the basis of their knowledge of nature (*Summa Contra Gentiles* I; *Summa Theologiae* I, qq. 2–26). W. Wallace interestingly comments that Galileo "not only used nature as a principle to explain the acceleration of freely-falling bodies; he also believed that nature was highly intelligible to the divine mind and could be made equally so to the human mind provided it reasoned correctly" (Wallace 2023, p. 14). This means that for Galileo, the intelligibility of nature was not merely something that was assured through effect-to-cause reasoning capable of unraveling the underlying nature of the processes being investigated. For him, the idea of intelligibility was also a means to extoll God putting the world in motion. Isaac Newton expressed his admiration for God in a similar manner in the General Scholium to his *Principia*. Let us also recall here Albert Einstein's famous comment on the problem of intelligibility:

> One may say "the eternal mystery of the world is its comprehensibility"... . In speaking here of "comprehensibility", the expression is used in its most modest sense. It implies: the production of some sort of order among sense impressions, this order being produced by the creation of general concepts, relations between these concepts, and by definite relations of some kind between the concepts and sense experience. It is in this sense that the world of our sense experiences is comprehensible. The fact that it is comprehensible is a miracle. (Einstein 1954, p. 292)

Einstein clearly emphasized that science of any kind is possible due to the amazing "philosophical fact" that nature is intelligible. Scientists try to conceptually grasp reality through some sort of unifying intellectual penetration into things in the world that are

themselves internally coherent. The scientific endeavor is activated by a wonder in front of the comprehensibility of the world.

Undoubtedly, the Christian idea of the world created by God out of nothing (*ex nihilo*) contrasts with many philosophical doctrines of the world. Nevertheless, the Christian reading of the Book of Scripture and the book of nature together not only became an integral part of medieval contemplative practice but also has informed philosophical understanding of the intelligibility of the world in modern times. Peter Harrison rightly recognized this from a Christian point of view:

> The intelligibility of nature lay not only in the realm of meaning, however. As a divine artifact, the world was also causally related to God—as pagan thinkers, albeit in different ways, had recognized. In the Christian understanding of this relation, God was not only the efficient cause of things—the original cause that had brought them all into being—but was understood to be the source of the matter and form of the creatures, and the end or final cause to which all things were drawn. The study of nature, on this understanding, pointed to God as the causal power that ultimately underpinned the existence of all things. (Harrison 2015, pp. 56–57)

In other words, from a Christian perspective, it is possible to catch a glimpse of divine reality through things that are material, visible, and mutable. It is because the intelligibility of created reality finds "an ultimate ground in the transcendent and uncreated Rationality of God" (Torrance 2001, p. 44). Moreover, this sort of primacy of divine intelligibility invites human inquiry to penetrate more and more deeply into the intelligible reality that ultimately derives from God and is not merely imposed by the human epistemic relation to reality. This theological claim about the independence of the intelligibility of the world from the human agent may be construed to reinforce human scientific activity, where the latter is to be understood as making intelligible what has yet been unknown.

In another paper (Oleksowicz and Kłosowski 2023, p. 10), a number of possible perspectives on the problem of intelligibility were proposed. In the context of this article, we would like to reiterate that Christian theology refutes the agnostic position (according to which it is not known whether the world is intelligible) and the surrender position (i.e., the belief that the search for intelligibility is not worth pursuing). On the contrary, from the Christian perspective, the world is intelligible in its ontic and epistemic aspects, and the latter depends on the former, which is ultimately grounded in God. From the epistemic perspective, both science and theology operate according to proper principles and are aimed at unifying their domains of discourse and giving a proper understanding of them. From the ontic point of view, both pertain to the universe: science does so by applying its own principles and working under empirical commitments, whereas theology either discusses God himself or the things that depend on him (Roszak 2023). We add two more aspects to this existing classification: (1) intelligibility points to the invariant reality of being, and (2) the world is intelligible, but it does not follow that everything is intelligible to us.

Let us comment on the first aspect. As Thomas Torrance notes, while the ontic intelligibility inherent in reality is unchanging, it is our changeable knowledge that is objectively grounded in the reality independent of ourselves:

> In objective knowledge of this kind there come to light invariant elements which govern our basic conceptions and affirmations of the reality concerned, but in so far as that reality exceeds our capacity to master it or resists encapsulation in our forms of thought and speech, there inevitably arise tentative variable representa-

> tions of it which are to be regarded as having their truth not in themselves but in that to which they refer beyond themselves. (Torrance 2001, p. 137)

In other words, while the objective referent of the conceptual framework (the world or some aspect of the world) does not change, our conceptual frameworks in which we seek to express the meaning of reality are variable, and their openness to change is measured by the depth of the invariance of the objective referent.

Moving on to the second aspect, let us note that our basic intuitions about the character of truth suggest that there are true propositions that exist independently of the human subject. In other words, whether something may be true or not does not depend on it being known or not. Essentially, the plethora of philosophically discussed concepts of truth can be exhaustively divided into epistemic and non-epistemic (Künne 1995). The former relies on the subject and on the conditions in which it can state whether the sentence is true. The non-epistemic concepts are based on the belief that the logical value of a sentence depends entirely on the objective perspective. To determine the objects that decide whether certain sentences are true or not, philosophers introduced different theoretical terms. For our aims, it suffices to adopt the concept of state of affairs and the following definition of truth: "The sentence is true if and only if it describes a certain state of affairs (claims the existence of a certain state of affairs) and if this state of affairs exists (happens)" (Borkowski 1980, p. 119). In fact, from the semantic point of view, classical logic assumes that each proposition has one of two logical values, regardless of the subject's knowledge (Aristotle, *De Interpretatione*, ch. 9). This position has been known as semantic realism on truth (Dummett 1991). In fact, it emphasizes that, on the one hand, the domain about which a given proposition states something is independent of human knowledge, and on the other, that there is a link between the proposition and the thing to which it refers such that the sentence is true regardless of whether any subject performs the appropriate cognitive act. However, this principle of bivalence is inconsistent with the philosophical doctrine of anti-realism on truth, which associates the truth of a proposition with its warranted assertibility, meaning that the truth value of a proposition depends on the knowledge of the subject (Dummett 1978). We evoke this debate on the character of truth in this article because the notion of intelligibility tacitly (in the background, so to speak) assumes the notion of knowledge, which is often combined with the notion of truth. In fact, modern epistemic logic often assumes that knowledge consists exclusively of true sentences.

Coming back to our main point, we must stress that semantic realism and anti-realism on truth are not the only viable options with regard to the problem of intelligibility. That is, besides the position that there are truths independent of the human agent and that only the things that meet specific conditions of assertibility can be true, at least two other positions are also possible. Specifically, there are some sentences for which we cannot ascertain their truthfulness but which potentially are (or were, or will be) true (e.g., if I were living at the same time and place as Copernicus, I would be able to verify the truth of the statement that "on 25 December 1539 at 4 PM Copernicus was singing Christmas carols", but since I am not, I cannot do this). Also, it cannot be ruled out that there are sentences for which we cannot specify their truthful character whatsoever (e.g., the future events or past events occurring in spacetime regions of light cones separated from us) (Jarmużek 2018).

At this point, we would like to take stock of what has been discussed so far. For Christian theology, God *is* the Truth. In this context, we cannot say that God is True (what we are saying about God can be true or false) but that God *is* the (ultimate) Truth. Thus, there is the Truth that is independent of the human agent, and there is the created world in which we can grasp some traces (*vestigia*) of the Creator. In particular, a human being is created in the likeness of God. In what we have discussed here, we have used the expression "being intelligible" as a synonym for "being possible to be known". However,

it cannot be ruled out that such a possibility may never become reality for some reasons. If this is so, then we have the following options:

1. Truth may be the object of our knowledge, but our knowledge does not construct it (realism).
2. Truth may be the object of our knowledge, but the cognitive act co-constructs it (weak anti-realism).
3. Truth is not currently the object of our knowledge, but in principle, it can be the following:
    a. Realist position: the knowledge mentioned in item 3 does not construct the truth;
    b. Anti-realist position: the knowledge mentioned in item 3 co-constructs the truth.
4. There are truths that, in principle, cannot be the object of our knowledge.
5. Our cognitive acts create truth (strong anti-realism).

Let us now consider some important theoretical stimuli from the works of de Chardin and Lemaître on how to articulate the science–theology relationship by raising the issue of intelligibility.

3. Relating Science and Theology: Articulation

Science has nothing to do directly with religious content, that is, content received and accepted in the context of an act of faith. Here, we make an implicit assumption that such content pertains to those truths of the Christian faith about which the natural sciences have nothing to say (because such truths cannot be grasped by empirical and/or formal methods). Nonetheless, when one is attempting to express such content in search of its intelligibility, one is implicitly or explicitly using philosophical concepts or ideas, paving the way for a philosophical reflection that emerges from science itself. To give meaning to such a statement, we have to say that science, in the process of its development, implicitly and continuously addresses questions of a philosophical nature. For example, if we want to know what a thing is or what reality is, we have to face the question of the source of its being. However, physics is not able to answer this question because it explains what something is by reference to another already existing thing. It cannot explain where existence as such is coming from. This question is a metaphysical one and comes naturally from physics, but the latter cannot resolve it without going beyond its scope.

Furthermore, when reflecting on its foundations, science cannot do anything but admit some ontological assumptions. For example, as demonstrated by Einstein's comments quoted above, physics implicitly admits that reality is intelligible and can be described by mathematics. This means that human thought can apprehend something of the structure and properties of the world and translate them in terms of a particular (quasi-)formal language. This is an assumption that cannot be justified by science itself but is the implicit starting point and prerequisite for a physical understanding of nature. In the process of constructing mathematical theories, it is, thus, not possible not to reflect on the very nature of mathematics. Answering the question of what mathematics is may not be directly necessary to apply it, but if one is interested in answering this question, one has to adopt—explicitly or implicitly—a particular philosophy (Platonist, empiricist, formalist, etc.). In fact, it is not possible to reflect seriously on science (whether formal or empirical) without being confronted with some philosophical assumptions or reasoning.

Our conclusion here is that science, in its foundation and in its practice, may be the suitable context for generating many questions that are philosophical in nature. Theology, being a rational clarification of religious content, also uses rational concepts and notions that are philosophical in nature (being, time, life, person, history, etc.). Therefore, philosophy is the proper "space" in which articulation between questions coming from science and

questions emerging from rational expressions of religious traditions may have a place (Heller 2011).

Starting with science, some solutions to metaphysical problems coming from it delineate the borders of a possible philosophical interpretation of science—an interpretation that is not necessarily logically compatible with some other philosophical frameworks. Then, science can refute, so to say, some philosophical statements. If we adopt, for example, a philosophical assumption saying that the universe (and reality as a whole) must always remain the same in space and time (as some Marxists assumed in order to build the so-called "steady-state cosmology"), we face a contradiction with what is coming from recent cosmological thought. In the same vein, if we reject evolution and assume that life is the product of instantaneous creation, then we are faced with a direct contradiction with the historical interpretation of life that comes from biology. If this is the case, some theological expressions happen to be non-compatible or non-homogeneous with the content of empirical sciences. Teilhard expressed this fact in a letter written on 2 November 1947, to the French philosopher Emmanuel Mounier. Speaking of what he referred to as the "theology of science" ("théologie de la science"), Teilhard said that

> given certain developments in the Sciences, certain representations of God and certain forms of worship are excluded because they are not homogeneous with the experimental dimensions of the Universe. (Teilhard de Chardin 1965, p. 291, transl. from French by D.L.)

With his cosmology, Lemaître (Lemaître 1946), as the philosopher and mathematician Ferdinand Gonseth emphasized (Emery 1985, 2006), produced a refutation of some of Kant's antinomies. The latter "proved" that the concept of the beginning of time cannot be part of science (that is, of human understanding). However, in 1931, Lemaître showed that the beginning of time is a natural beginning that can be completely described by physics: by general relativity (as a singularity of the spacetime manifold), by thermodynamics (as a state of minimum entropy), and by quantum theory (as a unique primeval quantum). This means that philosophical obstacles can be refuted using a reflection coming from science. This was also done by Lemaître when he emphasized the fact that the theological concept of creation cannot be identified with the natural beginning of the universe (the expression "natural beginning" comes from Lemaître himself). If we are reflecting philosophically on the meaning of the natural beginning of the universe, we realize that this is an initial state that exists and is completely described by physics. Still, creation is not a process that acts on already existing beings but an act that gives existence to all beings. Hence, philosophy and logic can be used to refute the identification between creation and the natural beginning of the universe. Here, we see that philosophy and science can help clarify some theological concepts, and theology can, in turn, help refute some misplaced meanings given to the Big Bang, such as that of being an expression of metaphysical creation (Heller 1996).

Similarly, a philosophical reflection coming from theology and saying that human knowledge cannot be absolute can express some doubts concerning the tacit philosophical assumption that science should be identified with absolute knowledge, or a similar philosophical reflection can criticize a possible identification of the mathematical infinite with some divine attribute. All this shows that science and philosophy are not at all independent. However, as theology is expressed using philosophical frameworks, we can see that science and theology cannot meet directly and only via philosophical mediation.

Teilhard criticized the tendency to confuse science and theology. In fact, he rejected a certain kind of "concordism" and instead defended what can be described as "coherence" in the sense described below. When one approaches certain questions concerning the universe as a whole, the meaning of the history of life or of human thought, etc., the possible interpretations of scientific content (i.e., the possible hermeneutics of nature) converge

towards a philosophy of nature and also towards metaphysics (and, starting from the latter, they may also converge towards a theology of creation). This stance was expressed as follows:

> Religion and science obviously represent, in the mental sphere, two different meridians that it would be wrong not to separate (concordist error). But these meridians must necessarily meet somewhere on a pole of common vision (coherence): otherwise, everything collapses within us, in the realm of thought and knowledge. (Teilhard de Chardin 1976, p. 174, transl. from French by D.L.)

Some authors have considered Teilhard to be concordist in his theological interpretation of the scientific evolutionary perspective. However, if one studies Teilhard's texts carefully, it becomes evident that he was not, in fact, a concordist. Teilhard defended the epistemological autonomy of science with respect to theology. To express that idea, he used the Louvain geologist Canon Henry de Dorlodot's terms, speaking of "Christian naturalism": the fact that one has to respect the distinction between the level at which second causes are acting and the level describing the proper action of the first cause (Teilhard de Chardin 1957, p. 40). What he defended was not concordance between science and theology but convergence without confusion between the two domains.

Articulation between science and theology is related to the fact that while science is never identical to theology, it can nevertheless converge towards the latter through the mediation of the set of philosophical questions (about foundations, value, or meaning) that it inevitably generates in the process of its very development. In fact, this convergence means that certain philosophical questions generated by science are progressively approaching certain themes, concepts, or notions studied by theology.

The interesting point here is that we can preserve the epistemological autonomy of science without severing the link to theological reflection. Duhem, who developed an epistemological position (based on a conventionalist reading of science) that refuses any confusion between science and metaphysics or between science and theology, nevertheless admits a kind of original articulation based on the observation that some deep and invariant structure is revealing progressively through the historical development of science. This structure is provided by "mathematical representation": "an ever more ample and ever more precise mathematical representation of the inanimate world that experience reveals to us" (Duhem 1914, p. 201, transl. from French by D.L.).[1] This means that even more recent theories are replacing the oldest ones and that some deep and unifying formal structures can be progressively exhibited. Thus, according to Duhem, there is some kind of deep, cumulative truth. What is more, he considered in his time that this deep formal and unifying structure was provided by "general thermodynamics":

> Among the various ways of treating the physical theory which are at present shared by men of science, which is the one that carries within it the seeds of the ideal theory?. . . This theory, as we have often said, is, in our opinion, the one we call general thermodynamics. (Duhem 1914, p. 201, transl. from French by D.L.)

Then, and this is an important point, such "ideal science" (i.e., the formal or structural "horizon" towards which theories are converging) can be interpreted philosophically by using some kind of analogy. There is an analogy (not an equivalence) between the formal structure of the aforementioned "general thermodynamics" and the structure of a philosophical cosmology. According to Duhem, philosophical cosmology is an Aristotelian one, but this is not so relevant to our discussion. What matters is the following: science, in its progress, exhibits a deep formal structure. This is what Duhem called an "ideal science", which, according to him, was "general thermodynamics" (but, of course, we now have a rather different idea of what ideal science is). Science *converges* towards a unified

structure (today, we can speak of unifying schemes, unification theories, etc.). By way of philosophical analysis, one can establish a formal analogy between this structure and the one of a "philosophical cosmology". In more recent terms, one can say that it is possible to provide semantics to this unifying theory by using a philosophy of nature (or metaphysics), which, in turn, can be linked with the one used to express a theology of creation. This gives a precise meaning to a *convergence* (rather than *concordance*) of science towards theology because science and theology remain at two distinct epistemological levels. If sciences are shown to converge formally towards a unifying theory, and if the formal structure of the latter happens to be (formally) analogous to the *structure* of a philosophy of nature, then, in some sense, by way of an analogy (conceived philosophically), science can be thought to converge towards some theological vision. To illustrate this point succinctly, all sciences today reveal an evolutionary structure. By way of an analogy, the evolution of the universe and of life can relate to a philosophy of nature that is based on history. This category of history is also crucial in Christian theology (history of salvation, for example). Therefore, one could say that sciences converge progressively towards a historical philosophy of nature (whereby biological evolution and evolutionary philosophy of nature reveal a common historical structure) that happens to be coherent (i.e., what comes from a philosophy of nature interpreting science does not contradict the theological content) with a theology of creation.

Articulation between science and theology is not at all constructed conventionally or imposed arbitrarily from the outside. The complete intelligibility of reality needs to go far beyond science. This follows naturally from an epistemological and historical study of science because if we are searching for the meaning of science and its productions, we are led directly to the realm of philosophy (which is obvious in what we have said concerning the use of analogy). And by entering this field, we can also benefit from the conceptual clarifications of the expressions of some religious beliefs.

4. The Scientific and Theological Worldviews Confronted

It seems to be a common view that science is a suitable (or even the best) path towards understanding the world. Science and technology have become so pervasive in our daily lives that modern societies are mainly permeable to forms of rationality shaped by scientific and technological knowledge. Thus, it is widely assumed that truth should be the outcome of scientific knowledge. At the same time, Christian theology, which we conceive of as an attempt to make understandable the truths of Christianity, is called upon in the contemporary culture to take seriously not only the history of salvation but also God's revelation through nature (Tanzella-Nitti 2022, pp. 121–235). As a consequence, there is an inevitable tension between the scientific and theological ways of looking at the same object, that is, the world. This tension has specific implications for the science–theology relationship.

God's revelation in the created world is, ultimately, the source not only of the ontic intelligibility of the world but also of those epistemic experiences of the intelligibility that many scientists encounter while studying the underlying structure of the world, such as wonder, awe, beauty, rationality, intelligibility, comprehensibility, etc. For a theologian, there is no doubt that God sustains the world and is active in it. As we have mentioned, the biblical and theological account is straightforward: God is the Creator of the world, and everything depends upon him. There can be, however, a disagreement between the perspective on the source and character of the intelligibility of the world that comes from a worldview shaped by scientific-technological knowledge and that proposed by theology. Why is this the case? We think that one of the main roots of the conflict between science and theology is, in fact, the presumed or emerging contradiction, contrariety, or divergence

not between scientific and theological truths but rather between theological and scientific worldviews (Grabowski 2000, pp. 126–35).

In what follows, we will first present a set of basic notions needed to properly understand the concept of the worldview, and then we will show how these notions can be applied when one is dealing with different worldviews, that is, the scientific worldview and the theological one, which concurrently yet differently address the problem of intelligibility.

4.1. Basic Notions and Their Definitions

Here, we would like to introduce a list of basic notions needed for our further discussion. The definitions provided below were developed within the theoretical framework established by the prominent Polish philosopher and logician Ajdukiewicz, a member of the Lvov-Warsaw School (Ajdukiewicz 1978, pp. 1–89).

Language (L) consists of three elements: (1) vocabulary (the class of words), (2) syntactic rules (which explain how to build complex expressions from atomic ones), and (3) semantic directives (which determine the meaning of language expressions).

Semantic directives (SDs) express the relationship between meanings attributed to language expressions and the way in which these expressions are used. More precisely, if someone correctly relates words (expressions) of a certain language L to meanings attributed to those words (expressions), then under the circumstances C, that person is willing to accept the proposition P. For instance, if Tom relates the word "pain" in English to its proper meaning, then he is willing to accept the expression "I feel pain" when he falls off his bike while riding at a high speed.

There are three types of *basic semantic directives*: (1) *axiomatic semantic directives* (SDAs), which prescribe propositions that cannot be rejected, as otherwise the meanings attributed to language expressions would be changed; (2) *deductive semantic directives* (SDDs), which assign to sentences of a certain type (premises) other sentences of a different type (conclusions); and (3) *empirical semantic directives* (SDEs), which assign to experience data the propositions that should be accepted in the face of such data. Each of these directives has its own *range* of application, that is, a class of axioms (SDAs), a class of sentences–sentence pairs (SDDs), or experience data–sentence pairs (SDEs).

There are two additional *truth-conducing semantic directives*: (1) to be a true proposition in own language (SDT1), whereby one accepts the proposition P and, at the same time, accepts the proposition "P is true in my language" (in other words, a proposition is true if and only if that proposition is asserted within a specific language according to its own basic semantic directives (SDAs, SDDs, and SDEs)); and (2) to be a true proposition in another language (SDT2), whereby if one accepts the proposition P and, at the same time, accepts the proposition "the expression P in the language L is a translation of the expression P_1 in the language L_1", then one accepts the proposition "P_1 is true in the language L_1".

Open language (OpL): Let us assume that there are two languages, S and M. If the language M contains all the expressions of the language S and assigns to them the same meanings as those in the language S, but in the language M there are also expressions that do not occur in the language S and at least one such expression has a direct semantic connection to an expression that also occurs in the language S, then we will say that the language S is *open* to the language M. The term *direct semantic connection* denotes that different expressions belong to the same element of the *range* of semantic directives (SDs).

Closed language (ClL) is a language that is not open.

Total language (ToL): We use the term *isolated part* to denote the non-empty class of language expressions whose elements do not have any semantic connections with other expressions of that language. A language that does not have any isolated parts is *total*.

Having the same meaning: If A and A' have the same meaning in the language L, then they have to behave in the same manner within the whole *range* of applications of SDs. That is, the whole *range* of applications of SDs cannot be modified by the substitution of A' for A and of A for A' in all of its elements.

Mutually translatable languages (MT): Two languages are *mutually translatable* if and only if, for every expression in one language, there is at least one expression in the other language that is a translation of that expression from one language into the other, and vice versa.

Translation relation (TR): If the expression A in the language S *has the same meaning* as the expression A_1 in the language S_1, then we will consider the expression A to be the translation of the expression A_1 from the language S_1 to the language S. TR is a reflexive, symmetric, and transitive relation.

Meaning is a family of classes (properties) of abstraction specified by a translation relation (TR). In other words, the meaning A in the language S is the property A in the language S, which can be ascribed to A_1 in the language S_1 if and only if A_1 in S_1 has the same meaning as A in S. From a more general point of view, the meaning is what links specific thoughts (epistemic states) to the way in which one uses language to express these thoughts. Thus, meaning determines—to a certain degree—the use of semantic directives (SDs).

Conceptual framework (CF) is the class of all meanings attributed to expressions of a certain closed (ClL) and total language (ToL). This class has a proper structure based on the basic semantic directives (SDAs, SDDs, and SDEs) adopted in that language.

Worldview (WV) is the set of all propositions designated by the application of semantic directives (SDs) of a specific language and certain experience data. In other words, the worldview is the set of all true propositions within a certain conceptual framework (CF). Synonyms of WV are image of the world, paradigm, and *Weltbild*.

Let us now comment on the above notions and definitions. Firstly, let us note that the class of all meanings attributed to expressions of a certain language constitutes the semantic field of that language. In fact, the CF is built on the basis of that semantic field. Secondly, Ajdukiewicz makes an idealized assumption about languages, claiming that they are closed and total. This means that he analyzes languages as having well-defined SDs and CFs and, thus, any given language is isolated from other languages. This highly idealized assumption implies that any revision (change) within the SDs will, in fact, produce a different CF (and, by extension, a different WV). If it is so, then such an idealized assumption blocks any possibility of the revision or refinement of the existing CFs (WVs), as well as the formulation of new ones based on those precedents. As a result, we end up with a certain incomparability (or incommensurability) of various CFs or WVs. The separation of CFs or WVs precludes any comparison between them. If one stops at this point, Ajdukiewicz's approach does not differ from Thomas Kuhn's notion of incommensurability (Kuhn 1962).

