PERSPECTIVES on Science and Christian Faith

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In This Issue …

"The fear of the Lord
is the beginning of Wisdom."
Psalm 111:10

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James C. Peterson

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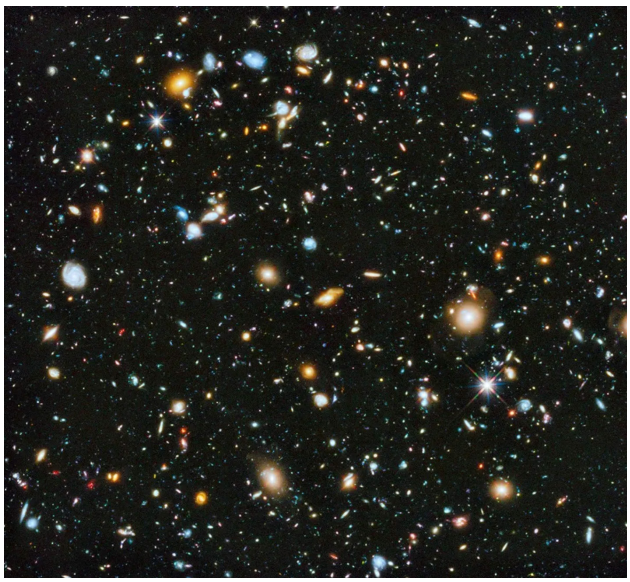
One Dot to Another

It is clear that I am just one person out of eight billion people on our planet today. And that when one sees a picture of the earth passing before the sun, the earth appears as a barely visible dot. And for that matter, our massive and explosive sun that dwarfs our planet, is just one star out of 100 billion stars in our Milky Way Galaxy. There are twelve times as many stars in our galaxy as there are people on our planet, so in a picture of our galaxy as a whole, our mighty sun presents as just a dot too. And our Milky Way Galaxy as a whole is just one galaxy out of two trillion galaxies that we are aware of so far. So I am a dot, on a dot, circling but a dot, that is one dot out of 100 billion dots, that all combined together are just one dot out of two trillion dots.

It is a wonder that God knows our Milky Way galaxy exists, let alone our sun within it, and our planet revolving around that sun, and me on that planet. I am like one grain of sand on Grand Cayman's Seven Mile Beach. Yet we are told that God knows my name, indeed how many hairs are on my head. I do not know the count of my hairs, granted such a count gets easier every passing year. God is not only the creator of seemingly infinite astronomical distances, but also of infinitesimal detail. God knows within me my thirty trillion cells, and the three billion base pairs of my personal DNA copied in a complete set, inside each of my nucleated cells.



The Hubble Ultra Deep Field 2014 image is a composite of separate exposures taken by the telescope from 2002 to 2012.

NASA, ESA, H. Teplitz and M. Rafelski (IPAC/Caltech); A. Koekemoer (STScI), R. Windhorst (Arizona State University) and Z. Levay (STScI), https://science.nasa.gov/mission/hubble/science/universe-uncovered/hubble-deep-fields/.

Thanks to Gerd Altmann via Pixabay, https://pixabay.com/illustrations/dna-analysis-research-3539309/.

The one God, at once vast in distance and detail, remarkably not only knows that we exist, but also cares about us enough to be with us. Such is what we celebrate at Christmas, that God the Creator knows us and who we are, better than we know ourselves, and yet cares about us enough to come live among us. When we meet Jesus of Nazareth, born in Bethlehem, we meet God the Creator, face to face.

For this December issue, one dot to another, miniscule and treasured,

Merry Christmas!

James C. Peterson
Editor-in-Chief

ASA 2024 Call for Abstracts

One Body, Many Gifts:
The Diversity of Divine and Human Endeavor

Program Chairs Mike Beidler and Sy Garte invite you to participate in the 2024 ASA Annual Meeting on July 26–29, 2024, at The Catholic University of America (CUA) in Washington, DC. Check our website frequently, asa3.org, for meeting information updates.

The theme for ASA 2024 is "One Body, Many Gifts: The Diversity of Divine and Human Endeavor." Participants will have the opportunity to learn and dialogue on multiple science and faith issues related to the concept of diversity. Diversity takes many forms: ethnicity, national origin, Christian denomination, gender, age group, scientific field, metaphysical paradigm, ecology, etc. The theme highlights the ASA's broad tent and focuses on

1. interpreting and understanding diversity in all of its forms and scales—cosmic, terrestrial, social, genetic—and its implications for our lives as people of faith,
2. working together despite our differences and leveraging those differences to seek broader and wider influence within both the church and the scientific community to grow God's kingdom, and
3. promoting a climate within our personal spheres of professional influence to increase access and development for groups underrepresented in the sciences.

Meeting registrants are invited to contribute oral or poster presentations along several parallel session tracks on a range of topics at the intersection of science and faith: physical sciences, life sciences, environmental sciences, social and psychological sciences, theological perspectives, and engineering and technology.

You may propose an abstract as either a *20-minute oral presentation* (plus 5-minute Q&A) on an important topic in the science-faith dialogue, or a *conference-style poster* for viewing and presentation. The poster should include scientific data and analysis as well as discussion about its theological significance.

The annual meeting's planning committee will evaluate and review submitted abstracts for both technical and theological content as well as overall quality and applicability. Since accepted presentations must show an adequate understanding of both science and faith, we encourage you to collaborate with other science professionals and/or theologians in preparing your presentations.

Please remember not to speak outside your field of expertise, double-check your facts, consider multiple possible scientific and/or theological interpretations, and be appropriately tentative and humble in your conclusions.

Submit your abstract at https://network.asa3.org/page/asa-2024-submit.

Abstract Submission Deadline:
January 31, 2024

Derek C. Schuurman

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Virtue and Artificial Intelligence

Derek C. Schuurman

Two questions concerning artificial intelligence (AI) and virtue are explored. The first question is whether AI is capable of virtue, and the second question explores if AI can assist humans in the acquisition of virtue. It is argued that AI cannot be a moral agent and therefore cannot genuinely be virtuous. However, AI can perform behaviors that are in accordance with virtuous behavior. The notion of "virtue-by-proxy" is introduced in which virtuous programmers can strive to design AI programs that are trained to mimic certain virtues or behave in accordance with virtue. Next, it is argued that since AI systems can nudge humans toward repeated practices and habits, they will inevitably shape and form users. Thus, AI systems might be designed to assist humans with virtue formation; likewise, they could be misdirected to encourage certain vices. Finally, the concept of virtue in the Christian tradition is contrasted with secular notions of virtue and is used to inform limits on the role of AI in virtue formation.

Keywords: Artificial Intelligence (AI), machine learning, virtue, vice, design, habits, ethics

As I write this article, my streaming music service is offering new songs that match my current selections. Recommendation engines can make use of AI (artificial intelligence) to recognize my listening patterns to make future song suggestions. In fact, I receive daily nudges from AI systems through internet search suggestions, purchase recommendations, video streaming prompts, auto-completion of texts and emails, and personalization of my social media feeds. These daily prompts and nudges can have major impacts on our habits and practices.[1]

Aristotle, the ancient Greek philosopher, observed that "moral virtue comes about as a result of habit."[2] Likewise, certain vices can be encouraged through poor habits. Aristotle concludes,

> It makes no small difference, then, whether we form habits of one kind or another from our very youth; it makes a very great difference, or rather all the difference.[3]

If AI can be used to influence habits, and habits shape the kind of person we become, then it follows that "it makes a very great difference" how we will design these new tools.

The topic of AI and virtue pairs a computer science term with a philosophical term. This topic is intrinsically interdisciplinary and requires drawing upon technical, theological, social, and philosophical resources. In fact, any attempt to address this topic strictly from a technical perspective will necessarily involve philosophical and religious presuppositions. As such, these presuppositions are best laid out on the table right from the beginning. Likewise, a strictly philosophical approach to this topic without technical grounding will treat AI as a "black box" (that is, the inner workings are unknown), and consequently, AI will be susceptible to popular myths and assumptions about its capabilities, limits, and features. One

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benefit of joining conversations about AI and virtue is that it brings into dialogue "the two cultures" of technology and humanities.[4]

Philosopher Rebecca Konyndyk DeYoung defines virtue as "habits or dispositions of character" that help us "to live and to act well."[5] The question is, can an AI have virtue? In other words, can we take AI and "train it up in the way it should go" to show virtue?[6] A related question is, might AI serve to help humans in the acquisition of virtue? In this article, I will argue that although AI is not capable of virtue itself, it can display a certain degree of *virtue-by-proxy*. I conclude with some thoughts about how AI might assist humans with virtue formation, along with insights from the Christian tradition on virtue.

Is AI Capable of Virtue?

The first question to be addressed is whether AI is capable of virtue. This article will concur with the conclusions of prior works that have claimed, "AI systems cannot genuinely *be* virtuous but can only *behave* in a virtuous way."[7] In this section, I will explore how AI and virtue may be connected through a concept that will be referred to as "virtue-by-proxy."

If virtue helps us to live and to act well, this presupposes a moral agent exercising moral responsibility. Aristotle reflects on moral responsibility in *Nicomachean Ethics* and suggests that moral responsibility hinges on two conditions. The first is a "control condition" which requires that an agent must have a choice over whether to perform an action. The second is an "epistemic condition" that requires the agent to be aware of what they are doing.[8]

In the classic text, *Artificial Intelligence: A Modern Approach* by Stuart Russell and Peter Norvig, AI is defined as "the designing and building of intelligent agents that receive percepts from the environment and take actions that affect that environment."[9] Although an AI system receives inputs and produces output, it meets neither the control condition nor the epistemic condition. While an AI can produce outputs which have ethical implications, it does not meet the control condition since its outputs are predetermined by the computations within its neural network.

Neural networks are "trained" using an algorithm (such as backpropagation) to adjust the weights within a network to minimize or maximize some mathematical goal function. Once the weights are set, the future outputs for a given set of inputs are predetermined, and hence, the AI system does not directly *control* its output.[10] Even AI systems with stochastic elements rely on pseudorandom algorithms, which are also deterministic. Secondly, an AI system does not have *awareness* since it is simply performing calculations. Even impressive large language models (LLMs) are "simply a system for haphazardly stitching together sequences of linguistic forms … without any reference to meaning: a stochastic parrot."[11] An AI system has no more awareness than a spreadsheet and therefore does not meet the epistemic condition. In a nutshell,

> To be responsible, you need to know what you are doing and bringing about, and, in retrospect, know what you have done ... Responsibility then means answerability and explainability.[12]

Since AI systems do not meet these two conditions for moral responsibility, neither can they be capable of virtue.

To be clear, the lack of moral responsibility does not imply that AI is neutral, nor does it preclude the responsibility of those who design and deploy AI systems. Moral responsibility is distinct from the area of AI ethics, which is the application of ethical principles to ensure that machines are designed in ways to protect people and the environment. A helpful document titled "Moral Responsibility for Computing Artifacts," developed by an interdisciplinary group of philosophers, computer scientists, practitioners, and lawyers, states this clearly: "The people who design, develop, or deploy a computing artifact are morally responsible for that artifact, and for the foreseeable effects of that artifact."[13]

The Possibility of Virtue-by-Proxy

Since AI systems cannot have moral responsibility, it follows that they cannot display virtue and any appearance of virtues are, in fact, *ersatz* virtues. However, some have speculated that autonomous software systems might conceivably serve as a *proxy* for human responsibility. Computer scientist Nick Breems proposes the notion of "subject-by-proxy"

by which "responsibility could be inherited by programs from the programmer."[14] Breems suggests that a developer "exercises her responsibility by creating a system that will behave normatively *in the real* world, after the developer's participation is no longer active" and can do so "by encoding normativity."[15] However, Breems is careful to qualify his proposal, acknowledging the challenge of encoding the "nuanced, intuitively grasped concepts of diverse normativity … into a form that could be actualized as 'goals' for the artificial agent."[16] Breems relies on the philosophical framework of the Dutch philosopher Herman Dooyeweerd which rejects the notion that everything can be reduced to algorithms. Dooyeweerd's philosophy contends that only humans can function as subjects in normative areas such as justice, ethics, and faith.

The notion of "subject-by-proxy" could be extended to a similar notion of "virtue-by-proxy." Using this approach, one might maintain that AI systems are not capable of virtue but, nevertheless, serve as a proxy to the virtue of the programmers. Virtuous programmers can strive to create AI programs that are trained to mimic virtue-like behaviors. Such virtues might include humility; for example, by anticipating the need for extensive error detection and exception handling. AI systems might also echo the virtue of civility through friendly and hospitable user interfaces, or autonomous vehicles could mimic the virtues of courteous drivers. Furthermore, AI programs could create conditions where users are afforded opportunities to practice habits that accord with humility.

Recent research has uncovered an effect called "latent persuasion" in which large language models (LLMs) can provide nudges to change human behavior "by making some choices more convenient than others."[17] Whereas this could be exploited for ill, it could also be directed toward virtue by nudging people toward a "disposition to live well with one's fellow citizens" in their online interactions.[18]

AI system design might exercise virtue-by-proxy by being attentive to justice and fairness and addressing bias in machine learning. Author Cathy O'Neil provides insightful suggestions for working toward justice in machine learning in her book *Weapons of Math Destruction.*[19] The virtue of empathy may be implemented by proxy by creating software that responds to the emotional state of the user. One researcher, Rosalind Picard, has explored "affective computing" by designing "computers that interact with people." She writes that these computers "recognize emotions and how to intelligently respond to them, including when to show empathy."[20] To say a computer can "show empathy" is problematic language since it implies agency, but the notion of virtue-by-proxy shifts the agency to a virtuous programmer who designs an AI system to *mimic* virtuous behaviors, such as empathy.

Since machine learning requires a mathematical goal function to optimize, the question immediately arises as to how behaviors that accord with virtue might be implemented as goal functions. One recent approach that has been explored is reinforcement learning from human feedback (RLHF) in which human feedback is used to further tune an AI model.[21] In the case of virtue-by-proxy, human feedback could be used to nudge a machine learning model to exhibit behavioral outputs that accord with virtue. In this case, the virtues that are implemented by proxy are not those of the programmers, but rather of the humans providing the reinforcement learning feedback. One example might be to train an LLM to mimic the virtue of civility. However, recent work with LLMs has demonstrated that RLHF tuning has many challenges and tamping down unwanted behavior remains challenging.[22] Some of the issues include the vast amount of feedback needed to tune a large model, variance in feedback among multiple human trainers, and the fact that feedback is typically limited to simple preference ordering of outputs.[23]

Aside from the limits intrinsic to reinforcement learning from human feedback, there are additional limits to virtue-by-proxy. For example, while an AI system may be able to mimic empathy, it is entirely incapable of *feeling* empathy. The social scientist Sherry Turkle suggests that "children need to be with other people to develop mutuality and empathy; interacting with a robot cannot teach these."[24] Likewise, it should be noted that there are many challenges in implementing justice and fairness in computers. For example, individual and group fairness can sometimes form competing requirements in machine learning.[25] Other justice challenges can arise in datasets due to effects such as Simpson's Paradox which underscores "the importance of human experts in

the loop to examine and query Big datasets."[26] In fact, there will be times when justice may demand that certain things *not* be automated. Frankly, it is difficult to imagine how many of the "technomoral virtues" suggested by philosopher Shannon Vallor might even be approximated in software—virtues like courage or magnanimity.[27] This presents further complications if one holds to the "unity of the virtues" (as Aristotle did) in which one virtue depends on all the others.[28] Furthermore, if computers can manipulate only quantifiable values, and if virtue includes factors that are not easily quantifiable, then virtuous behavior can only be approximated at best. The adage is true that "not everything that counts can be counted," and thus, virtue cannot be reduced to mathematical computations or an algorithm. Hence, one should be quick to acknowledge the many limitations to the notion of virtue-by-proxy.

The wider challenge of steering AI toward human goals and ethical behavior is an open area of research referred to as the "value alignment" problem.[29] Already in 1960, the AI pioneer Norbert Wiener anticipated this problem when he wrote,

> If we use, to achieve our purposes, a mechanical agency with whose operation we cannot interfere effectively … we had better be quite sure that the purpose put into the machine is the purpose which we *really desire*.[30]

Cautionary tales include "The Sorcerer's Apprentice" in the Disney film *Fantasia*, in which Mickey Mouse instructs a broom to fill a cauldron, only to have it multiply and run amok. Similarly, philosopher Nick Bostrom's thought experiment imagines an AI whose goal function is to maximize the production of paper clips, and then it proceeds to convert the earth and large portions of the observable universe into paper clips.[31]

In the end, it requires wisdom to discern the extent to which virtue-by-proxy is appropriate or even possible. For this reason, while the notion of virtue-by-proxy may be philosophically intriguing, its practicality will be extremely limited. In his "subject-by-proxy" proposal, Breems is careful to remind us that we should "avoid attempts to imbue software with emergent moral agency."[32] He concludes that it is ultimately "involved human beings," both users and developers, "that must bear the responsibility," and they must "*delegate* [their] responsibility to the computer with great care."[33]

Finally, it should be noted that attempts to build machines using the notion of virtue-by-proxy should *not* be conflated with creating machines that pretend to be human. Creating machines that look and sound like human persons can lead to a kind of ontological confusion. Machines are machines—they are not human—and the virtue of honesty should oblige us not to create machines that pretend to be human persons. In fact, one could make the case that building a machine that looks and responds like a human is essentially a form of deception.[34] In the words of theologian Craig Bartholomew,

> We should start with ontology—this is our Father's world, and we are creatures made in his image—and then move on to epistemology—as his creatures, how do we go about knowing this world truly?[35]

A common pitfall is to anthropomorphize our machines and, in so doing, to elevate machines and reduce the distinctiveness of human beings.[36] Once we have established the ontological distinction of who we are and what machines are, we can then begin addressing questions about the appropriate use of AI.[37]

Can AI Assist Humans in the Acquisition of Virtue?

If virtuous AI is not possible, could it still be used to assist humans in the acquisition of virtue? In a recent paper by Boyoung Kim et al., an experiment was performed in which a robot verbally provided advice to "guide humans to comply with the norm of honesty."[38] Their experiment "indicated that robots may not be suitable for serving in the role of a moral advisor."[39] While verbal advice from a robot may have limited impact, the ability for AI systems to nudge humans toward repeated practices and habits will inevitably shape and form users toward virtue—or vice.[40]

Some current examples of software that can nudge us toward virtues of self-control are apps which remind users to exercise, or even gamify exercise to entice users toward improved fitness. Dieting apps can help users manage their appetites and food

intake and digital well-being apps can help users limit screen time and social media usage. There are also apps that can help users cultivate spiritual disciplines, such as prayer, personal devotions, as well as scripture reading and memorization. A focus on virtue formation could stimulate further innovative ideas that leverage the capabilities of AI.

In a similar manner, AI can be crafted to encourage vice. In book 2 of his *Republic*, Plato describes the "Ring of Gyges." The ring is a kind of technology that allows the user to become invisible at will. Plato uses this thought experiment to consider whether such a technology might encourage a rational person to act unjustly since they could perform actions without being seen and therefore avoid any consequences. Plato observes,

> If you could imagine anyone obtaining this power of becoming invisible, and never doing any wrong or touching what was another's, he would be thought by the lookers-on to be a most wretched idiot …[41]

A modern equivalent could ask the question, "Would a decent person act differently when they are able to view and post anonymously online?"

There are many examples of how AI-driven algorithms can encourage certain types of vices. Consider how video streaming services entice you to binge-watch by automatically playing the next episode or recommending other things to view. Likewise, consider the dopamine effects of video games and social media that keep their users playing or scrolling for long periods of time. Such systems can encourage the vice of sloth. Social media can also encourage the vice of envy as we absorb the highlights of other people's curated lives. Moreover, social media can "foster and feed on vainglory impulses."[42] Online pornography inflames lust, and online conversations driven by social media algorithms optimized for engagement can often spiral into outrage and wrath. AI can be easily misdirected to encourage each one of the seven vices.[43]

Virtue in the Christian Tradition

AI may plausibly assist in a limited way with virtue formation through nudging us toward good habits and practices. But virtue formation in the Christian tradition is not just about "what to do and what not to do," it also involves the "larger category of the divine purpose for the entire human life."[44] Philosopher Alasdair MacIntyre observes, "I can only answer the question 'What am I to do?' if I can answer the prior question 'Of what story or stories do I find myself a part?'"[45] For the Christian, virtue involves living into the biblical story. Aristotle's vision of virtue was that of the "moral giant striding through the world doing great deeds and gaining applause."[46] In contrast, "Christian virtue isn't about you … It's about God and God's kingdom."[47]

The word for virtue does not occur in the New Testament, but there is an emphasis on "the careful development and cultivation of Christian character."[48] In fact, the goal of the Christian life is to become more like Christ—something we cannot do on our own. Saint Augustine recognized this when he hears God ask, "Why are you relying on yourself, only to find yourself unreliable?" Rebecca Konyndyk DeYoung observes, "You won't practice the spiritual disciplines long, however, before you confront the sober truth: We can't make ourselves Christlike, no matter how hard we try."[49] She continues, "Practice, discipline, and all the things we do can't be the whole story, because human agency is not the whole story."[50] Theologian N.T. Wright observes that the Christian virtues "remain both the work of the Spirit and the result of conscious choice and work on the part of the person concerned."[51]

In addition to the four "cardinal" virtues described by the ancient Greeks (wisdom, justice, courage, and temperance), the Christian tradition recognizes the three theological virtues of faith, hope, and love. While ancient Greek virtues were aimed at cultivating the individual, Christian virtues "point away from ourselves and outward: faith, toward God and his action in Jesus Christ; hope, toward God's future; love, toward both God and our neighbor."[52] If love is the primary virtue, then it is one that needs to be practiced in the context of community.[53]

In fact, modern notions of virtue are often humanistic versions of what were once distinctively Christian concepts, what MacIntyre calls "fragmented survivals from an older past" and "ghosts of conceptions of divine law."[54] Many modern conceptions of virtue are operationally defined and are very different outside their original theological frame. For example, a Christian view of humility is not just a view of self

or others but is also grounded in "a trust that one's well-being is entirely secured by the care of God."[55] In some modern definitions, humility might be connected to a "wonder at the universe's retained power to surprise and confound us"; that is quite different from trusting in the care of a personal God.[56]

Since virtue is not just operationally defined in the Christian tradition, the notion of virtue-by-proxy is a limited concept. Likewise, the potential role for AI in virtue formation is more modest. But Christians should nevertheless recognize the contribution of habits and rituals in their spiritual formation, including the nudges that may come from the AI systems they encounter. Christian philosopher, James K. A. Smith, refers to habits and practices as kinds of *liturgies* that "take hold of our gut and aim our hearts toward certain ends."[57] It is for this reason that Smith recommends that we perform a "liturgical audit" of our lives.[58] A prudent extension to this advice would be to include an audit of the liturgies that may come with AI technology, for both discerning users and responsible designers.

Conclusion

In conclusion, I have argued that AI is not capable of virtue, but there might be an argument for a very limited form of virtue-by-proxy. While virtue-by-proxy is an intriguing philosophical notion, ultimately, it has many limitations and shortcomings. At the very least, the notion of virtue-by-proxy is a reminder that AI systems should be designed with care and responsibility since they operate far from the programmer in both time and space. Of course, virtue-by-proxy presupposes a virtuous system designer. For this reason, it is essential that the education of engineers and computer scientists address virtue formation alongside the development of technical skills.[59]

Although AI is not capable of virtue, AI systems are capable of nudging users in a variety of ways, and thus may have some limited role in virtue formation (or alternately, in encouraging vices). In the case of the Christian tradition, the role of AI in virtue formation will be even more limited, since the Christian notion of virtue is situated within the context of the biblical story and is not just operationally defined.

The Christian computer scientist, Frederick Brooks, has suggested that rather than striving for AI (artificial intelligence), a better approach would be IA (intelligence amplification). Rather than striving to build "giant brains" with AI, Brooks suggests that IA is the better approach—using a machine alongside a human mind.[60] This sentiment might inform AI and our approach to virtue as well: instead of trying to build "AV" (artificial virtue), a wiser approach will be to build machines for "VA " (virtue amplification)—machines that can assist humans in exercising virtue. But first we need to practice virtue ourselves—cultivating habits and liturgies that help shape us into the kind of people God calls us to be. Only then can we begin to develop AI with the wisdom needed to direct it in responsible and obedient ways.

Notes

[1]Richard H. Thaler and Cass R. Sunstein, *Nudge: The Final Edition* (New York: Penguin Books, 2021), 4.

[2]Aristotle, *Nicomachean Ethics,* trans. Terence Irwin (Indianapolis, IN: Hackett Publishing, 1985).

[3]Ibid.

[4]C. P. Snow, *The Two Cultures: And a Second Look* (Cambridge, UK: Cambridge University Press, 1964).

[5]Rebecca Konyndyk DeYoung, *Glittering Vices: A New Look at the Seven Deadly Sins and Their Remedies*, second edition (Grand Rapids, MI: Brazos Press, 2020), 7–8.

[6]This is a similar phrase to that found in Proverbs 22:6 where it refers to training up children in the way they should go.

[7]Mihaela Constantinescu and Roger Crisp, "Can Robotic AI Systems Be Virtuous and Why Does This Matter?," *International Journal of Social Robotics* 14, no. 6 (August 2022): 1548, https://doi.org/10.1007/s12369-022-00887-w.

[8]Matthew Talbert, "Moral Responsibility," in *The Stanford Encyclopedia of Philosophy* (Fall 2023 edition), ed. Edward N. Zalta and Uri Nodelman, https://plato.stanford.edu/archives/fall2022/entries/moral-responsibility/.