Being aware of this deep limitation, Ajdukiewicz proposed four (more realistic) tendencies according to which WV (or CF) evolves, making it possible to compare different WVs (CFs):

1. The elimination of contradictions—avoiding contradictions not only in the proposed scientific theories but also within any CF or L;
2. Rationalization—choosing the CF that can resolve more problems without invoking empirical methods of inquiry;
3. Improvement of the CF—reducing the number of unsolvable problems within a given CF;
4. Increase in the empirical sensitivity of the CF—improving the ability to differentiate responses to given experiences.

These criteria work as tools to compare different WVs or CFs, and to a certain degree, they limit the above idealizing assumption.

Let us now address the following problem: if different Ls produce their own CFs (WVs), then they have their own criteria of truthfulness (SDT1 and SDT2). If this is the case, then each CF (WV) formulates its own truths. How, then, can one build a global worldview, even if one accepts the evolutionary tendencies for separate WVs or CFs? At first glance, it seems that one is forced to merely aggregate isolated worldviews, selecting from them what one wishes to take. Ajdukiewicz is well aware that if one uses an L, then one is always bounded by a certain set of SDs and CFs. In other words, it is not possible to speak without using an L, and it is not possible to interpret reality without using a certain CF. Moreover, if one accepts a given set of SDs, then one is forced to accept the propositions that come from the use of these SDs in the context of a given experience. One can choose a different L or CF, with all the consequences of that choice, but it is not possible to be neutral in the sense of not adopting any of them.

As previously mentioned, the specificity of a WV depends on two main factors: the experience data on the basis of which the WV is built and the character of the WV, which depends on the CF. The first factor does not require further explanation. The second one, as we have noted before, emphasizes that any revision within the SDs will produce a different CF and, as a consequence, a different WV. A change in the CF implies that new problems or issues become the focus of our epistemic attention. Not only do different sciences use different CFs, but also each science refines and changes its own CF. It is a common point of view in contemporary history and philosophy of science that scientific rationality has changed its shape throughout the ages and that styles of reasoning have changed (Hacking 1992; Nickles 2021). Although many people today regard science as a human enterprise that does not escape the contingencies of history, there is still a certain tendency within the scientific approach (but also the theological one) to formulate a global CF or WV. However, according to Ajdukiewicz, science cannot reach a perfect WV (Ajdukiewicz 1978, pp. 79–81). Rather, it chooses its own CF because of certain aims at hand and, at the same time, rejects any extensions of that CF that disagree with the already assumed SDs. In other words, there is a sort of self-limitation of science at play, which means that science is "sensitive" only to those propositions that belong to its CF and neglects those that do not. Does it mean that a perfect (unified) scientific WV is not attainable?

Firstly, it does not seem that for all sciences that have their own CFs, there exists an ideal or perfect CF on the basis of which a sort of perfect (global) WV can then be formulated. On the contrary, it seems that there are many coexistent WVs, each based on the locally perfect WV. It is not difficult to imagine that in a set of possible WVs, there can be many locally perfect WVs, but there does not have to be the most perfect and unique WV. For instance, one can think of many different WVs, each of them bound to a specific scientific discipline investigating a limited domain of reality, and it is not necessary to claim that, for instance, the physicalist worldview is the unique one since it is possible to assume a biological or sociological one at the same time. While the perfect global WV may be seen as a certain epistemic ideal associated with the notion of objective truth about reality, one cannot rule out the possibility of the coexistence of various epistemic perspectives (CF) on how to approach such an ideal limit (perfect WV). In our opinion, this neither undermines the objectivity of truth nor implies that any claim about reality can be equally valuable. Rather, it means that the notion of truth is bound to the local CF.

We think that Ajdukiewicz's approach is a precise tool that is well-suited for the reconstruction and analysis of cases in which we are dealing with various WVs. Let us now see how it can be applied to such a case.

4.2. Different Worldviews and the Intelligibility of the World

Let us assume that there are two basic languages: the scientific language L_S and the theological language L_T; that there are two worldviews, the scientific worldview (WV_S) and the theological worldview (WV_T); and that in L_S and L_T, there are the expressions I_S and I_T, respectively, which describe the intelligibility of the world according to the proper language. When I_S and I_T are added to L_S and L_T, respectively, then we obtain two other languages: L_{SI} and L_{TI}. Each of the WVs has its own CF and SD, which are CF_S and SD_S and CF_T and $SD_{T,}$ respectively. Let us now consider four cases:

1. L_S and L_T are both total (ToL) and closed (ClL).
2. L_S is open to L_{SI}.
3. L_T is open to L_{TI}.
4. I_S can be translated to I_T.

Ad. 1. If both languages are total, this means that there are no isolated parts in either language and that any part of each respective language can be compared with any other. If both languages are closed, this means that adding any new expression that is not a synonym of any of the expressions already present in the respective language will cause an expression to appear in that language that does not have any direct semantic connection to the expressions already present in the language. Thus, the language will no longer be total. As a consequence, I_S and I_T within L_S and L_T, respectively, are incomparable. In other words, I_S added to L_T or I_T added to L_S will not be semantically connected with the respective language to which it is added.

Ad. 2. From the definition of OpL, we know that adding the new expression I_S to the language L_S will not change the meanings of existing expressions in L_S. The latter will remain a ToL and will be a richer language than L_S since it is able to describe the problem of intelligibility within a new CF, that is, CF_{SI}.

Ad. 3. Here, our reasoning is analogous to that in item 2. We obtain that L_{TI} will remain a ToL and will be a richer language than L_T since it is able to describe the problem of intelligibility within a new CF, that is, CF_{TI}.

Ad. 4. Let us note that L_{SI} and L_{TI} are both total (ToL) and closed (ClL). Each of these languages preserves the specificity of the domain that it describes. For instance, in L_{SI}, one can find expressions about electrons, gene expressions, and biological evolution, but also about the intelligibility of the world; in L_{TI}, one can find expressions about the Trinity, Incarnation, history of salvation, and the intelligibility of the world. Let us now assume that I_S can be translated (TR) to I_T. If this is the case, then, as Ajdukiewicz has proved (Ajdukiewicz 1978, pp. 53–57), those languages (and all their expressions) are mutually translatable (MT).

Let us comment further on this point and its striking outcome. Firstly, we have assumed that L_S and L_T are closed (ClL) and total (ToL). This assumption follows the common perception of the scientific and theological languages as being very different, speaking about different domains, etc. (ClL). At the same time, however, each of these languages tries to be well integrated (ToL). Secondly, L_{SI} and L_{TI}, understood as proper extensions of the previous ones, remain total and closed. The difference between these new languages and the previous ones is that new expressions (i.e., a set of expressions) have been introduced into L_S and L_T, that is, I_S and I_T, respectively, both aimed at describing the intelligible character of the world. We do not specify here the content of these expressions, the manner in which they have been formulated, etc. The point is that the two languages speak about intelligibility in different ways, as we have argued in the preceding sections of this article. Thirdly, notwithstanding the differences between the scientific and theological ways of expressing the intelligibility of the world, it seems that it cannot be ruled out that I_S and I_T can be conceived of as translatable. Referring to our previous analysis, we

think that such a minimum meaning of the notion of intelligibility could be expressed, for instance, in the following way: notwithstanding the changeable character of the CF (WV), along with the previously mentioned tendencies, what remains as invariant (constant) is a continuous openness of the proposed CF (WV) to be revised/reformulated in the light of further disclosure of investigated reality. Fourthly, if I_S and I_T are translatable (TR), the conclusion is that L_{SI} and L_{TI} are mutually translatable (MT). This conclusion is striking (counterintuitive) since it suggests that all expressions from L_{SI} and L_{TI} are mutually translatable.

This possibility is hard to imagine when one thinks about the domains of science and theology. Let us, however, emphasize that this striking result is due to very strong idealizations, namely that (1) L_{SI} and L_{TI} are ToL and ClL; (2) L_{SI} and L_{TI} are still ToL after adding new expressions (meanings) such as I_S and I_T, respectively; and (3) I_S is translatable to I_T.

5. Convergence: A Worldview That Unifies

Let us now describe more precisely the link between the notion of articulation, which we discussed in Section 3, and the notion of convergence. First, let us briefly recall what we have discussed so far concerning Lemaître and Teilhard de Chardin. In the case of Lemaître, we have shown that his thinking evolved towards a juxtaposition of science (understood in a conventionalist way *à la* Poincaré) and theology. His approach recognizes the existence of two paths to truth and respects the autonomy of each field while at the same time avoiding any convergence and articulation. In the case of Teilhard, we have presented a conception according to which if science is pushed to its limits (for instance, considering the universe and its history as a whole), it converges towards a philosophy of nature and theology. Thus, what we obtain here is a conception of increasing coherence (rather than concordance) between science and theology—a convergence of both when we are considering foundational questions. In the case of Duhem, we have noted that (like Poincaré and Lemaître) he also provided a conventionalist approach to science, which allowed him to sharply distinguish between science and theology. At the same time, according to him, science in its development tends towards an ideal form that is coherent with philosophy (for example, according to Duhem, thermodynamics—the "ideal science"—describes processes that are analogous to the transition between potency and act in Aristotelian philosophy).

What we refer to as articulation is a link established between science and theology through the mediation of philosophy. Articulation is not arbitrary (that is, imposed from the outside without any foundation in science itself) because one can pose—within the context of science—philosophical questions that cannot be tackled in the field of science as such. The main point concerning convergence is that science is not merely generating philosophical questions. In fact, one can observe that science is converging progressively, despite theoretical changes, errors, fallible models, etc., towards some unifying scheme. For instance, as we have mentioned, cosmology and biology are progressively outlining an explanation scheme characterized by evolution. Hence, the view that we are adopting here is the opposite of Kuhn's idea of incommensurability of worldviews (WVs) or paradigms. In our opinion, this unifying scheme (which is, in a sense, a CF), which goes beyond separated worldviews, can be elaborated within a certain philosophical interpretation. For instance, an evolutionary unifying scheme that arises from physics and biology can be formulated using the philosophical category of history. By way of an analogy provided by what one can call a hermeneutics of nature, cosmological and biological evolution is, thus, the trace of a deep history. One can say that science is converging (tending) towards a philosophy of nature (or towards metaphysics, a philosophy of history) by virtue of a philosophical interpretation (hermeneutics). If this philosophical interpretation is also

used in the field of theology, it is not difficult to see that while science remains completely distinct from theology, it may converge towards the latter on the basis of a certain kind of philosophical semantics. We interpret such convergence as the emergence of a worldview (WV) or conceptual framework (CF) that is capable of unifying what comes from science and philosophy, from philosophy and theology, or from science and theology due to the mediation of philosophy. Such a convergence should not be conflated with any sort of concordism. To put it succinctly, we argue that the intelligibility of reality as a whole is a necessary condition for any kind of convergence, but, at the same time, that convergence is activating a wonder in front of the comprehensibility of the world.

Now, we must discuss more precisely what we mean when we say that convergence is able to unify what comes from science and theology. For that purpose, we will refer to the notion of worldview as we have reconstructed it within Ajdukiewicz's approach (Section 4). Let us assume, as in Section 4, that there are two basic languages: the scientific language L_S and the theological language L_T; that there are two worldviews, the scientific worldview (WV_S) and the theological worldview (WV_T); and that in L_S and L_T, there are the expressions I_S and I_T, respectively, that describe the intelligibility of the world according to the proper language.

5.1. Independence à la Lemaître

Lemaître suggested a mode of independence between L_S and L_T, which means that according to his interpretation, each of the languages is closed (ClL) and total (ToL). This corresponds then to case 1 from Section 4.2.

5.2. Convergence à la Teilhard de Chardin/Duhem

Teilhard de Chardin suggested a convergence of science toward a philosophy of nature and then toward theology. According to his interpretation, this means that the scientific language L_S is open to some language L_{SP}, which is enriched by a philosophy of nature. Moreover, let us assume that L_{SP} is potentially open (converging) to the sort of unifying language $L_{S\text{-}T}$ (that is, a language that unifies science and theology). At the same time, the theological language L_T is open, for instance, to the language L_{TH}, which is a philosophical interpretation of Christian theology focused on the crucial role of the category of history in theological reasoning. Let us also assume that the latter, like L_{SP}, is potentially open (converging) to the language $L_{S\text{-}T}$. As a consequence, we have that L_S, via a philosophical mediation expressed in the language L_{SP}, is converging to $L_{S\text{-}T}$. Also converging to the latter is L_T, but this time via a philosophical mediation expressed in the language L_{TH}. This situation corresponds to cases 2 and 3 from Section 4.2.

Let us comment further on this approach. Firstly, we have assumed that L_S and L_T are closed (ClL) and total (ToL). This assumption resembles Teilhard's criticism of any confusion between science and theology and Duhem's conventionalist epistemology of science.

Secondly, L_{SP} and L_{TH}, understood as proper extensions of L_S and L_T, respectively, remain ToL and ClL. The difference between these new languages and the previous ones is that new expressions have been introduced into L_S and L_T and, as a consequence, so have new semantics: that of a philosophical (evolutionary) interpretation of nature and that of a philosophical interpretation of Christian theology that focuses on history, respectively, both aimed at describing the intelligible character of the world that is evolutionary. We do not specify here the content of these expressions, the manner in which they have been formulated, etc., but the main point is that the two languages speak about the intelligibility of the evolutionary world, at least to some extent, in a similar (analogous) way since both are converging to the same language $L_{S\text{-}T}$.

Thirdly, let us reiterate that in Section 4.2, we assumed that I_S can be translated (TR) to I_T. If this is the case, then those languages (and all their expressions) are mutually translatable (TR). But in the case that we are considering now, we cannot a priori assume that L_{SP} and L_{TH} are mutually translatable. On the contrary, we must note that some deep and invariant structure of reality (in its ontological and epistemological aspects) is being revealed progressively through the historical and fallible development of science and theology. It can be said that both science and theology result in being convergent (i.e., they tend to the same limit, but without reaching it) under the same respect, but only after a piecemeal a posteriori evaluation of what has effectively been done within each of the disciplines. Thus, a convergence is possible due to articulation, which is like a dynamic process of translation between L_S and L_T, thanks to philosophical mediation performed on a case-by-case basis. This articulation may be conceived of as the analog of TR. Although the two languages are not mutually translatable (MT), thanks to the articulation process, the meanings of expressions from different languages become analogous (i.e., more similar than dissimilar). It seems, then, that within the approach *à la* Teilhard de Chardin/Duhem, a sequence of different partial science–theology worldviews (e.g., $WV_{S\text{-}T}{}^1$, $WV_{S\text{-}T}{}^2$, $WV_{S\text{-}T}{}^3$, etc.) may be formulated during the articulation process, thus avoiding concordism and discordism and tending towards the ideal limit of the unified $WV_{S\text{-}T}$, but without reaching it.

The last remark seems to contradict what we stated in Section 4.1 (Basic Notions and Their Definitions). There, we mentioned, referring to Ajdukiewicz's approach, that in a set of possible WVs, there can be many locally unified WVs, but there does not have to be a perfect global WV conceived of as a certain epistemic ideal associated with the notion of objective truth about reality. This contradiction, however, is only apparent since one must have in mind that we have suggested an example of two languages in order to describe the intelligible character of the world that is evolutionary. In other words, we have proposed a domain-specific (in some respect) example of articulation, that is, local articulation, rather than an unrestricted (global) articulation of everything. Thus, we cannot exclude the possibility that several CFs (WVs) can be proposed, which are not to be confused but may be convergent. We use the term convergence (meaning a tendency to reach some sort of an ideal limit) to describe a type of articulation—avoiding concordism and discordism—between science and theology that tends towards offering a unified worldview (WV) to a certain extent. We leave the problem of why a unified universal $WV_{S\text{-}T}$ cannot be reached for another discussion.

Fourthly, within this approach, which does not assume that L_{SP} and L_{TH} are mutually translatable (MT), we avoid the position of concordism. In addition, due to the convergence, we can also avoid discordism.

Briefly put, the articulation mode consists in maintaining methodological boundaries between L_{SP} and L_{TH} and, at the same time, a tendency towards a common space for dialogue. In our example, the subject of this dialogue is the issue of the intelligibility of the world. What deserves further attention is the fact that in the case of L_{SP} and L_{TH}, there can be differences between SDs and their formulation. Such differences may, in consequence, influence the characteristics of the similarities and differences between L_{SP} and L_{TH}. We leave this problem for another discussion.

6. Conclusions

In simple terms, something can be intelligible or comprehensible by virtue of making sense to us. What is intelligible is self-evident; it is given to us. The unintelligible is simply unspeakable; it is not given to us. It seems very reasonable to assume ontic intelligibility—that there is an objective reality that can, at least partially, be comprehended. At the same time, we have argued that objective reality can be understood using different cognitive

tools. Thus, there also exists epistemological intelligibility—a never-ending disclosure of the objective reality due to our epistemic activity. Science, philosophy, and theology are modes of understanding. The crucial question is whether these modes are completely independent, linked by articulation thanks to a convergence of the formal structure of two philosophical interpretations: a hermeneutics of nature (provided by a philosophy of nature giving philosophical meaning to scientific content) on the one part, and a hermeneutics of theology (trying to extract the philosophical structure of theological discourses) on the other. The latter would mean that what is reached in the process of articulation could be more and more similar since pushing science to its limits may lead to reaching semantic domains normally elaborated within philosophical or theological conceptual frameworks. We think that while Lemaître was defending a certain kind of independence of science with respect to theology, Teilhard was defending what can be described as a convergence of science towards theology. These two positions have been carefully analyzed in our study by applying Ajdukiewicz's philosophy of language.

The aim of our article has been to show that it is important to continue to defend the epistemological autonomy of science and theology and, at the same time, to avoid a radical separation between the two when we are considering the hermeneutical level, that is, the level of philosophical interpretation, which naturally arises when we are facing the question of the deep meaning of scientific content and practices and the question of the deep intelligibility of theological discourses. It would be worthwhile to revisit the attempts made, for example, by Jean Ladrière (1970) to overcome the limits of concordism and separatism, respecting the autonomy of science but refusing to enclose its meaning within its own formal limits. In addition, it would also be important to demonstrate that the power of science is to show, from the inside, that its complete intelligibility requires moving on to another form of discourse, that is, a philosophical hermeneutics that can face another hermeneutical attempt—the search for the rational and always partial intelligibility of theology.

Author Contributions: Conceptualization, D.L. and M.O.; investigation, D.L. and M.O.; resources, D.L. and M.O.; writing (original draft), D.L. and M.O.; writing (review and editing), D.L. and M.O. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: No new data were created or analyzed in this study. Data sharing is not applicable to this article.

Acknowledgments: Special thanks to Szymon Chlebowski who has read the manuscript and suggested many valuable comments.

Conflicts of Interest: The authors declare no conflicts of interest.

Note

[1] Duhem 1914 is Quoted in Jaki, Stanley. 1990. *Pierre Duhem. Homme de Science et de foi*. Paris: Beauchesne, pp. 200–6 [English translations of some of Duhem's works are available on: https://en.wikipedia.org/wiki/Pierre_Duhem].

References

Ajdukiewicz, Kazimierz. 1978. *The Scientific World-Perspective and Other Essays, 1931–1963*. Edited and with an Introduction by Jerzy Giedymin. Dordrecht: D. Reidel Publishing Company.

Barbour, Ian G. 1997. *Religion and Science: Historical and Contemporary Issues*. New York: HarperCollins Publishers.

Borkowski, Ludwik. 1980. Pewna wersja definicji klasycznego pojęcia prawdy. *Roczniki Filozoficzne* 28: 119–31.

Duhem, Pierre. 1914. De l'analogie entre la theorie physique et la cosmologie péripatéticienne. In *La Théorie Physique*. Paris: Rivière.
Dummett, Michael. 1978. *Truth and Other Enigmas*. London: Duckworth.
Dummett, Michael. 1991. *The Logical Basis of Metaphysics*. Cambridge: Harvard University Press.
Einstein, Albert. 1954. Physics and Reality. In *Ideas and Opinions by Albert Einstein*. New York: Crown Publishers, pp. 290–323.
Emery, Éric. 1985. *Ferdinand Gonseth: Pour Une Philosophie Dialectique Ouverte à L'expérience*. Lausanne: L'Âge d'Homme.
Emery, Éric, ed. 2006. *Actes du Colloque du Centenaire de Ferdinand Gonseth*. Lausanne: L'Âge d'Homme.
Grabowski, Marian. 2000. *Elementy Filozofii Nauki*. Toruń: Wydawnictwo Mikołaja Kopernika.
Hacking, Ian. 1992. 'Style' for Historians and Philosophers. *Studies in History and Philosophy of Science Part A* 23: 1–20. [CrossRef]
Harrison, Peter. 2015. *The Territories of Science and Religion*. Chicago: University of Chicago Press.
Heller, Michał. 1996. *The New Physics and a New Theology*. Notre Dame: University of Notre-Dame Press.
Heller, Michał. 2008. *Sens Życia i sens Wszechświata*. Studia z Teologii Współczesnej. Tarnów: Biblos.
Heller, Michał. 2011. How is Philosophy in Science Possible? In *Philosophy in Science: Methods and Applications*. Edited by Bartosz Brożek, Janusz Mączka and Wojciech P. Grygiel. Kraków: Copernicus Center Press, pp. 13–24.
Jarmużek, Tomasz. 2018. *On the Sea Battle Tomorrow That May Not Happen: A Logical and Philosophical Analysis of the Master Argument*. Berlin: Peter Lang.
Kuhn, Thomas. 1962. *The Structure of Scientific Revolutions*. Chicago: University of Chicago Press.
Künne, Wolfgang. 1995. Prawda. In *Filozofia. Podstawowe Pytania*. Edited by Ekkehard Martens and Herbert Schnädelbach. Translated by Krystyna Krzemieniowa. Warsaw: Wiedza Powszechna, pp. 138–96.
Ladrière, Jean. 1970. *L'articulation du Sens. Discours Scientifique et Parole de foi*. Paris: Cerf.
Lambert, Dominique. 1999. *Sciences et Théologie. Les Figures d'un Dialogue*. Namur: Éditions Lessius.
Lemaître, Georges. 1946. *L'hypothèse de L'atome Primitif: Essai de Cosmogonie (Préface de F. Gonseth)*. Les Problèmes de la Philosophie des Sciences. Neuchâtel: Éditions du Griffon, pp. 119–46.
Marcacci, Flavia, and Michał Oleksowicz. 2023. The World as a Gift: Scientific Change and Intelligibility for a Theology of Science. *Religions* 14: 572. [CrossRef]
Nickles, Thomas. 2021. Historicist Theories of Scientific Rationality. In *The Stanford Encyclopedia of Philosophy*. Edited by Edward N. Zalta. Available online: https://plato.stanford.edu/archives/spr2021/entries/rationality-historicist/ (accessed on 1 January 2020).
Oleksowicz, Michał. 2018. Aristotle on the Heart and Brain. *European Journal of Science and Theology* 14: 77–94.
Oleksowicz, Michał. 2019. La biologia aristotelica nelle opere *De partibus animalium* e *Historia animalium*. *Cauriensia* 14: 367–86. [CrossRef]
Oleksowicz, Michał, and Michał Kłosowski. 2023. The Theodicy Challenge and the Intelligibility of the World. *Religions* 14: 1513. [CrossRef]
Peters, Ted. 2018. Science and Religion: Ten Models of War, Truce, and Partnership. *Theology and Science* 16: 11–53. [CrossRef]
Roszak, Piotr. 2023. Theological Explanation—Redundant or Indispensable? On Modern Science, Reductionism and Conjunctive Interpretation. *European Journal of Science and Theology* 19: 1–15.
Tanzella-Nitti, Giuseppe. 2022. *Scientific Perspectives in Fundamental Theology: Understanding Christian Faith in the Age of Scientific Reason*. Claremont: Claremont Press.
Tanzella-Nitti, Giuseppe. 2024. Dialogue Between Theology and Science: Present Challenges and Future Perspectives. *Religions* 15: 1304. [CrossRef]
Teilhard de Chardin, Pierre. 1957. Comment se pose aujourd'hui la question du transformisme (1921). In *La Vision du Passé*. Oeuvres de Teilhard de Chardin 3. Paris: Seuil, pp. 17–40, [English translation available on: https://archive.org/details/VisionOfThePast/mode/2up]
Teilhard de Chardin, Pierre. 1965. Appendice. In *Science et Christ*. Oeuvres de Teilhard de Chardin 9. Paris: Seuil, pp. 291–93, [English translation available on: https://teilhard.com/teilhard-de-chardin-resources/]
Teilhard de Chardin, Pierre. 1976. Ma position intellectuelle. In *Le Cœur de la Matière*. Oeuvres de Teilhard de Chardin 13. Paris: Seuil, pp. 173–74, [English translation available on: https://archive.org/details/HeartOfMatter]
Torrance, Thomas F. 2001. *Reality and Scientific Theology*. Eugene: Wipf and Stock.
Wallace, William A. 2023. *Intelligibility of Nature: A William A. Wallace Reader*. Washington: The Catholic University of America Press.
Wittgenstein, Ludwig. 1973. *Philosophical Investigations*. New York: Macmillan. First Published 1953.