[9]Stuart J. Russell and Peter Norvig, *Artificial Intelligence: A Modern Approach*, third edition, Prentice Hall Series in Artificial Intelligence (Upper Saddle River, NJ: Prentice Hall, 2010), viii.

[10]There are systems called hypernetworks which use a network to generate the weights for another network, but the weights of the hypernetwork themselves are fixed. For more information on hypernetworks, see David Ha, Andrew Dai, and Quoc V. Le, "HyperNetworks," version 4, December 1, 2016, https://arXiv.org/abs/1609.09106.

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William Horst

Article

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Did the New Testament Authors Believe the Earth Is Flat?

William Horst

Certain scholars find evidence that the authors of the New Testament held to the cosmology of the ancient Near East, in which the sky is regarded as a solid dome over a flat earth. However, it was uncontroversial among Greco-Roman astronomers that the earth was spherical and was surrounded by a celestial sphere of stars. This article explores knowledge of the "two spheres" model of the cosmos in the first century CE, as this would have been become known to inhabitants of the Mediterranean world through education, word of mouth, popular astrology, and representations of the terrestrial and celestial spheres on sundials, coins, and public art. Based on these factors and the sophistication of their compositions, a number of contributors to the New Testament likely understood the earth to be spherical; their knowledge has exegetical and hermeneutical implications for discussions about scripture vis-à-vis modern science.

Keywords: New Testament, cosmology, flat earth, geocentrism, globe, astronomy, education, Schneider

Science-faith discussion commonly includes consideration of the biblical authors' worldviews, and how our understanding of their ancient worldviews might bear on our modern interpretation of biblical passages. For example, the account of creation in Genesis, along with various other Old Testament passages, is often understood to express a typical ancient Near Eastern cosmological model in which the shape of creation could be likened to a snow globe, with a hemispherical domed sky atop a flat earth.[1] Scholars who identify this "snow globe" model in Old Testament writings typically distinguish between the timeless theological significance of the biblical texts and the time-conditioned worldview content that the biblical authors accepted by default. So, although passages such as the first chapter of Genesis presume a standard ancient Near Eastern cosmological model, these passages are particular in affirming that the one God of Israel is the sovereign creator of the whole world. This theological truth can be sustained even though the "snow globe" structure of the world must be abandoned.[2]

Some scholars have drawn hermeneutical implications from the notion that a number of New Testament writings likewise express something like an ancient Near Eastern "snow globe" world-structure. Two key voices in evolutionary creationist literature, Denis O. Lamoureux and Peter Enns, identify this model in Paul's comment that "in the name of Jesus every knee should bow, in heaven and on earth and under the earth" (Phil. 2:10). They use this text as a key example of the principle that the authors of the New Testament express the gospel of Jesus Christ using inaccurate and now defunct science that reflects the worldview assumptions of their day.[3] Both authors thus make a distinction between the erroneous, outdated claims of the New Testament writings

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that must be discarded (for example, death entered the world through Adam) and the timeless revelatory truths that Christians should maintain (for example, eternal life is available in Christ).[4]

Although Lamoureux and Enns cite Philippians 2:10 in particular, biblical scholars have identified other passages in which New Testament authors may evoke an ancient Near Eastern-style double- or triple-decker cosmos (with heaven above the earth and hades or hell below).

- In an article on the cosmology of Hebrews, Edward Adams argues that the author references a two-story conception of creation, with heaven located physically atop the earth, so that Jesus can be said to have passed into heaven, much as a high priest enters the holiest part of the temple.[5]
- Michael F. Bird analyzes Mark's conception of the cosmos on the basis of references at various points in this text to "heaven," "earth," and "hell," which potentially suggest the ancient, triple-decker model.[6]
- Steve Walton notes that similar language appears in Luke/Acts, and he identifies a number of additional elements of the Gospel of Luke that could potentially be heard to evoke triple-decker cosmological ideas, including Capernaum's descent to Hades (Luke 10:15), Satan's fall from heaven (Luke 10:18), and Jesus's ascent after his resurrection (Luke 24:51; Acts 1:9–11).[7]
- Joel White, like Lamoureux and Enns, suggests that Paul references a three-level model in passages such as Philippians 2:10 and 1 Corinthians 15:40, where Paul contrasts believers' (present) earthly bodies with their (future) heavenly ones.[8]

All of these scholars rightly emphasize that the New Testament authors' primary interests and aims lie in the theological significance of their language about the cosmos, not in discussing the structure of creation per se. Nonetheless, the highlighted scriptural elements are relevant to the question of whether the New Testament can be said to express an understanding of the cosmos that is hopelessly obsolete in modern times.

The notion that certain New Testament passages imagine the earth to be flat is curious since a strong consensus existed among Greco-Roman astronomers and geographers that the earth is spherical. Indeed, Kyle Greenwood takes for granted that the New Testament authors understood the earth to be a sphere. He identifies a number of biblical phrases that have been understood by others as evidence of a flat earth perspective, and shows how they can instead be interpreted in light of a spherical world-structure.[9] For example, the phrase "four corners of the earth" (Rev. 7:1; 20:8) can be understood in light of the limits of the habitable portion of the spherical earth known to first-century Greco-Roman thinkers.[10] The prospect that the New Testament authors did understand the earth to be spherical is intriguing, but Greenwood does not construct a detailed argument in favor of his view, and it turns out that knowledge of a spherical earth cannot be assumed *a priori* for everyone within the first-century Mediterranean world. A study is thus in order to determine whether and to what extent we can conclude that the authors of the New Testament understood the earth to be spherical rather than flat, and the extent to which it is fair to predicate hermeneutical arguments on the premise that the New Testament authors articulate the gospel of Jesus using definitively obsolete cosmological claims.

In this article, I will explore how people of the first-century Mediterranean world would have come to know about the spherical earth, and what social factors would affect the probability that a given person would have known about it. I will begin with a brief account of the development of notions of a spherical cosmos and spherical earth in Greek thought. I will then analyze certain limited writings which suggest that the notion of a spherical earth was controversial in the first-century Mediterranean world and that a person's view on this issue was largely determined by their level of education. This will be followed by overviews of formal Greco-Roman education in general, and then education related to the sphericity of the earth in particular. I will supplement this discussion with an account of some additional ways in which a person of the first-century Greco-Roman world might become familiar with spherical cosmology outside of formal education. Finally, I will discuss the likelihood that particular contributors to the New Testament did know and potentially accept that the earth is a sphere. Although the matter is not definitively clear in every case, my argument weakens the common claim that the authors of the New Testament express a defunct flat-earth cosmology that necessitates a hermeneutical bifurcation

between timeless, authoritative truths and naïve, obsolete ancient assumptions.

The Spherical Earth in Greek Thought

In earliest Greek thought, as in the ancient Near East, the world was understood to be flat, with a domed sky and underworld.[11] However, the standard model among Greek intellectuals changed in favor of a spherical, geocentric conception several centuries prior to the advent of Christ. The earliest known mentions of a spherical cosmos occur in the sixth through fifth centuries BCE among such philosophers as Pythagoras, Anaximander, Parmenides, and Empedocles. Philolaus (fifth century BCE) understood both the cosmos and the earth to be spherical, and further imagined that the earth orbited around an unseen "hearth" of the cosmos, along with the sun and planets.

In the fourth century, Plato and Aristotle make reference in various writings to a spherical earth around which the sun, moon, and planets revolve in concentric orbits. Eudoxus of Knidos, a student of Plato, wrote multiple now-lost astronomical works that apparently mapped out the position of the various constellations on the celestial sphere, which he understood as a massive, rotating, solid shell that encompasses the other heavenly bodies, and on which the stars are fixed. A third lost work of Eudoxus's sought to describe the motion of the planets. To a significant extent, much of subsequent Greek and Roman astronomy is basically a development on and refinement of Eudoxus's model of the cosmos.[12]

One additional noteworthy contribution from the field of geography is that of Eratosthenes of Cyrene (third century BCE), who calculated the circumference of the earth by comparing the differing lengths of shadows in the cities of Alexandria and Syene at noon on the summer solstice. Based on the assumption of a spherical earth, the distance between the two cities, and the difference in angles of each city relative to the sun's rays, Eratosthenes was able to determine a figure for the size of the earth that is approximately accurate by modern calculations.[13]

The point is that a model involving concentric spheres replaced the older flat-earth model of the cosmos in Greek (and eventually Roman) philosophical, astronomical, and geographical thought well before the time of the New Testament. Although this geocentric model differs from a modern understanding in many crucial ways, it represents a significant development toward a modern view.[14]

Controversy about the Spherical Earth in the Greco-Roman World

By the time the New Testament was authored, it was basically uncontroversial among Greco-Roman astronomers and geographers that the earth was a sphere situated inside a larger celestial sphere. Indeed, it appears that this "two spheres" cosmology was widely accepted among people of high education. However, the spherical earth was not necessarily accepted by all of society, as a comment from Pliny the Elder (first century CE) suggests:

> Here there is a mighty battle between learning on one side and the common herd on the other: the theory being that human beings are distributed all round the earth and stand with their feet pointing towards each other, and that the top of the sky is alike for them all and the earth trodden under foot at the centre in the same way from any direction, while ordinary people enquire why the persons on the opposite side don't fall off—just as if it were not reasonable that the people on the other side wonder that we do not fall off.[15]

Pliny gives the impression that everyday people tended to question the notion of a spherical earth, despite its wide acceptance among those of a particular level of education, even to the point that he can say that the earth's shape is "the first fact about which men's judgement agrees."[16]

Pliny's remarks are not specific enough to clarify the level of education that would distinguish the learned few who accepted the spherical earth from the masses who did not. For that matter, Pliny is perhaps the only author who provides a clear witness to this controversy about the earth's shape in surviving writings from around the first century,[17] so the task of filling out the details behind his comments is not straightforward. Furthermore, Pliny's description of the controversy presumably reflects his particular social context, and cannot safely be generalized to the entirety of the Mediterranean world. One must also be careful not to assume that he provides an unbiased account of the views of people of lower education, since ancient authors commonly portray uneducated people as categorically inferior to the

educated, with faults ranging from poor taste in music to inadequate opinions about the divine.[18] In other words, it should not surprise us if Pliny offers a caricature of uneducated people rather than a careful historical account.

In his dissertation, Sean Michael Ryan suggests a connection between an ancient person's education and the assumptions they would make about the structure of the world. A person of lower education would be more inclined to conceptualize the world according to the older, flat-earth model, whereas a person of higher education (and thus a familiarity with a larger set of writings) would more likely conceptualize the world according to the spherical model.[19] Much of the information Ryan discusses is relevant here, but his study focuses on three test cases of interpreters of the book of Revelation from the third through sixth centuries CE, so his analysis cannot easily be generalized to the era of the authorship of the New Testament.[20]

In a recent monograph about spherical imagery on ancient Greek and Roman coins (see further below), Raymond V. Sidrys posits that many Romans of our era of interest likely accepted the concept of the celestial sphere, but were more reluctant to accept a spherical earth, imagining instead a flat earth at the center of a rotating, spherical sky.[21] Sidrys certainly presents a compelling correction to earlier numismatic scholarship that exaggerated the presence of terrestrial sphere imagery on Greek and Roman coins. He demonstrates that many coins previously thought to portray a terrestrial globe more likely depict a celestial sphere or some other circular or spherical object (for example, sun or moon, pomegranates, athletic balls or disks), but he does not proffer any clear examples of people in ancient times who imagined a flat earth within a rotating celestial sphere, and his direct evidence for disbelief in the spherical earth is mostly limited to the passage from Pliny quoted above.

That relatively few terrestrial sphere images appear on Roman coins from around the first century CE does not prove that the bulk of the populace thought the earth was flat. Further, in Greek and Roman astronomical understanding, the notions of the terrestrial and celestial spheres were normally tightly linked conceptually.[22] It is difficult to imagine that a significant number of people who had trouble accepting the notion of a spherical earth were satisfied with the image of a flat earth inexplicably hovering inside a rotating spherical shell.[23] At the least, Pliny's remark gives us reason not to assume that everyone in the first-century Mediterranean world accepted the "two spheres" model of the cosmos. In all likelihood, education was a significant factor in whether a person was acquainted with and accepted the notion of the earth's sphericity.

In the sections that follow, I will examine educational and other factors relevant to how people in this world might have come to know about the spherical, geocentric astronomical model. This, in turn, will lay the foundation for some initial comments about what we can and cannot reasonably assume about the New Testament authors' familiarity with and acceptance of the same cosmological model.

Education in the Greco-Roman World

Certain members of Greco-Roman society would have learned about the spherical earth and celestial sphere through formal schooling. Education in the first century differed significantly from modern systems, so it is necessary to explore the Greco-Roman education system in a fair amount of detail in order to understand the extent to which different kinds of people may or may not have learned about the terrestrial globe through schooling.

The ancient Mediterranean world is distinguished from most modern contexts by the fact that the vast majority of people were nearly if not completely illiterate. In the most populous cities, the rate of literacy was likely no higher than 15% of the population, and the rate in other areas was probably no more than 5–10%.[24] Many in the ancient world required a proxy even to sign their own name, and most of those who did possess rudimentary literacy would have had a difficult time doing something as sophisticated as composing a personal letter.[25] Formal education, even at elementary levels, was primarily for the wealthy.

For those who were fortunate enough to participate in literate education, their learning could be conceptualized in terms of three stages.[26] Primary education was normally undertaken by small children, and it focused on basic literacy and counting. Secondary education, generally undertaken by adolescents, focused primarily on working with grammar.

Tertiary education, which a student typically began at about fifteen years of age, most commonly focused on mastery of rhetorical techniques, though some students instead specialized in other areas, such as philosophy or one of the sciences (that is, natural philosophy). At every stage, instruction relied heavily on exemplary passages from classic literary works, most especially Homer's *Iliad* and *Odyssey*.[27] The further a student progressed, the more texts he or she would be exposed to.[28] The majority of students who began a given stage of education would not complete it, and only a modest portion of those who completed a given stage would move on to the next. So, only a tiny percentage of people who participated in formal education reached the tertiary level.

Although the three-stage model works as a general description, ancient education was characterized by a great deal of variation. Some children were given a primary education at home, either by a parent, a household slave, or a paid tutor, whereas others were educated outside the home with a group of students studying under a paid instructor.[29] Some students—typically from less elite families—were trained in a manner that focused on practical career skills. For example, a student aspiring to be a clerk might focus exclusively on the skills needed to perform that job. By contrast, a minority of students—normally the children of comparatively wealthier families—would undergo an *encyclical education*, which emphasized a breadth of important subjects. This well-rounded version of education would typically include discussions of art, mathematics, medicine, music, astronomy, geography, rhetoric, metaphysics, and ethics, in addition to the core elements of literacy.[30] Students from privileged families in major urban centers would often be educated in *gymnasia*, which emphasized physical education in addition to other elements of the *encyclical* model,[31] though some would have learned from instructors in other contexts. In certain instances, primary and secondary students learned in the same room with multiple different instructors.[32] There was no widespread regulation of education, so it is not surprising that a great deal of variety can be found throughout the Roman Empire.

In addition to wealth, several other factors affected a person's access to formal education in the Greco-Roman world. Geography was one significant factor. Literacy was significantly lower in rural areas than in urban ones, both because the demand for reading and writing skills was lower in less populous regions, and because educational options were sparser.[33] Gymnasia would have been found only near significant population centers, and the most qualified teachers would likewise normally have lived in cities or larger towns rather than in smaller settlements or villages. In many cases, teenagers pursuing a tertiary education would have been sent away from home to a particular city where such training was available.[34]

In contrast to what many modern people might assume, the average literacy rate among slaves may well have been higher than among the general population. Many slave owners could afford to pay for a slave's education, and literacy made a slave more valuable, especially in an urban context. Most slaves were not educated, but some of those living in more populous areas certainly were. It is fair to say that in the world of the New Testament, an urban slave was more likely to possess basic literacy than a rural free person.[35]

Although some girls from wealthy families did participate in formal education, boys were educated at much higher rates, and girls seldom progressed past the rudimentary stages of learning. Nonetheless, some women obtained enough education that they were able to become teachers themselves, and a number of letters authored by women survive.[36]

First-century Judaism also involves an interesting set of educational particularities. Jewish people of the early centuries CE commonly found standard Greco-Roman school texts problematic because they introduced children to a different history, a foreign cultural identity, and a set of values that were seen as inconsistent or at least in tension with Jewish norms.[37] This is especially true in that Greek gods and goddesses factor so prominently in Homer's poems. Thus, alongside the Hellenistic system of education in Israel, there existed a distinctively Jewish system of education that centered on the Torah in place of classical Greek texts such as Homer's works.[38] This form of teaching was normally carried out by individual rabbis, and focused primarily on the skills necessary to read the Torah aloud, with little attention to writing.[39] One important factor to keep in mind here is that in the time of the New Testament, most Jewish people lived outside the land of Israel, that is, in the *diaspora*, and thus lived as ethnic minorities.

Although some options for Torah-based learning would have been available through diaspora synagogues, the richest and most advanced educational options for wealthy Jewish families would have involved standard Greco-Roman schooling, and despite the inherent cultural tensions, some families did choose to educate their children in this manner.[40] Even within Israel proper, some options for Greco-Roman education were available.[41] Like their diaspora counterparts, some upper-class Palestinian Jewish families educated their children in this system. Students of the Palestinian gymnasia would have been educated alongside the children of Roman imperial officials, soldiers, and any other prominent non-Jewish families living in the region.

Greco-Roman and Jewish forms of education need not represent a strict dichotomy, as some known Jewish figures from the first century were clearly informed by both types of intellectual training. Philo of Alexandria—who is one of the wealthiest, most educated, and most socially prominent first-century Jews known to us today—clearly had a robust encyclical education, but he also spoke of the synagogue like a kind of school,[42] and considered it unacceptable to attend encyclical schools on the Sabbath, a day on which Torah-based education is appropriate.[43] It is possible, though not certain, that the Apostle Paul underwent standard Hellenistic primary and secondary education in Tarsus before moving to Jerusalem to undergo something of a tertiary education under the rabbi Gamaliel.[44] So then, Roman and Jewish education, while different, are not mutually exclusive.

Finally, it is worth noting that the rate of literacy in Israel proper was probably significantly lower than the average rate of perhaps 10–15% across the Roman Empire in general. Scholars commonly place the rate in the land of Israel closer to 3% or less, if "literacy" signifies anything more sophisticated than reading very basic words and sentences and writing one's name.[45] This particularly low rate of education is probably largely due to the relative scarcity of major population centers in the region, which resulted in both less access to educational opportunities and less need for reading and writing skills.

In sum, formal education of any kind was not a given in the context of the first-century Mediterranean world, education took on many different forms, and only a tiny number of people completed all three major stages of learning. A person was more likely to be educated, and more likely to receive a well-rounded education, the wealthier they were. Education mostly occurred in more highly populated cities and towns, whereas even basic reading and writing skills were scarce in rural settings. Women were educated much less often than men, though somewhat surprisingly, slaves were probably educated at slightly higher rates than the general population. Jewish education was also distinctive due to many Jewish people's discomfort with aspects of the dominant, Greco-Roman culture of this age. All of these considerations must be borne in mind when examining who would have known what about the natural world in the first century CE.

Education and the Spherical Earth

Some forms of ancient education touched on knowledge of the natural world. Primary education did not normally include any formal discussion of natural philosophy, though of course a given teacher might have made reference to some basic concepts in passing.[46] Expert knowledge of natural philosophy would normally be attained only in specialized tertiary schooling or in some form of more-advanced mentorship, and only a minuscule portion of the population partook in this level of instruction.[47]

However, rudimentary information about the study of the natural world was commonly imparted to students during secondary education, especially to students undertaking an encyclical education. Some discussion of natural philosophy was necessary to help students analyze the sorts of poetic texts studied during secondary education, as such texts commonly make reference to subject matter pertinent to astronomy, anatomy, botany, mineralogy, and zoology. The first-century Roman author Quintilian explains that secondary education teachers ought not to be ignorant of astronomy, since the poets studied make frequent reference to astronomical phenomena.[48] For that matter, astronomy was apparently the most popular branch of natural philosophy in the Greco-Roman world, in part because of the connection of this field to astrology. Therefore, one can imagine that basic astronomical concepts were of especial interest in secondary schooling.[49]

Richard Carrier explains that instruction in natural philosophy at this level of education would not generally have been very sophisticated, and potentially might include some amount of misinformation,[50] but the basic facts of the spherical earth, together with the notion of the celestial sphere, were the most elementary astronomical convictions in the Roman era. Therefore, it seems reasonable to assume that even the most rudimentary exposure to astronomy would make students aware of these concepts.

One particular astronomical poem, the *Phaenomena* by third-century BCE author Aratus of Soli, was widely popular among educated people of the Greco-Roman era, and appears to have been used regularly as a school text for secondary students studying in either Greek or Latin.[51] Although the text did not represent the cutting edge of astronomical knowledge in the first century CE, Aratus does discuss the location of the major constellations relative to some standard reference circles on the celestial sphere,[52] and therefore even a cursory investigation of the text would be expected to make the basic "two spheres" conception of the cosmos apparent to students. Further, some evidence indicates that it was common for teachers to employ a small model of the celestial sphere with images of the constellations in their positions as a visual aid to help students follow along with Aratus's descriptions. A few examples of this sort of portable celestial model survive, and ancient literary references confirm the use of such models in educational contexts.

Due to the difficulty of constructing a solid spherical object using the technology of the first century, some astronomical instruction was instead carried out using an *armillary sphere*—a set of interconnected metal rings representing the important circles on the celestial sphere (ecliptic, equator, tropics, arctic, antarctic). This also provided a visual aid for understanding astronomical writings such as Aratus's *Phaenomena,* but was much easier to construct than a solid sphere.[53]

As noted earlier, ancient education included a great deal of variation. It would be unreasonable to assume that everyone who undertook a secondary education studied Aratus's *Phaenomena* or interacted with a celestial sphere model or an armillary sphere, but it does appear that these elements commonly augmented whatever discussion of astronomical rudiments was normally deemed necessary at this stage in a student's learning.

Geography, alongside astronomy, was a typical ingredient of an encyclical education. As with astronomy, the spherical earth was fundamental to Greco-Roman geography, so it is reasonable to assume that geographical discussions at the secondary level also made students aware that the earth is not flat. However, terrestrial globes were probably not commonly used as visual aids, since only a modest percentage of the earth had been mapped by Romans in the first century CE, and most of a globe would have to be blank or purely speculative.

Although a secondary education was a privilege available to a small percentage of the population, we cannot assume that such educational experience was uniform from place to place and from family to family. Nonetheless, it is fair to say that those who did participate in ancient secondary education were *typically* aware of the basic "two sphere" model of the cosmos.

Enrollment in secondary educational studies would have been one of the main ways people of the Greco-Roman world learned about the "two spheres" cosmology; however, the system of ancient education potentially brought knowledge of the natural world to additional individuals in less official ways. One way this might have happened is through school lessons in public places. Sources suggest that school instruction commonly took place under shady trees or in colonnades, courtrooms, and other public venues where passers-by would potentially listen in or perhaps even chime in with questions.[54] A painting on the wall of the forum of Pompeii depicts such a scene, where students sit with their teacher while members of the public look on with interest.[55] Galen (second century CE) describes his father going with him to listen to lectures by different teachers in order to determine which teachers would be most suitable; this account further confirms that ancient school instruction was not necessarily closed off to the public.[56]

Given the especial interest in astronomy in the Greco-Roman world and given the use of visual aids such as celestial sphere models and armillary spheres, it is not difficult to imagine people in public places taking time to listen with interest as a secondary school teacher discussed astronomical writings such as

Aratus's *Phaenomena* with students. We cannot know exactly how many people would have learned of the "two spheres" model of the cosmos in this way. Such exposure would certainly have taken place primarily in more populous contexts in particular; nonetheless, it is reasonable to imagine that some number of city-dwellers of the first century would have encountered the concept of a spherical earth and sky in this manner.

In addition to random passers-by, certain slaves of wealthy households were designated to accompany children to their school lessons, and thus were exposed to the same content that the children learned. These slaves, or *pedagogues*, likely picked up a significant amount of the knowledge conveyed to the children, and in some cases, played a role in facilitating a student's learning, especially at the elementary level.[57] It is likely that some pedagogues learned of the "two spheres" cosmology by accompanying students to their classes.

Outside of school instruction proper, public speeches and lectures were common in ancient Roman cities, and although they were primarily attended by people who were formally educated, or students in the process of undergoing education, members of the general public were known to attend occasionally as well. For example, Galen refers to some illiterate and poorly educated people attending his lectures.[58] Literature and history were apparently more common subjects for these lectures than natural philosophy, but natural philosophical subjects, including astronomy, were discussed from time to time.[59] The pool of people familiar with the "two spheres" understanding of the world would have been expanded significantly in many urban centers due to public lectures addressing astronomy and/or geography.

In addition to the aforementioned ways in which one might learn about the spherical cosmos, it figures that this information also traveled by word of mouth.[60] Presumably, students who learned about astronomy and geography as part of their formal education, pedagogues who accompanied children to lessons, members of the public who eavesdropped on school meetings in public places, and attendees of public lectures sometimes discussed elements of what they had learned with friends or acquaintances. This is all the more true in reference to the basic facts of the celestial and terrestrial spheres, since astronomy and cosmology were popular topics in the Greco-Roman world.[61] Thus, even though secondary education was a privilege reserved for a relatively small percentage of the population, and discussions of astronomy and geography would generally be confined to this and higher levels of education, we can reasonably assume that the basic facts of the "two spheres" cosmology were known to a wider group of people beyond this privileged circle.

Additional Ways One Might Learn of the Spherical Earth

Outside the realm of education, inhabitants of the Greco-Roman world—especially those who spent time in urban settings—might have encountered portrayals of the "two spheres" cosmology in a number of ways. One major example would be sundials, that is, devices used to trace the passage of time by casting a shadow onto a surface. Public sundials were pervasive in ancient Roman cities, as they facilitated appointment keeping. Private sundials in urban homes, and even portable, pocket-sized sundials, were also common.[62]

Sundials came in a variety of shapes, but all types of Roman-era sundials presumed the "two spheres" cosmology of the time, and basically served to project the sun onto the spherical earth.[63] The correspondence between the spherical cosmos and a planar sundial—that is, one that projects a shadow onto a flat surface—would not be terribly obvious to a casual observer, but the connection would be more obvious in the common case of a spherical sundial, which traces a shadow's movement over a section of a concave sphere. Alexander Jones describes this type of sundial as "a vivid didactic image of the foundations of Greek geometrical astronomy."[64] It is not a given that everyone who saw a public, spherical sundial would necessarily understand it as relating to a spherical earth and sky,[65] but presumably many did understand these sundials in this way.

Armillary spheres and celestial and terrestrial globes were employed in secondary education (see above), but these types of objects were apparently also used for public display.[66] For example, Crates of Mallus (second century BCE) constructed a massive terrestrial globe about three meters in diameter that he exhibited in the Royal Palace of Pergamum.[67] The

Roman geographer Strabo (first century BCE) provides guidelines for the construction of terrestrial globes, and recommends that such a globe should be at least three meters in diameter, which seems to imply that it would be put on display in a public place.[68] One of the few surviving celestial sphere models is part of a human-sized statue of Atlas, the Titan of Greek mythology, who is portrayed bearing on his shoulders a celestial sphere with a map of constellations.[69] This statue would be impractical for instrumental or educational purposes, and was instead clearly ornamental.

Indeed, all surviving examples of celestial sphere models were apparently intended for ornamental purposes.[70] A statue of the Roman general Pompey (first century BCE) holding a terrestrial globe in his hand was displayed prominently at the entrance to the theatre of Pompey in Rome. This image evidently evoked the idea of the general's domination of the known world.[71] According to Cicero (first century BCE), the Roman general M. Claudius Marcellus sacked the Sicilian city of Syracuse in 212 BCE and brought back to Rome as trophies two celestial sphere models made by Archimedes (third century BCE). Marcellus took one model to his home, but placed the other in the Temple of Vesta, where some members of the public would have seen it.[72]

In addition to actual three-dimensional models, a few examples survive of images of cosmological spheres in Greco-Roman artwork.

- A floor mosaic found in Solunto, Sicily (second or first century BCE), depicts an armillary sphere with a spherical earth at the center.[73]
- A fresco found near Pompeii (first century CE) appears to depict a globe with parallel and meridian lines.[74]
- Two mosaics found near Pompeii and San Marino (first century CE) depict philosophers gathered around models of terrestrial or celestial spheres.[75]

We cannot be sure from the limited evidence exactly how common it was to find models or artistic depictions of the spherical earth or sky on public display in the world of the first century, but examples like those just mentioned suggest that it was by no means unusual. At least some people who lacked exposure to astronomy through formal education probably encountered ornamental images of the spherical cosmos in private homes or in public spaces.[76]

Images of celestial and terrestrial spheres also appear on a number of Roman coins from around the time of the New Testament. Sidrys's recent monograph analyzes this material extensively.[77] Sidrys argues that previous numismatic scholarship overestimated the number of cases in which coins of this era portrayed celestial and especially terrestrial spheres, but the fact remains that many coins were minted with images reflecting the spherical cosmology of the era, and these images were intended to convey symbolic significance to everyday people. Of course, it is not a given that everyone who handled such coins would have given serious thought to the imagery, but the inclusion of these images suggests that those who commissioned the coins expected a certain portion of the population to find their symbolism intelligible. It is also likely that coins featuring cosmological spheres would have prompted at least a few people to discuss aspects of world-structure with one another as they tried to make sense of the coins.

Astrology is another context in which people of various classes would encounter the notions of a spherical earth and/or celestial sphere. Not only were Greco-Roman horoscopes predicated on a spherical understanding of the earth and rotating sky, but astrologers also commonly employed various kinds of instruments, including globes, as visual aids.[78] Whereas formal secondary education was mostly limited to people of relatively high social privilege, and included very few women, astrologers were consulted by people of all classes, including many women.[79] Thus, astrology likely did a great deal to expand the circle of people who were familiar with the "two spheres" cosmology of the Roman age. Although early Christians might not have been inclined to consult astrologers, a certain number of Christians from the early generations certainly would have done so prior to their own conversion, or they would have associated with people who had.

In sum, formal education was a key avenue through which privileged people of the Greco-Roman world came to understand the sphericity of the cosmos, yet we should not imagine that knowledge of the "two spheres" was a function of education alone. Sundials, celestial and terrestrial sphere models, images of spheres in art and on coins, and popular astrology all bore witness to the spherical, geocentric conception of the world, and thus expanded the pool of people who shared this understanding.

It is significant that most of the aforementioned ways one might have learned of the "two spheres" model pertain especially to urban settings. In addition to the fact that higher levels of education were primarily available in more-populous areas, members of the public would be much more likely to encounter a public-school lesson in which the celestial or terrestrial spheres were being discussed or modeled in a large city rather than in a small village. Public lectures by astronomers and geographers would likewise happen exclusively in major urban centers. Public sundials, globes, and art would also be concentrated in urban spaces.[80] Insofar as an urban center contained a greater concentration of people acquainted with the "two spheres" cosmology, it would be correspondingly more likely that a person would hear about the sphericity of the earth by word of mouth in such a context. The upshot of all this is that in addition to educational considerations, a person's inhabiting an urban environment is another factor that significantly increases the likelihood that he or she was familiar with the spherical conception of the cosmos.

Awareness of the Spherical Earth among New Testament Authors

Based on the historical information discussed above, should we imagine that the authors of the New Testament understood the earth to be spherical? A comprehensive and critical discussion of each biblical author here would be cumbersome, but some basic remarks are in order.

First of all, it is important to understand that identifying the "author" of a New Testament text is less than straightforward. The production of texts in the ancient world commonly involved multiple people. For instance, ancient letters and certain other kinds of texts were commonly composed with the help of a secretary who actually wrote on the page. Tertius, the secretary for Paul's letter to the Romans, identifies himself near the end (Rom. 16:22). Likewise, the author of 1 Peter states that the letter was written "through Silvanus" (1 Pet. 5:12), who likely served as the secretary.[81]

Even in cases where a secretary is not named explicitly, ancient conventions should prompt us to assume that a secretary was used unless we have strong reason to think otherwise. The level of a secretary's involvement varied case-by-case. On one end of the spectrum, a secretary merely transcribed dictation from the author. On the other end of the spectrum, a secretary would be given general guidelines and would make virtually all of the actual compositional decisions on behalf of the person who hired them. More commonly, a secretary would take detailed notes while an author spoke slowly and would then form those notes into a draft that would be presented to the author for feedback. A series of revised drafts might be produced over a period of weeks or months before the final draft was completed.[82]

In addition to the secretary, it was not uncommon for others to give input in the process of producing a text, and several of Paul's letters explicitly identify additional senders, for example, "Paul, Silvanus, and Timothy" (1 Thess. 1:1).[83] It is difficult to determine with certainty the extent to which a given secretary or co-sender contributed to the content of one of these texts, though the notion that several people had significant creative influence would go a long way toward explaining idiomatic differences that scholars have identified between biblical writings traditionally attributed to the same author (for example, between the "undisputed" and "disputed" Pauline letters).[84]

Given the complexity of ancient authorship, we cannot link a feature of a given text directly with that text's author. For example, if the Epistle of James exemplifies strong Greek composition, does this bespeak the author's education, or the education of a secretary? However, the traits of a given text can tell us something about *someone* involved in the composition of that text. So, it is fair to say that someone involved in the composition of the Epistle of James had a high level of Greek education. Furthermore, some features of a given text might suggest general truths about those involved in the text's composition. For example, Paul's ministry focused on urban contexts, and any given secretaries or coauthors with whom he worked were likely also primarily familiar with an urban context.

Based on the above discussion of education in the Greco-Roman world, it is reasonable to assume that at least one person involved in the composition of each New Testament text had at least a significant secondary education, as primary education typically covered the rudiments of reading and

writing, whereas the necessary grammatical and compositional skills would normally be learned in the secondary stage. As already discussed, the best forms of secondary education would have included an introduction to the basic facts of astronomy and geography (including the sphericity of the earth), though this would not necessarily be the case for more vocationally oriented forms of secondary education.

In the absence of explicit references to the sphericity of the earth in New Testament writings, we cannot determine with certainty whether a given text's author(s) understood the earth to be spherical. However, we can assess the likelihood based on several factors that emerge from the discussion above. First, all other things being equal, the author(s) of a text are more likely to have understood the earth to be spherical the more sophisticated the Greek composition is, as this bespeaks a higher level of education.

The compositions in the New Testament are not uniform in linguistic sophistication. Hebrews is widely recognized to exemplify the most sophisticated and elegant Greek.[85] The epistles of James, Peter, and Jude, though not as impressive as Hebrews, are likewise written with strong Greek style that betrays the presence of at least one author or secretary of substantial education.[86] Luke and Acts are perhaps a notch less sophisticated than these epistles, but they exemplify an extensive Greek vocabulary.[87] On the opposite end of the spectrum, the book of Revelation employs peculiar and unimpressive Greek,[88] and Mark's gospel employs rough and clumsy language that Matthew and Luke frequently smooth out in their parallel accounts of many of the same stories.[89] The Johannine books, while perhaps not as clumsy, employ language that is plain and straightforward, in contrast to the more artful writings such as Hebrews.[90] Matthew and the Pauline letters lie somewhere in the middle between the more- and less-sophisticated ends of the New Testament linguistic spectrum.[91]

Other elements of a New Testament text may betray that one or more contributors likely had a high level of education. For example, the use of athletic imagery as a metaphor for the moral life in Hebrews (5:14; 12:1–3, 12) suggests familiarity with the gymnasium and thus probably with other aspects of cultured Roman life.[92] Paul's claims to Roman citizenship (Acts 21:39; 22:28; cf. 23:1), his familiarity with athletic imagery that would be associated with the gymnasium (especially 1 Cor. 9:24–27; cf. Gal. 2:2; Phil. 2:16; 3:14), and his view of his own manual labor as a severe burden (1 Cor. 4:12; 9:19; 2 Cor. 6:5; 1 Thess. 2:9; 2 Thess. 3:8) all suggest that he had an aristocratic background, which would be consistent with a robust, encyclical education—though the question of whether Paul specifically had a rhetorical education is surrounded by significant academic debate.[93] Discussions of Luke/Acts often find evidence for a rhetorical education on similar grounds, although some scholars recently have argued that these texts require only a sophisticated secondary education.[94] If a contributor to a text does possess some amount of rhetorical education, we can reasonably assume that they were familiar with the basic evidence in favor of the sphericity of the earth and the cosmos.[95]

If the biblical author inhabited an urban context, he is more likely to have been familiar with the spherical conception of the cosmos, since city dwellers had many more occasions to be confronted with this idea. Some New Testament writings certainly emerge from urban contexts, while the matter is more obscure in other cases. For example, Paul is known for his urban ministry, and the churches he founded and wrote to were generally located in major urban centers such as Rome, Ephesus, and Corinth.[96] Furthermore, social-scientific studies of the Pauline churches suggest that their membership was basically a cross-section of the social makeup of the cities.[97] Pauline churches were not merely made up of the poorest of the poor, but rather included people of various social levels, including some people with significant formal education. Indeed, Christ-focused communities like these would have been one of the few places in the ancient world where people of differing social classes and differing levels of education could have associated as peers.[98] It is not a given that members of Pauline churches regularly discussed astronomy or geography when they met together, but one can imagine that the subject likely did come up from time to time, especially since the Old Testament scriptures, which were regularly read and taught, commonly make reference to "the heavens and the earth," and sometimes seem to express a cosmology different from the "two spheres" model that would have been familiar to those with substantial formal education.

In addition to the Pauline letters, a number of other New Testament writings are widely recognized to emerge from urban contexts. The provenance of Luke/Acts is virtually always identified with one or another major city, as these works show particular interest in urban matters.[99] First Peter is commonly located in Rome,[100] and 2 Peter is likewise located in a major city, whether Rome, Alexandria, or another.[101] If James the brother of Jesus is the authentic author of the epistle of James, then this text would appropriately be located in Jerusalem,[102] and the discussion of how to treat a well-dressed person at a church gathering (James 2:1–7) seems to imagine a scenario that would most likely occur in some sort of population center. The sophisticated Greek composition of Luke/Acts, Hebrews, James, 1–2 Peter, and Jude likewise implies that someone involved in the production of these texts would have spent time living in a major city, as the level of education necessary to compose texts like these would not ordinarily be attainable in a rural town or village. The provenance is less clear for Matthew, Mark, Revelation, and the Gospel and Epistles of John, though some of these texts are also placed in major cities by certain scholars, and the resources necessary for the production and distribution of lengthy texts would certainly be available primarily in more-populous areas.

A great deal of ink could be spilled discussing the considerations pertinent to each specific New Testament text, but based on general scholarly consensus about the sophistication and provenance of these compositions, we can say tentatively that some or all of the contributors involved in the composition of Hebrews, 1–2 Peter, James, Jude, Luke/Acts, and the Pauline letters quite probably would have been familiar with the basic idea that the earth is a sphere within a larger celestial sphere. When these texts employ language like "heaven and earth," or otherwise say things that could be understood in reference to a double- or triple-decker flat-earth cosmology, we should not imagine that they do so naively. For example, the epistle to the Hebrews is among the New Testament texts that could potentially be read in light of an ancient Near Eastern two-story, stacked world-structure (see above), yet this text evidences a level of linguistic and rhetorical sophistication, as well as a familiarity with elite urban life, that would almost certainly imply a knowledge of (and likely acceptance of) the basics of Greco-Roman, sphere-based astronomy and geography. Furthermore, nothing indicates that this or any other text of the New Testament is launching a deliberate polemic against the "two spheres" cosmology of the day. No one is going out of their way to argue in favor of a flat earth. This suggests that when these authors use language like "heaven, earth, and under the earth," these comments would be better understood as evocations of common Old Testament idiom—presumably for symbolic purposes—rather than expressions of a two- or three-level cosmology per se. Early Christian thought and writing is thoroughly informed by the Jewish scriptures, and it is reasonable to imagine that the New Testament authors would express God's sovereignty over the totality of creation using language from those earlier scriptures without accepting uncritically the "snow globe" cosmology of the ancient Near East.[103]

The matter is initially less clear as to whether the spherical earth would have been familiar to the authors of Matthew, Mark, the Johannine literature, and Revelation, though it is certainly perfectly plausible that they too knew and accepted this idea, since concrete evidence for disbelief in the "two spheres" model in the first-century Mediterranean world is minimal.

Conclusions

It follows from my discussion that some scholars engaged in science-faith dialogue have assumed too quickly that the New Testament authors imagined the earth to be flat. For a substantial majority of New Testament writings, it is highly likely that at least one contributor was aware of the spherical model.[104] It is possible that some New Testament authors did imagine the world according to an ancient Near Eastern model, but the matter is unclear based on the presently available evidence. The likelihood that a given passage betrays one or the other cosmological model must be established through careful analysis.

Of course, the Greco-Roman "two spheres" cosmology, though closer to a modern understanding than the earlier "snow globe" model, is still thoroughly out-of-date in comparison to a twenty-first century scientific understanding. The point here is not that the New Testament authors understood the structure and scale of our universe properly, but rather that it is not actually clear that the New Testament texts *express* an incorrect understanding of world-structure. For example, if, as is likely, Paul understood the

earth to be spherical, then his reference to "in heaven and on earth and under the earth" (Phil. 2:10) does not express a three-tiered "snow globe" model of the world; rather, it should be interpreted in a manner consistent with his worldview.[105]

The proposition that the New Testament writings express a flat-earth cosmology is not the only basis on which one could argue that the Bible contains inaccurate information about the natural world. Most obviously, I have not made any argument here about the prospect of explicit flat-earth cosmology in the Old Testament. The discussion of whether the Bible articulates false science is a larger and more complex one. However, insofar as some authors have appealed to ancient Near Eastern cosmology in New Testament passages as a key premise to establish the need for a distinction between timeless revelatory truths and outdated elements to be discarded (for example, a historical Adam and Eve, a historical Fall), the information I have presented here weakens their arguments. At the least, it should now be clear that more-thorough argumentation would be necessary to establish the position that the New Testament authors express a flat-earth cosmology.

In addition to nuancing treatments of cosmological content in the New Testament, this study should underscore the importance of treating the two Testaments of the Bible in their own right. The New Testament texts were authored in a very different era from those of the Old Testament with respect to culture, education, the state of knowledge of the natural world, and numerous other factors. So, a hermeneutical argument constructed in relation to the Old Testament cannot be applied to the New Testament without thorough justification, and vice versa.

Notes

[1]See, e.g., J. Edward Wright, *The Early History of Heaven* (New York: Oxford University Press, 2000), chap. 3; Denis O. Lamoureux, *Evolutionary Creation: A Christian Approach to Evolution* (Eugene, OR: Wipf & Stock, 2008), 106–35; John H. Walton, *Genesis 1 as Ancient Cosmology* (Winona Lake, IN: Eisenbrauns, 2011); Robert J. Schneider, "Does the Bible Teach a Spherical Earth?," *Perspectives on Science and Christian Faith* 53, no. 3 (2001): 159-69, https://www.asa3.org/ASA/PSCF/2001/PSCF9-01Schneider.pdf; Sean Michael Ryan, *Hearing at the Boundaries of Vision: Education Informing Cosmology in Revelation 9* (London: T&T Clark, 2012), 39–42; Kyle Greenwood, *Scripture and Cosmology: Reading the Bible between the Ancient World and Modern Science* (Downers Grove, IL: IVP Academic, 2015), 71–102; Olli-Pekka Vainio, *Cosmology in Theological Perspective: Understanding Our Place in the Universe* (Grand Rapids, MI: Baker Academic, 2018), 14–19; and Carol Hill, *A Worldview Approach to Science and Scripture* (Grand Rapids, MI: Kregel Academic, 2019), 9–12. Lamoureux's discussion cites extensive references from the Old Testament that potentially presuppose the ancient Near Eastern model.

[2]My goal here is not to confirm or deny the validity of these claims in reference to the Old Testament, and my argument does not depend on a given position. Some authors argue that the standard ancient Near Eastern cosmology is not as obvious in the Old Testament as is commonly supposed. See recently William Lane Craig, *In Quest of the Historical Adam: A Biblical and Scientific Exploration* (Grand Rapids, MI: Eerdmans, 2021), 175–77.

[3]Lamoureux, *Evolutionary Creation*, 106–11; and Peter Enns, *The Evolution of Adam: What the Bible Does and Doesn't Say about Human Origins,* 2nd edition (Grand Rapids, MI: Brazos, 2021), 131–33. The standard ancient Near Eastern cosmological model commonly includes an underworld, which can potentially be identified with Paul's reference to "under the earth."

[4]Hill's worldview approach makes a similar distinction between obsolete science and divine revelation, but she resists asserting that the biblical texts make untrue claims. Rather, the biblical writers gave true accounts from their ancient perspectives. So, e.g., Hill posits that Adam and Eve were real people, whereas Lamoureux does not (see esp. Hill, *Worldview Approach*, 6–7). A similar hermeneutical argument to that of Lamoureux and Enns can be found in a recent correspondence in *Science and Christian Belief* (Tom Ambrose, "Death through Adam—William Horst," *Science and Christian Belief* 33 [2021]: 132–36; and cf. William Horst, "Reply to Tom Ambrose," *Science and Christian Belief* 33 [2021]: 137–40).

The hermeneutical distinction between obsolete culturally conditioned elements and timeless scriptural truths has deep roots in modern biblical scholarship, and I do not have space to engage this body of literature in detail here. It is nonetheless worth noting that the approach of scholars such as Enns and Lamoureux is paralleled by some biblical scholars who likewise assume that the New Testament authors betray their culturally conditioned assumption of a "snow globe" cosmology, and conclude that biblical passages along these lines must be "demythologized" in order to have relevance for modern readers. See esp. Rudolf Bultmann, "New Testament and Mythology," in *Kerygma and Myth: A Theological Debate*, ed. Hans-Werner Bartsch (London, UK: SPCK, 1957), 1–44; cf. James D. G. Dunn, "The Ascension of Jesus: A Test Case for Hermeneutics," in *Auferstehung – Resurrection: The Fourth Durham-Tübingen Research Symposium: Resurrection, Transfiguration, and Exaltation in Old Testament, Ancient Judaism, and Early Christianity (Tübingen, September 1999)*, ed. Friedrich Avemarie and Hermann Lichtenberger (Tübingen, Germany: Mohr Siebeck, 2001), 301–22.

[5]Edward Adams, "The Cosmology of Hebrews," in *The Epistle to the Hebrews and Christian Theology*, ed. Richard Bauckham et al. (Grand Rapids, MI: Eerdmans, 2009), 130–31. See Hebrews 4:14; 7:26; 9:24; cf. 12:25–26.

[6]Michael F. Bird, "Tearing the Heavens and Shaking the Heavenlies: Mark's Cosmology in Its Apocalyptic Context," in *Cosmology and New Testament Theology*, ed. Jonathan T. Pennington and Sean M. McDonough

(London, UK: T&T Clark, 2008), 47–49. Bird is careful to specify that the triple-decker cosmological language in Mark serves Mark's cosmological narrative, and does not necessarily constitute an affirmation about the structure of creation per se. This nuance lends itself to my suggestion (near the end of this article) that certain passages that could sound like expressions of "snow globe" cosmology might be better understood as evocations of common Old Testament idiom for symbolic purposes.

[7]Steve Walton, "'The Heavens Opened': Cosmological and Theological Transformation in Luke and Acts," in *Cosmology and New Testament Theology*, ed. Jonathan T. Pennington and Sean M. McDonough (London, UK: T&T Clark, 2008), 60–73, esp. 62. Walton, like Bird, emphasizes the symbolic significance of this language, not the author's convictions about world-structure per se. In a later essay, Walton discusses the theological significance of Jesus's ascension in detail, and also challenges the notion that this account must be understood in light of an ancient flat-earth cosmology (Walton, "Identity and Christology: The Ascended Jesus in the Book of Acts," in *The Earliest Perceptions of Jesus in Context: Essays in Honour of John Nolland*, ed. Aaron W. White, David Wenham, and Craig A. Evans [London, UK: Bloomsbury T&T Clark, 2018], 129–47).

[8]Joel White, "Paul's Cosmology: The Witness of Romans, 1 and 2 Corinthians, and Galatians," in *Cosmology and New Testament Theology*, ed. Pennington and McDonough, 93–94.

[9]Greenwood, *Scripture and Cosmology*, 131–54, esp. 137.

[10]Greenwood, *Scripture and Cosmology*, 136.

[11]Ryan (*Hearing at the Boundaries of Vision*, 40–41) notes that this basic understanding is evident in all-important Greek writings such as Homer's *Iliad* and *Odyssey* (ca. eighth century BCE), and Hesiod's *Theogony* (eighth–seventh century BCE), as well as in ancient Near Eastern writings such as the *Epic of Gilgamesh* (ca. 2100–1200 BCE), the *Atrahasis* epic (ca. 1700 BCE), the *Enuma Elish* (ca. 1100 BCE), and the Babylonian *Mappa Mundi* (ca. eighth–seventh century BCE).

[12]My summary in this section has been necessarily cursory, but detailed discussion of the development of Greek astronomical thought can be found in Georgia L. Irby-Massie and Paul T. Keyser, *Greek Science of the Hellenistic Era: A Sourcebook* (New York: Routledge, 2002), 47–81. See also James Evans, *The History and Practice of Ancient Astronomy* (New York: Oxford University Press, 1998).

[13]Evans, *The History and Practice of Ancient Astronomy*, 63–65. It is impossible to convert Eratosthenes's figure of 250,000 stadia to modern units with precision, since several variations of this unit were in use in his time, but it is fair to say that, given his antiquity, he was remarkably close to the modern measurement of just over 40,000 kilometers.

[14]Although the Copernican revolution took place many centuries later, it is worth noting that another Greek astronomer, Aristarchos (ca. 250 BCE), proposed an initial heliocentric theory of the cosmos. His idea was widely and vehemently rejected (Raymond V. Sidrys, *The Mysterious Spheres on Greek and Roman Ancient Coins* [Oxford, UK: Archaeopress, 2020], 13).

[15]Pliny, *Natural History, Volume I: Books 1–2*, trans. H. Rackham (Cambridge, MA: Harvard University Press, 1938), 2.161. The controversy Pliny mentions seems not to be limited to the question of whether humans inhabit what would now be called the Southern Hemisphere, as he goes on to assert that the masses particularly dispute whether it is reasonable to believe that the oceans would conform to a sphere-shaped earth, and spends several pages proffering arguments that they would in fact do so (Pliny, *Natural History, Volume I,* 2.163–66 of Rackham's translation). On Greco-Roman speculation about humans living on the Southern Hemisphere, see Avan Judd Stallard, "Origins of the Idea of Antipodes: Errors, Assumptions, and a Bare Few Facts," *Terrae Incognitae* 42, no. 1 (2010): 34–51, https://doi.org/10.1179/008228810X12755564743525.