Disclaimer/Publisher's Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.

religions

MDPI

Article

Theology of Science as an Intertextual Reading: The Bible, the Book of Nature, and Narrative Paradigm

Tadeusz Sierotowicz [1,2,3]

[1] Centrum Kopernika Badań Interdyscyplinarnych w Krakowie, 31-011 Kraków, Poland; sierotowicz@gmail.com
[2] Istituto di Scienze Religiose di Bolzano, 39100 Bolzano, Italy
[3] IISS Gandhi di Merano, 39012 Merano, Italy

Abstract: The paper addresses the question of the identity of theology of science, fostering its interpretation as an intertextual narration. The starting point is the consideration of the domain of theology of science, which is viewed as a third domain of truth, according to Hans Urs von Balthasar. An analysis of the Swiss theologian's perspective on this subject and the concept of God's unknowability presents a strong counterargument to the claim that the natural sciences serve as a *locus theologicus*. Theology of science, nonetheless, exists and is engaged in a lively dialogue between science and theology, encompassing both the Revelation of God and the natural world or the Bible and the Book of Nature. What kind of discourse is this? This question concerns the position of theology of science within the field of science, specifically its objectivity and rigour, according to Evandro Agazzi's analogical notion of science. Both the Bible and the Book of Nature ensure the objectivity of theology of science, while its rigour is established by the narrative paradigm. Therefore, theology of science can be seen as an intertextual narrative that engages both the Bible and the Book of Nature. The narrative paradigm of theology of science is subsequently elucidated, with particular emphasis on its cognitive aspects, narrative reasoning, the corresponding verification method, and Jewish corrective. The conclusion outlines a special task for theology of science in the modern age.

Keywords: domain and rigour of theology of science; *locus theologicus*; the narrative paradigm; Midrash; Hans Urs von Balthasar; Evandro Agazzi

> If nature is understood as what it is meant to be for man, it can and must speak to us with the language God has given it. The question, however, is whether we do not prevent it from doing so.
>
> (Balthasar 1967, pp. 25–26)

> . . .the Lord breathes on this poor gray ember of Creation and it turns to radiance—for a moment or a year or the span of a life. And then it sinks back into itself again, and to look at it no one would know it had anything to do with fire, or light. [. . .] But the Lord is more constant and far more extravagant than it seems to imply. Wherever you turn your eyes the world can shine like transfiguration. You don't have to bring a thing to it except a little willingness to see. Only, who could have the courage to see it?
>
> (Robinson 2004, p. 245)

> The grand challenge for literature is to be capable of weaving together the various branches of knowledge, the various 'codes', into a manifold and multifaceted vision of the world.
>
> (Calvino 1988, p. 112)

1. Introduction: The Identity of Theology of Science

In this paper, I propose an interpretation of theology of science as the intertextual reading of both the Bible and the Book of Nature. The proposed solution, the Bible and the Book of Nature Narrative (B^2N^2) Model situates theology of science within the realm of narrative paradigm, but not necessarily within narrative theology (note that the term 'B^2N^2 Model' will be used interchangeably with the term 'narrative paradigm'). Instead, the B^2N^2 Model should be understood in terms of a theological narration which, as to the *genere proximum*, is near to the narrative paradigm, while the *differentia specifica* with respect to that paradigm is homologous to the *differentia specifica* that exist between the midrashic model of reading the Bible and modern theories of narration.

The paper focuses on whether theology of science is a science. To answer this question, I will use the following blueprint. I will begin with the analogical model of science proposed by Evandro Agazzi, which is briefly outlined in Section 2. This Italian philosopher teaches that the attribute of science can be credited to any rigorous reflection conducted in a certain domain of study. I will then offer a short description of the domain of theology of science (Section 3). This issue, as I will demonstrate, is strictly connected to the question of whether the natural sciences can be considered a *locus theologicus*. The discussion of that topic will introduce the pivotal section of the paper, which is dedicated to the inquiry regarding the rigour of theology of science (Section 4). I will argue that such rigour can be described with reference to the features of the B^2N^2 Model (Section 4.1). Subsequently, Vito Mancuso's narrative on physical evil in the universe will be briefly presented as an example of the B^2N^2 Model (Section 4.2). Finally, I will discuss the role of theology of science in the modern age (Section 5).

Throughout my paper, I will consider theology of science as a fully feasible enterprise, accepting the discourse of Christian-Catholic theology and its Judaic roots.[1] Following Marc Harris's suggestion, I will always write 'theology of science', dropping "the 'a' before the name" (Harris 2024, p. 37). Lastly, if there is something original in the present paper, it is the novel arrangement of ideas previously expressed by various thinkers, theologians, philosophers, and scientists (see below principles P1–P3). Therefore, I will sometimes make extensive use of nominal quotations to support my persuasive argument on behalf of different features of the B^2N^2 Model.

2. On the Analogical Concept of Science

My case for the scientific character of theology of science must begin with the question: what is science? To answer, I will adopt the point of view of Agazzi, an eminent Italian philosopher of science. There are three key words that characterize his concept of science: objectivity, rigour, and analogy (Agazzi 1979, 2014).

Agazzi's most significant contribution to the understanding of science is his original theory of scientific objectivity. He tackles the question of objectivity in both diachronic (with particular attention to the writings of Galilei) and systematic aspects. Agazzi disagrees with a view of science as merely a certain procedure without a specified domain of application. Moreover, he criticizes the naive tendency to attribute the role of the paradigm of any rigorous knowledge to science: "we now speak rather unproblematically of the sciences of economics, political science, philology, history, and so on. In other words, every field of research is today admitted as a possible branch of scientific knowledge, proviso that it is pursued in accordance with certain standards of rigour; and this implies that science is no longer characterized by what it investigates, but by how it investigates".[2]

Consequently, Agazzi devotes significant attention to the objectivity of scientific investigation.[3] His idea is simple and can be formulated in just a few words: "objectivity as reference to objects" (Agazzi 2014, p. 48). He distinguishes between objectivity in the weak and the strong sense. The former is linked to the intersubjectivity of scientific statements, while the latter expresses the fact that all scientific discourse refers to certain fields of objects. Now, in principle, two types of objects can be distinguished: existent and abstract ones (Agazzi 2014, pp. 277–93). To the former, the status of real existence is credited, while

the latter are intentional correlates of the human mind (such as mathematical objects, for example, or even the concept of God for one who does not believe in His existence). Each science, following its particular perspective, carves out, so to speak, its own domain of research in which it applies a specific method or rigour. Naturally, at least some of the characteristic traits according to which a particular science carves out its domain must be controllable or objective in a weak sense in order to ensure the intersubjectivity of its research.

To be controllable means that "an object of a certain science is simply an aspect of reality capable of being described by propositions that can be directly or indirectly assigned a truth-value by means of the criteria which are specific for that science" (Agazzi 2014, p. 89). Agazzi calls these 'criteria of protocollarity' or 'criteria of objectivity'. He intends by these expressions "those specific criteria which, within a certain science, permit the determination of which propositions are immediately true" (Agazzi 2014, p. 87).

Mario Alai synthesizes the following: "from [Agazzi's] premises derives a general and non-reductionist characterization of the concept of science: it is any form of knowledge endowed with the requirements of objectivity and rigour. Therefore, the concept of science is neither univocal nor equivocal, but analogical, that is, despite shared fundamental traits, it preserves the specificity of the various fields and styles of investigation" (Alai 2009, p. 18). Thus, the analogical concept of science can be applied in the fields of mathematics, physics, chemistry, biology, psychology, economics, and, as I shall argue, in the domain of theology of science. Agazzi's definition indicates the way to examine its application: from the identification and description of the domain to the account of the specific research style (rigour) of theology of science.

3. Is Theology of Science a Science? The Domain of Theology of Science

One possible answer to the question of the domain of theology of science can be sought in the first volume of Hans Urs von Balthasar's *Theo*Logic (Balthasar 2000; for more details, see Sierotowicz 2023). According to the Swiss theologian, "the world as it concretely exists is one that is always already related positively or negatively to the God of grace and supernatural revelation". Consequently, "the world, considered as an object of knowledge, is always already embedded in this supernatural sphere, and, in the same way, man's cognitive powers operate either under the positive sign of faith or under the negative sign of unbelief" (Balthasar 2000, p. 11). If the former is the case, that is, if "man's cognitive powers operate under the positive sign of faith", the truth of the world will be described "in its prevalently worldly character, without [. . .] ruling out the possibility that the truth we are describing in fact includes elements that are immediately of divine, supernatural provenance'. In such a case, between the domains of the natural and the supernatural, it is necessary to examine what Balthasar, following Romano Guardini, calls 'a third domain of truths, that genuinely belong to creaturely nature yet do not emerge into the light of consciousness until they are illuminated by a ray of the supernatural" (Balthasar 2000, p. 12).[4]

The third domain of truths, then, is constituted by truths 'visible' only under certain conditions: that is, only when illuminated by 'a supernatural ray' or, as an equivalent, when 'man's cognitive powers operate 'under the positive sign of faith'. Perhaps the most relevant element of this domain from Balthasar's point of view is the real distinction between essence and being (*essentia-esse*), which leads to the contingency of the world, that is, to its dependence on the Creator. As a matter of fact, if, following Balthasar, one considers 'to be' in the sense of 'to be real', then "no worldly entity can attain the coinciding of essence and reality (*essentia-esse*), even in the case of consciousness, because it can never create its own reality but must accept a reality already given to it. That is why the freest entity lives out its essence in itself but is grounded, not in itself, but in what is trans-essential, in Being absolutely".[5]

In order to more clearly define the domain of theology of science, I will recall the metaphor of the 'Book of Nature'. The expression itself "was used in Patristic times to

underline a parallelism between Holy Scripture on the one hand and the created world on the other. Since they both originated from God as their common author it was possible to regard nature as a kind of 'book'" (Pedersen 2007, p. 141). The concept of the Book of Nature embraces the universe created by God, which, as Galilei wrote in *The Assayer*, stands "continually open to our gaze" (Drake 1957, p. 237). Nevertheless, to read and understand the Book of Nature, it is necessary to learn the language "in which it is composed. It is written in the language of mathematics, and its characters are triangles, circles and others geometric figures without which it is humanly impossible to understand a single word of it; without these, one wanders about in a dark labyrinth" (Drake 1957, pp. 237–38). Strictly speaking, all of the Book of Nature can be considered the domain, as one day or another, each 'page' may be read with the help of the language of mathematics. Consequently, the domain of theology of science consists of the pages of the Book of Nature that have already been read or have yet to be read by science, illuminated by a supernatural light. Now, the latter requires a closer look.

Olaf Pedersen underlines a parallel between the two books: the Bible and the Book of Nature. With reference to Galilei's words written in his *Letter to the Duchess Christina*, he reminds readers that "the Holy Bible and the phenomena of nature proceed alike from the Divine Word, the former as the dictate of the Holy Spirit, and the latter as the executrix of God's commands" (Pedersen 2007, p. 225). This is a common Catholic doctrine. The Book of Nature can be read thanks to the natural capacities of human senses, language, and intellect, as Galilei writes in his *Letter to Benedetto Castelli*,[6] arriving at "physical conclusions of which we are already certain and sure from clear sensory experience or from necessary demonstrations" (Galilei 1613). As to the Bible, Pedersen recalls quoting Galilei. It was written with "the primary purpose of the salvation of souls and the service of God" (Pedersen 2007, p. 225).

It must be stressed that the Bible—the Holy Scripture—is the "self-revelation of God", the "revelation of the absolute reality in whose midpoint stands the figure of Christ". Consequently, theology is the second-order reflection, being, as the Revelation or the Word of God, the first-order discourse (see: Balthasar 2004, pp. 65 and 90).

In Donald Lococo's words, theology is "a systematic study of divine revelation, the speaking of God that introduces into human discourse notions and values that could not otherwise be rationally anticipated or imagined" (Lococo 2002, p. 30). It should be stressed that "theology is distinct from all other human inquiries in that its foundation is a decision to believe; it always has faith in revelation as its explicit presupposition" (Lococo 2002, p. 37, following Hans Urs von Balthasar). In other words, and giving a Catholic meaning to the sentences formulated here, the fundamental object of theological reflection is the 'content' of God's Revelation concerning Himself and the salvation of man. This 'content' of Revelation is expressed specifically in the articles of the Christian Creed, in the dogmas, in the teaching of the Magisterium, and in the testimony of Tradition, which is understood as normative. It must be added that Revelation, in terms of content, is already definitive: "The Christian dispensation, therefore, as the new and definitive covenant, will never pass away and we now await no further new public revelation before the glorious manifestation of our Lord Jesus Christ (see 1 Tim. 6:14 and Tit. 2:13)".[7]

In the case of theology of science, its domain is disclosed by a supernatural ray. It is a ray that illuminates, but it is also a ray that can be reflected. In fact, Balthasar's theological project relies on a daring presupposition. It conjectures that this supernatural light, thanks to a sort of reflection—'retrospectively cast light'—makes it possible to see peculiarities of being that illuminate such a domain (see Balthasar 2004, p. 47). With this idea in mind, Balthasar wrote his trilogy, in which theological aesthetics, dramatics, and logic are "built from within this mutually illuminating light. What one calls the properties of being that transcend every individual being (the 'transcendentals') seem to give the most fitting access to the mysteries of Christian theology. From these common properties, three were drawn out for separate emphasis: the beautiful, the good, and the true" (Balthasar 2004, p. 47). It

seems as if that reflected supernatural light, in some sense, discloses the vitality of "God's threefold personality". Balthasar writes:

> [T]ranscendence over what we think of as identical (where God is simply *causa sui*, the ground of his own self, an axiom that only produces a figment of thought) is revealed in Jesus Christ. Only in this way is God's perfect freedom unveiled as an inner vitality in which the transcendentals are identified with his identity. There is no possibility of separating the life of the three Persons from God's essence. This essence is no fourth element, something common to the three Persons. Rather, it is their eternal life itself in its processions. This is why God's 'Being' (thought of as a substance) does not manifest itself in the true-good-beautiful. On the contrary, the manifestation of the inner divine life (the processions) is as such identical with the transcendentals.
>
> (Balthasar 2004, p. 97)

Were Balthasar's supposition the case, the domain of theology of science would have become a proper *locus theologicus* by virtue of the reasoning just presented. But Balthasar, in many places, formulates a clear warning that "God cannot be 'constructed' from the point of view of the world simply by equating an infinite substantiality with the 'simple, indivisible, but non-subsisting' real" (Balthasar 2004, p. 51; see also Balthasar 2003, pp. 91–96). It is precisely this point at which Balthasar contradicts his own presuppositions. In fact, as Karen Kilby brilliantly states, "it is not difficult to find passages in which [Balthasar] specifically acknowledges the limited nature of our knowing, the need for epistemic humility, the inescapability of mystery'. Nevertheless, Balthasar 'is in fact caught in a significant performative contradiction: the way his theology is done presumes something which the content of the theology rules out" (Kilby 2012, p. 26).[8]

Therefore, the domain of theology of science—and all the more so the created world, or speaking in other terms, the Book of Nature and consequently even the natural sciences—cannot be interpreted as a *locus theologicus* without committing Balthasar's fallacy. It may seem trivial to add that, and reciprocally, theology cannot be seen as *a locus scientificus*. This separation of *loci* is but a reformulation of Galilei's comments on different purposes of both the Book of Nature and the Bible. Theology of science is neither science nor theology as such. It is a reflection that examines the natural world (the Book of Nature [BN]) as illuminated by a supernatural light (a theological light originated in the Bible [B]). Thus, strictly speaking, the domain of theology of science is constituted by these two books—both of them real and, in that sense, objective, at least for the person operating "under the positive sign of faith" (Balthasar 2000, p. 11; see also Balthasar 2004, p. 49).[9] These books, taken together, form a *locus classicus* (Barth 2010b, pp. 183–84), or, to be more precise, a *locus narrationibus* for theology of science.

How does theology of science tell its story? Or, to ask the equivalent, what is the rigour of theology of science as a science? It is the rigour of the narrative paradigm. The account of that rigour renders it possible to advance the B^2N^2 Model of theology of science.

4. Is Theology of Science a Science? The Rigour of Theology of Science

The rigour of theology of science is determined by its intertextual nature. It is necessary to clarify that throughout this essay, the term 'intertextual' is used in its letteral sense, that is, to indicate the narrative connection between different texts. Therefore, it has none of the post-structuralist or postmodern meaning given to the term by the thinkers collaborating with the *Tel Quel* or *L'Infini* journals, like Julia Kristeva, Philippe Sollers, Roland Barthes, or Gerard Genette.

Intertextuality, as intended here, signifies an overarching narrative space open between the Bible and the Book of Nature,[10] a sort of book with blank pages on which a theologian of science can write down a diachronically or synchronically knitted narrative plot that presents an account of events and responds to the specific quest for their meanings, thus giving a more profound intelligibility, understanding, and participation to knowledge about God, the world, and ourselves.[11] The presence of the postulated, blank book between

the two books involved in the narration signifies that theology of science strives to account for the gap of meaning and tell a coherent story. What is at stake, however, is a gap of meaning, not a causation gap. Hence, theology of science does seek the exact point where God's 'finger' enters into contact with and moves the physical world, whether it be a point somewhere in the subatomic world or a point somewhere in the midst of neurons in the human brain. To reiterate, then, a narrative in the context of theology of science is engaged in creative activity that allows it to fill, in a meaningful and coherent way, the gap of meaning between the Bible and the Book of Nature.

It is vital to emphasise that narrative, as understood here, not only conveys meaning but also, contextually, provides a compelling or good reason to act and make choices. Theology of science is a form of narration, but it has yet to be seen as a branch of narrative theology. In fact, theology of science, which is both theological and scientific narration, applies the features of the narrative paradigm rather than the rigours of this or that model of narrative theology.[12]

The following propositions specify the rigour of the narrative paradigm or, in other words, outline key aspects of the B^2N^2 Model of theology of science:

(P1) The B^2N^2 Model has significant cognitive aspects ('logos' and 'mythos', 'Gestalt' and mental models).

(P2) The B^2N^2 Model is based on narrative reasoning and the corresponding mode of verification (narrative probability and narrative fidelity, believability and consilience, illative sense).

(P3) To create theology of science narration, both theological and scientific narration (and not a solely scientific or solely theological one), the Jewish corrective is required.

The next section will elaborate on these propositions to describe a refined structure of the B^2N^2 Model.

4.1. Key features of The B^2N^2 Model

4.1.1. P1: The B^2N^2 Model and Its Cognitive Aspects

The abbreviation 'B^2N^2 Model' consists of three components: **B^2N** for the Bible and the Book of Nature, **N** for Narration, and lastly, the term **Model**. I will start with narration as seen in the context of the narrative paradigm.

(N). A systematic description of the narrative paradigm was proposed by Walter Fisher several years ago as a communication paradigm (see Fisher 1984, 1985; Stroud 2016). "To begin, narrative is generally the representation of an event or sequence of events. It is closely tied to description, but it goes beyond description" (Worth 2008, p. 43). Where theology of science is concerned, the narrative goes beyond the description of a given event, sequence of events, or change in the states of affairs taken from the Bible and the Book of Nature. Theology of science instead seeks the understanding that can be gained from engaging with narrative. As for the term 'paradigm', I adopt the meaning attributed to it by Fisher, slightly changed and adapted to the perspective of theology of science. A paradigm, then, is a representation designed to formalize the structure of two components: scientific achievements, that is, deciphered pages of the Book of Nature, and theological beliefs (rooted in the Bible), with the aim of arriving at a more profound understanding and exploring the what is associated with the topic of the narration. The narrative paradigm, in turn, "can be considered a dialectical synthesis of two traditional strands in the history of rhetoric: the argumentative, persuasive theme and the literary, aesthetic theme" (Fisher 1984, p. 2). I will elaborate on an argumentative aspect of the B^2N^2 Model later (see P2 below). Next, I will focus on the persuasive aspect of the narrative paradigm.

Fisher's narrative paradigm reunites *logos* and *mythos* in the sense Fisher attributes to these terms. Fisher, writing about Kenneth Burke and his contribution to the modern understanding of rhetoric, recalls Burke's affirmation that "Wherever there is persuasion, there is rhetoric and wherever there is meaning, there is persuasion". For Burke, Fisher comments, rhetoric "is not purely an epistemological transaction', and it 'works by identification rather than demonstration". In that way, "reason as well as aesthetic qualities" are

recaptured "in all forms of human communication, [which] reinforms the original sense of *logos*" (Fisher 1985, p. 86). Fisher uses in his comment the term 'reinforms' because "in the beginning was the word or, more accurately, the *logos.* And in the beginning, *logos* meant story, reason, rationale, conception, discourse, and/or thought". It was only later, after Plato and Aristotle, that the terms *logos* and *mythos,* firstly conjoined, were separated. As a consequence, "*logos* was transformed from a generic term into a specific one, applying only to philosophical (later technical) discourse; poetical and rhetorical discourse were relegated to a secondary or negative status in regard to truth, knowledge, and reality" (Fisher 1985, p. 74).

What is a *mythos* for Fisher? He gives an answer in the context of human communication: "some persons know more than others, are wiser, and are more to be heeded than others. But no one knows all there is to know, even about his or her own area of specialization. Human communication in all of its forms is imbued with *mythos*—ideas that cannot be verified or proved in any absolute way, including metaphor, values, gesture, and so on—as well as, on occasion, clear-cut inferential or implicative structures" (Fisher 1985, p. 87). In Fisher's opinion, *mythos* have relevant cognitive significance and are intrinsic to the narrative paradigm.

(B^2N). The abbreviation refers to the Bible and the Book of Nature, and it signifies that there are two different plots interwoven in one narration. This circumstance is not new in the theory of narrative, as Peter J. Rabinowitz notes in the context of his analysis of detective stories written by Dostoyevsky and Faulkner. He emphasizes that there are two plots in these stories: on the one hand, there is a detective story, in which careful investigation (*query*) leads to the identification of 'whodunnit'. On the other hand, there is a plot of a philosophical nature, in some ways more complex, which leads to a greater understanding of the man's situation in the reality around him. Rabinowitz attributes to these stories the status of 'discovery novel':

> [T]he novel of discovery is structured in such a way as to move towards a climax in which the protagonist suddenly and usually unexpectedly acquires key knowledge, experiencing a sudden enlightenment of the "meaning of things" that radically changes his worldview. This flash of insight [. . .] usually involves ethical, metaphysical, or social rather than scientific knowledge; and it usually forces the protagonist to re-examine his previous relations to the world.
>
> (Rabinowitz 1979, p. 356)

Following this description, the narrative of theology of science can be attributed (via analogy) to the same status. As a matter of fact, in each theology of science narration, there are two plots: on the one hand, a scientific story, which through a careful query, investigates this or that page of the Book of Nature, and on the other hand, a theological plot of a different character. These two plots are then knitted into one narration, which leads to the discovery of the meaning and a greater understanding of the reality that surrounds man.