[16]Quoted from Pliny, *Natural History, Volume I,* 2.295 of Rackham's translation.

[17]The scarcity of references is noted by Donald John Campbell, a commentary on *C. Plini Secundi Naturalis Historiae, liber secundus* (Aberdeen, UK: The University Press, 1936), 74; and Hugo Berger, *Die geographischen Fragmente des Eratosthenes* (Leipzig, Germany: B. G. Teubner, 1880), 86. A fragment attributed to Achilles Tatius does make reference to the controversy, but it would be dated to the second or third century CE. Certain later Christian authors do discuss controversies about the size and shape of the earth (see chap. 4 of Richard Carrier, *The Scientist in the Early Roman Empire* [Durham, NC: Pitchstone, 2017]), but this is not necessarily relevant to understanding the attitudes of first-century Christians, many of whom would have been converted from non-Christian backgrounds, and who would have been educated (to whatever extent they were educated) in non-Christian contexts.

[18]Allen R. Hilton, *Illiterate Apostles: Uneducated Early Christians and the Literates Who Loved Them* (London, UK: T&T Clark, 2018), 26–29.

[19]Ryan, *Hearing at the Boundaries of Vision*. Ryan also discusses a possible hybrid model that includes a flat earth and a series of concentric, hemispherical domes. He places Paul's account of being caught up into "the third heaven" (2 Cor. 12:2–4) in this category, though Paul's comments here are quite cryptic, and nothing in his writings clarifies whether he understands this "third heaven" as spherical or dome-shaped.

[20]For that matter, Ryan's test cases do not conform perfectly to the expectations he lays out in his earlier chapters, as he acknowledges (Ryan, *Hearing at the Boundaries of Vision*, 210). Cf. Eric J. Gilchrest, "Review of *Hearing at the Boundaries of Vision: Education Informing Cosmology in Revelation 9*," *Religious Studies Review* 40, no. 3 (2014): 157, https://doi.org/10.1111/rsr.12153_13.

[21]Sidrys, *The Mysterious Spheres on Greek and Roman Ancient Coins*, esp. 45.

[22]Claude Nicolet, *Space, Geography, and Politics in the Early Roman Empire* (Ann Arbor, MI: University of Michigan Press, 1991), 35.

[23]Cf. Pliny, *Natural History, Volume I,* 2.162.

[24]See esp. Richard Carrier, *Science Education in the Early Roman Empire* (Durham, NC: Pitchstone, 2016), 24; and Catherine Hezser, "The Torah versus Homer: Jewish and Greco-Roman Education in Late Roman Palestine," in *Ancient Education and Early Christianity*, ed. Matthew Ryan Hauge and Andrew W. Pitts (London, UK: T&T Clark, 2016), 5–24.

[25]Chris Keith, *The Pericope Adulterae, the Gospel of John, and the Literacy of Jesus* (Leiden, Netherlands: Brill, 2009), 58, 70.

[26]This three-stage model was initially articulated by Henri Irénée Marrou, *A History of Education in Antiquity* (London, UK: Sheed and Ward, 1959). Subsequent scholarship

on Greco-Roman education, including the various works cited below, basically engages and nuances his model.

[27]Teresa Morgan refers to a model of "core" and "periphery," in which "core" texts (most especially certain portions of Homer and some gnomic sayings) were visited more frequently in the educational process, and texts further from the core occurred less frequently. See Morgan, *Literate Education in the Hellenistic and Roman Worlds* (Cambridge: Cambridge University Press, 1998), 67–73. Greco-Roman schooling did not follow a uniform curriculum, but it did focus on a fairly consistent core.

[28]The expanding range of texts with which a student would be familiar is a particular focus of Ryan, *Hearing at the Boundaries of Vision*.

[29]Alan D. Booth, "Elementary and Secondary Education in the Roman Empire," *Florilegium* 1 (1979): 1–14, https://www.utpjournals.press/doi/pdf/10.3138/flor.1.002; Robert A. Kaster, "Notes on 'Primary' and 'Secondary' Schools in Late Antiquity," *Transactions of the American Philological Association* 113 (1983): 323–46, https://doi.org/10.2307/284019; Karl Olav Sandnes, *The Challenge of Homer: School, Pagan Poets and Early Christianity* (London, UK: T&T Clark, 2009), 27; and Keith, *The Pericope Adulterae*, 62–64.

[30]See, e.g., Kaster, "Notes on 'Primary' and 'Secondary' Schools in Late Antiquity," 324; and Royce M. Victor, *Colonial Education and Class Formation in Early Judaism* (London, UK: T&T Clark, 2019), 138, though numerous other sources on ancient education cover this subject.

[31]On Hellenistic gymnasia, see esp. Robert S. Dutch, *The Educated Elite in 1 Corinthians: Education and Community Conflict in Graeco-Roman Context* (London, UK: T&T Clark, 2005), 95–167.

[32]Raffaella Cribiore, *Gymnastics of the Mind: Greek Education in Hellenistic and Roman Egypt* (Princeton, NJ: Princeton University Press, 2005), 15–17.

[33]See, e.g., Carrier, *Science Education in the Early Roman Empire*, 24.

[34]For instance, Abraham J. Malherbe suggests that the apostle Paul may have moved from Tarsus to Jerusalem to study under Gamaliel in what would essentially be a Jewish form of a tertiary education. See Malherbe, *Social Aspects of Early Christianity*, 2nd ed. (Minneapolis, MN: Fortress, 1983), 34–35. Cf. Stanley E. Porter and Andrew W. Pitts, "Paul's Bible, His Education and His Access to the Scriptures of Israel," *Journal of Greco-Roman Christianity and Judaism* 5 (2008): 9–40; and Andrew W. Pitts, "Paul in Tarsus: Historical Factors in Assessing Paul's Early Education," in *Paul and Ancient Rhetoric: Theory and Practice in the Hellenistic Context*, ed. Stanley E. Porter and Bryan R. Dyer (Cambridge, UK: Cambridge University Press, 2015), 43–67. See also Acts 22:3.

[35]Carrier, *Science Education in the Early Roman Empire*, 12.

[36]For a thorough discussion of women in ancient Greco-Roman education, see Cribiore, *Gymnastics of the Mind*, 74–101.

[37]Sandnes, *The Challenge of Homer*, 43. Another significant point of cultural tension was the performance of athletic activity in the nude in the gymnasium (Victor, *Colonial Education and Class Formation in Early Judaism*, 140).

[38]Tyler A. Stewart, "Jewish Paideia: Greek Education in the Letter of Aristeas and 2 Maccabees," *Journal for the Study of Judaism* 48 (2017): 187–202. Stewart shows that a difference of opinion regarding Hellenistic education can be found in Jewish literature well before the first century CE. In Stewart's analysis, the letter of Aristeas, a Jewish text written in the second or third century BCE, reflects a view in which Hellenistic and Jewish cultural elements have a basic harmony, whereas 2 Maccabees, a Jewish text from the mid-second century BCE, reflects more of a sense that Hellenistic teaching was a "dangerous infringement" on Torah-centric Jewish education (p. 202).

[39]Keith, *The Pericope Adulterae*, 74. Hezser ("The Torah versus Homer," 19) notes that rabbinic education began in Palestine in the first century CE and spread to Persian Babylonia in the third century CE, but it was always confined to the Middle East. Although this form of education was in some ways a reaction against Hellenistic education, scholars point out a number of ways in which the influence of the gymnasium system can be found in distinctively Jewish education as well. See, e.g., Victor, *Colonial Education and Class Formation in Early Judaism*, 118–32; and David McLain Carr, *Writing on the Table of the Heart: Origins of Scripture and Literature* (Oxford, UK: Oxford University Press, 2005), 212.

[40]See, e.g., Hezser, "The Torah versus Homer," 22.

[41]Victor, *Colonial Education and Class Formation in Early Judaism*, 131–32. Andrew W. Pitts, "Hellenistic Schools in Jerusalem and Paul's Rhetorical Education," in *Paul's World*, ed. Stanley E. Porter (Leiden, Netherlands: Brill, 2008), 19–50, argues that elementary Greek education was available in Jerusalem, and secondary Greek education may likewise have been present, but rhetorical education most likely was not.

[42]Philo, *On the Embassy to Gaius,* 311–12; Philo, *On the Special Laws,* 2.62; and Philo, *On the Life of Moses,* 2.216.

[43]Sandnes, *The Challenge of Homer*, 77. Josephus's writings likewise make clear that he is informed by extensive Jewish and Greek education. See Catherine Hezser, *Jewish Literacy in Roman Palestine* (Tübingen, Germany: Mohr Siebeck, 2001), 189; and Victor, *Colonial Education and Class Formation in Early Judaism*, 126.

[44]See Malherbe, *Social Aspects of Early Christianity*, 34–35; and Porter and Pitts, "Paul's Bible, His Education and His Access to the Scriptures of Israel," 9–40.

[45]Hezser, *Jewish Literacy in Roman Palestine*, 496; and Chris Keith, "Urbanization and Literate Status in Early Christian Rome: Hermas and Justin Martyr as Examples," in *The Urban World and the First Christians*, ed. Steve Walton, Paul R. Trebilco, and David W. J. Gill (Grand Rapids, MI: Eerdmans, 2017), 188–95.

[46]Carrier, *Science Education in the Early Roman Empire*, 44.

[47]Ibid., 87.

[48]Quintilian, *Education in Oratory*, 1.4.4.

[49]Marrou, *A History of Education in Antiquity*, 182; and Stamatina Mastorakou, "Aratus and the Popularization of Hellenistic Astronomy," in *Hellenistic Astronomy: The Science in Its Contexts*, ed. Alan C. Bowen and Francesca Rochberg (Leiden, Netherlands: Brill, 2020), 396.

[50]See Carrier, *Science Education in the Early Roman Empire*, 44–47.

[51]On the popularity of Aratus, see Emma Gee, *Aratus and the Astronomical Tradition* (New York: Oxford University Press, 2013), 5–7; and Mastorakou, "Aratus and the Popularization of Hellenistic Astronomy," 383–97. On the use of the *Phaenomena* as a school text, see Marrou, *A History of Education in Antiquity*, 185; Ryan, *Hearing at the Boundaries of Vision*, 17–20; and Carrier, *Science Education in the Early Roman Empire*, 49.

One of the only explicit quotations of an extra-biblical text in the New Testament is Paul's quotation of one of the opening lines of Aratus's *Phaenomena*, which says, "For we too are his offspring" (Acts 17:28). Some scholars caution that this simple quotation could have come from word of mouth, or could perhaps be dependent on a quotation of the same passage by Aristobulus, a Jewish author of the second century BCE. See Carrier, *Science Education in the Early Roman Empire*, 49; and Mark J. Edwards, "Quoting Aratus: Acts 17,28," in *Christians, Gnostics and Philosophers in Late Antiquity* (Burlington, VT: Ashgate Variorum, 2012), 266–69. At the least, the quotation does something to confirm the particular popularity of the *Phaenomena* in the world of the New Testament.

[52]See James Evans and J. Lennart Berggren, *Geminos's Introduction to the Phenomena: A Translation and Study of a Hellenistic Survey of Astronomy* (Princeton, NJ: Princeton University Press, 2006), 5.

[53]For discussion, see Evans and Berggren, *Geminos's Introduction to the Phenomena*, 27–43; James Evans, "Mechanics and Imagination in Ancient Greek Astronomy: *Sphairopoiïa* as Image and Tool," in *The Alexandrian Tradition: Interactions between Science, Religion, and Literature*, ed. Luis Arturo Guichard, Juan Luis García Alonso, and María Paz de Evans Hoz (Bern, Switzerland: Peter Lang, 2014), 35–72; and Sidrys, *The Mysterious Spheres on Greek and Roman Ancient Coins*, 13–20. On celestial and terrestrial globes in education, see also Edward Luther Stevenson, *Terrestrial and Celestial Globes: Their History and Construction, Including a Consideration of their Value as Aids in the Study of Geography and Astronomy* (New Haven, CT: Yale University Press, 1921).

[54]Cribiore, *Gymnastics of the Mind*, 25–38; and Sandnes, *The Challenge of Homer*, 17, 32–34. On various kinds of school accommodations more broadly, see Cribiore, *Gymnastics of the Mind*, 21–36.

[55]Sandnes, *The Challenge of Homer*, 34.

[56]Galen, *On the Passions and Errors of the Soul* 1.8.

[57]Beryl Rawson, *Children and Childhood in Roman Italy* (Oxford, UK: Oxford University Press, 2003), 165–67; and Sandnes, *The Challenge of Homer*, 8. Booth notes that in some cases, a child's primary education may have been handled entirely at home by a pedagogue (Booth, "Elementary and Secondary Education in the Roman Empire," 10).

[58]Galen, *On the Passions and Errors of the Soul* 2.2.

[59]Carrier, *Science Education in the Early Roman Empire*, 52–56. Cf. Dio Chrysostom, *Discourses* 33.4.

[60]See, e.g., Mastorakou, "Aratus and the Popularization of Hellenistic Astronomy," 396. Carrier in *Science Education in the Early Roman Empire*, page 23, cautions that natural philosophical information that traveled from person to person orally would be prone to distortions and errors; this is a reasonable point.

[61]Carrier points out that the apparent popularity of astronomy may be exaggerated to some degree by bias in favor of astronomy in medieval times. In other words, those texts which were of particular interest in later centuries would more likely be preserved as valuable. Nonetheless, he acknowledges that the particular prominence of astronomy is supported by significant historical evidence (Carrier, *The Scientist in the Early Roman Empire*, 368–72).

[62]The definitive resource on Greco-Roman sundials is Sharon L. Gibbs, *Greek and Roman Sundials* (New Haven, CT: Yale University Press, 1976). See also Sara Schechner, "The Material Culture of Astronomy in Daily Life: Sundials, Science, and Social Change," *Journal for the History of Astronomy* 32 (2001): 189–222; and Jérôme Bonnin, "Symbolic Meanings of Sundials in Antiquity: Introduced by an Explanation of Ancient Timekeepers," *British Sundial Society Bulletin* 23 (2011): 6–10.

[63]Robert Hannah, "The Sundial and the Calendar," in *Hellenistic Astronomy: The Science in Its Contexts*, ed. Alan C. Bowen and Francesca Rochberg (Leiden, Netherlands: Brill, 2020), 323–39.

[64]Alexander Jones, "Introduction," in *Time and Cosmos in Greco-Roman Antiquity*, ed. Alexander Jones (Princeton, NJ: Princeton University Press, 2016), 25. Jones also describes here another, rarer type of sundial that traced a shadow-boundary on the face of two convex half-spheres representing the earth.

[65]Indeed, a form of concave spherical sundial dates back to earlier Babylonian astronomy, which understood the sky to be a dome rather than a sphere. See Peter I. Drinkwater, "The Spherical Sundial," *British Sundial Society Bulletin* 90 (1990): 12–13, https://sundialsoc.org.uk/wp-content/uploads/bulletins/B1990/Bull090-3.pdf.

[66]On this general point, see Stevenson, *Terrestrial and Celestial Globes*, 14; and Sidrys, *The Mysterious Spheres on Greek and Roman Ancient Coins*, 13–20.

[67]Stevenson, *Terrestrial and Celestial Globes*, 7–8; and Sidrys, *The Mysterious Spheres on Greek and Roman Ancient Coins*, 20.

[68]Strabo, *Geography* 2.5.10.

[69]James Evans, "The Material Culture of Greek Astronomy," *Journal for the History of Astronomy* 30, no. 3 (1999): 239, https://doi.org/10.1177/002182869903000305; and Sidrys, *The Mysterious Spheres on Greek and Roman Ancient Coins*, 13. This statue, the Farnese Atlas, dates to the first or second century CE, but is likely a Roman copy of a second-century BCE Greek original. Sidrys discusses additional examples of statues that include celestial spheres on pages 33–35.

[70]Sidrys, *The Mysterious Spheres on Greek and Roman Ancient Coins*, 15.

[71]Ibid., 84.

[72]Cicero, *On the Republic* 1.21–22; cf. Cicero, *Tusculan Disputations* 1.63; and Ovid, *Fasti* 6.277–80.

[73]Sidrys, *The Mysterious Spheres on Greek and Roman Ancient Coins*, 16.

[74]Stevenson, *Terrestrial and Celestial Globes*, 21.

[75]See Otto J. Brendel, *Symbolism of the Sphere: A Contribution to the History of Earlier Greek Philosophy* (Leiden, Netherlands: Brill, 1977), 1–18; and Sidrys, *The Mysterious Spheres on Greek and Roman Ancient Coins*, 35–36. Both mosaics are understood to be copies of an earlier Greek painting. The sphere in one of the mosaics includes a grid of intersecting lines that Brendel interprets as a series of reference lines on a celestial sphere model (Brendel, *Symbolism of the Sphere*, 14), though they may better resemble parallel and meridian lines on a globe.

[76]Evans and Berggren, *Geminos's Introduction to the Phenomena*, 28. Sidrys rightly suggests that these sorts of depictions were generally located in places more accessible to upper class people than to those of lower classes (Sidrys, *The Mysterious Spheres on Greek and Roman Ancient Coins*, 90), though slaves and freed persons of prominent members of society would potentially accompany their head of household to certain places not accessible to the general public. Richard L. Rohrbaugh describes how ancient cities

had areas designated for social elites, often surrounded by protective walls. However, certain non-elites also had access to such areas in order that they might serve the needs of the elite (Rohrbaugh, "The Pre-industrial City in Luke-Acts: Urban Social Relations," in *The Social World of Luke-Acts: Models for Interpretation*, ed. Jerome H. Neyrey [Peabody, MA: Hendrickson, 1991], 125–49, esp. 144). A modern analogy might be a country club that is accessible to both elite club members and non-elite staff.

[77]Sidrys, *The Mysterious Spheres on Greek and Roman Ancient Coins*. Sidrys suggests that some spherical images may intentionally present an ambiguous image that could be interpreted as either a celestial or terrestrial sphere, perhaps due to a greater public familiarity with and acceptance of the former over the latter (pp. 91, 182). This is possible, but little clear evidence shows a public rejection of the spherical earth apart from the quotation of Pliny discussed above. So, an intentional ambiguity of this sort is far from clear.

[78]Wolfgang Hübner, "The Professional Ἀστρολόγος," in *Hellenistic Astronomy: The Science in Its Contexts*, ed. Alan C. Bowen and Francesca Rochberg (Leiden, Netherlands: Brill, 2020), 315; and Sidrys, *The Mysterious Spheres on Greek and Roman Ancient Coins*, 52.

[79]Hübner, "The Professional Ἀστρολόγος," 309. Cf. Juvenal, *Satire* 6.585–91.

[80]It is probably reasonable to imagine that astrologers also primarily interacted with the public in urban environments, such as the Circus Maximus, a chariot-racing stadium in Rome near which astrologers were known to operate (Hübner, "The Professional Ἀστρολόγος," 310–11).

[81]However, Jongyoon Moon argues that Mark, rather than Silvanus, was the secretary of 1 Peter, and significantly influenced the content of the text. See Moon, *Mark as Contributive Amanuensis of 1 Peter?* (Berlin, Germany: Lit Verlag, 2009).

[82]On the authorship of texts in the New Testament world, see Stanley Kent Stowers, *Letter Writing in Greco-Roman Antiquity* (Philadelphia, PA: Westminster, 1989); E. Randolph Richards, *The Secretary in the Letters of Paul* (Tübingen, Germany: Mohr Siebeck, 1991); and Steve Reece, *Paul's Large Letters: Paul's Autographic Subscriptions in the Light of Ancient Epistolary Conventions* (London, UK: Bloomsbury, 2017).

[83]See also 1 Cor. 1:1; 2 Cor. 1:1; Phil. 1:1; Col. 1:1; 2 Thess. 1:1; and Philem. 1:1.

[84]See, e.g., Scot McKnight, *The Letter to the Colossians* (Grand Rapids, MI: Eerdmans, 2018), 5–18. Among New Testament scholars, the "undisputed" Pauline letters include Romans, 1–2 Corinthians, Galatians, Philippians, 1 Thessalonians, and Philemon. The "disputed" Pauline letters include Ephesians, Colossians, 2 Thessalonians, 1–2 Timothy, Titus, and (sometimes) Hebrews, though some of these are more disputed than others. Authentic Pauline authorship is disputed because of perceived differences in vocabulary, grammatical idiom, and theological and practical content (e.g., how is the church assumed to be governed?). However, many of the arguments against the authenticity of the "disputed" Pauline letters could also be levied against passages of the "undisputed" letters, so a number of twenty-first-century scholars treat these categories loosely. The literature on this subject is voluminous, but the basics are discussed in virtually any critical commentary on a "disputed" Pauline letter.

[85]See, e.g., Luke Timothy Johnson, *Hebrews: A Commentary* (Louisville, KY: Westminster John Knox, 2006), 8–9.

[86]See, e.g., Douglas J. Moo, *The Letter of James*, 2nd ed. (Grand Rapids, MI: Eerdmans, 2021), 18; and Jerome H. Neyrey, *2 Peter, Jude: A New Translation with Introduction and Commentary* (New Haven, CT: Yale University Press, 2007). The language of 2 Peter has at times been seen as confusing and unnecessarily complicated, but a number of scholars recognize that this composition is written in the Asianic (as opposed to Attic or Koine) style of Greek, which is characterized by "a loaded, verbose, high-sounding manner of expression leaning toward the novel and bizarre, and careless about violating classic ideas of simplicity": see Bo Reicke, *The Epistles of James, Peter, and Jude* (Garden City, NY: Doubleday, 1964), 146–47; cf. Ben Witherington III, *A Socio-Rhetorical Commentary on 1–2 Peter*, vol. 2 of *Letters and Homilies for Hellenized Christians*, 2 vols. (Downers Grove, IL: IVP Academic, 2006), 273. First Peter likewise can be understood to employ this Asianic style, though perhaps to a less extreme degree (Witherington, *A Socio-Rhetorical Commentary*, 42).

[87]See, e.g., Joseph A. Fitzmyer, *The Gospel According to Luke I–IX* (Garden City, NY: Doubleday, 1981), 109–14.

[88]See, e.g., Stanley E. Porter, "The Language of the Apocalypse in Recent Discussion," *New Testament Studies* 35 (1989): 582–603.

[89]Ben Witherington III, *The Gospel of Mark: A Socio-Rhetorical Commentary* (Grand Rapids, MI: Eerdmans, 2001), 18–19. Ronald F. Hock posits that even Mark should be understood to have some amount of tertiary education, based on the sophistication involved in composing such a lengthy historical narrative (Hock, "Reading the Beginning of Mark from the Perspective of Greco-Roman Education," *Perspectives in Religious Studies* 44 [2017]: 292–93).

[90]See, e.g., Craig S. Keener, *The Gospel of John: A Commentary*, 2 vols. (Peabody, MA: Hendrickson, 2003), 1:47–48.

[91]See, e.g., Ben Witherington III, *Matthew* (Macon, GA: Smyth & Helwys, 2006), 25–26; Paul Robertson, *Paul's Letters and Contemporary Greco-Roman Literature: Theorizing a New Taxonomy* (Leiden, Netherlands: Brill, 2016), 48–49.

[92]Johnson, *Hebrews*, 16. David A. deSilva is not certain that the author had a proper rhetorical education, but acknowledges indicators that would bespeak a thorough, formal Greek secondary education at the least ("How Greek Was the Author of 'Hebrews'? A Study of the Author's Location in Regard to Greek Παιδεία," in *Christian Origins and Greco-Roman Culture: Social and Literary Contexts for the New Testament*, ed. Stanley E. Porter and Andrew W. Pitts [Leiden, Netherlands: Brill, 2013], 648–49).

[93]See esp. Ronald F. Hock, "The Problem of Paul's Social Class: Further Reflections," in *Paul's World*, ed. Stanley E. Porter (Leiden, Netherlands: Brill, 2008), 7–18. Recent scholars who doubt that Paul had a rhetorical education include Ryan S. Schellenberg, *Rethinking Paul's Rhetorical Education: Comparative Rhetoric and 2 Corinthians 10–13* (Atlanta, GA: Society of Biblical Literature, 2013); and Robertson, *Paul's Letters and Contemporary Greco-Roman Literature*, 48–49. For scholarly argument in favor of Paul having a rhetorical education, see, e.g., Jerome H. Neyrey, "The Social Location of Paul: Education as the Key," in *Fabrics of Discourse: Essays in Honor of Vernon K. Robbins*, ed. David B. Gowler, L. Gregory Bloomquist, and Duane F. Watson (Harrisburg, PA: Trinity Press International, 2003), 126–64; and Ronald F. Hock, "Paul and Greco-Roman Education," in vol. 1 of *Paul in the Greco-Roman*

World: A Handbook, ed. J. Paul Sampley, 2 vols. (London, UK: Bloomsbury, 2016), 198–227. See also the various essays in Stanley E. Porter and Bryan R. Dyer, eds., *Paul and Ancient Rhetoric: Theory and Practice in the Hellenistic Context* (New York: Cambridge University Press, 2016).

[94]In favor of Luke's rhetorical education, see, e.g., Michael W. Martin, "Progymnastic Topic Lists: A Compositional Template for Luke and Other *Bioi*?," *New Testament Studies* 54, no. 1 (2008): 18–41, https://doi.org/10.1017/S0028688508000027. Scholars who argue that Luke did not necessarily have a rhetorical education include esp. Garrett Best, "The Historical and Rhetorical Gamaliel: Reading Luke's Composition with Quintillian," *Restoration Quarterly* 60, no. 3 (2018): 147–61; Sean A. Adams, "Luke and *Progymnasmata*: Rhetorical Handbooks, Rhetorical Sophistication and Genre Selection," in *Ancient Education and Early Christianity*, ed. Matthew Ryan Hauge and Andrew W. Pitts (London, UK: T&T Clark, 2016), 137–54; and Osvaldo Padilla, "Hellenistic παιδεια and Luke's Education: A Critique of Recent Approaches," *New Testament Studies* 55, no. 4 (2009): 416–37.