What happens in a discovery novel is a sort of consilience of two plots, which leads to a new *Gestalt*—in this case, to a new organization of two different plots taken from the Bible and from the Book of Nature. This *Gestalt* belongs to the 'universe of discourse' of theology of science, to use Agazzi's terms. Agazzi notes that in the literature on the subject, the 'universe of discourse of a science' means 'the domain of the individuals of that science'. This notion involves two assumptions: the first assumption is that by 'universe of discourse', we must understand a set of entities endowed with properties and relations about which a given discipline or theory is supposed to speak. The second is the identification of meaning with reference. In fact, when one speaks of a 'domain of discourse', one is using an expression that is in itself linguistic in nature. Simply put, these terms refer to the framework in which the discourse is intended to be meaningful, as Agazzi explains. In this sense, the universe of discourse can be called a conceptual space characteristic of each science and, within a science, of its various theories. The structure or configuration of this conceptual space could then be seen as a new form (*Gestalt*) in which several already known details are organized in a different way or suddenly appear to be

relevant to each other in a way not previously recognized (see: Agazzi 2014, pp. 139–40). The emergence of a new *Gestalt* gives insight, or 'produces' meaning, a specific narration that theology of science is seeking.[13]

What is the meaning of the verb 'produce' in this context? The 'machinery of production' is put in motion whenever something new is created. This applies to mathematics, physics, philosophy, music, theology, and literature.[14] Readers of Agatha Christie will remember that in *Murder on the Orient Express*, Hercules Poirot solves the case by coherently ordering the framework of clues around the frequently recurring number twelve: there were twelve passengers in the Istanbul-Calais carriage, the victim was stabbed twelve times, a jury is composed of twelve people (Christie 2011, p. 215). There is no space here to thoroughly describe the stages of the creative process, or as Poirot says, of his 'scheme of 'guessing' (Christie 2011, p. 211) that led him to the solution. However, it should be noted that the emergence of a new organization, of a new understanding of facts, seems to occur around centres of crystallization (i.e., around focal points of interpretation, like the number twelve in Poirot's case). Probably the most apt description of the 'scheme of guessing' mentioned by Poirot is offered by the theory of abduction, that is, 'the inference that makes science' (McMullin 1992).

(Model). The term 'model' refers to a 'mental model'. Models can be considered alongside 'thought experiments', which constitute a fundamental evolutionary achievement of humankind.[15] The notion of mental models dates to ideas formulated by Charles Peirce and Ludwig Wittgenstein. Often, the presentation begins with Kenneth Craik's theory, which identified the ability to predict events as a fundamental property of human thought and a particularly advantageous adaptive achievement. Craik described mental models with a strong emphasis on their ability to mirror the processes of the real world, both in terms of their structure and the processes that occur there:

> [B]y a model we [. . .] mean any physical or chemical system which has a similar relation-structure to that of the process it imitates. By 'relation-structure' I do not mean some obscure non-physical entity which attends the model, but the fact that it is a physical working model which works in the same way as the process it parallels, in the aspects under consideration at any moment.
>
> (Craik 1943, p. 51)

In short, mental models have a structure similar to the structure of a 'fragment' (in the case of the present discussion, fragments) of the reality they represent. According to Craik, the construction of mental models belongs to the natural capacities of the human mind. The mental process that constitutes a model is based on three fundamental processes: translation of the processes of the external world into words, numbers, or symbols, reasoning (i.e., the transition to other symbols through deduction, induction, etc.), and finally, re-translation of these symbols into external processes or the recognition of the correspondence between symbols and external processes.

Since the 1980s, mental models have been studied intensively by philosophers, theologians, literary critics, computer scientists, and cognitive scientists. According to scholars who follow Craik's approach, mental models are constructs of the human mind that represent situations, events, and processes for solving certain problems. These models can be dynamically manipulated, transformed, and developed through forms of reasoning that differ from the forms of reasoning applied to systems of propositions, such as deduction or induction. A recourse to thought experiments is often cited as one example of this specific type of reasoning.[16] Ultimately, it is relevant to point out that some scholars interpret narrative in terms of mental models and thought experiments (see Nersessian 1993, pp. 293–95; Elgin 2017, pp. 221–47; Fehige 2019; Stierstorfer 2022). To sum up, theology of science functions like a discovery novel in that its narration can be interpreted as a mental model of the question which represents the narration's subject matter.

4.1.2. P2: A Narrative Reasoning and Verification of the B^2N^2 Model

The 'flash of insight' mentioned above with reference to the discovery novel (which emerges thanks to the presence of a centre of crystallization) enables the two-plot narrative process, which results in a *Gestalt* and a related mental model. Here is the proper place of the *mythos* component of the narrative paradigm. It appears as an idea that originates a new way of understanding and gives the reader/hearer courage to live in the world. As Aldous Huxley writes in reference to the words of Clémenceau, "Ce qui donne du courage, ce sont les idées".[17] But the B^2N^2 Model is not only *mythos*. It is also *logos* in Fisher's meaning of these terms. The next section will scrutinize the latter: the reasoning which is specific to the narrative paradigm.

It has already been noted that narratives organize how the world is perceived, as well as respective forms of knowledge. This procedure, which can rightly be called 'narrative reasoning', leads to verisimilitude and is distinct from discursive reasoning, which is built on logical forms of argumentation and scientific procedures. In this framework, Fisher proposed the concept of the *homo narrans*, whose sense of self is formed through the narration of his own history, identity, and place in the world, among others. *Homo narrans*' way of reasoning is determined by his inherent awareness of narrative probability and constant habit of testing narrative fidelity. He evaluates what constitutes a coherent story and ensures that the stories he experiences sound true to the stories he knows to be true in his life (see Fisher 1984, pp. 7–8).

In the words of Jerome Bruner, "we organize our experience and our memory of human happenings mainly in the form of narrative-stories, excuses, myths, reasons for doing and not doing, and so on".[18] Narrative, as such, is a conventional form transmitted culturally. Unlike the constructions created by logical and scientific procedures that can be falsified, narrative constructions can be attributed to some degree of verisimilitude. Narratives, then, are a version of reality whose acceptability is governed by convention and narrative necessity rather than by empirical verification and logical necessity.

Narrative reasoning is descriptive in its character. It offers an understanding of human beings and their actions and is not the 'laws of thought' that can be taught. Instead, the traditional reasoning, that of *logos* in Fisher's sense, *can* be taught. It posits a set of rules of prescribed calculation or inference-making. In that sense, *logos* has a normative character. But what makes theology of science narration a credible story? Or, asked another way: what makes one given story better than another?

As previously stated, narrative probability and narrative fidelity appear as two features of narrative reasoning.[19] The former involves a coherence theory of truth, with the consistency of narration with the tenets of the Bible and the Book of Nature at stake. The latter involves "how people come to adhere to particular stories" because they are seen as "more sound than another". In that sense, the narrative paradigm provides 'good reasons' to accept the story. Fisher suggests that "the logic of good reasons is the most viable scheme presently available by which narratives can be tested. Its application requires an examination of reasoning and "inspection of facts, values, self, and society". In epistemological terms, "narrative fidelity is a matter of truth according to the doctrine of correspondence" (Fisher 1984, pp. 15–16). In that case, a sufficiently convincing correspondence of the B^2N^2 Model to the world in which a storyteller lives provides plausible reasons for belief and action.

The correspondence mentioned above evokes the classical definition of truth. As the present discussion of the B^2N^2 Model is not supported by a formal apparatus, it is not possible (nor, in my opinion, necessary) to develop a strictly technical formulation of this affirmation. Nevertheless, if we accept Agazzi's assertion that scientific theories "are essentially sets of sentences connected" in case of theology of science by narrative links, a theory is essentially "a unique sentence of considerable length" (Agazzi 2014, p. 387). If so, it is possible to say whether a given theory "can be more or less 'faithful', 'accurate', or adequate to the description of the domain of objects [it tries] to interpret in making a

given *Gestalt* explicit, and this notion of 'adequacy' is precisely the one used in the classical definition of truth" (Agazzi 2014, p. 388).

Narrative fidelity also posits the question of verification of the persuasive ability of reasoning. While logico-scientific reasoning, or as Sarah Worth puts it, discursive reasoning, persuades because of the strength of the laws of thought applied, of their conclusions, and possibly their truth, narrative reasoning convinces because of its believability.[20] In consequence, "narrative lines of reasoning do not generally prove anything, but they do show how something might have come to be the case" (Worth 2008, p. 49). The fact that narrative lines of reasoning do not prove anything beyond any doubt promotes a worldview that "is not a set of puzzles to be solved. Instead, the world is known as a story, and there are always a range of potential stories to choose among in explaining the world and our place in it" (Stroud 2016, p. 2).

The concept of narrative believability can be further explained in reference to consilience and illative sense. These two notions are helpful in exploring why people accept this or that narration. Consilience is William Whewell's term, but my use of it is somewhat different. Whewell coined several neologisms, including 'the colligation of facts', 'the explication of conceptions', 'the decomposition of facts', or 'the superinduction of conceptions'. In his writing on the philosophy of the author of *The Philosophy of the Inductive Sciences*, Larry Laudan emphasizes that the concept of 'the consilience of inductions' is one of the most productive and important doctrines in Whewell's methodology. Laudan writes that consilience is "not only vital to a comprehension of his philosophy of science, but it also the key to his historiography of science, for it is largely in terms of consiliences that Whewell formulates his theory of the *progressive* nature of scientific growth and evolution" (Laudan 1971, p. 368; Laudan's italics). Richard Di Rocco applies this concept to theology and science discourse, accepting Edward Wilson definition: consilience means "literally a 'jumping together' of knowledge by the linking of facts and fact-based theory across disciplines to create a common groundwork of explanation". But here Di Rocco's approach diverges from mine. For Di Rocco, as well as for Wilson, consilience "takes place when an Induction, obtained from one class of facts, coincides with an Induction obtained from another different class', confirming 'the truth of the Theory in which it occurs" (Di Rocco 2018, p. 116). Instead, I use the term 'consilience' in a much weaker sense. Given the different rigour of theology and the natural sciences, the consilience means a coherent convergence and does not confirm the truth of theology of science narration in which 'inductions obtained' coherently converge but only contributes to the discovery of meaning, reinforcing the believability of a given narration.

The mention of convergence leads to the concept of the illative sense proposed by John Henry Newman.[21] The English cardinal addresses the subject in some of his writings, mainly in *The Grammar of Assent*. The illative sense is about how human beings arrive at certitude. This common thought process is nothing more than "the sole and final judgment on the validity of an inference in concrete matter [. . .] committed to the personal action of the ratiocinative faculty, the perfection or virtue". Newman sometimes compares this faculty or instinct to a 'good sense', a 'common sense', or a 'sense of beauty' (see Newman 1874, p. 345). The illative sense represents a capacity to judge and draw conclusions about a totality to which different, individual propositions lead through a convergence of clues. It must be emphasised that for Newman, the illative sense is a faculty of the mind: "it is the mind that reasons, and that controls its own reasonings, not any technical apparatus of words and propositions" (Newman 1874, p. 343).

Although the illative sense is a faculty of reasoning, one cannot say that its resulting inferences have a formal character in the sense of the lines of reasoning proper to classical logic. Consequently, "the illative sense [. . .] supplies no common measure between mind and mind, as being nothing else than a personal gift or acquisition" (Newman 1874, p. 362). This is why the certainty provided by inferences of this kind remains similar to what is usually called a 'moral certitude'. In other words, for Newman, a proposition is certain (*certainty*) if the human being himself is certain in the sense of subjective certainty (*certi-*

tude). Similarly, "certitude is a mental state", while "certainty is a quality of propositions" (Newman 1874, p. 344).

In Newman's words, "the formal logical sequence is not in fact the method by which we are enabled to become certain of what is concrete [. . .]. It is the cumulation of probabilities, independent of each other, arising out of the nature and circumstances of the particular case which is under review" that leads to certitude of a given narration (Newman 1874, p. 288). The point is, as Newman writes, that the rule of acceptation "for one man is not always the rule for another, though the rule is always one and the same in the abstract, and in its principle and scope" (Newman 1874, p. 356). Hence, with the Bible and the Book of Nature taken together, many stories can be told. Nevertheless, the question arises: are there any limits to this storytelling? For a possible answer, I investigate what is called the 'Jewish corrective'.

4.1.3. P3: The Jewish Corrective of the B^2N^2 Model

The expression 'Jewish corrective' was used by Jean Baptiste Metz, who rightly considered "storytelling [. . .] a specifically Jewish strength" (Mauz 2009, p. 266). Perhaps the most evocative example of this storytelling strength is Midrash. Midrash is a specifically Jewish mode of exegesis of the biblical text that was developed by rabbis writing between 400 and 1200 AD.[22] The term refers to a way of interpreting biblical text, as well as to a literary genre that led to an extremely rich corpus of works. In this subsection, I will focus on Midrash understanding as a way of reading biblical text that combines exploration and the posing of critical questions.[23]

How does Midrash proceed? Let me use an example. Genesis 22 tells the well-known story of *Akedah*, short for the 'binding of Isaac'. God calls Abraham and commands him to take his son Isaac and offer him as a sacrifice on Mt. Moriah. In the end, having seen that Abraham fears Him, God sends a ram so Abraham can offer it instead of his young son. Astonishingly, immediately after the sacrifice, the name of Isaac disappears from the pages of the Bible until Chapter 24, when the story of his wedding is told. The Scripture is silent on whether Issac was angry with his father, whether he understood what had happened, or whether Abraham and Isaac ever conversed, exchanged ideas, or even, perhaps, argued after such a dramatic moment (see Wiesel 1976, pp. 69–97).

The Midrash, which attempts to fill this textual and narrative gap, proposes a kind of extended account in light of the changed historical and cultural situation. It does so without changing the biblical text, as far as the words are concerned. This approach, characterized by an unconditional acceptance of the biblical text, opens the hearts and minds of the listener to the values, issues, and theology that underlie the biblical story. In doing so, Midrash freely crosses the boundaries of literary genres by combining the biblical parable with other forms of narrative (Stern 1998, p. 31). By its very nature, Midrash is an interdisciplinary endeavour of telling the story 'between the words' of the Text.

Ithamar Gruenwald proposed a generalisation of the midrashic approach to the Text, introducing the concept of 'the midrashic condition'. He describes the condition by stating that "scholars and literary critics have gradually realized that Midrash as a literary genre and form of interpretative expression is present in almost all form of literary creation" (Gruenwald 1993, p. 6). Gruenwald then underlines the interpretative elasticity and creativity of Midrash while simultaneously conveying its role in preserving Jewish religious and cultural tradition. Furthermore, Gruenwald comments on the cognitive potential of Midrash as "a vital instrument in creating patterns of perception, conceptualization, and realization in which scriptural terms of reference are applied for existential. [. . .] Midrashic-like modes of relating to a scriptural or canonical text can be extended to any type of mental relationship that entails the concern for establishing relevance or relatedness to any given fact or piece of information" (Gruenwald 1993, p. 7). For Gruenwald, Midrash is not a mere strategy for understanding texts. In fact, "Midrash not only creates exegetical information, [. . .] but also the spheres of meaning" (Gruenwald 1993, p. 9). By and large, "Midrash

should be viewed as a mode of cognition in the same sense as literature, philosophy, or science" (Gruenwald 1993, p. 13).

Midrash's source of fruitfulness, and at the same time, its difficulty (at least for scholars not engaged in the Jewish tradition) is the polysemic nature of Midrash. In short, as Myrna Solotorevsky notes, "each element of the Bible (letters, words, verses, chapters) is allowed to function as an autonomous unit which has endless possibilities of combination with other units", and thus "provokes the polysemic radiation of the text". In that sense, "Midrash is the metatext of a sacred text", but—as Solotorevsky highlights—"it must apparently revolve around a centre (the Scripture as the Word of God)" (Solotorevsky 1986, pp. 254–55).

Solotorevsky wrote her paper beginning in the 1980s, during a period when scholars in English and Jewish studies aimed to connect Midrash with literary theory criticism. This 'Midrash–theory connection', as it was later called, produced a stream of papers and important monographs, but its influence weakened by the end of the 1990s (see Freer 2016, p. 336; for an extensive overview with commentary, see Catlin 2023). David Stern described the reason for the decline of this extraordinary interdisciplinary research in his paper on Midrash and indeterminacy. Stern's answer indicates the precise point where the Jewish corrective comes in.

Midrash, because of its polysemy, frequently leads to contradictory opinions from rabbis of different schools. However, for rabbis, on the condition that the biblical text remains unchanged, different opinions do not exclude each other. What is important is the conviction that the sanction "for such paradoxical truth [. . .] is the common divine origin" of different interpretations. "This divine sanction for Scriptural polysemy also differentiates the midrashic concept of polysemy from its post-structuralist counterpart, indeterminacy". However, it is not the style that differentiates Midrash from postmodern indeterminacy, "but rather the latter's formal resistance to closure" caused by the final revelation of only one perspective. Postmodern indeterminacy predicates "the absence of one and only one context from which to view the flux of time or the empirical world, of one and only one method that would destabilize all but itself, of one and only one language to rule understanding and prevent misunderstanding". Midrashic polysemy, on the contrary, "is predicated precisely on the existence of such a perspective, the divine presence from which all the contradictory interpretations derive". The polysemy of Midrash, referred in the last instance to the divine origin of Torah is, as Stern notes, "a claim to textual stability rather than its opposite". For that reason, as Stern comments, whereas "the ruling interpretive ideologies of Western culture [. . .] may be said to be motivated by an anxiety over the loss of meaning or presence [. . .], Rabbinic interpretation is not worried by the possible absence of meaning, by a fear that presence in the text may be irrecoverable or lost" (all quotes in the present paragraph are from Stern 1988, pp. 153–54).[24]

What does Midrash mean for theology of science? As reported above, Myrna Solotorevsky writes that Midrash revolves around a centre, which is the Bible. The narration of theology of science revolves around two centres, two *heteronomous* utterances of the same author, looking for meaningful coherence between them (see Mauz 2009, p. 278). The presence of two centres of rotation is the greatest challenge for theology of science, especially when examined through the B^2N^2 Model. Here, on the one hand, is the Bible, a text characterized by polysemy of words, leading to multiple interpretations of the same unquestionable Text. On the other hand, the Book of Nature, as written in the language of mathematics, fosters the univocity of its reading expressed in mathematical theories confirmed by experiments.

The revolution around two centres proceeds following two laws of rotation. The first law concerns the distance and separation between two centres; the second describes the trajectory of the rotation. As to the first—Menachem Kellner, in writing about science and understanding of Torah (and hence about what, in some sense, corresponds to the dialogue between science and theology[25]), invokes a sort of principle of modesty. This idea, in fact, rephrases Galilei's statements from his letter to the *Letter to the Duchess Christina*. Kellner writes:

> to reject the claim that the earth is vastly old, for example, is not only to reject the science of geology, but the entire edifice of contemporary physics and chemistry. The cosmos simply cannot be under 6000 years old. This, of course, is only a problem for the most stubborn of biblical literalists. [. . .] In these and other matters, the Written Torah cannot be taken literally without rejecting the crushingly overwhelming weight of scientific evidence. [. . .] On God's existence, the creation of the cosmos, Sinaitic revelation, providence, prophecy, miracles, efficacy of prayer, the special relationship of God to the Jewish people, divine reward and punishment, etc., science seems to have little definite to say to us, and it appears to me, is not likely to have much to say in the foreseeable future. [. . .] The Torah cannot contradict that which has been *proven* scientifically but science often proves less than what some scientists think they have proven. We must live in a world of fewer absolutes than many thinkers (rabbis and scientists alike) would like.
>
> (Kellner 2020, p. 10; Kellner's italics)

Strictly speaking, Kellner's version of the principle of modesty draws impassable silhouettes around each of the two centres: silhouettes that can change with time but which maintain two centres that are distinct and impenetrable to each other. However, the narration of theology of science attempts to give an account of a specific query that engages both books. It is, as previously stated, the complex rotation around two centres—around midrashic polysemy and scientific univocity—which leads to the question of the second law, the law of rotation around these centres. The movement under discussion cannot pierce the silhouettes mentioned above. The revolution must necessarily embrace two centres. Otherwise, one would only have to deal with either the scientific or the theological narration. For that reason, theology of science narration should not change even a 'single jot' of the Bible (Matthew 5, 18) or of the Book of Nature. Midrash refreshes, reaffirms, and interprets the biblical text and, at the same time, fully respects it (Taggart 2010, p. 18). Likewise, the narration of theology of science refreshes, renews, and interprets both biblical and scientific texts while simultaneously respecting them. This is precisely the Jewish (midrashic-like) corrective. It confirms both the theological and scientific character, as well as objectivity in Agazzi's sense and non-fictional features in Fehige's meaning of the narration at hand.[26]

4.2. The B^2N^2 Model and the Discovery of Sense—An Example

Vito Mancuso proposed a helpful example of the B^2N^2 Model in his book on the problem of physical evil in the universe created by God and specifically on the condition of handicapped persons. Mancuso writes that this topic is particularly important to him for personal reasons.[27] He draws a strict connection between the issue of the suffering of the innocent and the freedom of human beings. In his book *Dolore innocente* (*Innocent Pain*), Mancuso admits the former in order to ensure the latter. In brief, Mancuso argues that the world is governed by impersonal logic "which proceeds without regard for individuals", allowing various handicaps because "the personal God has willed it so, as the only indispensable condition for the birth of freedom' and also of love. Freedom, however, has a high price, since it 'consists in the very real possibility of evil, with all the burden of pain it brings".[28] In fact, as Mancuso writes, "under the fiery rays of divine necessity, the seedling of freedom would wither before it was even born". Mancuso, therefore, suggests that the personal God, God the Father, withdraws from Creation. He exists, yes, but he is absent here and now while at the same time present in a different way and elsewhere. God, Mancuso emphasizes using scientific-like phrasing, "is donation of energy, is energy that gives itself", and that energy is the source of the impersonal nature that leads to the emergence of freedom in man. To make this freedom possible, "God the Father creates man and by creating him gives him the Son through the action of the Spirit. In this sense we are created in the Son", and "everything was made through him" (Mancuso 2009, p. 157). In short, to account for the freedom of man, Mancuso proposes a doctrine of the creation

of the world by God the Father with a contextual handing over of the world to the Son. In this way, creation is marked by the Incarnation and, at the same time, handed over to impersonal forces that govern the evolution of the natural world.

The core of Mancuso's *Gestalt* is expressed in the following quote:

> The distinction between spirit and matter, as contemporary physics has shown, ultimately does not exist, being that all that exists is energy. The Big Bang is the irruption of God's energies in the physical world, the cross is the irruption of the Son of God in the human world: God crucified in nature, God crucified in history. The Big Bang was the rupture of the original symmetry that held the four fundamental forces together. From this rupture, this tearing of the original unity, comes the energy that continuously generates the cosmos. Creation, from the physical point of view, is the diffusion of primordial energy, its incessant transformation until the generation of intelligent and spiritual life, which represents the stage in which energy completes its cycle: spirit, pure energy, becomes matter that then becomes spirit again.
>
> (Mancuso 2009, p. 160)

In Mancuso's complex narration about the Creation, one can see how purely scientific language (energy/Big Bang/symmetry rupture) intertwines with exquisitely theological language (Creation/Incarnation/the Cross). The resulting narration gives meaning to the suffering of handicapped persons within the *Gestalt*, in which the fabric of the world is described in terms of energy, God's withdrawal, and Incarnation. However, human liberty is preserved, notwithstanding its price. It is even possible to identify in Mancuso's approach the abductive pattern of reasoning from the effect (suffering) to a cause (the maintenance of liberty), which underpins the entire argument, leading to the construction of the corresponding mental model.

Mancuso's *Gestalt* is highly believable and is distinguished by a significant degree of narrative fidelity. Using Fehige's wording (see Fehige 2019, p. 1), one can say that Mancuso tells how God runs the cosmos. His narration *is* a mental model. Its *aim* is to give sense to the suffering of the innocent. Its *topic* is men's freedom. In general, that of Mancuso is a *theology of science* narration.

However, subordinating theological discourse to a scientific one does not fully respect the Jewish corrective. This is particularly evident when Mancuso addresses the issue of verification principles. One of them requires the translatability of the basic concepts of the proposed *Gestalt* and, by and large, of theology into the language of science. Mancuso writes:

> God is the source of life, repeats the pontifical Magisterium, taking up the teaching of the Bible and Tradition. This is an affirmation that not only concerns spiritual life, but also life in its entirety, including the physical dimension. It is necessary for such an affirmation to be subjected to science in order to have a translation in terms of contemporary science if it is not an empty problem.
>
> (Mancuso 2009, p. 205)

In some of his writings, Mancuso goes as far as to support a thesis according to which the laws of nature are to be identified with the name of God, understood as the Ordering Principle that "injects into the cosmos the information necessary for the complex process of life to take place" (Mancuso 2013, p. 401). In this way, Mancuso delegates to science the role of the interpreter of the Bible, violating the principle of modesty (see P3 above).

5. Conclusions: Let Nature Speak—Theology of Science as a Possible Means of Narrative Consilience between Science and Theology in the Modern Age

Judith Oster recalls Eli Wiesel's assertion that "God created human beings because He loves stories—a conclusion Weisel reaches based on the Chasidic tale of the Baal Shem Tov" (Oster 1999). What kind of stories? The great Rabbi Israel Bal Shem Tov, as Wiesel recounts, was meditating on the misfortunes of the Jews and was accustomed to visiting a certain

place in the forest to light a fire and pray. And the hardships were alleviated. Years passed, and his disciple, the celebrated Magid of Mezritch, had to pray for the same reason, but he remembered only the place and the prayer, but not how to light the fire. Nevertheless, it was enough for the miracle. Again, years passed and the same problems returned. So, Rabbi Moshe-Leib of Sasov, to save his people, went to the forest, but he remembered only the place and not the prayer nor how to light the fire. Even in that case, it was enough for the miracle. When many years later, in the same troublesome situation, it was the turn of Rabbi Israel of Rizhyn. He sat in his armchair and spoke to God: "I am unable to light the fire and I do not know the prayer; I cannot even find the place in the forest. All I can do is to tell the story, and this must be sufficient. And it was sufficient" (Oster 1999).

Here is the forest and the fire (the natural world), here is the prayer to God for his chosen people (the Bible), and here are rabbis who combine these elements to solve an existential problem of the Jews. In the end, after many, many years, when the link between the forest, the fire, and the prayer was forgotten, there remained only the narration which unites all these elements. As far as the forest, the prayer, the rabbis, and God are considered, Wiesel's story can be interpreted, at least to some extent, as a metaphor for genesis and a need for theology of science narration. It is a story about how the connection between the natural world and the teachings of the Bible can easily be forgotten. It is important to tell this story, especially when considering that narration is especially needed in difficult times.

What about the present time? In a brilliant synthesis, Balthasar enumerates three stages of the road that led Western spiritual history to where it is now:

> In a certain sense three phases can be distinguished: a first in which the ancient solutions retain a strong poignancy as a form of thought and expression within the Christian message; a second in which, due to the fading of the Christian message, links to ancient motifs re-emerge more uncovered; and finally a third in which, following the radical changes leading to the modern vision of the world, the ancient forms also fade away, freeing up space for the new.
>
> (Balthasar 2019, p. 17; see also Lococo 2002, p. 12)

'The new' most likely stands for the vision and perception of the world dominated by science and technology. What does it mean? In the essay *The Question of God and Modern Man*, which appears to be Balthasar's only organic writing on science and the scientific worldview, the Swiss theologian stated: "if nature is understood as what it is meant to be for man, it can and must speak to us with the language God has given it. The question, however, is whether we do not prevent it from doing so" (Balthasar 1967, pp. 25–26).

It seems that as far as the Bible and the Book of Nature are considered, humankind is in the situation of Rabbi Israel of Rizhyn, which is sufficient reason to search for the story. But is the story necessary only in difficult times? Or rather, is it true that times are always both good and bad? Consider Charles Dickens's memorable incipit: "It was the best of times, it was the worst of times, it was the age of wisdom, it was the age of foolishness, it was the epoch of belief, it was the epoch of incredulity, it was the season of Light, it was the season of Darkness, it was the spring of hope, it was the winter of despair" (Dickens 1981, p. 1). If this is the case—if times are always good and bad, and thus there is no choice—the story must be told constantly. This observation demonstrates the necessity of theology of science.

In short, theology of science is essentially a narrative enterprise. Theology of science narration does not lead to anything that is solely scientific, nor to anything that is solely theological. Instead, theology of science lights up sparkles of meaning in the natural world when the latter is illuminated by a supernatural ray because, following Józef Tischner's intuition, 'meaning' is a modern name for 'light' (Tischner 2020, p. 164). Furthermore, "the light that causes everything to emerge in such a way that it is evident and comprehensible in itself is the light of the word" (Gadamer 2006, p. 478). Therefore, theology of science, thanks to its storytelling ability and creativity, is able to "[decipher] the world, which without that narrative would remain unknown and mute", to use Fisher's words in reference to the rhetorical art of Ernesto Grassi (Fisher 1985, p. 11). One theology of science narrative

engenders another; this is due to the intricate intertwining of the inexhaustible depth of significance of the Bible and the ever-expanding reading of the Book of Nature. While the thematic connection 'light-meaning-word-narrative' in the context of theology of science requires further exploration, it is exactly at this intersection that the essentiality, necessity, and irreplaceability of theology of science are rooted. It is, therefore, possible to claim that theology of science narration makes divine reality shine in nature, and permits the Book of Nature to "speak to us with the language God has given it" (Balthasar 1967, p. 26).

Funding: This research received no external funding.

Data Availability Statement: No new data were created or analyzed in this study. Data sharing is not applicable to this article.

Conflicts of Interest: The author declares no conflicts of interest.

Notes

1 I have written 'Christian-Catholic theology', because one of the basic concepts, namely the specific domain of theology of science, stems from the insights of Hans Urs von Balthasar, an eminent Catholic theologian. However, the concept of theology of science described in this essay could also be applied to non-Catholic Christian theological currents, as it is based on the idea of an intertextual reading of the two Books. Further studies are required to undertake such an extension, which was not possible here due to space constraints.

2 (Agazzi 2014, p. 2). Agazzi's approach seems to align with the following statements of Balthasar: "certainly in the first rush of victory science did indeed try to apply to every sphere of life its own simplest and seemingly safest method, that is the principles of mathematics, physics, and chemistry. Yet this procedure contradicted its own program because it was not objective and failed to take into account the special claims of the object. Today this is being recognized, at least in the Western world. It was the principal result of the phenomenological movement to clarify these methodical questions of science and scholarship and *to demand for each sphere of knowledge its own appropriate method*. The deeper layers of nature will not answer to a superficial questioning, one that is suitable only for the lowest sphere of matter" (Balthasar 1967, p. 25; my italics to underline the analogy between the basic ideas of Agazzi's and Balthasar's synthesis). For a similar approach, see (Torrance 1969, p. 341).

3 In some way, Agazzi's theory of 'objectivity' is an answer to what Lococo describes as "an 'objectivity' fetish", a consequence of "a superficial appropriation of the method proper to natural science and a misunderstanding of the nature of theology". This misunderstanding, in Lococo's words, creates a situation in which "science views theology as a subjective world view that has nothing to do with 'real' knowledge" (Lococo 2002, p. 11). As to the objectivity in theology, see Karl Barth's considerations on the knowability of the word of God in (Barth 2010a, pp. 184–244).

4 In his essay *The God Question and Modern Man*, Balthasar rephrases this idea as follows: "the two realities of science and Christianity, though seemingly unconnected, are nevertheless related by an intermediate sphere. From the scholar's point of view this appears as *Weltanschauung*, from the Christian's as 'religion', and from the centre as philosophy" (Balthasar 1967, p. 10).

5 (Balthasar 2004, p. 51). Regarding the translation of *esse* in English, see, for example (LaZella 2010, pp. 4–5).

6 For the most recent history of this important letter, see (Camerota et al. 2019).

7 Dogmatic Constitution on Divine Revelation, solemnly promulgated by His Holiness Pope Paul VI, on 18 November 1965, *Dei Verbum* 4. Wherever I write about the Bible, I keep in mind what was stated in the present paragraph.

8 An inspiring analysis of David Brown indicates that the source of Balthasar's fallacy could be the equation of glory and beauty (for details, see Brown 2018).

9 In other terms: "what Physics describes is real/what the Bible says is real/and human's love and pain are real", as a paraphrased version of the poem *Veritas* by Halina Poświatowska, affirms ("fizyka jest prawdziwa/biblia jest prawdziwa/miłość jest prawdziwa/i prawdziwy jest ból"; Poświatowska 1989, p. 240).

10 Myrna Solotorevsky, in her essay on Borges and Midrash, writes: "the correspondences between Borges and Midrash [are] in the idea of intertextuality, in the concept of reading not as lineality but as a configuration of textual space, in the notion of destructuralization of the text as a condition for deciphering it" (Solotorevsky 1986, p. 263).

11 In this attempt at defining intertextuality and narration, as practised in theology of science, I draw upon Kate Finley's and Joshua W. Seachris's thinking (Finley and Seachris 2021).

12 As to the models of narrative theology, see, for example (Mauz 2009; Finley and Seachris 2021).

13 For a very similar approach, see (Elgin 2002). Catherin Elgin, in her book *True Enough*, notes that "disciplinary understanding is not an aggregation of separate, independently secured statements of fact; it is an integrated, systematically organized account of a domain" (Elgin 2017, p. 13).

14 See, for example, Jacques Hadamard's excellent description of this process in mathematics (Hadamard 1954; Sadler-Smith 2015) or Di Rocco's description with reference to John Dewey's and Arthur Bentley's theory of knowledge (Di Rocco 2018, pp. 107–28).

15 For an overview of recent developments, see (Johnson-Laird 2004; Stuart et al. 2018).

16 A "thought experimenting is a form of simulative model-based reasoning", writes Nancy Nersessian (1993, p. 291). See also (Fehige 2019, pp. 5–9).

17 (Huxley 1986, pp. 83–84). Likewise, Roman Ingarden notes in his work on the literary work of art that what he calls 'metaphysical qualities', like, for example, the sublime, the inexplicable, the tragic or the holy, "make life worth living" (Ingarden 1973, p. 291). I believe this is an appropriate place for a rather important digression. The analysis of the discourse of theology of science is conducted in this paper through the lens of a narrative paradigm. The reference to Ingarden wants to suggest that the concept of literary work of art developed by the Polish phenomenologist, for instance, may be more suitable for the analysis of a narrative of theology of science than the tools developed within the framework of philosophy of science. This subject matter would merit further investigation.

18 (Bruner 1991, p. 4). Regarding narrative reasoning and narrative time, see also (Patron 2006; Worth 2008; Ricoeur 1980).

19 For a synthesis, see (Stroud 2016, pp. 2–4).

20 (Worth 2008, p. 48), with reference to J. Bruner. The logico-scientific reasoning is sometimes called 'the clear-cut inferential' and is considered a standard account of argument (see Stroud 2016, p. 1).

21 The illative sense has an important place in Balthasar's synthesis; see (Balthasar 1990, p. 132).

22 In my synthesis, I rely on (Banon 2009; Stern 1998; Wiesel 1976); see also (Law-Vilijoen 1997; Taggart 2010; Carruthers et al. 2014).

23 Christopher B. Kaiser does not elaborate on what is referred to here as the B^2N^2 Model. However, in his stimulating book *Toward a Theology of Scientific Endeavour: The Descent of Science* (Kaiser 2007), he makes extensive use of the Midrash *Bereshit (Genesis) Rabbah* as a theological resource in Chapters 1 and 4.

24 Stern's reflections are similar to Erich Auerbach's considerations on the two modes of representing reality in European culture. Auerbach scrutinizes the Homeric style (Euryclea recognizes Odysseus), which is 'of background', and the Elohistic style (the account of the sacrifice of Isaac), which is 'fraught with background'. In *Mimesis*, he writes, "we have compared these two texts, and, with them, the two kinds of style they embody, in order to reach a starting point for an investigation into the literary representation of reality in European culture. The two styles, in their opposition, represent basic types: on the one hand fully externalized description, uniform illumination, uninterrupted connection, free expression, all events in the foreground, displaying unmistakable meanings, few elements of historical development and of psychological perspective; on the other hand, certain parts brought into high relief, others left obscure, abruptness, suggestive influence of the unexpressed, 'background' quality, multiplicity of meanings and the need for interpretation" (Auerbach 1953, p. 23).

25 On this issue, see also: (Schumann 2012, pp. 150–64; Tirosh-Samuelson 2018, p. 399).

26 See above, Section 2, and (Fehige 2019, p. 2).

27 (Mancuso 2009, all translations from Mancuso are mine). On Vito Mancuso as a lay theologian, see (Simuţ 2011a, 2011b).

28 See (Mancuso 2007, pp. 122 and 116). Mancuso's words are similar to Galilei's assertion from his *Letter to Benedetto Castelli*: "nature is inexorable and immutable, and she does not care at all whether or not her recondite reasons and modes of operations are revealed to human understanding" (Galilei 1613).

References

Agazzi, Evandro. 1979. Analogicità del concetto di scienza. Il problema del rigore e dell'oggettività nelle scienze umane. In *Epistemologia e scienze umane*. Edited by Vittorio Possenti. Milano: Massimo, pp. 57–76.

Agazzi, Evandro. 2014. *Scientific Objectivity and Its Contexts*. Heidelberg, New York, Dordrecht and London: Springer. [CrossRef]

Alai, Mario. 2009. *Il Realismo scientifico di Evandro Agazzi*. Udine: Editrice Montefeltro.

Auerbach, Erich. 1953. *Mimesis: The Representation of Reality in Western Literature*. Pricneton: Princeton University Press.

Balthasar, Hans Urs von. 1967. *The God Question and Modern Man*. New York: The Seabury Press.

Balthasar, Hans Urs von. 1990. Theological Dramatic Theory: The Dramatis Personae: Man in God. In *Theo-Drama*. Ft. Collins: Ignatius Press, vol. 2.

Balthasar, Hans Urs von. 2000. The Truth of the World. In *Theo-Logic*. Ft. Collins: Ignatius Press, vol. 1.

Balthasar, Hans Urs von. 2003. *Cosmic Liturgy. The Universe According to Maximus the Confessor*. Ft. Collins: Ignatius Press.

Balthasar, Hans Urs von. 2004. *Epilogue*, Kindle ed. Ft. Collins: Ignatius Press.

Balthasar, Hans Urs von. 2019. *Escatologia nel nostro tempo (Original work: Balthasar, Hans Urs von. 2003. Eschatologie in unsere Zeit. Die Letzte Dinge des Menschen und das Christentum. Johannes Verlag Eonsiedeln, Freiburg/D)*. Brescia: Queriniana.

Banon, David. 2009. *La lettura infinita*. Milano: Jaca Book.

Barth, Karl. 2010a. The Doctrine of the Word of God § 1–7. In *Church Dogmatics*. London and New York: T&T Clark—Study Edition, vol. I.1.

Barth, Karl. 2010b. The Doctrine of the Word of God § 16–18. In *Church Dogmatics*. London and New York: T&T Clark—Study Edition, vol. I.2.

Brown, David. 2018. Glory and beauty in the world and in God: A critique of Hans Urs von Balthasar. *International Journal for the Study of the Christian Church* 18: 173–86. [CrossRef]

Bruner, Jeremy. 1991. The Narrative Construction of Reality. *Critical Inquiry* 18: 1–21. [CrossRef]
Calvino, Italo. 1988. *Six Memos for the Next Millennium*. Cambridge, MA: Harvard University Press.
Camerota, Michele, Franco Giudice, and Salvatore Ricciardo. 2019. The reappearance of Galileo's original Letter to Benedetto Castelli. *Notes and Records of the Royal Society of London* 73: 11–28. [CrossRef] [PubMed]
Carruthers, Jo, Mark Knight, and Andrew Tate. 2014. *Literature and the Bible. A Reader*. London and New York: Routledge.
Catlin, Samuel. 2023. *Rabbinic Exegesis (Midrash) and Literary Theory*. Oxford: Oxford University Press. [CrossRef]
Christie, Agatha. 2011. *Murder on the Orient Express*. London: Harper Collins Publishers.
Craik, Kenneth. 1943. *The Nature of Explanation*. Cambridge: Cambridge University Press.
Dickens, Charles. 1981. *A Tale of Two Cities*. Toronto, New York and London: Bantam Classics.
Di Rocco, Richard J. 2018. *Consilience, Truth, and the Mind of God. Science, Philosophy and Theology in the Search for Ultimate Meaning*. Cham: Springer. [CrossRef]
Drake, Stillman, trans. 1957. *Discoveries and Opinions of Galileo*. New York: Doubleday.
Elgin, Catherine. 2002. Creation as Reconfiguration. Art in the Advancement of Science. *International Studies in the Philosophy of Science* 16: 13–25. [CrossRef]
Elgin, Catherine. 2017. *True Enough*. Cambridge, MA and London: The MIT Press.
Fehige, Yiftach. 2019. The Book of Job as a Thought Experiment: On Science, Religion, and Literature. *Religions* 10: 77. [CrossRef]
Finley, Kate, and Joshua W. Seachris. 2021. Narrative, Theology, and Philosophy of Religion. In *The Encyclopedia of Philosophy of Religion*. Edited by Charles Taliaferro and Stewart Goetz. Hoboken: John Wiley & Sons, Inc. [CrossRef]
Fisher, Walter R. 1984. Narration as a human communication paradigm: The case of public moral argument. *Communication Monographs* 51: 1–22. [CrossRef]
Fisher, Walter R. 1985. The Narrative Paradigm: In the Beginning. *Journal of Communication* 35: 74–89. [CrossRef]
Freer, Alexander. 2016. Faith in Reading: Revisiting the Midrash-Theory Connection. *Paragraph* 39: 335–57. [CrossRef]
Gadamer, Hans-Georg. 2006. *Truth and Method*. London and New York: Continuum.
Galilei, Galileo. 1613. Letter to Benedetto Castelli. Available online: https://inters.org/Galilei-Benedetto-Castelli (accessed on 30 October 2023).
Gruenwald, Ithamar. 1993. Midrash and the Midrashic Collection: Preliminary Considerations. In *The Midrashic Imagination: Jewish Exegesis, Thought, and History*. Edited by Michael Fishbane. Albany: SUNY Press, pp. 6–22.
Hadamard, Jacques. 1954. *An Essay on The Psychology of Invention in the Mathematical Field*. New York: Dover Publications.
Harris, Marc. 2024. A Scientist-Theologian's Perspective on Science-Engaged Theology: The Case for "Theology of Science" as a Sub-discipline within Science and Religion. In *God and the Book of Nature: Experiments in Theology of Science*. Edited by Marc Harris. London: Routledge.
Huxley, Aldous. 1986. *Music at Night*. London: Triad Grafton Books.
Ingarden, Roman. 1973. *The Literary Work of Art. An Investigation of the Borderlines of Ontology, Logic, and Theory of Language*. Evanston: Northwestern University Press.
Johnson-Laird, Philip N. 2004. The History of mental models. In *Psychology of Reasoning: Theoretical and Historical Perspectives*. Edited by Ken Manktelow and Man Cheung Chung. New York: Psychology Press, pp. 179–212.
Kaiser, Christopher B. 2007. *Toward a Theology of Scientific Endeavour: The Descent of Science*. Aldershot: Ashgate.
Kellner, Menachem. 2020. Faith, Science, and Orthodoxy. *Conversations* 35: 1–13.
Kilby, Karen. 2012. *Balthasar. A (Very) Critical Introduction*. Grand Rapids: Eerdmans.
Laudan, Larry. 1971. William Whewell on the Consilience of Inductions. *The Monist* 55: 368–91. [CrossRef]
Law-Vilijoen, Bronwyn. 1997. Midrash, myth, and prophecy: George Eliot's reinterpretation of biblical stories. *Literature and Theology* 11: 80–92. [CrossRef]
LaZella, Andrew T. 2010. *Thomas Aquinas, the Real Distinction between Esse and Essence, and Overcoming the Conceptual Imperialism*. Chicago: College of Liberal Arts & Social Sciences Theses and Dissertations. Available online: https://via.library.depaul.edu/etd/32 (accessed on 21 February 2024).
Lococo, Donald J. 2002. *Towards a Theology of Science*. Ottawa: Novalis-Saint Paul University.
Mancuso, Vito. 2007. *L'anima e il Suo destino*. Milano: Raffaello Cortina.
Mancuso, Vito. 2009. *Il dolore innocente. L'handicap, la natura e Dio*. Mondadori: Milano.
Mancuso, Vito. 2013. *Il principio passione*. Milano: Garzanti.
Mauz, Andreas. 2009. Theology and Narration: Reflections on the 'Narrative Theology'-Debate and Beyond. In *Narratology in the Age of Cross-Disciplinary Narrative Research*. Edited by Sandra Heinen and Roy Sommer. Berlin and New York: De Gruyter, pp. 262–86. [CrossRef]
McMullin, Ernan. 1992. *The Inference that Makes Science*. Milwaukee: Marquette University Press.
Nersessian, Nancy J. 1993. In the theoretician's laboratory: Thought experimenting as mental modelling. Paper presented at 1992 Biennal Meeting of the PSA, Pittsburgh, PA, USA, February; Edited by David Hull, Melissa Forbes and Kathleen Okruhlik. East Lansing: PSA, pp. 291–301.
Newman, John Henry. 1874. *An Essay in Aid of a Grammar of Assent*. London: Burns, Oates & Co.
Oster, Judith. 1999. 'God loves stories'. Jews love questions: I. B. Singer questions God. *Journal of the Short Story in English* 32. Available online: http://journals.openedition.org/jsse/164 (accessed on 14 November 2023).

Patron, Sylvie. 2006. On the Epistemology of Narrative Theory: Narratology and Other Theories of Fictional Narrative. In *The Traveling Concept of Narrative. COLLeGIUM—Studies across Disciplines in the Humanities and Social Sciences*. Edited by Matti Hyvärinen, Anu Korhonen and Juri Mykkänen. Helsinki: Helsinki Collegium for Advanced Studies, hal00698697v2. pp. 118–33. Available online: http://www.helsinki.fi/collegium/e-series/volumes/volume_1/index.htm (accessed on 29 April 2021).
Pedersen, Olaf. 2007. *The Two Books. Historical Notes on Some Interaction between Natural Science and Theology*. Edited by George V. Coyne S. J. and Tadeusz Sierotowicz. Città del Vaticano: Libreria Editrice Vaticana.
Poświatowska, Halina. 1989. Veritas. In *Wiersze Wybrane*. Edited by Halina Poświatowska. Krakòw: Wydawnictwo Literackie.
Rabinowitz, Peter J. 1979. The Click of the Spring: The Detective Story as Parallel Structure in Dostoyevsky and Faulkner. *Modern Philology* 76: 355–69. [CrossRef]
Ricoeur, Paul. 1980. Narrative Time. *Critical Inquiry* 7: 169–90. [CrossRef]
Robinson, Marilynne. 2004. *Gilead*. New York: Picador.
Sadler-Smith, Eugene. 2015. Wallas' four-stage model of the creative process: More than meets the eye? *Creativity Research Journal* 27: 342–52. [CrossRef]
Schumann, Andrew. 2012. *Talmudic Logic*. London: College Publications.
Sierotowicz, Tadeusz. 2023. Theology of Science. Its Collocation and Critical Role for Understanding of Limits of Theological and Scientific Investigations. *Philosophical Problems in Science (Zagadnienia Filozoficzne w Nauce)* 75: 183–205.
Simuţ, Cornel C. 2011a. *Essentials of Catholic Radicalism. An Introduction to the Lay Theology of Vito Mancuso*. Frankfurt am Main: Peter Lang Verlag.
Simuţ, Cornel C. 2011b. The theology of creation in Vito Mancuso's radical theology. *Acta Theologica* 31: 138–55. [CrossRef]
Solotorevsky, Myrna. 1986. The Model of Midrash and Borges's Interpretative Tales and Essays. In *Midrash and Literature*. Edited by Geoffrey H. Hartman and Sanford Budick. New Haven: Yale University Press, pp. 253–64.
Stern, David. 1988. Midrash and Indeterminacy. *Critical Inquiry* 15: 132–61. [CrossRef]
Stern, David. 1998. *Midrash and Theory*. Evanston: Northwestern University Press.
Stierstorfer, Klaus. 2022. Are Models Narratives? Perspectives on a Narrative Critique of Models. *ELH* 89: 833–63. [CrossRef]
Stroud, Scott R. 2016. Narrative Rationality. In *The International Encyclopedia of Communication Theory and Philosophy*. Edited by Klaus Bruhn Jensen, Robert T. Craig, Jeferson D. Pooley and Eric W. Rothenbuhler. Hoboken: John Wiley & Sons, Inc. [CrossRef]
Stuart, Michael T., Yiftach Fehige, and James R. Brown, eds. 2018. *The Routledge Companion to Thought Experiments*. London and New York: Routledge.
Taggart, Robert J. 2010. Marilynne Robinson's Gilead as Modern Midrash. Master's thesis, Brigham Young University Provo (USA), Provo, UT, USA. Available online: http://hdl.lib.byu.edu/1877/etd4082 (accessed on 17 December 2023).
Tirosh-Samuelson, Hava. 2018. Judaism and the Dialogue of Religion and Science: A Personal Journey. *Theology and Science* 16: 388–414. [CrossRef]
Tischner, Józef. 2020. *Nadzieja mimo wszystko*. Kraków: ZNAK.
Torrance, Thomas F. 1969. *Theological Science*. London and New York: Oxford University Press.
Wiesel, Elie. 1976. *Messengers of God*. New York: Simon&Schuster.
Worth, Sarah E. 2008. Storytelling and Narrative Knowing: An Examination of the Epistemic Benefits of Well-Told Stories. *Aesthetic Education* 42: 42–56. [CrossRef]

Disclaimer/Publisher's Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.

religions

MDPI

Article

Contemporary Theologies of Science in the Light of Bonaventure's *De Reductione Artium ad Theologiam*

Jacek Rodzeń [1,*] and Paweł Polak [2]

[1] Institute of History, The Jan Kochanowski University, 25-369 Kielce, Poland
[2] Faculty of Philosophy, Pontifical University of John Paul II, 31-002 Krakow, Poland; pawel.polak@upjp2.edu.pl
* Correspondence: jacek.rodzen@ujk.edu.pl

Abstract: For some time now, regardless of the still-common paradigm of Barbour's practice of science–religion relations, proposals have been emerging to develop a theology of science from a Christian perspective. This article begins by discussing three theologies of science as proposed by Michael (Michał) Heller, Christopher B. Kaiser, and Tom McLeish. It then goes on to present the theological vision of the arts and sciences as contained in the work *De reductione artium ad theologiam* by Bonaventure of Bagnoregio (c. 1221–1274). The aim of this article is to compare the contemporary variants for a theology of science with each other and then compare them with Bonaventure's theological project. Thus, we analyze this 13th-century thinker's concepts and their heuristic relevance to the modern theologies of science.