[95]Scholars sometimes find evidence of rhetorical education behind 1 Peter: see Craig S. Keener, *1 Peter: A Commentary* (Grand Rapids, MI: Baker Academic, 2021), 10; cf. Karen H. Jobes, *1 Peter* (Grand Rapids, MI: Baker, 2005), 7. Some scholars also find evidence of it behind 2 Peter: see Neyrey, *2 Peter, Jude,* 113–18; and Duane F. Watson and Terrance Callan, *First and Second Peter* (Grand Rapids, MI: Baker Academic, 2012), 134. Some scholars find evidence of it behind Jude as well, though this position is far from unanimous. See Peter H. Davids, *The Letters of 2 Peter and Jude* (Grand Rapids, MI: Eerdmans, 2006), 13, 24–25.

[96]On the urban context of Paul's ministry, see, e.g., Wayne A. Meeks, *The First Urban Christians: The Social World of the Apostle Paul*, 2nd edition (New Haven, CT: Yale University Press, 2003); and Todd D. Still and David G. Horrell, eds., *After the First Urban Christians: The Social-Scientific Study of Pauline Christianity Twenty-Five Years Later* (New York: T&T Clark, 2009).

[97]See Meeks, *The First Urban Christians*, 51–73; Steven J. Friesen, "Poverty in Pauline Studies: Beyond the So-called New Consensus," *Journal for the Study of the New Testament* 26 (2004): 323–61, https://doi.org/10.1177/0142064X0402600304; and Bruce W. Longenecker, "Socio-Economic Profiling of the First Urban Christians," in *After the First Urban Christians: The Social-Scientific Study of Pauline Christianity Twenty-Five Years Later*, ed. Todd D. Still and David G. Horrell (New York: T&T Clark, 2009), 36–59. With a few possible exceptions, members of the most elite social levels are not clearly evidenced.

[98]For example, Dutch argues that much of what Paul says in 1 Corinthians is addressed especially to the educated elite members of the Corinthian church, who presumably represented a small minority of the group, and whose presence generated conflict with lower-class church members. See Dutch, *The Educated Elite in 1 Corinthians*, 95–167. Cf. Rohrbaugh, "The Pre-industrial City in Luke-Acts," 125–49.

[99]In addition to commentaries on Luke and Acts, see Rohrbaugh, "The Pre-industrial City in Luke-Acts"; and Douglas E. Oakman, "The Countryside in Luke-Acts," in *The Social World of Luke-Acts: Models for Interpretation*, ed. Jerome H. Neyrey (Peabody, MA: Hendrickson, 1991), 151–79.

[100]On the consensus re: 1 Peter, see Keener, *1 Peter: A Commentary*, 31.

[101]See, e.g., Neyrey, *2 Peter, Jude*, 130–36; and Jörg Frey, *The Letter of Jude and the Second Letter of Peter: A Theological Commentary* (Waco, TX: Baylor University Press, 2018), 222.

[102]Cf. Acts 12:17; 15:13; 21:18 and Gal. 1:19; 2:9.

[103]Cf. Greenwood, *Scripture and Cosmology*, 131–54.

[104]Namely, Luke, Acts, Romans, 1–2 Corinthians, Galatians, Ephesians, Philippians, Colossians, 1–2 Thessalonians, 1–2 Timothy, Titus, Philemon, Hebrews, 1–2 Peter, James, and Jude, which constitute twenty of the twenty-seven New Testament writings.

[105]For example, Ralph P. Martin suggests that the phrase may be "a rhetorical pleonasm, expressed with the amplitude of poetic license, for the whole universe," which is not intended to describe creational layers at all in Martin, *A Hymn of Christ: Philippians 2:5-11 in Recent Interpretation and in the Setting of Early Christian Worship* (Downers Grove, IL: InterVarsity Press, 1997), 258. See pages 257–64, for a survey of key interpretations of Paul's threefold utterance.

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Article

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Real Structures and Divine Action Externalism: A Solution to Benacerraf's Problem

Walter J. Schultz

Paul Benacerraf claimed in 1973 that realist accounts of truth which are applicable to propositions of both mathematics and science inevitably conflict with accounts of how propositions are known. This article presents a solution to the problem based on two assumptions: (1) that the God of the Bible is absolutely self-sufficient; and (2) that God is creating, providentially guiding, and redeeming according to his plans for his purposes in Christ. A coherent synthesis of what these assumptions entail itself entails that "abstract" and physical structures are real and that propositional knowledge of them is a matter of one's cognitive faculties functioning properly due to God's acting.

Keywords: Paul Benacerraf, truth, mathematical structuralism, structural realism, epistemic externalism, divine action, abstract objects, Jonathan Edwards, continuous creationism

I. Overview

In "one of the most influential articles in the last half century of philosophy of mathematics," Paul Benacerraf argues that realist accounts of truth, which are uniformly applicable to propositions of both mathematics and physical theory, inevitably conflict with accounts of how such propositions are known.[1] A *realist* account of truth presupposes that the world exists objectively and independently of the way one thinks about it and that a proposition is true in virtue of its corresponding, in some sense, to the way the real world is.

The source of the conflict lies in this. On the one hand, holding that we gain knowledge of physical objects by standing in a causal relation to them in virtue of our *perceptual* capacities, we have no explanation of how we can have mathematical knowledge, given that abstract objects are causally inert. On the other hand, holding that knowledge of mathematical truths is gained in virtue of our *conceptual* ability to detect self-evidence and the relation of logical consequence, we have no explanation of how we know propositions regarding empirical phenomena, given that they are not matters of conceptual self-evidence and *logical* consequence. Various interpretations of Benacerraf's problem have appeared in the literature along with proposed solutions and their criticisms. This vast literature indicates the pertinence of the problem to areas beyond the philosophy of mathematics to metaphysics and to the philosophy of science.[2]

As far as I am aware, none of the accounts of the concept of mathematical truth or accounts of propositional knowledge to which Benacerraf refers, nor any proposed solution, is built on Christian biblical theism. I propose a solution based on the ideas of Augustine of Hippo (354–430) and Jonathan Edwards (1703–1758), who held that the universe is a matter of God's purposeful, universe-sustaining action according to his plan in Christ.

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This feature alone makes this a "Christian" view. God's acting according to his plans for his purposes in Christ is the organizing principle of "History of Redemption" biblical theology.[3] It distinguishes Christian biblical theism from other versions of "theism."[4] God's plan is only one of a range of alternative histories for a universe, each of which God is aware in virtue of being eternally and perfectly aware of his power. Hence, what makes the propositional content of sentences of both physical theory and mathematics true—that, in virtue of which, true propositions are true—is ultimately the *way* in which God continuously creates according to his *plan*. Briefly stated, the solution may be stated in three stages.

First, *God's being absolutely self-sufficient* involves *God's being perfectly aware of his power and plans*. Since both God's perfect awareness of his power and God's plans or representations *for* creation are structured in several respects, there are *real "abstract" structures* (these are the truthmakers for mathematical propositions). On the surface of things, it might appear that *God's being absolutely self-sufficient* conflicts with *God's acting for purposes.*

Jonathan Edwards showed how these are consistent; this brings us to the second point. Edwards's reconciliation entails a metaphysics of creation—*idealism*, *continuous creationism,* and (physical) *occasionalism*—which, in turn, entails that there are *real physical structures* (these are the truthmakers for scientific and other empirical propositions).

The third stage is that God's creating according to his plan involves humans' perceiving, conceiving, and knowing propositions both of science and mathematics. Thus, neither abstract objects nor states of physical systems are the cause of our knowledge of them. Rather, God causes such knowledge by sustaining both our perceptual and conceptual capacities and the physical environment in which such capacities are situated and function. With this, we have an *externalist* account of propositional knowledge: a person's true belief is produced by a reliable belief-producing process of which they do not have exhaustive internal access.

The proposed solution here is more rigorous than stated above. It depends on the idea that *structures* are real and fundamental. Section II of this article describes two distinct ideas: (physical) *structural realism*, which is the core idea of a cluster of theories in the philosophy of science; and *realist mathematical structuralism*, which is the core idea of a cluster of theories in the philosophy of mathematics. It then describes two extant theories regarding their correlativity. Section III defines the propositional content of physical theory and mathematical theory in these structuralist terms.

Section IV provides a *theological* understanding of physical and mathematical structures, and of how they are ontologically connected, and shows of how these are logical consequences of the metaphysics of Augustine and Jonathan Edwards. Section V presents an "*occurrent content*" view of propositions derived from this metaphysics; this view stands in contrast to the standard "*platonic entity*" view held by most Christian philosophers.

Section VI presents a formal account of truth that is derived from this theological understanding of mathematical and physical structures. Section VII describes how the combination of these ideas can ground an *externalist* account of propositional knowledge. With all of this in hand, we have a rigorous solution to Benacerraf's problem based on biblical theism.

II. Structuralism: Mathematical and Physical

Mathematical structuralism is a philosophy of mathematics, standing as an alternative to *objects-platonism*, *logicism*, *formalism,* and *constructivism* regarding the nature of mathematical objects and how they are known. The idea was first proposed near the beginning of the twentieth century by Richard Dedekind (1888) and Henri Poincaré (1902).[5] The last quarter of the twentieth century saw the development of structuralist views of mathematics along several distinct lines, mirroring the debate between realists and antirealists over the status of abstract objects in general.[6] As a result, there are *platonist*, *aristotelian*, and *nominalist* views of mathematical structures. The prominent contemporary expressions of these competitors are Stewart Shapiro's (realist) *ante rem* structuralism, Michael Resnik's (realist) *in re* structuralism, and Geoffrey Hellman's (nominalist) *modal structuralism*, respectively.[7]

All realist versions of mathematical structuralism hold that mathematics should not be thought of as

the science of number and quantity, nor as a meaningless but useful formalism, nor as the study of a set-theoretic universe, not even as (merely) possible structures. Rather, the proper subject matter of mathematics is *real* structures. Accordingly, mathematical *objects* are "places" ("offices" or "positions") in structures, and their *identity* and *essence* are matters of the totality of relations they have to other places in the structure. Shapiro holds that mathematical structures and their places "exist independently of whether there are any systems of objects that exemplify them."[8]

Resnik describes realist mathematical structuralism as follows:

> In mathematics, I claim, we do not have objects with an "internal" composition arranged in structures, we only have structures. The objects of mathematics, that is, the entities which our mathematical constants and quantifiers denote, are structureless points or positions in structures. As positions in structures, they have no identity of features outside a structure.[9]

This article proposes a *realist modal structuralism* as an alternative to these views. Real structures are the *truthmakers* for the propositions of mathematics, but these are not Platonic abstract objects existing independently of God.[10] Rather, such real structures are aspects of God's representational awareness of his ability, whose primary element is God's plan in Christ. (This idea is developed in Section III.)

Physical structuralism holds that scientific theories do not inform us about the *nature* of what is modeled, but rather its structure. The most significant advocates may be James Ladyman and Don Ross, who hold *Ontic Structural Realism* (OSR), the view that the universe exhibits an ontologically fundamental, objective structure.[11] This article agrees with Ladyman and Ross on this point—that there are real physical structures. It differs from their theory primarily by holding that there *being* a complex structure to the universe and its components, and that structure's being *objective,* are matters solely of God's sustaining the universe *according to* his plan in Christ.

The literature regarding scientific and mathematical structuralism is extensive, and there are competing ideas regarding how real physical and mathematical structures are related at the metaphysical level. There is no need to review all of these and the particular issues that were at stake.[12] What is required for this article is only a characterization of the structural realism of this proposal. The next step toward that end is to properly situate what is being proposed within the context of contemporary philosophy of science and mathematics.

This article adopts *the structuralist conception* of scientific representation and *the mapping account* of the applicability of mathematics to physical theory. The structuralist conception of scientific representation is a development of the "semantic" view of scientific theorizing introduced by Patrick Suppes and Frederick Suppe.[13] Its aim is to describe how representation "works." Physical science represents real physical things of various sorts depending on the interests and purposes of the scientist and the phenomena they intend to individuate. The types of representations themselves vary accordingly. For example, a representation may be an equation, a drawing, a description, a probability distribution, a scale model, or something else. The structuralist conception holds that a scientific representation "works" in virtue of there being a similarity of *form*, *pattern*, or *structure* between its propositional content and its intended target object.[14]

The mapping account reflects the currently predominant consensus response to a problem famously raised by Eugene Wigner, the 1963 Nobel Laureate in Physics. Wigner posited that the

> enormous usefulness of mathematics in the natural sciences is something bordering on the mysterious and that there is no rational explanation for it. 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.[15]

Wigner's paper provoked a plethora of responses from scientists, mathematicians, and philosophers, and the exact nature of the relation is far from settled. One sort of response, called "The Mapping Account," is the view that mathematics applies to the physical in virtue of the similarity (sometimes isomorphic) between the structures or patterns of the physical and a mathematical structure.[16] For both the structuralist conception and the mapping account, structures are fundamental. The task, now, is to specify and clarify the correlation and to provide examples.

III. Propositional Content of Physical and Mathematical Theory

Physical theories arise from perceptual experience, augmented in most cases by conceptual experience and imagination, and are often couched in mathematical terms. John Barrow observes that

> the intelligibility of the world amounts to the fact that we find [it] to be algorithmically compressible. We can replace sequences of facts and observational data by abbreviated statements which contain the same information content. These abbreviations we often call "laws of nature." This is why mathematics can work as a description of the physical world. It is the most expedient language that we have found in which to express those algorithmic compressions.[17]

There is perceptual/conceptual progression to our knowledge of the physical world. We perceive states of physical systems, then we abstract, idealize, and project detected *patterns* in repeated sequences of those states. We are further able to represent such patterns linguistically, thereby encapsulating extensive and often complex amounts of information. Examples are *Newton's Force Law*, F = ma; *Boyle's Law of Ideal Gases*, PV = cT; and most famously, *Einstein's mass/energy equivalence*, $E = mc^2$. What Barrow observes is helpfully expanded by Saunders Mac Lane:

> Mathematics begins with puzzles and problems dealing with combinatoric and symbolic aspects of the general human experience. Some of these aspects turn out to be systematic and intrinsic, rather than arbitrary and tied to one context. They become the stuff of elementary mathematics. From this starting point, the subject has developed to be a deductive analysis of a large number of very different but interlocking formal structures. *These structures have been derived from experience* [emphasis added] in many successive stages; by abstractions from various observations of the world, its problems, and the interconnections of these problems.[18]

The last sentence in the Mac Lane quote is salutary: "*These structures have been derived from experience*." It should be added that representation is intentional or purposeful and, at best, it approximates its target. Hence, *being similar to its target* is an insufficient characteristic of the relation of (structural) representation because the relation of (isomorphic) similarity is symmetrical, reflexive, and transitive, while representation is not. The difference lies in the intentional nature of a representation. As Bas van Fraassen observes: "*There is no representation except in the sense that some things are used, made, or taken, to represent things as thus and so* [emphasis given]."[19] Likewise, Otávio Bueno submits that a "representation is an *intentional* act relating two objects [emphasis given]."[20]

The point of this brief and admittedly selective discussion regarding the *origin* and *nature* of scientific representation is simply to underscore (1) the *dynamic context* within which mathematical and scientific propositions arise, (2) the nature of propositional representation as *approximate* at best, and (3) the *fundamentality of real structures*, thereby suggesting a way forward to a uniform theory of truth for both sorts of propositions in terms of divine purposeful action according to plan. Bearing in mind these features of the origin and nature of scientific representation, let us then proceed with this proposal:

> Let a *scientific representation* be the propositional content *p* of a set of sentences that is intended to represent either (1) a *state* of a particular physical system, detailing to some extent its *structure*, or (2) a *recurring pattern of states* (i.e., an apparent similarity) occurring either in one physical system at different times or in the states of several different physical systems (e.g., the geometric and bond structures of a sodium chloride crystal or *laws of coexistence*), (3) a *recurring pattern of change* in several states of one physical system or in the states of several different physical systems over some duration of time (e.g., a chemical and biological mechanism or *law of succession*).[21]

Let us turn our attention now to mathematics. There is a subtle, but crucial difference between a *mathematical theory* and a *mathematical structure*:

> A *mathematical theory* comprises two *sets* of (formal or informal) sentences and a (sound and complete) *system* of first-order logic. The *axiom* sentences express the essentials or lineaments of the subject matter of the theory and are taken for granted. The *theorem* sentences express the propositions which are derived from the axioms according to the system of logic. The system of logic comprises a *syntax*, a *semantics*, and a *deductive system*.[22]
>
> A *mathematical structure* is the complex concept (i.e., propositional content) expressed by a *mathematical theory* or by an *algorithmic compression*.

To avoid misunderstanding, it should be noted that the term "structure" is used in several other ways in

philosophy of science, philosophy of mathematics, and in mathematics itself. One prominent example is "algebraic structure," which consists of (1) a set of objects standing in defined relations arising from operations on that set and (2) a set of axioms which the relations and operations satisfy. Examples are groups, rings, fields, and lattices. In another sense, the term denotes a component in an axiomatic theory. In this latter sense, a structure is a list (i.e., a "tuple") consisting of a set of objects, an ordered sequence of relations (functions or operations) on the set, and names for distinguished elements in the set used for the interpretation of a formal language. Neither of these senses is intended by the definition. What I intend by use of the term "mathematical structure" is simply a common notion. Perhaps the best example is *Euclidean Geometry* as axiomatized by David Hilbert or Alfred Tarski.[23] The concept it expresses is *Euclidean space*. The "*relata*" of the structure are "*points*." Other examples are *Dedekind-Peano Arithmetic* (whose concept is an *omega sequence* whose relata, i.e., places or offices, are natural numbers), *Zermelo-Frankel* (ZF) set theory (whose concept is *the cumulative hierarchy of pure sets*), and *Causal Set Theory* (whose concept is *the discrete causal structure of spacetime*, whose relata are elementary events). Some mathematical structures such as the complex concept expressed by Causal Set Theory are also scientific representations.[24]

We have considered two types of propositional content, one associated with physical theory and the other with mathematical theory; both are structuralist. To serve the purposes of providing a solution to Benacerraf's problem, it must now be shown precisely how each sort of propositional content is related to divine action according to God's plan.

IV. An "Augustinian—Edwardsian" Synthesis

A *theological* understanding of physical structures and their correlativity to mathematical structures can be constructed from the metaphysics of Augustine and Jonathan Edwards. Both of them grounded their ideas in the biblical theme that G*od is creating, providentially guiding, and redeeming according to his plans for his purposes in Christ Jesus.* Augustine was the first to suggest that God's plan is only one of a range of alternative histories *for* a universe, things of which God is eternally aware in virtue of being aware of his power. Simo Knuuttila writes that God's

> acting by choice between alternative providential scenarios […] played an important role in the emergence of the intuitive idea of modality as referential multiplicity with respect to simultaneous alternatives. This modal paradigm hardly occurred at all among ancient thinkers. It was introduced in early medieval discussions which were strongly influenced by Augustine's philosophical theology.[25]

In short, the Augustinian element has two components: (1) God's plan in Christ is an ordered sequence of possibilities, only one among infinitely many alternative histories; and (2) God is perfectly aware of all possibilities in being aware of his power.

The second component is directly rooted in scripture and has been affirmed often in the history of Christian thought.[26] *That God is aware of his power and therein representationally aware of what is possible* is indicated most clearly perhaps by the rhetorical question posed several times in various settings, "Is anything too hard for the LORD?"[27] This pastorally motivated question is intended to evoke a response in the hearer. More is revealed implicitly. The posing of the question by God through the prophet presupposes that God is *aware* of his power. It could not have had its rhetorical effect had the hearer not been entitled to assume that God is aware of the answer. Edwards in his *Concerning the End for Which God Created the World* puts it this way:

> God as perfectly knew himself and his perfections, had as perfect an idea of the exercises and effects they were sufficient for, antecedently to any such actual operations of them, as since.[28]

What Edwards adds to the tradition is his showing how God's plan in Christ is a system of ends subordinate to God's "original ultimate end" and showing how this overcomes a famous conundrum.[29]

For Edwards and many others in the history of Christian thought, God's awareness of his ability *ad extra* is *representational*. These representations are not representations *of* things that exist, but representation *for* things to exist. God's *plan* in Christ is a history *for* a universe, according to which God confers existence, providentially guides the affairs of the world, and acts for his redemptive purposes. It includes a representation for every element of everything that falls under these categories, including an ultimate end in creation. It is like having a blueprint, a play, or a musical score in mind *prior* to the building of the house or *prior* to the performance.

The idea of *God's acting for purposes*, however, presents a conceptual problem which threatens the coherence of every metaphysical theory and systematic theology which holds it while also holding that *God is absolutely self-sufficient.* The ordinary concept of a person's acting to achieve an end entails three conditions *prior* to taking the first step in a course of action to achieve it, and *as* it is being pursued: (1) it is seen as having some objective value; (2) its achievement is actually treasured, cherished, or esteemed by the person pursuing it; and (3) something is gained by its achievement.[30] Hence, the concept of God's acting to achieve an ultimate end entails that God will gain something in achieving it and that God lacked it before creating, contradicting the idea that God is absolutely self-sufficient.

For centuries, this problem was well known among Jewish, Roman Catholic, and Protestant theologians. It was stated clearly by Baruch Spinoza in his *Ethics* (1677) and addressed in outline by Nicolas Malebranche in his *Dialogues* (1688). It was addressed in rigorous detail by Edwards in his *Dissertation Concerning the End for Which God Created the World* (1765). Today, it is almost completely unknown among contemporary Christian thinkers—at least inadequately appreciated and certainly seldom addressed.[31] Edwards was acutely aware of the conundrum and deductively demonstrates how the conjunction of the doctrines is conceptually coherent, thereby overcoming it.

Edwards's synthesis is crucial for this article in that it *logically entails* a version of physical and mathematical structural realism which is the conceptual foundation of the account of truth being proposed. To see this clearly, a brief explication of the problem and Edwards's solution is required. Edwards uses the phrase "absolute self-sufficience" three times, explicating it as follows: "God is infinitely, eternally, unchangeably, and independently glorious and happy."[32] *God's being absolutely self-sufficient* is revealed in God's names, *Yahweh* and *El Shaddai*. It is also revealed in scripture through prophetic statements, worshipful affirmations, and direct teaching. In eighteenth-century terms, Edwards observes that *God's being absolutely self-sufficient* includes at least three elements. First, God is *self-existent*. Second, God is *in himself excellent*, in goodness, in knowledge (wisdom), and in power. Third, God's Trinitarian nature is the sole source of God's dwelling in a state of complete *felicity and fulfillment*. Therefore, no created entity or set of conditions could be *necessary* for the *maintenance* of God's existence, excellence, or felicity or could be *sufficient* for the *reduction* or *increase* of any of them to any extent.

Accordingly, there are at least three concepts of value in accordance with which God might be thought to gain by creating something "external" to himself: (1) *ontological,* (2) *qualitative*, and (3) *psychological.* A thing's *ontological* value is its objective or real *existence*. A thing's *qualitative* value is its intrinsic *excellence*. Biblical cognates are "glory," "greatness," and "weightiness." The Hebrew word is *kabhodh*, דָּבָכ; the Greek (Septuagint) word is *dóxa*, *δόξα*. A thing's *psychological* value is the pleasure (felicity, joy, fulfillment) it provides. Again, for the sake of brevity, let's consider only the conceptual hypothesis of *ontological value* being added by God's creating. It alone is directly pertinent.

As did many theologians before him, Edwards recognizes that if God's ultimate end in creation involved the *addition* of real being, three contradictory positions follow. First, the sum total of all being would be greater than the being of God alone, thereby increasing God's glory or excellence by increasing his wealth and thereby increasing God's joy or fulfillment, which by supposition are unsurpassable. Second, the hypothesis contradicts the idea that creation is *ex nihilo*. Finally, if, at any moment of the additional being's existence, it were not completely dependent on God's *willing* its existence, then by definition it would be *real* with respect to God.[33] To exist independent of God's willing is to be self-existent. As Geerhardus Vos writes, "If it existed of itself, then so far as its being is concerned, it would be like God."[34] Here we have the only extant coherent account of how *God's acting for purposes* is consistent with *God's being absolutely self-sufficient.* It entails that the existence of the universe and all that belongs to it, at every moment of its existence, be *ideal* with respect to God. The universe in every respect depends radically and entirely on God's willing its nature and existence. If it were not, it would at that moment and in that respect be *self-existent*, which is a property only God can have.

Traditional systematic theology holds that *aseity* (self-existence) *is incommunicable.* Moreover, if the universe were not radically dependent on God's willing its nature and existence, God would gain "wealth" by creating. This idealism that is a logical

consequence of Edwards's synthesis is a position regarding *ontological dependence*; it is not an idealism of physical *fundamentality* or *constitution*.[35] The ideas that God had perfectly in mind before creation as *representational-intentions-for-existence* become ideas as *divine-acts-of-willing-existence* according to his plan—two kinds of divine ideas, but ideas in God's mind, nonetheless. In other words, there is a change in the ontological *form* of God's ideas regarding creation, but no additional being is added, because creation is *ex nihilo*.[36] (This sort of idealism makes sense of interpretations of Quantum Field Theory and Quantum Gravity which hold that what is fundamental are not "bits of matter," but elementary events which are excitations of quantum fields.[37])

To reiterate, the existence and nature of the universe depend entirely on God's continuously willing it according to his plan. Hence, physical systems cannot have "ontological momentum" or "existential inertia." Moreover, the apparent causal relation between events or between states of physical systems lies solely in the sequence of God's existence-conferring action according to his plan. In other words, Edwards's development of the Augustinian ideas in overcoming Spinoza's conundrum also entails *continuous creationism* and (physical) *occasionalism*.[38] These two views are essential to the proposed solution to the Benacerraf Problem presented in this article and are entailed by Christian biblical theism.