Keywords: science and religion studies; theology of science; Christopher B. Kaiser; Michael Heller; Tom McLeish; 13th century; Bonaventure of Bagnoregio; mechanical arts

1. Introduction

In recent decades, analyses of the interaction between science and religion/theology have been dominated by a paradigm based on the work of Ian G. Barbour.[1] In the most recent decade, however, a number of studies have emerged that suggest a need to revise this paradigm. A recent exchange between Josh A. Reeves and Peter Harrison focused on the alleged ineffectiveness of this paradigm. The not very revealing term "after science and religion" was even used as a successor to the Barbour project, suggesting a need to initiate a new phase of research on the relationship between science and religion (Reeves 2023; Harrison 2023). In some studies in a similar vein, one can find proposals to develop a new field of research called "theology of science". The work of Tom C. B. McLeish (2014, 2019) also emphasizes the need to go "beyond Barbour", and this work exemplifies this approach. A similar suggestion about constructing a "theology of science" was also recently put forward by Mark Harris. In his view, this would be a new "sub-discipline within science and religion" (Harris 2024a, p. 13) while also being an "alternative (or complementary)" approach to the new research project called "science-engaged theology" that has been initiated in recent years (Harris 2024b, p. 7).[2]

The main objective of this article is to compare some selected contemporary projects for the theology of science with the profoundly theological reflection on human cognition and the various types of knowledge as described by the medieval scholar, mystic, and Christian personality of his time, Bonaventure of Bagnoregio (Giovanni Fidanza, ca. 1221–1274) in his short work *De reductione artium ad theologiam*. While seemingly far removed from the realities of contemporary theological discussion, the choice of this author and his work

was determined firstly by the growing interest in recent years in Bonaventure's literary legacy, especially from the perspective of the contemporary debate within science and religious studies (cf. Hołda 2023; Boulding 2024; Mantini 2024). Secondly, the aim was to see whether Bonaventure's views on the relationship between secular knowledge and theological knowledge, the latter being based on Christian revelation, can serve as a useful inspiration for current attempts to develop a theology of science. In other words, we wish to see if classical theological intuitions that were expressed in the Middle Ages can be adapted and used when analyzing contemporary concepts using science as a *locus theologicus*.

This paper is divided over three parts: The first part comprises a brief discussion of some selected contemporary proposals for constructing a theology of science as a new field of inquiry, one that is more or less related to traditional questions in science and religious studies. These include the projects of Michael Heller (1982, 1996a, 1996b), Christopher B. Kaiser (1996, 2007), and the aforementioned Tom McLeish (2014, 2019). The choice of these projects is not based on any particular criteria, mainly due to a lack of previous work comparing the existing theologies of science. Nevertheless, we are aware that other proposals of this kind exist (cf. Dubarle 1967; Lococo 2002; Tyson 2022). It is worth noting that Kaiser's and Heller's proposals arose in the 1990s, before the current "beyond Barbour" revolt.[3]

The second part of this paper then presents the theological vision of the meaning of human knowledge, especially concerning nature and technology (or in medieval terms, natural philosophy and mechanical arts), from the theological perspective outlined by Bonaventure in *De reductione artium ad theologiam*. In the third part of this article, the projects for a theology of science presented by Kaiser, Heller, and McLeish are compared with each other and then contrasted with Bonaventure's theological vision of cognition and knowledge. This article concludes by illustrating the common features of today's conceptions for a theology of science and pointing out the inspiring aspects of Bonaventure's approach. Indeed, science as a *locus theologicus* is an idea that has long been embedded in the tradition of Christian theology, a tradition that for various reasons has been obscured by competing proposals.

2. The Various Contemporary Theologies of Science

Science's social relevance has increased, and it has been a subject of great interest to theologians of various religions. More often than not, theologians have turned their attention to specific scientific theories and analyzed their implications for certain elements of a religion's doctrine. These include cosmological theories and theories of evolution in relation to the Christian or Jewish doctrine for the creation of the world and humanity. It is something of a mystery as to why science itself, the conditions of its existence, its knowledge of the world, and the values it actualizes have so far been of relatively little interest to theologians, despite all these aspects being suitable for consideration as part of religious doctrine. Nevertheless, in the last 30 years or so, several projects for a theological reflection on science from a Christian perspective have emerged that address, to some extent, the issues mentioned above. Among these are the proposals of Michael Heller, Christopher B. Kaiser, and Tom McLeish.

2.1. Heller: The Value and Rationality of Science as Theological Topics

The earliest concept considered here originated within Catholic thought in the early 1980s. Polish cosmologist, physicist, philosopher, and theologian Michael Heller (1982), who later won the Templeton Prize, proposed a theology of science in an article. The concept was developed within the context of discussions held at the Second Interdisciplinary Seminar in Castel Gandolfo, which was organized by Polish scholars for pope John Paul II (cf. Życiński 1984). The article, however, did not initially arouse wider interest. Indeed,

despite Heller's subsequent publications (Heller 1996a, 1996b) on the theology of science, it has only been in the last fifteen years that there has been strong interest in this project, and not just among Polish philosophers and theologians concerned with the interaction between the natural sciences and religion (cf. Macek 2010, 2011; Mączka and Urbańczyk 2015; Sierotowicz 2023, 2024; Polak and Rodzeń 2023; Marcacci and Oleksowicz 2023).

Heller built his theology of science not just as a scientist and theologian but also as a philosopher of science. For him, the world is the keystone that connects the mathematical and natural sciences with Christian theology. The world is both the object of scientific investigation and a creation of God, so "the theology of science would explore the consequences of the fact that the empirical sciences investigate the universe created by God" (Heller 1996a, p. 42). In this context, the role of the philosophy of science (i.e., a philosophical reflection on the scientific method) is to analyze the limits of the applicability of the methods of the physical sciences (above all: cosmology, physics, chemistry, and the Earth sciences). It therefore becomes crucial that "[a] theology pushes on beyond those boundaries. The awareness that the world has been created by God permits the theology of science to glimpse aspects and dimensions of the world which cannot be reached by modern empirical investigations" (Heller 1996b, p. 98).

Using the tools of modern philosophy of science, Heller points to certain properties and presuppositions of the mathematical–empirical sciences that are unattainable using their methods. These properties and presuppositions of science can be considered on three levels that are borrowed not from philosophy but rather from the perspective of theological reflection under the new names of theological ontology (of science), theological epistemology, and theological axiology, respectively (Polak and Rodzeń 2023, p. 170). One of the most important issues considered by Heller at the level of theological ontology is the basis of the existence of science[4] and by implications the mathematical and empirical methods. The most important of these foundations is the rationality of the world, which means it can be studied within the framework of the sciences: "From a theological perspective, the rationality of the world is the mark of creation. And creation bears the mark of the Creator's rationality" (Heller 2015, p. 21). Heller here introduces the notion of a rational Creator, which relates to Einstein's idea of the "mind of God". This rational Creator is therefore to some extent discernible in the created world through the sciences.[5]

Concerning the possibility of studying the world through science while simultaneously treating the world as God's creation, Heller (2015, p. 18) considers the theology of creation to be "the center of interest in the theology of science". However, the theology of creation must take into account the current image of the world, and this contemporary image is primarily created by science (Heller 2019, pp. 12, 67). A characteristic feature of the modern scientific image of the world is its evolutionary dynamics on a global scale (i.e., the evolution of the cosmos) and on a local scale (e.g., the evolution of biological species). This image has at least three "hot spots" where science meets Christian theological doctrine: the origin of the universe, the origin of life, and the emergence of human consciousness. According to Heller, another useful element for a theology of science (i.e., a theology of creation) is the "reinterpretation of certain religious truths" (Heller 2019, pp. 15, 69–76), such as the creation of the world and of human beings. These issues can be categorized as theological epistemology while also being the theological ontology of science.

Another level of theology of science is theological axiology. According to Heller, embracing the idea of "the mind of God" being reflected in the created world means that scientific discovery is to some extent not limited to a purely ontological or cognitive dimension. God's purpose in creation also touches on questions of values, and not only "the Universe is impregnated with values" (Heller 1996a, p. 43), because science itself is a value. Cognitive and ethical values are of no interest to the physical sciences. Indeed,

such values are invisible to the methods of the sciences. Nevertheless, there are questions about the value of science, as well as values within the methods of science (i.e., so-called epistemic values) and the value of scientific work, and these can be relevant to a theology of science based on revelation (cf. Heller 2019, pp. 94–103).

2.2. Kaiser: From Theological Beliefs in Science to Science as a "Sacred Reminder"

In America, the idea of a "theology of scientific endeavor" has been developed since the 1990s, starting with Christopher B. Kaiser, a physicist, theologian, and member of the American Reformed Church. The concept of a "theology of science" was first proposed and developed in an article by Kaiser (1996), followed by an extensive elaboration in a book (Kaiser 2007). More recently, Kaiser has published an original work that can be viewed either independently of the earlier concept of a theology of science or as a further, highly sophisticated contribution to it. This latter work does not explicitly refer to a "theology of scientific endeavor", but it seems to present its concrete expression of the treatment of science as a kind of "sacred reminder" (Kaiser 2024).

In the first mentioned work, Kaiser (1996) stated that he is not interested in theories or scientific results in his project but rather in the research practice of scientists. What he wanted to address were certain beliefs upon which scientific practice is based, beliefs through which it operates but does not itself prove. Kaiser therefore considered these beliefs to be of a theological nature "in the work at the frontiers of science" (Kaiser 1996, p. 231). He listed three such beliefs: a belief in the accessibility of the structures of nature, a belief in the existence of the laws of nature, and a belief in the essential unity of the world. In Kaiser's own words, "these beliefs are inherently theological" and "constitute the theology of science" (Kaiser 1996, p. 233). He also mentioned certain dimensions of the theology of science, namely, the operability of the beliefs in scientific practice and their exemplarity in various religious traditions, not just Christianity. With regard to Judeo–Christian theology and the associated "creationist tradition", Kaiser lists four themes that link it to the beliefs presented above.[6] With comprehensibility (i.e., accessibility), he links the theme of the world, as an expression of God's wisdom and image, with the autonomy (laws) of natural processes. This in turn links to the theme of God as cosmic Lawgiver, the unity of nature, the non-dualistic character of God's creation, and finally the possibility of healing or curing human beings through the theme of God the Healer (Kaiser 1996, p. 234).

Although Kaiser (2007) returned to the earlier question of the beliefs on which he claims scientific practice is based, his attention also focused on the new "foundations-preconditions" of the scientific enterprise (Kaiser 2007, pp. 9–13). These are the societal, cultural, anthropological, and cosmic (natural) conditions. Kaiser based his analysis of these conditions on the concept of a "thick description of science", using the idea of "thick description" borrowed from cultural anthropologist Clifford Geertz. Like in his earlier work, Kaiser sought to link the cosmic condition to the idea of the lawfulness of the universe and the biblical idea of God as a lawgiving Creator, as well as the anthropological condition of God as an "animating governor and governing spirit" (Kaiser 2007, p. 115). The latter two conditions of science, societal and cultural, required him to provide a broader and more complex theological interpretation of various aspects of ancient and modern social life, especially the contemporary society–science–technology triad. Kaiser's goal was "to explore the theological dimensions embedded in these conditions" (Kaiser 2007, p. 1). The result was the first book-length monograph devoted to a developed variant of the theology of science.

In his latest work, which does not refer to his earlier "theology of scientific endeavor" project, Kaiser provided a theological interpretation of a certain feature of scientific discourse, one that is elusive within science itself, called the "sacred reminder". Referring

to this term, which he borrowed from Donald Walhout, Kaiser posited that "the thoughts of physicists about their own endeavors can serve as a 'sacred reminder' for Christians of aspects of biblical theology that are not normally engaged with the empirical world" (Kaiser 2024, p. 367). Kaiser found such a "sacred reminder" in the statements of two prominent scientists, namely, Stephen Hawking and John A. Wheeler. They concerned not only the mystery of the lawfulness of nature that had been expressed by physicists with mathematical equations but also what makes these equations "come alive" (Wheeler) or "experience ignition" (Hawking) in the real world (Kaiser 2024, p. 369).[7] According to Kaiser, the mathematical equations describing the world are a "sacred reminder" of the idea of the mind of God—which was used by Hawking, among others—and correspond to the Logos/Word of God. The enlivening actualization of these equations in the real world in turn corresponds to the action of the Holy Spirit. To support these claims, Kaiser developed elements of Trinitarian theology with extensive reference to Christian biblical and patristic traditions.

2.3. McLeish: Science as "An Intensely Theological Activity"

Another recent example is the project of a theology of science proposed by the late physicist and Anglican preacher Tom McLeish (1962–2023). Wanting to go "beyond Barbour", McLeish emphasized the usually overlooked detail of linking science and religion with the conjunction "*and*". In his view, the phrase "religion *and* science" raises doubts about whether religion and science belong to the same category and the possibility of distinguishing common "'domains' of discussion" (McLeish 2019, p. 33). In lieu of these potential complications, McLeish suggested combining "theology" and "science" with the preposition *of* and exploring a more compelling and practical *theology of science*.

On the way to developing such a theology of science, McLeish first gives the example of analyzing the debate over a critical assessment of the possible risks of the applications of an exemplary technology, namely, nanotechnology, in terms of the "underlying narrative" in this debate, and especially in terms of our relationship with nature. In his view, "science itself has no such source to draw on—*there is a narrative vacuum where the story of science in human relationship with nature needs to be told*" (McLeish 2019, p. 35, author's italics; cf. also McLeish 2014, pp. 249–55). In place of such a narrative, the debate includes references to elements of ancient myths like "Pandora's box" or the quasi-sacred view of nature. In place of this narrative void, McLeish proposes introducing elements of the biblical wisdom tradition, particularly those drawn from selected chapters of the Book of Job (Job 38:4, 22, 31). The "Hymn to wisdom" found there makes "an extraordinary claim: that wisdom is to be found in participating with a deep understanding of the world, its structure and dynamics". The message of the Book of Job is a potential source of the "missing narrative" about nature: "It is rooted in creation and covenant rather than pagan or atheistic tradition [. . .]; it points away from stagnation to a future of greater knowledge, understanding, and healing" (McLeish 2019, p. 38).

To strengthen the theological basis of his own conception of the theology of science, McLeish refers to the views of the medieval scholar Robert Grosseteste (1175–1253). Whether one studies Grosseteste's translations of the works of the Church Fathers or his commentaries on the works of Aristotle, McLeish argues that there are two basic themes running through them regarding nature. The first is the theme of the natural world, which is the creation of God that has been learned by humanity through various sciences. The second theme concerns the sinful fall of humanity and the impossibility of fully knowing or even understanding the world without the assistance of God, especially through the redemptive presence of Jesus: "Furthermore, the reason that this is possible is because this relationship with the created world is also the nexus at which human seeking is met by

divine illumination" (McLeish 2019, p. 40; cf. also McLeish 2014, pp. 42–47). Grosseteste's introduction of metaphysics, or rather a "theology of light", was in McLeish's view a means of substantially supplementing the cognitive capacities of the senses as framed by the epistemological perspective of Aristotle, whose natural philosophy gradually came to dominate the medieval worldview.[8]

With regard to Grosseteste's theological vision of science, McLeish uses the term "teleology of science" (McLeish 2014, p. 41) rather than "theology of science". By referring to the Apostle Paul's phrase "ministry of reconciliation" (2 Cor. 5:17–19), he again wants to emphasize the purposeful nature of man's intellectual adventure, which is also a journey of reconciliation toward salvation, as well as the practical, ministerial nature of the theology of science. For McLeish, the character of a "ministry of reconciliation" is also possessed by science itself, one of whose functions is to reconcile humanity with the natural world: "Science is the participative, relational and co-creative work within the Kingdom of God of healing the fallen relationship of humans with nature. [. . .] Science turns out to be an intensely theological activity" (McLeish 2019, pp. 42–43).

3. "Theologia Artium" in *De Reductione*

The work *De reductione artium ad theologiam*, though small in volume, is not a frequent subject of interest even among scholars of Bonaventure's life and writings. Nevertheless, especially in recent years, it has provoked considerable debate among a small group of historians, philosophers, and theologians, even on such fundamental issues as the more precise date of its composition or the form and purpose that guided its author (Benson 2011), and even on the question of authorship itself (cf. Hattrup 1997; Benson 2009).[9] Nor is the theological interpretation of Bonaventure's "secular arts" in the perspective of thirteenth-century discussions of the status of knowledge by any means closed (cf. Smith 2021, pp. 251–88). In this section, we will not go into the intricacies of these undoubtedly important questions. Instead, we are primarily interested in the image of the titular arts that Bonaventure presents in his *De reductione* from the perspective of the theology he preaches.[10]

3.1. Bonaventure's Theology of Creation, Knowing, and Reduction

In order to better understand the idea of reductio, which is central to Bonaventure's work discussed here, we need at least to give a brief introduction to the image he adopted of the creation of the world, its structure, and the possibility of its knowledge by man. The creation of the world was understood by Bonaventure in terms of the so-called metaphysics of light, which has a Neoplatonic origin, having been developed by Augustine of Hippo and renewed in the 13th century by the aforementioned Robert Grosseteste and other Oxford Franciscans. An important theological framework for the image of the Creator God is provided at the beginning of *De reductione* through a quotation from the Letter of the Apostle James: "Every good gift and every perfect gift is from above, coming down from the God of Lights" (James 1:17; *Red. art.* 1; cited after Bonaventure 1996, p. 37). God is presented in this passage as the "fontal source of light" from which all creation emanates, and light is the form of God's creative presence in all kinds of bodies. Light has not only a creational–ontological status but also a cognitive function in relation to rational beings. What is important here is the identification of primordial light with God, who is also truth (Hayes 1996, p. 6). God is not only the creator of the world but also the only guarantor of its full (and certain) knowledge and understanding.[11] It is from this perspective that the idea of divine illuminatio emerges.

The question of human knowledge, and more generally the human spiritual journey in search of truth, can be well served by beginning with a synthesizing quote from another

of Bonaventure's works, *Collationes in Hexaëmeron*: "This is the metaphysical center leading [us] back (*reducens*), and this is the whole of our metaphysics: emanation, exemplarity, and consummation, that is, to be illumined (*illuminari*) by spiritual rays of light and to be led back (*reduci*) to *the* Most High (*summum*)" (*Hex*. 1, 17; cit. after Bonaventure 2018, p. 102). Bonaventure then goes on to say that a person who does not know how things come into being, how they are lead back (*reducuntur*) to the end, and how God shines in them, will not arrive at true understanding (cf. *Hex*. 3, 2; Bonaventure 2018, p. 137).

The spiritual (life) journey of man that was outlined by Bonaventure, which leads from the beginning of his/her existence, through a special cognitive effort in her/his life, to the final *consummation* and return to the Creator, forms a kind of circle (cf. Bowman 1975, p. 181). Between the beginning and the end of this journey, in the light of the Christian faith, which constitutes the final loving union with God, Bonaventure introduces the concept of exemplarism, which together with the concept of the circle is of Neoplatonic–Augustinian origin. From the perspective of revelation, metaphysical exemplarism can be fully understood only in relation to the mystery of the Incarnation of the Word of God. According to metaphysical exemplarism, all entities created by God are but faint reflections of the idea patterns of His mind. In the light of revelation, all creation emanates from the one divine pattern Word (the divine Logos). By virtue of the fact that the Word, eternally born in God, took on the corporeal dimension of the created world in time, human beings are also able to understand more deeply the essence of creation and, to some degree at least, the mystery of the Creator Himself.

A fuller understanding of the meaning of creation and a return to God is not possible, according to Bonaventure, unless man opens himself to "spiritual rays of light", or in other words, enlightenment (illuminatio). Only in the case of this opening is it possible for the creature to return to a loving union with the Creator through a gradual conformation in some measure to the Incarnate Word. This is the meaning of the term "reduction" (reductio), as introduced by Bonaventure, which literally means "leading back". Its meaning can be read on an ontological level as the actual return of all creation to its creative source. It can also be explained on a cognitive level as an activity that leads to understanding the world as the work of God and, at the same time, Him alone: "Thus, it becomes clear why Bonaventure can respect the insights of all the human cognitive disciplines on the one hand, and yet see them as limited and in need of the insights of faith and theology on the other hand" (Hayes 1996, p. 8).[12]

3.2. The Lights of the Arts and Theology

Apart from the introductory (#1) and concluding paragraphs (#26), Bonaventure's *De reductione* consists of two thematically distinct but related parts. In the first part (#2–7), the author interprets the fields of arts/cognitions (artes/cognitionēs), which were known in the 13th century as realizations of a particular kind of illumination (illuminatio). Each illumination corresponds to one of the lights touching the human being, ones that ultimately derive from the one light of the divine. In the second part of his work (#8–25), Bonaventure shows "how the other illuminations of knowledge are to be traced back (*reduci habent*) to the light of Sacred Scripture" (*Red. art.* 8; Bonaventure 1996, p. 47), as well as to the knowledge and love of God (Smith 2021, p. 278). Bonaventure distinguishes four main lights (plus two others). The main lights include the "exterior light" of the mechanical arts, the "inferior light" of sense knowledge, the "inner light" of philosophical knowledge, and the "superior light" of grace and Scripture. In view of the subject matter of this article, we are interested in the light of the mechanical arts (i.e., the ancient counterparts of today's technology); the light of philosophical knowledge, especially the light of natural philosophy together with the disciplines based on mathematics (i.e., the ancient counterparts of today's natural and

exact sciences); and the light of Scripture (*sacra Scriptura*), which is identified with theology (cf. Hayes 1996, p. 2).

Among the "exterior light", Bonaventure includes seven mechanical arts: "weaving, armor-making, agriculture, hunting, navigation, medicine, and the dramatic arts" (*Red. art.* 2; Bonaventure 1996, p. 37). The listed skills and crafts led to the production of objects or worked in areas "external" to humans and processed the matter of the "external" world to satisfy basic human needs. Bonaventure borrowed the list of mechanical arts (*artes mechanicae*) from the *Didascalicon* of 12th-century theologian Hugh of St. Victor (ca. 1096–1141) (Hugh of the St. Victor 1991, p. 74): "In essence, they [the mechanical arts] offer a description of the basic structures of medieval life, beginning with the peasants working the fields and moving to the major guilds in which the craftsmen of the age were organized" (Hayes 1996, pp. 15–16).[13]

Associated with philosophical knowledge is the "inner light", "because it inquires into inner and hidden causes" (*Red. art.* 4; Bonaventure 1996, p. 41). This light is divided into natural, rational, and moral. Natural light corresponds to the truth of things (veritas rerum), which is the subject of natural philosophy. The knowledge of the truth of things concerns their formal principles (rationes formales) through the human mind (rationes intellectuales), "and in relation to *divine wisdom*, they are called *ideal* (*rationes ideales*)" (*Red. art.* 4, author's italics; Bonaventure 1996, p. 43). Moral light, on the other hand, refers to moral principles and human conduct, but will not be discussed in this article.

As principles of creation, divine ideas are called exemplars. In other words, the cognition of the formal causes of things through intellectual forms (concepts) in the human mind, which are reflections of archetypal forms in the mind of God, is made possible by the light that ultimately comes from God. The three "links" of the cognitive chain (i.e., things, the human mind, the Divine Mind) refer to the three sub-disciplines of natural philosophy: "*physics* in the proper sense, *mathematics*, and *metaphysics*". Physics, according to Bonaventure, studies the coming into being and passing away of things according to natural forces and seminal principles (rationes seminales). Mathematics deals with forms abstracted from the forms of material bodies (formarum abstrahibilium). Metaphysics, on the other hand, involves the knowledge of all entities, reducing them to a single First Principle "from which they proceeded, that is, to God, in as far as God is the *Beginning*, the *End*, and the *Exemplar*" (*Red. art.* 4, author's italics; Bonaventure 1996, p. 43).[14]

Finally, the fourth "superior light" refers to salvific truths, and it has its origins in Sacred Scripture and is related to theology. In Bonaventure's understanding, this level of truth transcends the cognitive capacity of human reason, which examines the created order of things (*Red. art.* 5). It is not concerned with the nature or form of thing but rather with their ultimate destiny, which is revealed to man through the historical revelation contained in Sacred Scripture. Indeed, "the whole of Sacred Scripture teaches these three truths: namely, the eternal generation and incarnation of Christ in time, the pattern of human life, and the union of the soul with God" (*Red. art.* 5; Bonaventure 1996, p. 45). The first truth concerns faith, the second is about morality, and the third relates to the purpose of both. In the second part of Bonaventure's work, the title reductio ("leading back") shows how these three truths expressing God's wisdom are hidden in the corpus of human skill and knowledge, as well as in the world itself (cf. Smith 2021, p. 267).

3.3. The Reduction of the Arts to Theology

The three truths of biblical revelation listed in paragraph #5 of *De reductione*—namely, the eternal generation and incarnation of Christ, the pattern of human life, and the union of the soul with God—can, according to Bonaventure, be seen in the illumination of the mechanical arts. This becomes possible when we consider "the *production*, the *effect*, and

the *fruit* of a work; or if we consider the *skill of the artist*, the *quality of the effect produced*, and the *usefulness of the product that results*" (*Red. art.* 11, author's italics; Bonaventure 1996, p. 49).

If we consider "the production" (egressus)[15] stage of artisanship, we see the artisan (artifex) making an external object based on the exemplary image of that object held in his mind (in mente). This is not an instantaneous process but rather a temporal one in which the artisan considers how best to render an image of the interior pattern (exemplari interiori). By analogy, Bonaventure says that no creature is brought into existence by the supreme Creator (a summo Opifice) except by the eternal Word in which He planned everything, "and by which Word God Has produced creatures bearing not only the nature of a *vestige* but also that of an *image* so that through knowledge and love creatures might become like God" (*Red. art.* 12, Bonaventure 1996, p. 51).[16]

In the effect (effectus) of artisanship, in turn, we can see the order of life. Every creator intends to create works that are beautiful, useful, and lasting. With regard to human life, knowledge makes life beautiful, will makes life useful, and perseverance makes life strong. If we consider fruits (fructūs), we will see in an artisan's creations the union of God and humanity. In the case of an artisan, what he does he does for praise, for his benefit, or for pleasure that he derives from his work. Similarly, God created humanity to glorify Himself, to serve Him, and to find satisfaction and rest in Him. In this way, Bonaventure shows how the enlightenment of the mechanical arts "is path to the illumination of sacred Scripture. [. . .] For this reason sacred Scripture quite rightly makes frequent use of such similitudes" (*Red. art.* 14, Bonaventure 1996, p. 53).

Like in the mechanical arts, elements of theology should also be seen in natural philosophy. Natural philosophy is concerned with the formal causes of things. According to Bonaventure, these formal causes exist on three closely related levels as formal principles: in matter, in the human soul (mind), and in the divine wisdom (Mind of God). They are considered in three ways, "namely, as regards the *relation of proportion* (*habitudinem proportionis*), the *effect of causality*, and the *medium of union*". We are primarily interested in the cognitive–ontological level of the relation of proportion, because "if we consider the formal principles in terms of their relation of proportion, we shall see the Word Eternal and the Word Incarnate" (*Red. Art.* 19–20; author's italics; Bonaventure 1996, p. 55).

Intellectual and abstract principles (in the human mind) are, for Bonaventure, something intermediate between seminal principles (rationes seminales)[17] in the matter of things and ideal principles (in the Mind of God). Seminal principles are responsible for the birth and formation of the forms of bodies in matter. Similarly, intellectual ideas in the human soul are related to the birth of the word in the mind, and when the ideas are in God, then, according to the corresponding proportion, the God–Father gives birth to the Word (Logos). With similar reasoning, it can also be argued that "the highest and noblest perfection cannot exist in the world" if the world/nature, in which the seminal principles reside, the mind, in which the intellectual principles exist, and the Mind of God, in which the ideal principles exist "are simultaneously brought together in the unity of one person, as occurred in the Incarnation of the Son of God" (*Red. art.* 20; Bonaventure 1996, p. 57). Therefore, for Bonaventure, all natural philosophy, by virtue of the relationship of proportions, proclaims that the Word of God is thus begotten and incarnate (cf. John 3:16).

As Hayes has pointed out, in paragraph #20 of *De reductione*, Bonaventure succinctly presents the essence of his cosmic Christology. The incarnate Word–Christ is not only the mediator between the Father and the world, but also the fulfillment of the deepest potential of the created cosmos, and the cosmos without Christ would not have reached fulfillment (consummatio). It would not have returned to its Creator in the sense of reductio (Hayes 1996, p. 30). Therefore, the discovery of the deep theological sense of both the mechanical

arts and natural philosophy is an indication of the direction of the cognitive and ontological (and at the same time redemptive) loving union of the whole of creation, especially that of humanity with its Father in the incarnate Word (Logos).

4. What Could "Old" Bonaventure Contribute to New Projects for the Theology of Science?

In order to answer the question of the possible validity of Bonaventure's concepts for the theology of science, it is first necessary to make some comparisons and systematizations. If we want to compare the variants of Heller's, Kaiser's, and McLeish's theology of science, for the sake of simplicity, we will refer to them by the abbreviations ToS_H, ToS_K, and ToS_M. The first two (ToS_H and ToS_K) are united primarily by the question of scientists' presuppositions about the science they practice. Heller limits his analysis to biases of an ontological and cognitive nature. Kaiser, in his thick description of science, also considers social and cultural presuppositions. Heller refers primarily to a theology of creation based on the biblical tradition with elements of a Christological perspective (the creator role of the *Logos*). Kaiser, on the other hand, refers to a deep and comprehensive analysis of the Christian and Jewish biblical tradition as well as the patristic and rabbinic traditions. The guiding idea of his research is to uncover theological aspects "embedded in the foundations of scientific endeavour" (Kaiser 2007, p. 10, footnote #34).

ToS_H and ToS_K share some primarily axiological and teleological dimensions with ToS_M but of the three authors, McLeish elaborates most fully. He states that "science is blind to purpose—it has no 'teleological' methodology or goals" (McLeish 2014, p. 214). In place of the axiological void in the narrative of modern sciences and technologies and their relationship to nature, McLeish offers the perspective of an axiology based on the wisdom of the Book of Job, the theology of the Apostle Paul, and the thought of the philosopher–theologian Grosseteste. It is noteworthy that McLeish is aware of the differences between the sciences (knowledge of the world) and technologies (transformation of the world), and the variable purposes attributed to them that are today primarily practical and instrumental.

In a brief comparison of the theologies of science discussed above, one might be tempted to compare them with Bonaventure's "*theologia artium*". But is this even possible, given that seven centuries separate them? It may help to point out that we are comparing only the theology of science rather than the corpus of medieval and modern scientific knowledge. Evidence of the comparability of these theologies can be seen, for example, in the fact that modern theologians quite freely apply ancient terminology and concepts, including Bonaventurian ones, to modern doctrinal issues. As far as the corpus of non-theological knowledge is concerned, it is worth noting, as has also been shown above, that both the theologies of Heller, Kaiser, and McLeish as well as Bonaventure's vision are not so much concerned with knowledge and concrete theories (although these are also present to some extent) but rather with the conditions and meaning of scientific knowledge of the world (i.e., nature).

Nevertheless, one should always keep in mind the differences between the state of theological and non-theological knowledge in the 13th century and at the 21st century. Bonaventure preached within the context of the gradual transition from a Neoplatonic–Augustinian conception of the world and science to an Aristotelian–Thomistic one. The first site of this breakthrough was the university circles of the 13th century. Bonaventure's sermon preceded the most famous condemnations of some claims of Aristotelian science by the Parisian bishop Etienne Tempier in 1270 and 1277, after which Aristotelian science made its way into the universities of the time, thanks largely to the creative efforts of Thomas Aquinas. Despite these developments, secular knowledge at the time was much closer to theology than it is today, although this does not mean there was no conflict between

the two (cf. Grant 1996). For a long time, theology retained its status as the queen of the sciences. From today's perspective, the general opinion is that the queen of the sciences is mathematics (increasingly together with computer science), and theology was usually deemed too distant and incomprehensible for scientists. Such are the realities of the rise of the modern theologies of science.

In order to compare the three contemporary concepts of the theology of science with the 13th-century theological vision of the arts, we propose to distinguish four leading themes in Bonaventure's vision of *De reductione*, namely: illumination, exemplarism, reduction, and the theology of the mechanical arts. This is of course not an exhaustive list of the extraordinarily rich content of Bonaventure's work but rather a preliminary outline of a theme that may await future continuation and development. We have chosen these themes because of their relation to the contemporary sciences also understood as *locus theologicus*.

4.1. Illumination: "A Theological Completion"

By associating various kinds of light with the secular arts and theology in *De reductione*, Bonaventure introduced the idea of illumination, which is quite mysterious to us. Apart from his reference to the source of light, namely God, we have not said anything more about its nature. In fact, it is not "entirely clear" (Cullen 2006, p. 85) and easy to understand, especially for a modern person who has been formed from the perspective of a different image of the world.

For Bonaventure, following Augustine, illumination is primarily concerned with the question of the certainty of human cognitive activity and knowledge. Man, as a fallen (sinful) being with finite cognitive faculties, cannot have certain knowledge of the world created by God without the help of God Himself. On the other hand, illuminatio cannot be equated with grace or God's special intervention. Excluded from this sphere of influence is the superior light, which is precisely the light of grace and holy Scripture (Cullen 2006, p. 86).[18]

As we saw above, of the three contemporary authors discussed here, only Tom McLeish (2019, p. 40) alluded to Robert Grosseteste's concept of illumination in his ToS_M. However, the thread is not sufficiently developed in his work to be able to say with certainty whether McLeish actually adopts the idea of illuminatio or uses it only in a metaphorical sense. It seems that modern proponents of a theology of science may be moving in the direction of adopting Bonaventure's idea of illuminatio in a sense that is limited to the superior light (as the light of grace and of Scripture), which is of course nothing new to Christian theology. Reflection on science then becomes a kind of theological completion, especially when it comes to understanding the preconceptions upon which science is based, as is the case with ToS_K and ToS_H. This was especially emphasized by Heller when he wrote about the need to go beyond the limitations of scientific methods in order to understand their meaning (Heller 1996b, p. 98).[19] At the same time, it is assumed that cognition within the framework of non-theological sciences does not require any special immanent enlightenment and retains full autonomy within its own methods.[20]

In another of his works, *Quaestio disputata de scientia Christi* (*Disputed question on the knowledge of Christ*), Bonaventure poses a question: whether illumination is "an instance of the general influence (*influentia generalis*) through which God operates in all creatures, or it is a special influence (*influentia specialis*) such as that which God exercises by means of grace" (*Scien. Chr.* q. 4 concl.; Bonaventure 1992, pp. 133–34). He concludes that positive answers to either question are absurd. In the first case, illumination cannot be God's general interaction with creatures (concursus divinus), since it refers to the preservation of being in existence, while illumination refers to interaction with the cognition of the human mind. Nor can illumination be, as in the second case, a divine influence in the manner of grace, for

then it would be knowledge infused and leave no room for experiential or innate cognition. Therefore, Bonaventure gives a third solution (tertius modus), intermediate between the two above. Illuminatio is, according to him, a kind of special influence of the divine eternal reason (ratio aeterna) "as the regulative and motivating principle, but certainly not as the sole principle" (Scien. Chr. q. 4 concl.; Bonaventure 1992, p. 134). Thus, man comes to know the world in a way that is autonomous for him, and from Bonaventure's theological perspective, he is accompanied in this by the presence of God. Close to this perspective was McLeish when he wrote that "science is the participatory, relational and co-creative work within the Kingdom of God" (McLeish 2019, p. 42).

It is worth mentioning that the limits of scientific and theological knowledge have already been thoroughly analyzed by Tadeusz Sierotowicz (2023) within the framework of Michael Heller's research program (ToS_H). Sierotowicz used the approach of Hans Urs von Balthasar in his analysis and postulated the adoption of three domains of truth. He wrote: "This third domain of truths is constituted by truths 'visible' only under certain conditions, that is only when illuminated by 'a super-natural ray'" (Sierotowicz 2023, p. 220).

4.2. Exemplarism: "A Christology of Science"

As Cullen states: "Bonaventure's exemplarism is not an aspect of his thought but rather its heart and center" (Cullen 2006, p. 71). This should not be surprising, since with the metaphysical idea of exemplarism, Augustine of Hippo and later Bonaventure sought to express the deepest and most fundamental truths of the Christian faith about the relationship within the Trinity between the Father and the Son–Word as the first Exemplar (*Red. art.*, 4), as well as Logos' relationship to the world that was created. Through the Word incarnate in human nature, human beings are not only able to know the Father but also discover the purpose and destiny of all creation. The multiple references to the idea of "God's self-projection" in the Word and the world in ToS_K and the notion of Word/Logos as the source of the world's rationality in ToS_H are also not surprising (see Kaiser 2007, pp. 44–45; Heller 2008). Thus, Kaiser's and Heller's frequent references to quotes from physicists such as Einstein, Hawking, and Paul Davies, for whom the discovery of the so-called ultimate theory (or the theory of everything) is at the same time a discovery of God's thought as it is encoded in the natural world. Thus, the ancient idea of exemplarism, despite being unnamed, has become one of the main threads of modern theological reflection on scientific activity.[21]

With regard to the views of Kaiser and Heller, it should again be made clear that the object of their interest was not the religious beliefs (in the confessional sense) of Einstein or Hawking, but the question whether "the thoughts of [these] physicists about their own endeavors can serve as a 'sacred reminder' for Christians" (Kaiser 2024, p. 367). For Kaiser, such a "sacred reminder" is, for example, the realization in the world of certain laws of nature (describable in the language of mathematics) that reflect God's creative purpose. As is well known, God in this case was conceptualized by Einstein and Hawking not as the Holy Trinity in Christianity or Allah in Islam, but as a more unspecified rational "ultimate instance". Heller and Kaiser gave this "sacred reminder" interpretation a Christological one, and Kaiser even a pneumatological one. Only such an interpretation can be compared with the concept of Christological exemplarism shown by Bonaventure in *De reductione*.

Analyses by modern theologians rarely refer to *De reductione*. This does not mean, however, that there are missing references to the metaphysical idea of exemplarism and the theological idea of the Son–Word as the first Exemplar, based on Bonaventure's other works such as *Itenerarium mentis in Deum*, *Breviloquium*, and the already mentioned *Collationes in Hexaëmeron*. These works do not address the question of the determinants of the existence of science, which is taken up by ToS_H, ToS_K, and ToS_M. However, they do not lack attempts to

reflect, in the light of the Bonaventurian idea of theological exemplarism, on such scientific questions as the evolution of life on Earth or ecology (cf. Edwards 1999, pp. 121–23; 2020, pp. 239–42; Lee 2020). It seems that these works, despite their different perspective, can also provide some inspiration for researchers in the theology of science.[22]

4.3. Reduction: "A Theological Teleology of Science"

As it turns out, the idea of reduction (reductio) in Bonaventure's *De reductione* has nothing to do with the methodological or linguistic reduction of scientific disciplines to theology. Instead, it is rather about something very deeply rooted in Christian thought. Reductio, which means leading back, in relation to the dimensions of the human knowledge selected and discussed in this article, means discovering through philosophia naturalis the formal principles of things that are reflections of divine ideas and through mechanical arts, the hidden intention of the divine craftsman. It is thus a reduction of worldly knowledge to the knowledge of God, which is directly referred to under the light of Scripture. For Bonaventure, reduction also has a soteriological dimension. It is not merely reduced to knowledge, but it is primarily aimed at showing humanity a way back to the Father and to salvific fulfillment (consummatio).

On the cognitive level, the meaning of Bonaventure's reductio is close to Heller's reflections on the idea of (non-Kantian) a priori assumptions of scientific research developed by Karl Rahner. According to the German theologian, "God is not the final hypothesis that results from the sketching of a rounded picture of the world; on the contrary, he is the single thesis that is posited with every hypothesis with which we build up our picture of the world" (Rahner 1967, p. 388). Heller, however, is more cautious than Rahner because of his involvement in physics and cosmology and his experience conducting science. Heller believes that the existence of God does not necessarily follow immediately from the a priori assumptions of science, such as the rational investigability of nature or its mathematizability. According to Heller, only "a certain interpretation of the *a priori* assumptions leads to theism" (Heller 1986, p. 112). It seems that these assumptions can also be regarded as "sacred reminders" in the sense of Kaiser.

From a theological point of view, McLeish has approached the topic of reduction in a more fundamental, soteriological sense. Through an axiological and teleological orientation, he assigned to his ToS_M a primarily servant role in accordance with the Apostle Paul's message of the "ministry of reconciliation". Reconciliation is primarily concerned with man's relationship to nature, but it also applies to science and technology as practiced by man. A sermon echoes from McLeish's message (physicist Tom McLeish was also an Anglican preacher), just as Bonaventure's sermon echoed from his *De reductione* seven centuries earlier. In both cases, the truth about the fallen nature of humanity—who by its own powers, including intellectual ones, will not be able to draw conclusions about its goals from secular knowledge alone—found its place.

4.4. Theology of the Mechanical Arts

One of the most spectacular themes in *De reductione*, one that is rarely (if ever) discussed by contemporary commentators, is Bonaventure's quite unique incorporation of the mechanical arts of the 13th century into his theological vision. From antiquity through to the Middle Ages and then the Renaissance, the mechanical arts received little attention from philosophers, let alone theologians (cf. Whitney 1990; Ovitt 1987, pp. 107–36). In Bonaventure's case, however, they were incorporated into his concept of light and played an important role in deepening his understanding of the ideas of divine exemplarism and reduction.

If it can today be said of the theological vision of the arts that Bonaventure presents in *De reductione* that it is a kind of theology of science, by analogy with contemporary realities, then nothing should stand in the way of defining his view of the mechanical arts as a kind of theology of technology. Despite the seven centuries that separate us from this view, it seems that theologians and scientists alike can still draw more than a little invigorating inspiration from it, in keeping with Bonaventure's ever-present message in the concluding paragraph of his *De reductione*: "it is evident how the *manifold wisdom of God*, which is clearly revealed in sacred Scripture, lies hidden in all knowledge and in all nature" (*Red. art*. 26, author's italics; Bonaventure 1996, p. 61).[23]

The postulated theological dimension associated with the production and use of technology and technological processes remains the same whether it is 13th-century or 21st-century technologies Both John Scotus (Eriugena) (c. 800–c. 877) and Hugh of St. Victor "linked the mechanical as well as the liberal arts directly to salvation and restoration of fallen man" (Whitney 1990, p. 73). This is also one of the ideas present in Bonaventure's *De reductione*. The treatment of modern technology and the human labor it supports as a possible path to liberation and salvation in Jesus Christ the carpenter–artisan (Mark 6:2) is still valid today (cf. Chenu 1960), even if today, the view of the enslavement of human beings by large-scale technologies prevails.

Today's strong connection, even interpenetration, between science and technology, expressed, for example, in the introduction of concepts such as technoscience, indicates that Bonaventure's intuition to link the theology of science with the theology of technology seems to be a message that could be worth taking up.

5. Conclusions

In a discussion between Smedes and Barbour in the pages of the *Zygon* periodical, the former charged Barbour's paradigm of science–religion relations with a clear shift in emphasis regarding these relations to the side of science, including the charge of treating science as the sole source of rationality, affirming "cultural scientism", and the implicitly implementing the neo-positivist demand for a unification of science and religion (Smedes 2008a, p. 237). Regardless of the validity of these accusations, a striking feature of the new proposals to develop a theology of science by Heller, Kaiser, and McLeish is the clearly visible shift in emphasis toward theology. This is a natural feature of the variants of theology of science discussed here, regardless of the particular denominational affiliation represented by these authors, although all three were Christian.

When Smedes spoke of "cultural scientism", he explained that he meant "a cultural mode of thinking" prevalent in modern highly developed societies (Smedes 2008a, p. 242), which expresses a strong faith in science and its associated rationality. The extreme expression of this faith was the neo-positivist program of unifying knowledge, which collapsed in the mid-20th century. Nevertheless, according to Smedes, "cultural scientism" persists, and it has also influenced perceptions of the relationship between science and religion. It seems that Smedes' expression, "a cultural way of thinking", can also be applied to the social mentality of medieval people, which at that time was predominantly theocentrism and a particular kind of rationality of the Christian faith. Not surprisingly, theology, as regina scientiarum, had a superior cognitive role to other types of knowledge. In the case of Bonaventure's concept of reductio, however, this was not a unification in the style of 20th-century neo-positivists with the chauvinistic attitude of theology toward the artes. The goal of Bonaventure's unification was, first and foremost, to obtain the wisdom to tap into the deepest, salvific purposes of human life. Thus, the guiding idea of *De reductione* reflected the pursuit of Christian paideia in Augustine's sense (cf. Cullen 2013, p. 137; Bougerol 1964, p. 163). The theology of science, or, pluralistically conceived, theologies of

science, can draw on Bonaventurian inspirations, with theology not being a discipline that subordinates anything, including other sciences, but rather a benevolent complement to them, especially in times of supposedly dominant "cultural scientism".

In the contemporary proposals presented, science is a source of theological reflection, although, as we have shown, views on how this can be achieved vary. This does not indicate that any of the approaches is wrong. Indeed, they are complementary while sometimes moving in a similar direction, since science as a *locus theologicus* gives rise to many strands of theological reflection. We therefore see the proposals of Heller, Kaiser, and McLeish as complementary rather than competitive. Against this background, we can better understand Bonaventure's medieval intuitions. Although the sciences were still in an embryonic stage, the fundamental questions concerning the relationship between faith and knowledge and the relationship of the believer to the natural world created by God were already apparent to the insightful theologian.

Modern conceptions of theology of science turn out to be strongly rooted in the tradition of pre-Thomistic theology. Bonaventure's work, when one looks at his basic theological concepts and intuitions, turns out to be a surprisingly good guide for developing a contemporary theology of science. Bonaventure's vision does not juxtapose science and theology but rather inscribes them in an organic whole of human existence, and this is an important reminder for us. Bonaventure points out that dialogue is more important than a relationship of subordination between different spheres of human activity. This vision of dialogue as a new welding together of the various, very different spheres of human activity seems more promising than the vision of feudal subordination and strict dependence.[24] Not surprisingly, modern ToS proposals were developed in a climate of dialogue, so they are also critical of the previous institutionalized way of thinking in theology (Heller 1996b, pp. 16–17). Reading the modern proposals in the light of Bonaventure's work, we see them as an attempt to free theology from the traps it has created for itself in the course of its historical development. This perspective makes us realize that instead of seeking a vague "cultural revolution" in theology, a return to the sources with an open mind can have great liberating power.

Bonaventure's approach also shows that a theology built on Thomism, despite its great value, fails to capture some important theological intuitions. His work demonstrates the value of pluralism, for it seems that truth is too complex and sophisticated to be fully expressed within a single system. The revealing validity of Bonaventure's ideas suggests that the pluralism of an approach is an important value that belongs to the heritage of Catholic theology. Reading Bonaventure in the context of today's consideration of science as a *locus theologicus* reminds us once again of Hans Urs von Balthasar's insight that the Truth is symphonic.

Author Contributions: Conceptualization, J.R. (Bonaventure) and P.P. (modern approaches); methodology, J.R. and P.P.; writing—original draft preparation, J.R. and P.P. (additions); writing—review and editing, J.R. and P.P.; supervision, J.R. and P.P.; project administration, J.R. and P.P. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: This study does not involve human subjects.

Data Availability Statement: No data are associated with this paper.

Acknowledgments: We would also like to thank the anonymous reviewers for their valuable comments and inspiration for further research.

Conflicts of Interest: The authors declare no conflicts of interest.