The crucial point of this extended discussion is this: *God's being absolutely self-sufficient, God's being perfectly aware of power,* and *God's acting according to his plan for his purposes in Christ* together *entail* structural realism in three respects. First, God's awareness of his ability *ad extra* is structured in the form of alternative histories *for* a universe. Second, God's plan in Christ is structured. God's plan is real with respect to creatures and is a *system* of ends, which are events and stages in the history of redemption. By analysis of the concept of *system*, God's plan involves structure. From another angle, as a *history for a universe*, God's plan is an ordered sequence of component representations *for* divine action. It must have a *proto-temporal* structure, which is a linear order of "places" whose contents are these component representations. Third, the universe itself existing solely as a matter of God's creating *according to* his plan in Christ is also structured. God's plan—being a history for a universe and a system of ends—must also have a *representational* structure, which includes all of the relations between and among these components. Part of this structure must be a *proto-causal* structure, which is the *abstract* structure of those relations between and among these component representations, which becomes the *causal* structure of the universe as God continuously creates according to plan. Dispositions, laws of nature, chemical bond structures, and biological mechanisms are the manifestations of God's acting.

In short, since God is perfectly aware of his power and since God's plans or representations *for* creation are structured in several respects, there are *real* "*abstract*" *structures* (these are the truthmakers for mathematical propositions) and, given the metaphysics of creation (*idealism*, *continuous creationism,* and [physical] *occasionalism*), there are *real physical structures* (these are the truthmakers for scientific and other empirical propositions). Section VI is devoted to showing how these play a role in truth and knowledge. To make the case in that section, we must first describe the view of *propositions* assumed in this article that contrasts with the divine *plans*, which are God's representations *for* existence.

V. Propositions Distinguished from Divine Representations

A *proposition* is the informational (or information-like) *content* of an occurrent intentional mental state of a created agent. It is a short-lived, abbreviated, synoptic representation of some state of affairs or concept which is introspectively accessible and has a phenomenology of being necessary and abstract.[39] This "*occurrent content*" view of propositions, grounded in God's acting, stands in contrast to the standard "*platonic entity*" view held by most Christian philosophers. As Friederike Moltmann has observed,

> A number of philosophers have therefore argued that the notion of an abstract proposition, conceived as a formal object of one sort or another, should be replaced by a cognitive notion of proposition, a mind-dependent object whose truth-directedness is tied to the intentionality of an agent.[40]

To reiterate what was stated earlier, God is perfectly aware of his power, which is his ability *ad extra.* God's awareness is *representational*. These representations are not representations *of* things that exist, but representations *for* things to exist. God's *plan* in Christ is a history *for* a universe, according to which God confers existence, providentially guides the affairs of

the world, and acts for his redemptive purposes. It includes a representation for every element of everything that falls under these categories, including an ultimate end in creation. The point is that *God's representations for existence* are not propositions. Even though both are representations in a generic sense, they are distinct. Propositions can only be gross abbreviations of the content of divine thoughts, which are themselves exhaustively detailed representations *for* existence.

This difference affects philosophy of mathematics. Recent Christian philosophy of mathematics has taken the form of either *theistic activism*[41] or *theistic conceptualism*[42] regarding the existence and nature of abstract objects in general, while ignoring or denying the difference between propositions and God's representations. *Theistic conceptualism* takes the referents of mathematical terms (and other abstract objects) to be *concepts in* the divine intellect; *theistic activism* takes them to be *products of* the divine intellect. My view has both conceptualist and activist features, but it differs from them in that it treats abstract objects as a matter of God's representational *awareness* of his ability to create; they are representations *for* existence. Hence, God's "thoughts" cannot be propositions.

Conceptualizing God's plan in Christ as a sequence of divine representations for existence, and not as some sort of "possible world" or "book on a world" comprising propositions, precludes the threat of paradox in several ways.[43] First, since it is a composite plan, it must be a *sequential* and *infinite* representation *for* the universe. The possibility of global self-reference is eliminated because, unlike propositions, divine representations *for* existence cannot be self-referential. Second, since representations as plans are not self-referential, no power set of representations is entailed. Third, since God's plan in Christ is a complex relational structure whose parts are themselves mereological sums, each component plan that is not a simple representation is a *convex* sequence of such. This also precludes the construction of a power set. For these reasons, this structure is not subject to *Russell's Paradox*. For the same reasons, it is not subject to incoherence by applying *Cantor's Theorem*. In today's language, letting *the power set* $\wp(A)$ of a given set *A* be the set of all the subsets of *A*, *Cantor's Theorem* holds that, for any set *A*, *A* has fewer members than its power set $\wp(A)$. In particular, Cantor showed by way of an indirect *diagonal argument* that, for any set A, there is no one-to-one function from $\wp(A)$ into A. But again, since God's representational awareness of his ability *ad extra* is a mereological whole whose parts are convex, there is no power set of the collection of all of God's representations.

VI. A Formal Account of Truth

This Augustinian-Edwardsian development of Christian biblical theism suggests how to state a formal account of truth in structuralist terms. The first step toward that statement is to describe its general approach to *propositional truth*. William Alston proposes a "realist conception of truth," which he offers as an "account of our ordinary concept of truth."[44] Alston says that it is a "way of thinking of truth in that the truthmaker is something that is objective vis-à-vis the truthbearer and has to do with the relation of a potential truthbearer to a REALITY beyond itself."[45] This affirms Andrew Ushenko's claim that "semantics cannot be confined to purely linguistic relationships because it contains such concepts as 'truth,' which in the sense of 'agreement with reality' involves reference beyond discourse."[46] The same idea is voiced by Donald Davidson observing that relativized notions of truth in model-theoretic semantics—*truth-in-a-model* (i.e., *truth-under-an-interpretation*)—fail to express our ordinary nonrelative concept of truth.[47]

What is needed is a formal semantics that indicates *how* a proposition *p* which is *true-in-a model* is true *per se* by giving its truth-conditions in terms of *reality as it is*. Reality *as it is*, however—*reality beyond* every truthbearer—is a matter of God's purposeful, universe-sustaining *action according to his plan*, which is only one of a range of alternative histories *for* a universe, things of which God is eternally aware in virtue of being aware of his power. Hence, mathematics and physical theory are ultimately about *what God knows*, *how God acts in creating,* and *what exists as purposeful and planned divine creation*. With this in hand, we may now address the following question:

> Under what necessary conditions are *scientific representations* true *per se*, given that they can be only approximations?

Given the assumed theological metaphysics, a proposition of physical theory or of mathematics is true *per se* if (1) its *ultimate* referent—its *truthmaker*—is an element of *what God knows* regarding his ability *ad extra,* his purposes, and his plans and (2) its *intended*

referent is *what exists* as God's conferring existence to the universe.

To reiterate, God is perfectly and completely aware of God's power. God's awareness of God's power is in the form of an array of alternative histories for a universe, each of which is an ordered sequence of representations for divine action. For the sake of the precision of formalization, let $\mathcal{K}$ denote God's knowledge of power. Medieval theologians and philosophers used the expression, *potentia Dei absoluta*, which means "the absolute power of God." God's power is God's competence to bring about various states of affairs ad extra (i.e., outside of himself) as they are guided by his wisdom within the constraints of his holiness. It is God's ability to create, to providentially guide, and to redeem. Let us henceforth use the expression "God's ability ad extra" to refer to what we colloquially refer to as "God's power."

Let the italicized letter *r* be a (divine) representation *for* the result of a creative act. Hence, $\mathcal{K}$ includes *r*. A scientific representation, by contrast, is a human idea; it is a proposition which can only approximate what it denotes. Hence, let the expression consisting of the lower-case letter in brackets [*p*] be the element *r* of $\mathcal{K}$ represented by the propositional content *p*. In other words, the expressions '[*p*]' and '*r*' denote the same thing. The difference between the two expressions lies only in the *sense* of what they denote. The sense of the expression '*r*' is its being a divine *representation for* something's existence. The expression '[*p*]' denotes the exhaustively detailed component of God's representational awareness of his ability *ad extra*, insofar as it is ultimately represented by a proposition *p*. Because the existence of a physical system *x* is a matter of God's conferring existence to *x* according to his plan and since *r* is a constituent of God's plan according to which he confers existence, we can say: "*p* represents *r*" even though seldom (if ever) is a created agent conscious that *this* is what *p* ultimately represents. Since a true proposition *p* is—and can only be—an abbreviation of *r*, God's knowledge $\mathcal{K}$ includes [*p*]. Hence, in general, for any extant proposition *p* regarding a physical phenomenon or state of a physical system,

> *p is true per se* only if what *p* represents as being the case is included in God's knowledge $\mathcal{K}$.

This is the general form, though it is far from complete. To render this more precise, consider that since the universe is a matter of God's conferring existence according to his plan in Christ, the *truthmakers* for propositions regarding the physical world (i.e., scientific representations) are located in God's plan for creation. A truthmaker's "*actuality*" is prior to human ideas and to the existence of the entire universe itself (which is ideal and derivative). God's plan *for* the universe is *eternal* and *necessary* (being an aspect of God's eternal and necessary self-awareness). Since it encompasses all that God does and according to which every created thing owes its existence, nature, and functioning, God's plan alone deserves the name, "the actual history, α."

With this in mind, the truthmaker [*p*] lies in God's plan for the universe—the actual history α. It is either an *aspect* of α or "*located within*" α over some duration δ, where δ is a sequence of units *for* a minimal moment of existence (i.e., "frames for time"), not *of* moments of physical time itself. Furthermore, by definition, the truthmaker [*p*] for a scientific representation *p* is a real *possibility*. In other words, the truthmaker [*p*] is a *representation for* a *result* of an existence-conferring *act*. As discussed above, Augustine, Edwards, and scripture affirm that God, being perfectly aware of his ability ad extra, is perfectly aware of all real possibilities, as something he can create. With these refinements in hand, we have this more precise account:

> *p is true per se* only if God's knowledge $\mathcal{K}$ includes a representation *r* which is proposition *p*'s ultimate referent [*p*] and, for some duration δ, the actual history α includes [*p*] over duration δ.

We have stated two necessary conditions. Two more must be included to complete this account. The third is some created agent thinking a thought with proposition *p* as content. No proposition is true without this. Given the metaphysics of creation thus far derived, a *proposition* is the informational content of the *manifestation* of a mental disposition to believe. It is a person's subjective *intension* upon understanding a declarative sentence, existing briefly as the informational aspect of an occurrent intentional mental state. Hence, a proposition is an aspect of an event. Let the following, then, be the third condition:

> *p's being the content of some created agent's occurrent propositional attitude over δ is itself a component plan included in the actual history.*

An agent thinking a thought—just as the universe and every physical system it comprises—is a *process* of divine action according to God's plan. (This

element is crucial to the externalist epistemology to be described in section VII.) Thus, the fourth necessary condition is *God's existence-conferring action*. Without either of the latter two conditions, no proposition exists, much less has the property of *being true*. Accordingly, we have this refinement:

THESIS ONE:

> For any *scientific representation p*, *p is true per se* if and only if (1) God's knowledge $\mathcal{K}$ includes a representation *r* which is *p*'s ultimate referent (that is, $r = [p]$), such that (2) for some duration δ, the actual history α includes $[p]$ over δ, (3) *p's being the content of some created agent's occurrent propositional attitude over δ is itself a component plan included in the actual history*, and (4) *God is conferring existence according to his plan for his purposes in Christ*.

(This account expresses and develops the *correspondence conception of truth* understood in an ontologically realist sense.)

We have been addressing this question: Under what necessary conditions are scientific representations true, given that they can only be approximations? This stage in the development of the account takes one step, *reflecting* a grounding of the truth of a proposition in God's knowledge and existence-conferring action, where the proposition is of physical theory. None of the mathematical sentences mentioned above is a typical sentence of mathematics and its typical objects. Since what we require is a semantics regarding *truth per se* which applies coherently and unequivocally to propositions and theories of *both* physical theory and mathematics, the formal semantics must (somehow) apply *also* to the latter. The issue is how these two sorts of propositional content may be related to each other and then to *truth per se*.

Perhaps someone will now warn or protest that pure mathematics is the study of structures independently of whether they are exemplified in the physical universe. Accepting the thesis of the objection for the sake of argument, how are we to understand the nature of such structures? Are they constructs of the imagination only? Works of fiction are analogous examples. If so, what would it even mean to say that they are true per se? Just because we *can conceive* of some particular set of objects and some particular relations between those objects does not mean that those things are real.[48] (This issue is addressed below by Thesis Three.) With these definitions and examples in hand, we can address these questions:

> Under what necessary conditions are *mathematical structures* true *per se*, given that they can only be approximations?
>
> What sorts of things are *their* truthmakers—as the intended referents and the ultimate referents of such structures?

Real structures

Saunders Mac Lane reports that "mathematics consists in the discovery of successive stages of the structures underlying the world with emphasis on those structures of broad applicability and those reflecting deeper aspects of the world."[49] Similarly, *Ontic Structural Realism* (OSR) in the philosophy of science is the view that scientific theories do not inform us about the *nature* of what is modeled, but rather its *structure*.[50] The "structures underlying the world" to which Mac Lane and OSR refer are *real*. By definition, "*real structures*" do not depend on a human conceptualization for their existence. Therefore, the ultimate referent of a *true mathematical* structure is a *real* structure. (This satisfies *the mapping argument*). Here then, we have an *initial* suggestion of how to think about the truth conditions of propositions of mathematics.

As briefly described above, (1) *God's plan in Christ is an ordered sequence of possibilities, only one among infinitely many alternative histories* and (2) *God is perfectly aware of all possibilities in being aware of his power.* There are at least two broad types of *real* structures: Type I, the structures of *God's knowledge ad extra;* and Type II, the structures of *what we* perceive in perceiving the *result* of such acts—structures of, between, and among simple and complex physical systems.

For the sake of clarity, an elaboration is in order. A Type I real structure is a component of God's representational awareness of his ability *ad extra*. As such, it is either the structure of the array of alternative histories *for a universe,* or a structure of the actual history α (the history for our universe) as a system of ends, or a structure of a component of α. For example, God's plan *for* any two or more objects standing in some relation, involves a representation *for that relation*. A Type II real structure is the *result* of a way God confers existence according to the actual history α, God's plan in Christ. A representation *for* a Type II real structure (say *for* a sodium

chloride crystal or the mechanism of plant germination) is a complex representation: a representation which is itself a *relation* of representations for states of a physical system (occurring simultaneously in the sodium chloride example or sequentially in the mechanism example). In short, some representations are Type I real structures. Some of these are *for physical* structures, such that when enacted are Type II real structures. Thus, Type II real structures depend on Type I real structures.

Mathematical structure in relation to real structure

To reiterate, a mathematical structure *p* is true *per se* if and only if its ultimate referent is a divine representation. This general statement can now be developed further for the purpose of stating an account of *truth per se.* The type of structures to which Mac Lane and OSR refer are all physical structures. To reiterate, a physical structure is the continuing *result* of one of the continuing *ways* God confers existence.[51] For example, Meinard Kuhlmann observes that ontic structural realism takes

> symmetry groups to indicate that symmetry structures as such have an ontological primacy over objects. However, it is not altogether clear *how symmetry structures could be ontologically prior to objects* if they only exist in concrete realizations, namely in those objects that exhibit these symmetries.[52]

If what I am proposing is true, symmetry structures are Type II real structures ultimately grounded in one of God's representations *r*, which is a Type I real structure.

A true mathematical structure, in other words, involves a "chain" of referents terminating at its truthmaker, which is an element *r* of God's representational awareness of his ability *ad extra*, where *r* is a Type I real structure included in the actual history α. In other words, a true *mathematical structure*, which is also a *scientific representation,* correlates first to a Type II real structure and ultimately to a Type I real structure of the actual history α. Some true mathematical structures, however, are not scientific representations, but they correlate directly and only to a Type I real structure of the actual history α. The referent of a true mathematical structure is simply one of these real structures. The implications of these for a theory of truth for mathematical propositional content *p* is this account:

THESIS TWO:

> A *mathematical structure p* is *true per se* if and only if (1) God's knowledge $\mathcal{K}$ includes a representation *r* such that *r* is *p*'s ultimate referent (that is, *r* = [*p*]), such that (2) *r* is a real structure, where for some duration δ the actual history α includes [*p*] over δ, (3) *p's being the content of some created agent's occurrent propositional attitude over δ is itself a component plan included in the actual history*, and (4) *God is conferring existence according to his plan for his purposes in Christ*.

A *theorem* of a mathematical theory which is also intended to be a scientific representation of an *aspect* or a *component* of a physical system is *true per se* if and only if the actual history α includes a representation for it.[53] Hence, we have this corollary:

COROLLARY:

> A *mathematical proposition p* (if not intended as a scientific representation) is *true per se* if and only if there is a *mathematical theory* whose correlative mathematical structure is *true per se* and *p* is a theorem of that theory.

In other words, a proposition *p* of mathematics is *true per se* only if *p* is a logical consequence of a *true per se* mathematical structure.

Consider the following example, where the expression "<1+1=2>" denotes the proposition expressed by the mathematical sentence "1+1=2," the expression "Seq^{ω}" ("omega sequence") denotes an infinite sequence, the expression "$\wedge PA^2$" denotes the conjunction of the axioms of second-order Peano Arithmetic, and "α" denotes God's plan in Christ. Here is an analysis of the truth conditions of the proposition:

> The proposition <1+1=2> is true if and only if (1) God's representational awareness $\mathcal{K}$ includes a representation *r* for the omega sequence Seq^{ω} expressed by second-order Peano Arithmetic ($\wedge PA^2$), where (2) Seq^{ω} is a structure included in α and *1+1=2* is a theorem of $\wedge PA^2$, (3) (P) *p's being the content of some created agent's occurrent propositional attitude over δ is itself a component plan included in the actual world*, and (4) (G) *God is conferring existence according to his plan for his purposes in Christ.*

The *corollary* satisfies Benacerraf's requirement that "any theory that proffers theoremhood as a condition of truth also *explain the connection between truth*

and theoremhood."[54] In the *corollary*, theoremhood—that is, *being a theorem* of a mathematical theory—is indeed a condition of *p*'s being true *per se.* The "connection" is this: the truth of the proposition is "*transferred to it*" (so to speak) from the truth of the mathematical structure in virtue of the relation of logical consequence.

THESIS THREE:

> A *mathematical structure or theorem p* is *fictionally false* if and only if (1) God's knowledge $\mathcal{K}$ includes a representation *r* such that *r* is *p*'s ultimate referent (that is, $r = [p]$), and (2) *r* is a real structure but not included in the actual history α, and (3) *p's being the content of some created agent's occurrent propositional attitude over δ is itself a component plan included in the actual history*, and (4) *God is conferring existence according to his plan for his purposes in Christ*.

A fictionally false *mathematical structure p* is conceptually possible because it is logically consistent.[55] If a mathematical structure *p* is neither *true per se* nor *fictionally false*, it is *purely false*. God's knowledge $\mathcal{K}$ does not include a representation *r* such that *r* is *p*'s ultimate referent (that is, $r = [p]$).

In these three theses we have a formal account of truth which (1) is uniformly applicable to propositions of both physical theory and pure mathematics, (2) is derived from the fundamental reality that *God is creating, providentially guiding, and redeeming according to his plans for his purposes in Christ Jesus*, and (3) is sufficiently rigorous so as to serve a formal semantics of a system of quantified modal logic.[56]

VII. A Solution to Benacerraf's Problem

Stewart Shapiro observes that "most contemporary philosophy of mathematics begins" with Paul Benacerraf's argument that attempting to address two reasonable concerns leads inevitably to an impasse.[57]

Benacerraf's concerns are

> (1) for having a homogeneous semantical theory in which semantics for the propositions of mathematics parallel the semantics for the rest of the language, and (2) that the account of mathematical truth mesh with a reasonable epistemology.[58]

He concludes that "accounts of truth that treat mathematical and nonmathematical discourse in relevantly similar ways do so at the cost of leaving unintelligible how we can have any mathematical knowledge whatsoever."[59]

As it stands, Benacerraf's argument is not entirely obvious. Since this article is concerned with a uniformly applicable *realist* account of truth, it will be helpful to consider Shapiro's suggestion that the problem is a dilemma. A dilemma begins with a choice between at least two alternatives, whose consequences conflict. Shapiro approaches Benacerraf's problem as grounded in a choice between a realist and antirealist ontology regarding the objects of mathematical and physical theory.[60] Each alternative entails a problematic result. Only the realist alternative is pertinent.

This article proposes a uniformly applicable account of truth *per se* on the assumption that the propositional content of sentences of *both* physical theory and mathematics is ultimately about God's knowledge *ad extra* and about the ways God continuously creates according to his plan. Divine continuous creation pertains also to humans' perceiving, conceiving, and knowing; these three require believing a proposition. A created agent's *believing* a proposition is, in one sense, (1) an occurrent, intentional, doxastic state of consciousness and, in another sense, (2) a disposition to be in such states.

Given the divine action metaphysics presented earlier, even though the formation of choices of agents may not be produced by God-given free will, states of consciousness are produced by God. The *process* of coming to have the belief is inaccessible to the knower's consciousness. Hence, this is an instance of *externalism* with respect to *warrant*, where *warrant* is the element that, when added to justified, true belief, gives us propositional knowledge.[61] In addition and by contrast, the *justification* of an agent believing in *p* is (at least in part) grounded in what is *internal* to the mind, that is, the person is aware of reasons to think that *p* is true. The following statement succinctly combines *externalism* with respect to *warrant* with *internalism* with respect to *justification*:

> For any proposition *p* and any person *S*, *S knows that p* if and only if (1) *p* is true, (2) *S* believes that *p*, (3) *S* is aware of reasons for *p*'s truth and (4) both *S's* believing that *p* and *S*'s awareness of supporting reasons—the intentional state of consciousness and the propositional content in both cases—are produced by God even though *S*'s attending to *p* need not be.

This is sufficient because Benacerraf requires *only* that an account of propositional knowledge be *conceptually possible*—how one *might* have mathematical knowledge. As he puts it,

> an account of mathematical truth, to be acceptable, must be consistent with the possibility of having mathematical knowledge: the conditions of the truth of mathematical propositions cannot make it impossible for us to know that they are satisfied. To put it more strongly, the concept of mathematical truth, as explicated, must fit into an over-all account of knowledge in a way that makes it intelligible how we have the mathematical knowledge that we have.[62]

The account of truth *per se* combined with this externalist epistemology coherently satisfies both of the concerns noted by Benacerraf, thereby providing a solution.

A summary of the core idea of this article is this. Jonathan Edwards held with Augustine that God's plan in Christ is one of infinitely many alternative histories *for* a universe. On biblical grounds, Edwards provides a description of how *God's being absolutely self-sufficient* is consistent with *God's acting for purposes in Christ*. This coherent synthesis entails *idealism, continuous creationism,* and (physical) *occasionalism,* which ground real *physical* structures according to the real *abstract* structures of God's plan in Christ. A proposition of science or mathematics is true just in case its truthmaker is an element of one of these structures, and is known because God produces the belief according to his commitment to create, providentially guide, and redeem according to his plan in Christ. This solution to Benacerraf's problem is also an apologetic argument *for* Christian biblical theism.[63]

Notes

[1]See Bob Hale and Crispin Wright, "Benacerraf's Dilemma Revisited," *European Journal of Philosophy* 10, no. 1 (2002): 101, https://doi.org/10.1111/1468-0378.00151; and Paul Benacerraf, "Mathematical Truth," *Journal of Philosophy* 70, no. 19 (1973): 661–79, https://doi.org/10.2307/2025075.

[2]See Adam Morton and Stephen P. Stitch, eds., *Benacerraf and His Critics* (Hoboken, NJ: Blackwell Publishers, 1996); Fabrice Pataut, ed., *Truth, Objects, Infinity: New Perspectives on the Philosophy of Paul Benacerraf* (Switzerland: Springer Verlag, 2017); and Majid Davoody Beni, "The Benacerraf Problem as a Challenge for Ontic Structural Realism," *Philosophia Mathematica* 28, no. 1 (2019): 35–59, https://doi.org/10.1093/philmat/nkz022.

[3]See Edward W. Klink III and Darian R. Lockett, *Understanding Biblical Theology: A Comparison of Theory and Practice* (Grand Rapids, MI: Zondervan, 2012), 59–90.

[4]"Theism" is the belief that there is at least one god. As such, the term applies to the three Abrahamic religions: Judaism, Christianity, and Islam. The term also applies to the philosophical expressions of these religions such as (Aristotelian) classical theism and Anselmian theism. It also applies to systems such as Whiteheadian process theism and, of course, other sorts of monotheism.

[5]Richard Dedekind, *Was sind und was sollen die Zahlen?* [1888], trans. Wooster Woodruff Beman as "The Nature and Meaning of Numbers," in Dedekind, *Essays on the Theory of Numbers* (Chicago, IL: Open Court, 1901; reprint, Mineola, NY: Dover Publications, 1963): 31–115; and Henri Poincaré, *Science and Hypothesis*, trans. George Bruce Halsted (1902; reprint, Mineola, NY: Dover, 1952).

[6]See Erich Reck and Georg Schiemer, "Structuralism in the Philosophy of Mathematics," in *The Stanford Encyclopedia of Philosophy,* Spring 2020 Edition, ed. Edward N. Zalta, https://plato.stanford.edu/archives/spr2020/entries/structuralism-mathematics/.

[7]Stewart Shapiro, *Philosophy of Mathematics* (Oxford, UK: Oxford University Press, 1997); Michael D. Resnik, *Mathematics as a Science of Patterns* (Oxford, UK: Oxford University Press, 1997); and Geoffrey Hellman, *Mathematics without Numbers*: *Towards a Modal-Structural Interpretation* (Oxford, UK: Oxford University Press, 1989). See also the *Oxford Handbook of Philosophy of Mathematics and Logic*, ed. Stewart Shapiro (Oxford, UK: Oxford University Press, 2007).

[8]Stewart Shapiro, *Philosophy of Mathematics: Structure and Ontology* (Oxford, UK: Oxford University Press, 2000), 9, 75.

[9]Michael D. Resnik, "Mathematics as a Science of Patterns: Ontology and Reference," *Noûs* 15, no. 4 (1981): 530, https://doi.org/10.2307/2214851.

[10]The version of Platonism—Platonism with a capital "P"—that holds that there is a realm of abstract objects existing independently of God is to be rejected. My proposal is a "platonism" with a lower-case "p," following a long tradition of denying Platonism and holding that what we take to be abstract objects (propositions, universals, possible worlds, and sets) are matter of God's thoughts, which I specify as God's thoughts regarding his power.

[11]James Ladyman and Don Ross, *Every Thing Must Go: Metaphysics Naturalized* (Oxford University Press, 2007), 130. See also Robin Findlay Hendry, "Emergence in Chemistry: Substance and Structure," in *The Routledge Handbook of Emergence,* ed. Sophie Gibb, Robin Findlay Hendry, and Tom Lancaster (New York: Routledge, 2021), 315–26.

[12]See Steven French, *The Structure of the World: Metaphysics and Representation* (Oxford, UK: Oxford University Press, 2014); Christopher Pincock, "A New Perspective on the Problem of Applying Mathematics," *Philosophia Mathematica* 12, no. 2 (2004): 135–61, https://doi.org/10.1093/philmat/12.2.135; and Christopher Pincock, *Mathematics and Scientific Representation* (Oxford, UK: Oxford University Press, 2012); Mauro Durato, *The Software of the Universe: An Introduction to the History and Philosophy of Laws of Nature* (Farnham, UK: Ashgate, 2005); and James Ladyman, "Structural Realism," in *The Stanford Encyclopedia of Philosophy*, Winter 2020 Edition, ed. Edward N. Zalta, https://plato.stanford.edu/archives/win2020/entries/structural-realism/.

[13]Patrick Suppes, *Introduction to Logic* (Princeton, NJ: Van Nostrand Reinhold, 1957); Patrick Suppes, "A Comparison of the Meaning and Uses of Models in Mathematics and the Empirical Sciences," *Synthese* 12, no. 2-3 (1960): 287–301, https://doi.org/10.1007/BF00485107; and Frederick Suppe, *The Semantic Conception of Theories and Scientific Realism* (Chicago, IL: University of Illinois Press, 2000).

[14]Roman Frigg and James Nguyen, "Scientific Representation," in *The Stanford Encyclopedia of Philosophy,* Spring 2020 Edition, ed. Edward N. Zalta, https://plato.stanford.edu/archives/spr2020/entries/scientific-representation/.

[15]Eugene Wigner, "The Unreasonable Effectiveness of Mathematics in the Natural Sciences," *Communications on Pure and Applied Mathematics* 13, no. 1 (1960): 1–14. See also Mark Steiner, *The Applicability of Mathematics as a Philosophical Problem* (Cambridge, MA: Harvard University Press, 2002).

[16]Pincock, "A New Perspective on the Problem of Applying Mathematics," 135–61; and Pincock, *Mathematics and Scientific Representation*.

[17]John D. Barrow, *Theories of Everything: The Quest for Ultimate Explanation* (Oxford, UK: Oxford University Press, 1991), 11.

[18]Saunders Mac Lane, "Mathematical Models: A Sketch for the Philosophy of Mathematics," *American Mathematical Monthly* 88, no. 7 (1981): 463, https://doi.org/10.2307/2321751.

[19]Bas C. van Fraassen, *Scientific Representation: Paradoxes of Perspective* (Oxford, UK: Oxford University Press, 2008), 23.

[20]Otávio Bueno, "Models and Scientific Representations," in *New Waves in Philosophy of Science*, ed. P. D. Magnus and Jacob Busch (Basingstoke, UK: Palgrave Macmillan, 2010), 94, 95.

[21]Robin Findlay Hendry, "Structure as Abstraction," *Philosophy of Science* 83, no. 5 (2016): 1078, https://doi.org/10.1086/687939.

[22]Haskell B. Curry, *Foundations of Mathematical Logic* (New York: McGraw Hill, 1963); and Angelo Margaris, *First Order Mathematical Logic* (Waltham, MA: Blaisdell, 1967).

[23]David Hilbert, *Grundlagen der Geometrie 1902, The Foundations of Geometry*, trans. E. J. Townsend (Chicago, IL: Open Court, 1950); Alfred Tarski, "What Is Elementary Geometry?," *Studies in Logic and the Foundations of Mathematics* 27 (1959): 16–29, https://doi.org/10.1016/S0049-237X(09)70017-5; and Leon Henkin, Patrick Suppes, and Alfred Tarski, eds., *The Axiomatic Method: With Special Reference to Geometry and Physics: Proceedings of an International Symposium Held at the University of California, Berkeley, December 26, 1957–January 4, 1958* (Amsterdam, Netherlands: North-Holland, 1959), 16–29.

[24]David D. Reid, "Discrete Quantum Gravity and Causal Sets," *Canadian Journal of Physics* 79, no. 1 (2001): 1–16, https://doi.org/10.1139/p01-032; Fay Dowker, "Causal Sets as Discrete Spacetime," *Contemporary Physics* 47, no. 1 (2006): 5, https://doi.org/10.1080/17445760500356833; Carlo Rovelli, *Quantum Gravity* (New York: Cambridge University Press, 2009), 8, 9; and Christian Wüthrich, "The Structure of Causal Sets," *Journal for General Philosophy of Science* 43 (2012): 237–38, https://doi.org/10.1007/s10838-012-9205-1.

[25]Simo Knuuttila, "Time and Creation in Augustine," in *The Cambridge Companion to Augustine*, 2nd edition, ed. David Vincent Meconi and Eleonore Stump (New York: Cambridge University Press, 2014), 89.

[26]Medieval theologians include Thomas Bradwardine (1295–1339), Bonaventure (1221–1274), Thomas Aquinas (1225–1274), and Henry of Ghent (1217–1293). The reformers who affirmed it include Johannes Wollebius (1589–1629), *Abridgment of Christian Divinity*; Pedro Hurtado de Mendoza (1578–1641), *Universa philosophia* (Lyon 1624); Adriaan Heereboord (1614–1659), *Pneumatics* (1659); William Ames (1576–1633), *Marrow of Theology* (1648); Francis Turretin (1623–1687), *Institutio Theologiae Elencticae* (1688); Petrus van Mastricht (1630–1706), *Theoretico-Practica Theologia* (1699); Melchior Leydecker (1642–1721), *De providentia Dei* (1677), *Fax veritatis* (1677), and *Synopsis* (1684); and Johann Friedrich Stapfer (1708–1775), *Institutiones* (1743–1747).

[27]Genesis 18:14; Jeremiah 32:27; Matthew 19:26; Luke 1:37.

[28]Jonathan Edwards, *Concerning the End for Which God Created the World,* in *Ethical Writings*, vol. 8 of *The Works of Jonathan Edwards,* ed. Paul Ramsey (New Haven, CT: Yale University Press, 1989), 432.

[29]Edwards, *Concerning the End for Which God Created the World*, 413.

[30]These hold unless one is under moral obligation or subject to external standards of propriety and is acting purely out of respect for morality. These do not, however, apply to God.

[31]Two prominent exceptions are Norman Kretzmann, "A General Problem of Creation: Why Would God Create Anything at All?," in *Being and Goodness: The Concept of the Good in Metaphysics and Philosophical Theology,* ed. Scott MacDonald (Ithaca, NY: Cornell University Press, 1991), 208–28; and Philip J. Donnelly, "Saint Thomas and the Ultimate Purpose of Creation," *Theological Studies* 2, no. 1 (1941): 53–83, https://doi.org/10.1177/004056394100200104.

[32]Edwards, *Concerning the End for Which God Created the World*, 445, 450, 462, and 420.

[33]This applies even where the entity is part of a whole.

[34]Geerhardus Vos, *Reformed Dogmatics, Volume One: Theology Proper*, trans. and ed. Richard B. Gaffin Jr. (1896; reprint, Bellingham, WA: Lexham Press, 2012), 184.

[35]It is not *Berkeleyan idealism*. Rather, the universe is real with respect to creatures and involves genuine objects of scientific inquiry.

[36]Henry of Ghent (1217–1293) held that the difference between God's having a representation for a thing (*esse essentiae*) and God's volitionally conferring existence to the thing is an "intentional distinction" in God's mind. *Essence* and *being* are therefore different intentions, not different things. Porro explains Henry in this way: "Being is therefore an *intentio* that occurs to essence without adding anything real, and so it differs from essence only intentionally." Pasquale Porro, "Henry of Ghent," *The Stanford Encyclopedia of Philosophy,* Fall 2014 Edition, ed. Edward N. Zalta, 10, https://plato.stanford.edu/archives/fall2014/entries/henry-ghent/.

[37]Meinard Kuhlmann, "Processes as Objects of Quantum Field Theory: Consequences for the Interpretation of QFT," in *Things, Fact, and Events,* ed. Jan Faye, Uwe Scheffler, and Max Urchs (Amsterdam, Netherlands: Rodopi, 2000), 365–89; and Meinard Kuhlmann, "Quantum Field Theory," *The Stanford Encyclopedia of Philosophy,* Fall 2020 Edition, ed. Edward N. Zalta, https://plato.stanford.edu/archives/fall2020/entries/quantum-field-theory/.

[38]This is not *categorical* or *absolute* occasionalism. Like the occasionalism of Louis de La Forge (1632–1666) of the seventeenth century, this version differs from *pure*

occasionalism in that it applies *only* to physical causation, not to the intentions or choices of free agents.

[39]It is a matter of dispute among philosophers of logic whether truthbearers are *sentences*, *propositions*, or *judgments*. The view presented here shares features with a rough synthesis of the views of Friederike Moltmann, *Abstract Objects and the Semantics of Natural Language* (Oxford, UK: Oxford University Press, 2013); Jeffrey C. King, *The Nature and Structure of Content* (Oxford, UK: Oxford University Press, 2007); Scott Soames, *What Is Meaning?* (Princeton, NJ: Princeton University Press, 2010); C. B. Martin, *The Mind in Nature* (New York: Oxford University Press, 2010); Jeffrey C. King, Scott Soames, and Jeff Speaks, *New Thinking about Propositions* (Oxford, UK: Oxford University Press, 2014); and Eric Margolis and Stephen Laurence, "The Ontology of Concepts—Abstract Objects or Mental Representations?," *Noûs* 41, no. 4 (2007): 561–93, https://doi.org/10.1111/j.1468-0068.2007.00663.x.

[40]Friederike Moltmann, "Cognitive Products and the Semantics of Attitude Verbs and Deontic Modals," in *Act-Based Conceptions of Propositional Content*, ed. Friederike Moltmann and Mark Textor (Oxford, UK: Oxford University Press, 2017), 254–89.

[41]Christopher Menzel, "Theism, Platonism, and the Metaphysics of Mathematics," *Faith and Philosophy* 4, no. 4 (1987): 365–82, https://doi.org/10.5840/faithphil19874441; Christopher Menzel, "God and Mathematical Objects," in *Mathematics in a Postmodern Age*, ed. Russell W. Howell and W. James Bradley (Grand Rapids, MI: Eerdmans, 2001), 65–97; and Thomas V. Morris and Christopher Menzel, "Absolute Creation," *American Philosophical Quarterly* 23, no. 4 (1986): 353–62, https://www.jstor.org/stable/20014160.

[42]Paul Copan and William Lane Craig, *Creation out of Nothing: A Biblical, Philosophical, and Scientific Exploration* (Grand Rapids, MI: Baker Academic, 2004), 167–96.

[43]For arguments for this claim from differing angles, see Walter J. Schultz, "The Actual World from Platonism to Plans: An Emendation of Alvin Plantinga's Modal Realism," *Philosophia Christi* 16, no. 1 (2014): 81–100, https://www.academia.edu/en/10150447/The_Actual_World_from_Platonism_to_Plans_An_Emendation_of_Alvin_Plantinga_s_Modal_Realism; Walter J. Schultz, "Divine Action, Ontological Dependence, and Truthmaking," in *Mereologies, Ontologies and Facets: The Categorical Structure of Reality,* ed. Paul M. W. Hackett (Lanham, MD: Rowman & Littlefield Publishers, 2018), 201–33; and Walter J. Schultz and Lisanne D'Andrea Winslow, "The Structures of the Actual World," *Proceedings of the Association of Christians in the Mathematical Sciences* (2013): 168–86, https://acmsonline.org/home2/wp-content/uploads/2016/04/ACMS-2013-Proceedings.pdf.

[44]William P. Alston, *Realist Conception of Truth* (Ithaca, NY: Cornell University Press, 1996), 38.

[45]Ibid., 7, 8.

[46]Andrew Paul Ushenko, *The Problems of Logic* (Princeton, NJ: Princeton University Press, 1941), 121.

[47]Donald Davidson, "In Defense of Convention T," in *Truth, Syntax and Modality*, ed. Hugues Leblanc (Amsterdam, Netherlands: North-Holland, 1973), 76–86.

[48]This is one issue that divided Gottlob Frege and David Hilbert. Hilbert held that the consistency of axioms guaranteed the existence of the mathematical objects. Frege insisted that it cannot. Gottlob Frege, *Philosophical and Mathematical Correspondence,* ed. Gottfried Gabriel et al., trans. Hans Kaal (Chicago, IL: University of Chicago Press, 1980), 39, 40. See also Patricia Blanchette, "The Frege-Hilbert Controversy," *The Stanford Encyclopedia of Philosophy,* Fall 2018 Edition, ed. Edward N. Zalta, https://plato.stanford.edu/archives/fall2018/entries/frege-hilbert/.

[49]Mac Lane, *Mathematical Models,* 471.

[50]James Ladyman, "What Is Structural Realism?," *Studies in History and Philosophy of Science* 29, no. 3 (1998): 409–24; French, *The Structure of the World*; and Steven French and James Ladyman, "In Defense of Ontic Structural Realism," in *Scientific Structuralism, vol. 281: Boston Studies in the Philosophy of Science,* ed. Alisa Bokulich and Peter Bokulich (Heidelberg, Germany: Springer, 2011), 25–42.

[51]This conceptually coheres with Michael Esfeld, "The Modal Nature of Structures in Ontic Structural Realism," *International Studies in the Philosophy of Science* 23, no. 2 (2009): 179–94, http://philsci-archive.pitt.edu/id/eprint/4459. See also Wüthrich, "The Structure of Causal Sets."

[52]Kuhlmann, "Quantum Field Theory," 56.

[53]For an example, John P. Burgess, "Synthetic Mechanics," *Journal of Philosophical Logic* 13, no. 4 (1984): 379–95, https://www.jstor.org/stable/30226314; and John P. Burgess and Saul Kripke, "Synthetic Mechanics Revisited," *Journal of Philosophical Logic* 20, no. 2 (1991): 121–30, https://www.jstor.org/stable/30227246.

[54]Benacerraf, "Mathematical Truth," 666.

[55]Simply *being logically consistent* would make it true under a Platonist metaphysics.

[56]Although the three theses and the corollary constitute this ontological *account*, the account cannot serve as an *identifying account* of a proposition's truthmaker. In other words, the account cannot serve as a decision procedure or as an algorithm which takes the sentence as "input" and gives the truth-value of the proposition expressed by the sentence as "output."

[57]Shapiro, *Philosophy of Mathematics: Structure and Ontology*, 4.

[58]Benacerraf, "Mathematical Truth," 661.

[59]Ibid., 662.

[60]Shapiro, *Philosophy of Mathematics: Structure and Ontology*, 4.

[61]See Alvin Plantinga, *Warrant and Proper Function* (New York: Oxford University Press, 1993), 4, 194.

[62]Benacerraf, "Mathematical Truth," 667.

[63]This article is indebted to James McGlothlin, Brad Sickler, and Mark Dickson for detailed and enjoyable conversation which helped to clarify the core issues of this article, to the reviewers for helpful suggestions and probing questions that demanded further careful thought and precision, to Daniel Johnson for his keen eye regarding readability and grammar, and to my logic teachers C. Anthony Anderson and William H. Hanson.

Patrick S. Franklin

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Moving Forward Together: The Future of Science and Faith

Patrick S. Franklin

> *Not that I have already obtained all this, or have already arrived at my goal, but I press on to take hold of that for which Christ Jesus took hold of me. Brothers and sisters, I do not consider myself yet to have taken hold of it. But one thing I do: Forgetting what is behind and straining toward what is ahead, I press on toward the goal to win the prize for which God has called me heavenward in Christ.* Philippians 3:12–14

Keywords: allegiance, community, Christ, diversity, division, ideology, participation, peace, Philippians, polarization, unity, vision.

Moving *Forward …*

Our conference theme this year is "Moving Forward Together: The Future of Science and Faith."* I think it's good for us to stop and ponder this theme this morning. We could ask a number of questions about it. For example, moving forward—*to where, exactly*? What's our destination or goal?

In terms of science, this question must remain somewhat open and conjectural: we can't fully predict all the ways that science will develop, what discoveries will be made, and which applications will be pursued. As Alister McGrath has said,

> Science is on a journey, it's traveling. It hasn't yet arrived at definitive answers, it hasn't yet reached its goal, and every now and then it may even take wrong turnings.[1]

But today's passage contributes something important about the *faith* aspect of moving forward together: our singular goal—which supersedes, ranks, and aligns all other goals—is Christ! More specifically, our singular goal is to know, love, and participate in Christ together.

We at the ASA and CSCA agree on this central goal, and we affirm it in our belief statements about scripture and the ancient Nicene and Apostles' Creeds, both of which point to Christ as the center of our faith, and to the triune God whom Christ reveals in his earthly life, his resurrection appearances, and his sending forth of the Holy Spirit to create and fill the church.

In our passage today, Paul reminds us of the crucial importance of focusing on our very highest goal, Christ and his calling upon us. He uses powerful athletic imagery and emphatic rhetoric to make his point: "I don't look behind me … I strain toward what is ahead … I press on toward the goal to win the prize" (Phil. 3:13–14).

This is not like little league soccer. I remember coaching my son's soccer team, years ago, when he was very young.

*Sermon delivered by Patrick S. Franklin at the 77th Annual Meeting of the American Scientific Affiliation, celebrating the 50th Anniversary of the Canadian Scientific and Christian Affiliation, University of Toronto Mississauga, Mississauga, Ontario, July 30, 2023.

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Coaching little league soccer is hilarious! There's "the hive," the big ball of kids that collectively follows the ball wherever it goes on the field. There's the child who's looking up to the sky, fascinated by the birds soaring overhead. And my personal favorite, there's my goalie, hanging from the goalposts—*facing the wrong direction*—as the opposing team's players speed down the field, closing in with the nearly empty goal in their sights.

Instead, Paul's image is more like an athlete devoting her life to training to win Olympic Gold—strenuously, intentionally, and with keen focus and determination. All of this serves to emphasize the inestimable value of this very unique and specific prize Paul has in mind. It reminds me of Jesus's parable of the man who sold everything he had in order to purchase a field in which he had buried a precious treasure. The parable illustrates the central priority and value that Jesus and his kingdom should have for believers.

... Together!

So, our goal is Christ and his call. But why does Paul stress the importance of such single-minded, all-encompassing devotion, contemplation, and mental and physical focus and training?

Because there are many distractions that threaten to impede or even distort and redefine the goal. This deviation from goal leads to division, as each person begins to pursue their own conception of the goal. In the midst of this, we are reminded that Christian unity is found only in our joint togetherness in Christ in the Spirit.

At the ASA and the CSCA, we recognize that some agendas, goals, and disputes are a distraction to our mission and potentially harmful to our fellowship in Christ.

> The ASA is not an advocacy organization. Where there is honest disagreement on an aspect of science, Christian faith, or the relationship between the two, the ASA strives to create a safe environment in which dialogue can flourish and diverse, even contrasting, ideas can be discussed with courtesy and respect.[2]

Over the years, when cultural controversies and infighting within the church have arisen over matters of science and faith (for example, young earth creationism vs. evolution), it has been important for us to remember and preserve our commitment to this statement.

Our Context

I'd like to suggest this morning, however, that these kinds of issues and debates will not be the ones that threaten our oneness in Christ and our singular pursuit of "the goal" or "the prize" he calls us toward as we move forward together in the coming years (of course, healthy debate on scientific matters will certainly continue). I think that a much greater threat in our social and cultural context is the threat of *ideology*. I refer here to social, cultural, and political forces, which are pseudo-religious in nature (though not consciously acknowledged as such) and are disguised as all-important, supremely central moral causes calling for absolute allegiance. These ideological forces might be conservative, or they might be liberal, or progressive. What's key is that they come to displace Christ himself (the Living and Present LORD) as THE goal, THE prize, THE focus of Christians and the church. The temptation toward ideology is subtle, because some of its ideas and goals, taken on their own at face value, might be important and morally righteous. The problem is the idolatrous and divisive ways in which ideology works, and its tendency to foster further polarization and attitudes of self-righteousness and judgment of others (constant "othering").

We live in a deeply divided time, in a deeply polarized and polarizing society. A massive study recently conducted by the Edelman Trust Institute (composed of 30-minute interviews that included 32,000 respondents in 28 countries) analyzed public trust in various institutions, organizations, media, government, and other people; it found high degrees of division and polarization. (Incidentally, the US was found to be one of the top six most severely polarized countries of the 28 measured). In one stunning measure of the polarizing effects of ideology, the study found the following concerning American respondents: In answer to the statement: "If a person strongly disagreed with me or my point of view," I would help them if they were in need (only 30% responded positively); be willing to live in the same neighborhood with the person (only 20%); be willing to have them as a coworker (only 20%). For Canada, the numbers were quite similar at 26%, 24%, and 19%, respectively.[3]

This deep polarization might well be the greatest missional challenge the church faces today.

We Are Like the Philippian Church

Ideological threats of this kind are not new; actually, the Philippian church in Paul's day was facing similar problems. A Jewish faction (please note: not "Judaism" *per se*), zealously devoted to maintaining ethnic and cultic boundary markers as a condition of inclusion for Gentile Christians (e.g., circumcision), was infiltrating the church, proselytizing their agenda, and causing division and polarization (the work of ideology). This not only distracted the believers from their precious goal and prize, but more fundamentally, it also threatened to redefine the goal itself, and thus lead the church away from Christ as its one and only LORD.

Paul describes this group as being *characterized by self-righteousness and self-justification* (Phil. 3:13–14). And he worried that some within the Philippian church were vulnerable because they had become *focused on earthly rather than heavenly things* (vv. 18–21) and were *focusing on themselves and their desires* (selfishness, hedonism) rather than Christ and his sacrificial, missional call ("everyone looks to their own interests," Phil. 2:21). This lack of focus and dependence on Christ was producing *anxiety*, which threatened to deprive believers of the joy, gratitude, and peace which should have been theirs in Christ by the Spirit (Phil. 4:4–9). Does this sound like our culture today? Does it sound like the church?

The problem with ideology is that it makes promises it can't possibly fulfill. And when those promises are not fulfilled, it produces distrust, cynicism, division, and further polarization. And it deprives people of true joy, gratitude, and peace.

Moving Forward Together *in Christ!*

What does it mean to move forward *together in Christ* in the midst of such a polarized culture? Paul gives us helpful direction.

First, we are called to repent of our allegiances to other masters, leaders, systems, philosophies, and ideologies, and to realign ourselves to Christ's sole Lordship. Considering his own life and former zealous devotion to religious and political causes, Paul confesses, "whatever were gains for me I now consider loss for the sake of Christ" (Phil. 3:7). And Paul intentionally moves forward, "forgetting what is behind" (vv. 13–14), refusing allegiance to anything that displaces Christ himself as personal and living LORD.

Second, we are called to seek to know and to participate in Christ. Paul expresses this desire poignantly: "that I may gain Christ and be found in him, not having a righteousness of my own" (Phil. 3:9). It is helpful to observe that the theme of participation in Christ is pervasive in the book of Philippians. (The italicized text *reflects our active participation* while the underlined text stresses God's prior and ongoing work.)

- In chapter one, Paul refers to his readers as *partners* in the gospel (v. 5) and reminds them that God, who began a good work in them, will carry it on to completion until the day of Christ Jesus (v. 6).
- In chapter two, Paul exhorts the believers to *work out their salvation* with fear and trembling, for God himself is at work within them both to will and to act in accordance with God's purposes (vv. 12–13).
- In chapter three, Paul admits, "not that I have already obtained all this or have arrived at my goal," but "*I press on to take hold* of that for which Christ Jesus has taken hold of me" (v. 12).
- And then, finally, in chapter four, Paul instructs the believers to *rejoice, pray, be thankful, and intentionally think about* the goodness of God and his gifts to us in creation (whatever is true, noble, right, pure, lovely, etc.); and Paul reminds his readers that the God of peace will be with them and will guard their hearts and minds in Christ Jesus (vv. 4–8).