Abbreviations

Hex.	*Collationes in Hexaëmeron*
Red. art.	*De reductione artium ad theologiam*
Itin.	*Itinerarium mentis in Deum*
Scien. Chr.	*Quaestio disputata de scientia Christi*

Notes

1 One of the most thought-provoking discussions of the science–religion paradigm initiated by Barbour in the 1960s was an exchange between the Dutch theologian and philosopher of religion Taede Smedes and Barbour himself (Smedes 2008a, 2008b; Barbour 2008).

2 The concept of "science-engaged theology" (SET) was initiated by the work of John Perry, Sarah L. Ritchie, and Joanna Leidenhag (Perry and Ritchie 2018; Perry and Leidenhag 2023). We will not refer to this new project here. In Mikael Leidenhag's brief presentation of it, "SET is characterized as a 'reminder' or 'mindset' according to which the products and tools of the sciences should be sources for theological reflection and reasoning in order to improve our claims about the empirical world" (Leidenhag 2024, p. 9). As can be seen from this brief description, this project treats science as a *locus theologicus*.

3 Kaiser's 1996 article also includes a critical discussion of one of Barbour's typologies of science–religion relations (Kaiser 1996, pp. 224–28).

4 The question of the fact of the existence of science concerns not only the conditions of the historical genesis of science, but above all its continued existence, its effectiveness, and cognitive successes, especially in the last three centuries.

5 In recent years, Heller has sought to develop the idea of the "Mind of God" in a Christological perspective. In this perspective, the mathematical–empirical sciences discover not only the Creator's design in the world, but also the active presence in it of the Logos/Word, identified with the divine Word in the prologue of the fourth Gospel (John 1:3) (Heller 2015, p. 21; 2018).

6 The term "Judeo-Christian theology" used by Kaiser is not strictly correct, primarily because of the significant doctrinal differences between Jewish theology and Christian theology (including the various denominations within Christianity itself). It is possible, however, to speak in a broader sense of a common Judeo–Christian tradition, especially with regard to the message of the Hebrew Bible (or for Christians, the Old Testament).

7 Kaiser had already referred to the same quote from Hawking's work in his 2007 book and asked the question, "Who actualizes lawfulness?" (Kaiser 2007, pp. 28–29). At that time, however, he did not refer his answer to the person of the Holy Spirit.

8 According to McLeish, the combination of Aristotle's genetic empiricism with illuminism of Neoplatonic and Augustinian origin "suggests a theological motivation for the novel combination of experiment and mathematics implied in his scientific works—in every case, it is at the meeting point of observed phenomena and mathematical reasoning that understanding is born" (McLeish 2019, p. 40). This view of McLeish is close to the so-called Crombie thesis, which was put forward in the 1950s by the Australian–English historian of science Alistair C. Crombie. According to this thesis, both Grosseteste and Roger Bacon laid the foundations of the mathematical–empirical method as early as the 13th century and were forerunners of the future scientific revolution. For criticism of this thesis, see, for example, (Cohen 1994, pp. 105–7).

9 Research by Joshua C. Benson has shown that the *De reductione* was probably a kind of inaugural sermon given by Bonaventure as Master of Theology at the University of Paris in 1254. Until this research, the only version of the *De reductione* was considered to be the one published in 1891 by the Collegium Sancti Bonaventurae in Quaracchi, Italy (1882–1902) and more recently disseminated mainly in an English-language translation by Zachary Hayes (1996). In the early 2000s, on the basis of a 14th-century manuscript in the Vatican Library, Benson identified an earlier version of the contents of *De Reductione*, presumably also delivered by Bonaventure but under a different name (*Omnium artifex docuit me sapientia*), with only the first paragraph changed (cf. Smith 2021, p. 252; Levri 2015). In the widely known version of the Quaracchi edition, the paragraph refers to the biblical passage James 1:17, and in the version identified by Benson to Wisdom 7:21.

10 Bonaventure's activities as a preacher, lecturer, and writer took place during a very turbulent period of the gradual reception of Aristotle's philosophical and naturalistic works in the European universities. As is well known, in the 13th century, there was no instant and widespread acceptance of the introduction into the universities of that time of the teachings of Aristotle, which were treated as pagan and even heretical (this is evidenced, for example, by a series of condemnations by the local bishops of the time) in relation to the interpretation of Christian doctrine (doctrina Christiana) inherited from earlier centuries. It was a centuries-old construct whose essential elements were the Platonic and Neoplatonic worldview inherited from the patristic era and based largely on the philosophical and theological legacy of Augustine of Hippo, Christian wisdom (Wildiers 1982; Van Steenberghen 1955). Having grown up in the tradition of Francis of Assisi and with a particular reverence for Augustine's theology, Bonaventure sought in his works to preserve as much as possible the achievements of these traditions, with some consideration of new elements also related to Aristotle's philosophy (cf. Schloser 2014).

11 As Cullen states: "In Bonaventure's theory, light is the first form and disposes matter to the recepction of any other form that is" (Cullen 2006, p. 48). Thus, in the creation–ontological sense, light is a kind of primordial form (forma communis) that is essentially related to the matter created by God. The species of bodies, on the other hand, have special forms (formae speciales) that constitute their distinctiveness. It is worth noting certain parallels between the Bonaventurian concept of light as forma communis and Heller's concept of the *formal field*, which in turn refers to Joseph M. Życiński's idea of the *field of rationality*. In short, both concepts involve, among other things, the distinction between the world of potentialities (e.g., mathematical structures) and our real world, in which only some of them are actualized (and gradually discovered by us) (on Heller's concept of the *formal field*, cf. Grygiel 2022).

12 Speaking of the process of the return of all creation, including man, to the divine source, Bonaventure does not overlook the significance of the fall of man in *De reductione*. Along with the sinfulness of human nature, the Fall also affected man's cognitive capacity in relation to the world and God, and "had dimmed the eye of contemplation". Therefore, for Bonaventure, "it was most fitting that the eternal and invisible should become visible and assume flesh in order to lead us back to God (*ut nos ad Patrem reduceret*)" (*Red. art.* 12; Bonaventure 1996, p. 51).

13 The inclusion of the seven mechanical arts among the philosophical disciplines by Hugh of St. Victor and their symbolic introduction (by analogy with the seven liberal arts) into academic discourse in Paris by Bonaventure was an expression of the theological ennoblement of technical skills and crafts on a scale unknown before or since, until the Renaissance, when there was a qualitatively new growth of not only theoretical but above all practical interest in the technologies of the time (cf. Whitney 1990).

14 Although Bonaventure does not explicitly list the disciplines belonging to the university quadrivium (arithmetic, music, geometry, and astronomy), they seem to fall under the common name of "mathematics" (cf. Smith 2021, p. 265).

15 Hayes' translation of the word egressus as "production" (Bonaventure 1996, p. 49) somewhat obscures the essence of this process, which more accurately means "going out". It refers to "going out" from the mind of the artisan's idea to his external work. The theological analogy here refers to the eternal egressus of the divine Word from the mind of the Father (Smith 2021, p. 274).

16 In *Collationes in Hexaëmeron*, Bonaventure compares creation to a sculpture that reflects the wisdom of God: "nothing less than a kind of representation (*simulacrum*) of the wisdom of God, and a kind of sculpture (*quoddam sculptile*)" (*Hex.*, 12, 14; cited in Edwards 2020, p. 239). The contemporary editor and translator of the *Collationes*, Jay Hammond, dubiously translated the phrase quoddam sculptile as "like a kind of figure (*simulacrum*)", inserting the word simulacrum repeatedly and erroneously in the same sentence (Bonaventure 2018, p. 267).

17 The seminal principles were a concept of Stoic–Augustinian origin. They introduced, in Bonaventure's view, the element of potentiality of nature in the creation within it of differentiated entities with different forms (Bonaventure did not accept Aristotle's hylemorphism in its pure form, but he held the view that a multiplicity of forms existed even in the same thing).

18 In a relatively loose reference to the idea of illuminatio, some authors credit Bonaventure with the concept of so-called contuition (cf. Bowman 1975, pp. 197–98). This concept refers to the possibility of a person simultaneously knowing the form of a given body (e.g., a tree, a flower) and its creative Source. It also concerns the concept of the ultimate meaning and purpose of a given created thing.

19 In Heller's view, the limitations of the scientific method, especially the limitations imposed by mathematical methods, concern such questions as the existence of science itself, the ontological rationality of the world and the rationality of its knowledge, and the existence of values. In particular, on the other hand, the need to go beyond these limits does not in any way replace the postulation of theological explanations in place of the provisional cognitive (explanatory) limits of these or other scientific theories. In the latter case, we would be dealing with the introduction of the classical methodological error of the God of the gaps.

20 This is, in fact, an understanding close to the ideas of Aquinas (especially in his *Quaestiones Disputatae de Veritate*, q. 20), who does not recognize Bonaventure's concept of light and illumination. According to Aquinas, the human intellect has the imprint of God's truth and does not need special light to know with certainty the structures of the created world (Cullen 2006, pp. 86–87).

21 Giuseppe Tanzella-Nitti has recently pointed out that Bonaventure mentions a third book in addition to Scripture and the Book of Nature, which is Christ himself. This idea can be found, for example, in Bonaventure's *Sermones de Tempore, Feria VI in Parasceve*, sermon II, n. II: "Christ himself is this book of wisdom, who is written inside by the Father, as he comes from the power of God, and outside, when he took on a bodily form. However, this book was open on the cross, and it is this book that we have to read in order to understand the depths of God's wisdom" (cit. after Tanzella-Nitti 2005, p. 240).

22 Such inspiration can be found, for example, in Bonaventure's attribution of special significance to numbers in exemplary causality. In the *Itinerarium mentis in Deum*, Bonaventure assumes that beauty and pleasure in God cannot exist without proportion, and since proportion originally exists in numbers, "all things are subject to number. Hence number is the principal model in the mind of the Creator" (*Itin.*, 2, 10; Bonaventure 1956, p. 59). We will not elaborate on this theme here, including Bonaventure's borrowings from the Biblical *Book of Wisdom* and from the writings of Boethius (on this topic, see Wedell 2015, p. 1255). However, it is worth mentioning here that the question of the mathematicality of reality has become a *locus theologicus* in the case of Heller and his ToSH (Trombik 2025).

[23] Undoubtedly, the differences between mechanical arts and contemporary technological systems are obvious in many respects. On the other hand, we should not forget the continuity of the development of ancient technical solutions and modern technologies based on highly specialized knowledge. A similar continuity applies to the impact of medieval development technologies (agricultural technology, power technologies, textile production, shipbuilding, architecture, etc.) and modern technologies on social and economic life. Ovitt, for example, even writes of a "small-scale 'industrial revolution' [. . .] during the twelfth and thirteenth centuries" (Ovitt 2013, p. 636). One might be tempted to use a working, if debatable, unifying term for technology, encompassing the mechanical arts and later including contemporary technologies: diverse means of human assistance of individual, social, and global scope, based on the transformation of matter, energy, and information.

[24] Although it seems that the aforementioned remarks of Taede Smedes (2008a, 2008b) against the Barbourian account of the science–religion relationship cannot be taken as a clear signal suggesting the existence of a certain subordination of theology to modern science, such a threat always remains a possibility.

References

Barbour, Ian G. 2008. Taking Science Seriously without Scientism: A Response to Taede Smedes. *Zygon: Journal of Religion and Science* 43: 259–69. [CrossRef]

Benson, Joshua. 2009. Identifying the Literary Genre of *De reductione artium ad theologiam*: Bonaventure's Inaugural Lecture at Paris. *Franciscan Studies* 67: 149–78. [CrossRef]

Benson, Joshua. 2011. Bonaventure's *De reductione artium ad theologiam* and Its Early Reception as an Inaugural Sermon. *American Catholic Philosophical Quarterly* 85: 7–24. [CrossRef]

Bonaventure. 1956. *Itinerarium Mentis in Deum*. Edited by O. F. M. Philotheus Boehner and S. M. I. C. Mary Francies Laughlin. St. Bonaventure: The Franciscan Institute of St. Bonaventure University.

Bonaventure. 1992. *Disputed Questions on the Knowledge of Christ*. Edited by Zachary Hayes. St. Bonaventure: The Franciscan Institute of St. Bonaventure University.

Bonaventure. 1996. *On the Reduction of the Arts to Theology*. Edited by Zachary Hayes. St. Bonaventure: The Franciscan Institute of St. Bonaventure University.

Bonaventure. 2018. *Collations on the Hexaemeron*. Edited by Jay M. Hammond. St. Bonaventure: The Franciscan Institute of St. Bonaventure University.

Bougerol, Jacques Guy. 1964. *Introduction to the Works of Bonaventure*. Translated by José de Vinck. Paris, New York and Rome: St. Anthony Guild Press.

Boulding, Jamie. 2024. Seeing God in Nature: Rethinking Bonaventure after Evolutionary Biology. In *God and the Book of Nature Experiments in Theology of Science*. Edited by Mark Harris. London: Routledge, pp. 99–111.

Bowman, Leonard J. 1975. The Cosmic Exemplarism of Bonaventure. *The Journal of Religion* 55: 181–98. [CrossRef]

Chenu, Marie-Dominique. 1960. Vers une théologie de la technique. In *La Technique et l'Homme*. Edited by Jean-Yves Eichenberger, Louis Chevallier and Marie-Dominique Chenu. Paris: Arthème Fayard, pp. 157–66.

Cohen, H. Floris. 1994. *The Scientific Revolution: A Historiographical Inquiry*. Chicago: The University of Chicago Press.

Cullen, Christopher M. 2006. *Bonaventure*. Oxford: Oxford University Press.

Cullen, Christopher M. 2013. Bonaventure's Philosophical Method. In *A Companion to Bonaventure*. Edited by Jay M. Hammond, J. A. Wayne Hellmann and Jared Goff. Leiden: Brill, pp. 121–63.

Dubarle, Dominique. 1967. *Approches d'une Théologie de la Science*. Paris: Cerf.

Edwards, Denis. 1999. *The God of Evolution: A Trinitarian Theology*. New York: Paulist Press.

Edwards, Denis. 2020. The Relationship Between Risen Christ and the Material Universe. In *Denis Edwards in His Own Words. A Selection of Writings 1976 to 2019*. Edited by Anthony Kain and Hilary Regan. Adelaide: ATF Theology, pp. 231–44.

Grant, Edward. 1996. *The Foundations of Modern Science in the Middle Ages: Their Religious, Institutional, and Intellectual Contexts*. Cambridge: Cambridge University Press.

Grygiel, Wojciech P. 2022. A critical analysis of the philosophical motivations and development of the concept of the field of rationality as a representation of the fundamental ontology of the physical reality. *Philosophical Problems in Science (Zagadnienia Filozoficzne w Nauce)* 72: 87–108.

Harris, Mark. 2024a. A Scientist-Theologian's Perspective on Science-Engaged Theology: The Case for "Theology of Science" as a Sub-discipline within Science and Religion. In *God and the Book of Nature Experiments in Theology of Science*. Edited by Mark Harris. London: Routledge, pp. 13–39.

Harris, Mark. 2024b. Introduction. In *God and the Book of Nature Experiments in Theology of Science*. Edited by Mark Harris. London: Routledge, pp. 1–10.

Harrison, Peter. 2023. Naturalism and the Categories "Science" and "Religion": A Response to Josh Reeves. *Zygon: Journal of Religion and Science* 58: 98–108. [CrossRef]

Hattrup, Dieter. 1997. Bonaventura zwischen Mystik und Mystifikation. Wer ist der Autor von *De reductione*? *Theologie und Glaube* 87: 541–62.
Hayes, Zachary. 1996. Commentary on the Text. In *On the Reduction of the Arts to Theology*. Edited by Zachary Hayes. St. Bonaventure: The Franciscan Institute of St. Bonaventure University.
Heller, Michael. 1982. Stworzenie a ewolucja. *Communio* 10: 58–66.
Heller, Michael. 1986. *The World and the Word. Between Science and Religion*. Translated by Adam Chester Kisiel. Tucson: Pachart Publishing House.
Heller, Michael. 1996a. A Program for Theology of Science. *Studies in Science and Theology* 4: 41–44.
Heller, Michael. 1996b. *The New Physics and a New Theology*. Vatican City: Vatican Observatory Publications.
Heller, Michael. 2008. Deciphering the Mind of God. *First Things*. Available online: https://www.firstthings.com/web-exclusives/2008/03/deciphering-the-mind-of-god (accessed on 8 January 2025).
Heller, Michael. 2015. Wstęp do teologii nauki. In *Teologia nauki*. Edited by Janusz Mączka and Piotr Urbańczyk. Kraków: Copernicus Center Press, pp. 13–22.
Heller, Michael. 2018. *Ważniejsze niż Wszechświat*. Kraków: Copernicus Center Press.
Heller, Michael. 2019. *Nauka i teologia: Niekoniecznie tylko na jednej planecie*. Kraków: Copernicus Center Press.
Hołda, Miłosz. 2023. "Revelatio absconditorum": On the Possible Contribution of Saint Bonaventure to the Contemporary Philosophical Discussion on Divine Hiddennes. *Roczniki Filozoficzne* 71: 185–207. [CrossRef]
Hugh of the St. Victor. 1991. *Didascalicon*. Edited by Jerome Taylor. New York: Columbia University Press.
Kaiser, Christopher B. 1996. Scientific Work and Its Theological Dimensions: Toward a Theology of Natural Science. In *Facets of Faith and Science*. Edited by Jitse Van der Meer. Lanham: University Press of America, vol. 1, pp. 223–46.
Kaiser, Christopher B. 2007. *Toward a Theology of Scientific Endeavour: The Descent of Science*. London: Routledge.
Kaiser, Christopher B. 2024. The Agencies of God's Word and Spirit: Modern Science as a "Sacred Reminder". *Religions* 15: 367. [CrossRef]
Lee, Dahan. 2020. The Ecological Meaning of St. Bonaventure's Theology of the Created World. Ph.D. thesis, Australian Catholic University, Melbourne, Austrialia.
Leidenhag, Mikael. 2024. Can There Be an Apophatic Science-Engaged Theology? *Theology and Science*. Available online: https://www.tandfonline.com/doi/full/10.1080/14746700.2024.2436777#abstract (accessed on 8 January 2025). [CrossRef]
Levri, Catherine A. 2015. *Omnium Artifex Docuit Me Sapientia*: A Study of Bonaventure's Inaugural Sermon. Ph.D. thesis, The Catholic University of America, Washington, DC, USA.
Lococo, Donald J. 2002. *Towards a Theology of Science*. Ottawa: Novalis-Saint Paul University.
Macek, Wiesław M. 2010. *Teologia nauki według księdza Michała Hellera*. Warszawa: Wydawnictwo Uniwersytetu Kardynała Stefana Wyszyńskiego.
Macek, Wiesław M. 2011. Teologia nauki. In *Oblicza racjonalności: Wokół myśli Michała Hellera*. Edited by Bartosz Brożek, Janusz Mączka, Wojciech P. Grygiel and Michał L. Hohol. Kraków: Copernicus Center Press–Konsorcjum Akademickie Wydawnictwo, pp. 203–38.
Mączka, Janusz, and Piotr Urbańczyk, eds. 2015. *Teologia nauki*. Kraków: Copernicus Center Press.
Mantini, Alessandro. 2024. *A Franciscan Theological-Metaphysical Foundation of Emergence: Theology and Science in an Enriching Dialogue*. Cham: Springer.
Marcacci, Flavia, and Michal Oleksowicz. 2023. The World as a Gift: Scientific Change and Intelligibility for a Theology of Science. *Religions* 14: 572. [CrossRef]
McLeish, Tom C. B. 2014. *Faith and Wisdom in Science*. Oxford: Oxford University Press.
McLeish, Tom C. B. 2019. Beyond Barbour: A Theology of Science from Ancient and Modern Thinkers. In *Science and Religion in Education*. Edited by Berry Billingsley, Keith Chappell and Michael J. Reiss. Cham: Springer, pp. 33–45.
Ovitt, George, Jr. 1987. *The Restoration of Perfection: Labor and Technology in Medieval Culture*. New Brunswick: Rutgers University Press.
Ovitt, George, Jr. 2013. Technology and Science. In *The Cambridge History of Science: Medieval Science*. Edited by David C. Lindberg and Michael H. Shank. Cambridge: Cambridge University Press, vol. 2, pp. 630–44.
Perry, John, and Joanna Leidenhag. 2023. *Science-Engaged Theology*. Cambridge: Cambridge University Press.
Perry, John, and Sarah Lane Ritchie. 2018. Magnets, Magic, and Other Anomalies: In Defense of Methodological Naturalism. *Zygon: Journal of Religion and Science* 53: 1064–93. [CrossRef]
Polak, Paweł, and Jacek Rodzeń. 2023. The Theory of Relativity and Theology: The Neo-Thomist Science–Theology Separation vs. Michael Heller's Path to Dialogue. *Theology and Science* 21: 157–74. [CrossRef]
Rahner, Karl. 1967. Science as a "Confession"? In *Theological Investigations*. Translated by Karl-H. Kruger, and Boniface Kruger. London: Darton, Longman & Todd, vol. 3, pp. 385–400.
Reeves, Josh A. 2023. A Defense of Science and Religion: Reflections on Peter Harrison's "After Science and Religion" Project. *Zygon: Journal of Religion and Science* 58: 79–97. [CrossRef]

Schloser, Marianne. 2014. Bonaventure: Life and Works. In *A Companion to Bonaventure*. Edited by Jay M. Hammond, J. A. Wayne Hellmann and Jared Goff. Leiden: Brill, pp. 9–59.
Sierotowicz, Tadeusz. 2023. Theology of Science: Its Collocation and Critical Role for Understanding of Limits of Theological and Scientific Investigations. *Philosophical Problems in Science (Zagadnienia Filozoficzne w Nauce)* 75: 211–31. [CrossRef]
Sierotowicz, Tadeusz. 2024. Theology of Science as an Intertextual Reading: The Bible, the Book of Nature, and Narrative Paradigm. *Religions* 15: 293. [CrossRef]
Smedes, Taede A. 2008a. Beyond Barbour or Back to Basics? The Future of Science-and-Religion and the Quest for Unity. *Zygon: Journal of Religion and Science* 43: 235–58. [CrossRef]
Smedes, Taede A. 2008b. Taking Theology and Science Seriously without Category Mistakes: A Response to Ian Barbour. *Zygon: Journal of Religion and Science* 43: 271–76. [CrossRef]
Smith, Randall B. 2021. *Aquinas, Bonaventure, and the Scholastic Culture of Medieval Paris*. Cambridge: Cambridge University Press.
Tanzella-Nitti, Giuseppe. 2005. The Two Books Prior to the Scientific Revolution. *Perspectives on Science and Christian Faith* 57: 235–48.
Trombik, Kamil. 2025. The Idea of Mathematicity of the Universe as a *Locus Theologicus*: Michael Heller and Representatives of "The Kraków School of Philosophy in Science". *Religions* 16: 54. [CrossRef]
Tyson, Paul. 2022. *A Christian Theology of Science: Reimagining a Theological Vision of Natural Knowledge*. Grand Rapids: Baker Academic.
Van Steenberghen, Fernand. 1955. *The Philosophical Movement in the Thirteenth Century*. Edinburgh: Nelson.
Wedell, Moritz. 2015. Numbers. In *Handbook of Medieval Culture*. Edited by Albrecht Classen. Berlin: De Gruyter, vol. 2, pp. 1205–60.
Whitney, Elspeth. 1990. *Paradise Restored: The Mechanical Arts from Antiquity Through the Thirteenth Century*. Philadelphia: The American Philosophical Society.
Wildiers, Norbert Max. 1982. *The Theologian and His Universe. Theology and Cosmology from the Middle Ages to the Present*. New York: The Seabury Press.
Życiński, Józef. 1984. W poszukiwaniu teologii nauki. In *Nauka–religia–dzieje: II Seminarium Interdyscyplinarne w Castel Gandolfo, 6–9 września 1982 roku*. Edited by Jerzy A. Janik and Piotr Lenartowicz. Kraków: Wydział Filozoficzny Towarzystwa Jezusowego, pp. 80–85.

Disclaimer/Publisher's Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.

MDPI AG
Grosspeteranlage 5
4052 Basel
Switzerland
Tel.: +41 61 683 77 34

Religions Editorial Office
E-mail: religions@mdpi.com
www.mdpi.com/journal/religions

Disclaimer/Publisher's Note: The title and front matter of this reprint are at the discretion of the Guest Editors. The publisher is not responsible for their content or any associated concerns. The statements, opinions and data contained in all individual articles are solely those of the individual Editors and contributors and not of MDPI. MDPI disclaims responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.

Academic Open
Access Publishing

mdpi.com

ISBN 978-3-7258-6225-2