How might we participate in Christ in response to Paul's exhortations? One important way is by participating in Christ's sufferings (Phil. 3:10) and thus following his cruciform example (Phil. 2:5–11). Think of what Paul says in chapter two, where Christ the LORD of glory is our example in humility, obedience, and selfless service to others (even others who mock, insult, disrespect, and debase us). Recall too Paul's words in Philippians 1:29: "for it has been granted to you on behalf of Christ not only to believe in him, but also to suffer for him." Part of our suffering, in the context of a divisive and polarized culture and church is to resist the temptation to elevate our own

sense of righteousness (or "being right") by pointing out or cynically celebrating the ignorance, faults, and blind spots of others. This can be so difficult. Especially when others ARE CLEARLY WRONG (at least in our view!). In our time, we desperately need to hear and heed the cruciform witness of Dr. Martin Luther King Jr., who said:

> Another thing we had to get over was the fact that the nonviolent resister does not seek to humiliate or defeat the opponent but to win his friendship and understanding. This was always a cry that we had to set before people that our aim is not to defeat the white community, not to humiliate the white community, but to win the friendship of all the persons who had perpetrated this system in the past. The end of violence or the aftermath of violence is bitterness. The aftermath of nonviolence is reconciliation and the creation of a beloved community. A boycott is never an end in itself. It is merely a means to awaken a sense of shame within the oppressor but the end is reconciliation, the end is redemption.[4]

At the same time, God also wants to draw us to participate in Christ's resurrection power (Phil. 3:10). New Testament scholars Michael Bird and Nijay Gupta describe this as "the life-giving, death-crushing, and new world-creating power of God."[5] We are meant to move out in this power in order to do what we could not possibly do in our own strength and by our own desires. The church is meant to be a sign, foretaste, and instrument of the Kingdom of God (as Newbigin said).[6] We are called to be agents and ambassadors of reconciliation (2 Cor. 5:19–20), and therefore—"*somehow*" (Phil. 3:11)—to build and foster trust and to care more about others than we care about our own reputation (not being afraid to be associated with "the wrong people") or need for being right.

The good news is that you, as scientists, still enjoy a high degree of trust in our society. I know it may not feel that way (and, at the same time, people struggle to trust authorities outside of themselves in general), but people tend to trust scientists (76% trust them) more than they trust coworkers (73%), their CEO (64%), their neighbors (63%), people in their local community (61%), citizens of their country (59%), journalists (47%), and government leaders (41%).[7] This trust is a gift and you have the opportunity to lean on it in a Christlike way and move forward into new relational and influential possibilities by Christ's resurrection power.

Conclusion

In his classic work on Christian community, *Life Together*, Dietrich Bonhoeffer argues that true and genuine Christian community is not an ideal that we achieve, but a divine reality established in Christ by the Spirit.[8] We seek oneness in the Holy Spirit, which is not simply "getting along" in a sentimental way, but a deep spiritual union and joint participation in Christ together. This is something God has achieved and now invites us to pursue actively, including and perhaps especially when we face conflict and division in our midst. We are to press on to take hold of that for which Christ Jesus has taken hold of us.

In connection to what I've been saying today about the threat of ideology to Christian community, both for the Philippians in the past and for us in the present, Bonhoeffer cautions those who try to force their idealistic vision of Christian community on others, writing:

> They act as if they have to create the Christian community, as if their visionary ideal binds the people together. Whatever does not go their way, they call a failure. When their idealized image is shattered, they see the community breaking to pieces. So they first become accusers of other Christians in the community, then accusers of God, and finally the desperate accusers of themselves.[9]

Bonhoeffer's caution resonates with Paul's wise counsel to the Philippians: "Do nothing out of selfish ambition or vain conceit. Rather, in humility value others above yourselves, not looking to your own interests but each of you to the interests of others. In your relationships with one another, have the same mindset as Christ Jesus" (Phil. 2:3–5).

And so, may "the God of peace" (Phil. 4:7, 9), by the presence and power of his indwelling Holy Spirit, continually remind us of our unity in Christ as we pursue the future of science and Christian faith together. And may our unity in Christ extend outward in our missional presence in the world, as we seek to be peacemakers and ambassadors of reconciliation in our families, friendships, neighborhoods, and vocations. Amen.

Notes

[1]Alister McGrath, "Science Is on a Journey," BioLogos Podcast Animated Quotes (2020), 1 min., https://www.youtube.com/watch?v=TcQXHUl4Di8.
[2]American Scientific Affiliation, About the ASA, "Our Approach," https://network.asa3.org/page/ASAAbout.
[3]Edelman, 2023 Edelman Trust Barometer, "Ideology Becomes Identity: Few Would Help, Live, or Work with the Other Side," https://www.edelman.com/sites/g/files/aatuss191/files/2023-03/2023 Edelman Trust Barometer Global Report FINAL.pdf, 23. (The Canadian figures were shared with me directly via personal email.)
[4]Martin Luther King, Jr., "The Power of Nonviolence," in *A Testament of Hope: The Essential Writings and Speeches of Martin Luther King, Jr.*, ed. James Washington (New York: HarperSanFrancisco, 1991), 12.
[5]Michael F. Bird and Nijay K. Gupta, *Philippians*, New Cambridge Bible Commentary (Cambridge, UK: Cambridge University Press, 2020), 148.
[6]Lesslie Newbigin, *The Open Secret: An Introduction to the Theology of Mission* (Grand Rapids, MI: Eerdmans, 1995).
[7]Edelman, 2023 Edelman Trust Barometer, "Institutional Leaders Distrusted," https://www.edelman.com/sites/g/files/aatuss191/files/2023-03/2023 Edelman Trust Barometer Global Report FINAL.pdf, 11.
[8]Dietrich Bonhoeffer, *Life Together*, vol. 5 *Dietrich Bonhoeffer Works*, trans. Daniel W. Bloesch and James H. Burtness, ed. Geffrey B. Kelly (Minneapolis, MN: Fortress, 1996), 35.
[9]Ibid., 36.

Anthropology

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FEMINISM AGAINST PROGRESS by Mary Harrington. Washington, DC: Regnery Publishing, 2023. 249 pages. Hardcover; $29.99. ISBN: 9781684514878.

In many ways, this book is an autobiography of Mary Harrington losing faith. Not losing faith in God. It is not at all clear that she has any faith in God or a higher being. This is a book about her loss of faith in a post-modern worldview with ideas of progress that go along with that worldview. She suggests that this worldview is, in fact, a "quasi-theological regime" (p. 12), and one with powerful economic, social, and media support. In Christian terms, we could call it the "god of this age," a god with many false promises and claims.

At the heart of this worldview is the idea that "progress" entails "a structure of belief" in which "there exists a kind of axis along which progress can be measured, and that we're inexorably moving along that axis from 'more bad' to 'less bad,'" and furthermore, "this movement is unstoppable" (p. 12). Harrington writes that her starting premise for this book "is that this structure is a belief, not a fact" and that she is not "a believer in Progress Theology" (p. 13). The book is her attempt to demonstrate why this is the case, why she lost her faith.

The aspect of progress she is most interested in is purported progress with respect to gender, especially where that concerns women. Harrington still considers herself a feminist in the sense that she cares about women's interests. But she has rejected what she formerly took for granted: "that men and women are substantially the same," and that both sexes have the equal right "to self-realisation [sic], shorn of culturally imposed obligations, expectations, stereotypes or constraints" (p. 14).

Her transformation to "reactionary feminist" took hold when she became a mother. She realized that feminist ideals like radical autonomy and personal fulfillment are not the greatest goods. Mothering, she discovered, was a great good that entailed giving up one's autonomy and finding fulfillment in nurturing another.

The book lays out a comprehensive set of propositions for rethinking what it is to be man and woman in today's complicated world. She traces the various contours of the sexual revolution which has roots in the feminism of the early twentieth century. She is critical of the advent of the birth control pill for its effects on women's bodies, mental health, relationships, and the environment, citing various studies to support her critique. The pill, she suggests, is one of the first technological steps toward the feminist ideal of ridding society of sexed differences and increasing female autonomy. But this has not turned out as positive as feminists would have us believe. She asserts that "half a century of concerted feminist effort to stamp out sexed differences as baseless 'stereotypes,' in the name of furthering that freedom [from relationships], has succeeded only in shaping what's for sale" (p. 98). Furthermore, although women have the autonomy they desired with respect to their bodies, this has not led to the utopia they envisioned (pp. 99–100).

One of the most interesting chapters is entitled "Meat Lego Gnosticism." The premise of this "cyborg theology," writes Harrington, is "that inner identity is unrelated to physiological form" (p. 142). For cyborg theology, body parts are just that: exchangeable bits of meat that you can dispose of or take on at will—meat Lego pieces. Any wholistic notion of human persons is completely absent from this campaign, a campaign she claims was spawned by technology (pp. 138–39), encouraged by markets, embedded in elite class politics (pp. 150–51), and supported through a variety of sources.

In opposition to all of this, Harrington introduces readers to "reactionary feminism," a feminism that she claims is good not just for women, but also for men. She specifically argues for three things. First, she argues for traditional, life-long marriage as a common, and therefore a foundational and stabilizing, factor for society (pp. 178–81). Specifically, she suggests that marriage is less for "personal fulfillment, or even romantic love, than an enabling condition for building a meaningful life" (p. 182), and that it includes "cooperation on the domestic economy, and the intimate work of creating a safe and stable space for children" (p. 185).

Second, based on her research, she argues for men-only and women-only spaces because men and women are different by nature and therefore have different social needs. For Harrington, these sorts of

spaces allow men to interact with other men as men, and women to interact with other women as women, while also allowing young men to learn from older men and young women to learn from older women. Interestingly, both of these first two claims are supported by historic Christian teaching as well.

Finally, she advocates against hormonal birth control, not only because the physiological effects on women are often unhealthy, but also because of the effect of estradiol on the environment (p. 208). Once again, Christian teaching about stewardship both of one's body and the creation as a whole dovetail with her ideas here.

Harrington's book is comprehensive, weaving together aspects of marketing, technology, and sociology to provide a revised story of what it is to be male and female. Her research includes everything from personal interviews to Twitter feeds to peer-reviewed journals and studies, the details of which are included in her extensive endnotes. Although she writes in the context of the United Kingdom, she does, at times, refer to work done in the United States, noting the politicized nature of her ideas in that context.

The comprehensive nature of the book along with the lack of a clear thesis, is at times confusing. She is clearly critical of progressive feminism and the prevailing gender ideology that she associates with it, criticism that is lately being leveled by other women who were sold a story by gender studies gurus.[1] Her association of this story with the free-market system and the technology giants embedded in that system is interesting. But it seems, at times, as if she were trying to write two books: one defending male and female as ineluctable categories of nature, and one blaming tech-dominated markets for their profit-based interests in promoting the alternate paradigm of denying sexed differences. Trying to do both muddied the waters in ways that were not always helpful and sometimes confusing.[2]

Scientific specialists in the area of sex and gender may be more critical than I of the studies she cites. From my nonspecialist perspective, I appreciated that she not only took account of scientific studies from peer-reviewed journals, but also included personal reflections from her own experience, as well as that of others, and included opinions and experiences she learned of through various social media outlets. In general, these are not stories we are told.

As a Christian theologian, I found her insights both surprising and interesting. Surprising because they comport remarkably well with a Christian worldview despite the fact that she is not a Christian. It was also interesting because the new Gnosticism she describes is diametrically opposed to the historic Christian affirmation of the goodness of the material world, including our material bodies. She unknowingly affirms both the biblical teaching that humans are created male and female, and the biblical understanding that humans flourish when they live within the boundaries set by our Creator.

Although her language is at times crass, and some of the examples she offers may be offensive, this book is pro-women as women—including our bodies—and as such, is also pro-men. I would recommend this book to a wide variety of people, including social scientists, technology experts, and theologians. For Christians who feel marginalized by current cultural pressures toward a nonsexed society, pressures that are even supported by many churches, this book will ring true with respect to the historic teachings of the church on sex and gender. It will also encourage them that their basic instincts about sex and gender are, in fact, in line with God's created intentions for humans.

Notes

[1]For a Christian perspective on this, see, for example, Abigail Favale, *The Genesis of Gender* (San Francisco, CA: Ignatius Press, 2022).

[2]For a helpful look at the problem of big tech companies and their undue influence via social media on young people, a problem that is especially pronounced in young women as Harrington writes, see the Center for Humane Technology's various resources on this topic, including the 2020 film, "The Social Dilemma," https://www.humanetech.com/.

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Biological Sciences

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MODIFYING OUR GENES: Theology, Science and "Playing God" by Alexander Massmann and Keith R. Fox. London, UK: SCM Press, 2021. vii + 151 pages. Paperback; $21.49. ISBN: 9780334059530.

Modifying Our Genes: Theology, Science and "Playing God" is a thought-provoking exploration of the ethical, theological, and scientific implications surrounding human genome editing. Written by Alexander Massmann, a theologian, and Keith R. Fox, a scientist, this book examines the topic clearly and is comprehensible even for those without a background in genetics or bioethics. While their ethical considerations are biblically based, they also draw upon arguments in philosophy and other fields to facilitate a more inclusive debate.

Chapter 1 discusses the overall significance of genome editing using CRISPR-Cas9, and lays out key themes discussed in subsequent chapters. Developed by Emmanuelle Charpentier and Jennifer Doudna just over a decade ago, CRISPR-Cas9 greatly simplifies the process of making alterations at precise locations in DNA compared to previous methods. While this molecular tool can be used to genetically modify body cells in children or adults (somatic gene editing), these alterations are not passed on to future generations, unlike alterations to human embryos (germline gene editing), which are of greater ethical concern to Massmann and Fox.

For the benefit of the layperson, chapter 2 provides a basic primer in genetics and the CRISPR-Cas9 method. The authors note that over 10,000 different inherited human diseases are caused by a defect in a single gene and would be the most feasible targets for therapeutic genome editing. However, many human traits and disorders result from a complex interaction between multiple genes and are less amenable to genetic intervention. Moreover, Massmann and Fox point out that environmental, lifestyle, and developmental factors work together with genes to determine human traits and diseases—we are not simply a "product" of our genes alone! They describe, in simple terms, how the Cas9 protein uses a guide RNA to precisely direct the position of a double-stranded cut in DNA, and how repair of the cut by nonhomologous end-joining leads to short deletions or insertions that usually inactivate the gene. Repair of the cut by homologous recombination is less clearly explained in this book. The authors also do not mention base editing or prime editing at all. These variations of CRISPR-Cas9 technology, reported in peer-reviewed journals by 2019, correct mutated copies of genes without making double-stranded cuts in DNA or requiring a corrective donor DNA molecule.

In chapter 3, the authors briefly summarize the successes so far with therapeutic genome editing in children or adults, especially for genetic disorders involving the blood, such as sickle cell anemia, beta thalassemia, and leukemia. For disorders involving other body tissues and organs, they note the challenge that must be overcome in delivering gene editing tools to enough cells to achieve a therapeutic effect. The problem with delivery is greatly reduced, however, if genome editing is done on embryos.

While safety concerns tend to dominate many ethical analyses of genome editing, especially for germline gene editing, that is not true for Massmann and Fox. The authors acknowledge that technological improvements may eventually reduce the error rate in the editing process to an acceptable level. They reject germline gene editing on other grounds, even for medical purposes. Among their most compelling arguments is that using this technology to edit out "debilitating" characteristics could cause greater stigmatization and marginalization in our society for people with disabilities or serious genetic disorders. In support of this concern, the authors cite negative attitudes toward babies with Down syndrome in Denmark where free prenatal tests are available and 95% of babies diagnosed with Down's are aborted. From a Christian perspective, they invoke Matthew 25:31–46 in saying that those who are left behind by medical progress, or who are excluded, or who are looked down upon are among "the least of these" and are worthy of our care. On page 64, they call for a renewed effort to include people in society with chronic illnesses and disabilities as we continue to make progress in somatic gene editing.

Massmann and Fox maintain that genetically modifying human embryos carrying a disease mutation is unnecessary if healthy embryos can be identified by preimplantation genetic diagnosis (PGD) following in vitro fertilization, even if it leads to an increase in the number of unused and discarded human embryos. Some may view their preference for PGD over germline gene editing as inconsistent with their concern about stigmatizing those with disabilities, especially since it results in the destruction rather than the "healing" of some human embryos. All they could say in response to that criticism is that both

PGD and genome editing require embryo selection. They advocate limiting the use of PGD to medical considerations, preferably to avoid the birth of a child with a very severe disease. This is consistent with their view (p. 63) that "a meaningful and fulfilled life will be made more difficult by conditions that cause significant and persistent pain." On page 62, they suggest that it may be possible to select sperm without a harmful mutation before in vitro fertilization to increase the number of eligible healthy embryos for implantation. However, they give no explanation for how this selection might be done without destroying the sperm cells in the process, and no reference is provided.

In chapter 4, Massmann and Fox consider the possible use of somatic or germline gene editing for introducing nonmedical enhancements, such as improved athletic ability, memory, and life span. They argue that genetic enhancements could exacerbate social inequalities for underprivileged people, leading to diminished social participation and reduced political or economic opportunities. They challenge the assumption that greater physical and mental capabilities will produce more fulfilling lives and reiterate their concern that it could lead to discrimination against people living with genetic diseases or disabilities. The authors also question whether it is appropriate for parents to choose enhancements for their children. Would children become more like commodities than precious gifts, subject to our own design or will? Considering these arguments, the authors suggest limiting genome editing to medical and therapeutic procedures, which they define as any intervention that restores or preserves the function of an organ.

Chapter 5 focuses on the history of eugenics around the world. Massmann and Fox note that the murder of about 200,000 disabled people by the Nazis was not motivated by considerations of race or concerns that future generations might inherit a genetic impairment. Instead, it was motivated by economic considerations (the cost of care for the disabled and their lack of productivity) and an "ableist" mentality that emphasizes independence and physical functioning while marginalizing dependence, weakness, and vulnerability. The authors express concern that far-reaching genome modifications, especially genome enhancements, will reinforce an ableist mentality in our society, leading to antidisability prejudice.

In the final chapter (chap. 6), Massmann and Fox consider human dignity, arising from our creation "in the image of God," and its implications for advancements in biotechnology. They maintain that human dignity is more than just a respect for personal autonomy; it also includes a moral call to work for the benefit of others and to take care of our own bodies and personal health. The authors assert that society should not allow technologies, such as genetic enhancements, to be marketed freely if there is a significant health risk, even if individuals have given informed consent. On the other hand, they note that as God's image-bearers we can use science to "tame the destructive forces and to restore order where chaos threatens life" (p. 130). The authors conclude that as we employ new technologies to overcome disease and infirmity, we must do so in a way that respects the dignity of patients as well as of the scientists who develop the technologies and the caregivers who administer them. We must also ensure that our zeal for increased levels of function does not lead to the exclusion of those with disabilities.

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GOD AND GAIA: Science, Religion and Ethics on a Living Planet by Michael S. Northcott. New York: Routledge, 2023. 271 pages. Paperback; $40.00. ISBN: 9780367627744.

Biodiversity loss, water pollution, and declining soil health are major indicators of the ecological crisis facing our planet today. Science can be consulted to address these issues; however, as Michael Northcott argues in his latest book, *God and Gaia: Science, Religion and Ethics on a Living Planet*, unless science resists its scientism it will only exacerbate the current ecological crisis.

Northcott, an ordained Anglican priest and Professor Emeritus of Ethics at the University of Edinburgh, has written extensively on environmental issues.[1] In *God and Gaia*, Northcott explores the Gaia theory of James Lovelock—that "the Earth and her creatures are active agents in the generation of conditions which make the Earth habitable for Life" (p. 2)—from a religious ethics perspective. In effect, "God" in the book title does not indicate that the author will be taking a specifically Christian angle on the Gaia

theory, but rather taking something more akin to a comparative religions approach. The book is a collection of previously published papers along with new material curated into eight chapters, each with its own abstract and notes section. This arrangement, along with chapter subheadings, aids the reader in following along with Northcott's exploration of the Gaia theory. Northcott draws from a variety of published sources, along with his diverse experiences in Borneo, to get his main points across regarding the dangers of scientism in contrast to the restorative powers of Gaia.

Scientism, the condition in which only knowledge gained from observations is considered true, is an ideology that has created, according to Northcott, a "bifurcation between nature and culture." Northcott provides a history of scientism describing how, following the European enlightenment, anything that was not measurable tended to be viewed with suspicion by many in the West. He elaborates that scientific reductionism led to a top-down approach where the "rights of corporate agents trump the rights of people and species to stable and safe habitats" (p. 157). Northcott uses the example of the global response to the COVID-19 pandemic to demonstrate the full potential of scientism and its globalist and technocratic top-down control. Here, Northcott's one-sided argument regarding the benefits of ivermectin, the ineffectiveness of vaccines, the dangers of lockdowns, and the evils of the United Nations may distract readers from his intent of describing top-down control.

In contrast to scientism and its top-down control, Northcott recommends a Gaian approach to addressing the ecological crisis. While *God and Gaia* is not an introductory textbook, it does provide a thorough overview of the theory and its history. With an understanding of the Gaia theory in place, Northcott focuses on connections between Gaia and Hindu, Taoist, and Christian religious traditions. For Northcott, the Gaia theory can be interpreted as a rediscovery of beliefs held by earlier faith traditions. With great respect, he demonstrates how the Vedic Trinity and the Tao have parallels with Gaia theory's emphasis on the agency of all organisms. Northcott then eloquently demonstrates that medieval Christianity also emphasized the sense of agency in all organisms. Northcott, drawing on philosophers such as Seyyed Hossein Nasr, explains that most western Christians are unaware of the sacred cosmology of their tradition and its emphasis on the agency of being. For the betterment of the planet, Northcott urges religious traditions "to make more prominent in their liturgies the symbiotic relations between humans and other animals which for most of human history has been central to their mutual flourishing" (p. 261).

Overall, *God and Gaia* does an excellent job of contrasting the current approach of scientism versus the moral and spiritual Gaian philosophy to address the ecological crisis. Northcott is calling for a revival of core aspects of human traditions which modern secular science and philosophy have diminished. This Gaian revival recognizes the agency of all of Earth's systems. Although the Gaian revival and its earth-centered philosophy deviates from a distinctly Christian approach to creation care, readers should find some comfort in this revival as it shows that we are not alone in our efforts to restore the ecological integrity of the Earth.

Note

[1]See Michael S. Northcott, *The Environment and Christian Ethics* (New York: Cambridge University Press, 1996); ___, *A Moral Climate: The Ethics of Global Warming* (London, UK: Darton, Longman and Todd, 2007); and ___, *A Political Theology of Climate Change* (Grand Rapids, MI: Eerdmans, 2013).

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A HISTORY OF BIOLOGY by Michel Morange. Translated by Teresa Lavender Fagan and Joseph Muise. Princeton, NJ: Princeton University Press, 2021. 418 pages. Hardcover; $29.95. ISBN: 9780691175409.

A book that introduces the history of biology will be of interest to many readers of this journal. The Preface states that the author, Michel Morange, will present a broad historical overview of the history of biology that, unlike some other histories of biology, will include developments in the twentieth and twenty-first centuries. In this regard, he mentions Lois N. Magner, *A History of the Life Sciences*, 3rd ed. (New York: Marcel Dekker, 2002). Magner's book does cover many scientists and developments in the twentieth century, although, significantly, she does not discuss the modern evolutionary synthesis.

Morange states that he will present a "history which leans on the present to look at the past." That is, he will use "the past to shed light on the present, not to justify it" (p. xvii). To do this, the author uses a novel approach. Each chapter is subdivided into three sections: The Facts; Historical Overview; and Contemporary Relevance. "The Facts" is the first main section of each chapter; in the subsequent two, he reflects on some of the investigators and their discoveries. As he does so, he is not reticent to give his own evaluations and ideas; this is a strength of the book. Thus, he states that the book will not be a simple listing of facts and persons. For example, in the first chapter Morange suggests that the "hunt for pioneers" (for example, ancient thinkers who used the word "atom") is futile because the ancient idea had little to do with the development of the modern concept. Excursions such as these can be topics for fruitful classroom discussions.

Five succinct chapters take the reader from ancient Greece and Rome, through the Middle Ages, the Renaissance, the seventeenth century, and the Enlightenment. Chapter 1, in which Aristotle is designated as "the father of biology" (p. 2), offers some welcome thoughts on experimentation and the atomists. The discussion of the Middle Ages includes the suggestion that in the history of a science there may be long periods in which there is little growth in scientific knowledge. The chapter on the Age of Enlightenment, the eighteenth century, examines the history of the classification of organisms and the reproduction of animals. An introduction to the subjects related to reproduction, such as the importance of eggs versus sperm, preformation versus epigenesis, parthenogenesis, and spontaneous generation, would have made this topic more accessible.

Two chapters cover the history of biology in the nineteenth century. The author agrees with the idea that Theodor Schwann and Matthias Schleiden deserve much credit for the emergence of cell theory, but he mentions that some others, notably J. E. Purkinje, also deserve credit for this discovery. Under the heading The Rise of Germ Theory, the author describes many investigations that led to the understanding of infectious agents. Pride of place—and the (French) author may surely be forgiven for this—goes to Louis Pasteur and the diverse aspects of his work. This chapter offers a comprehensive description of the three important French post-revolutionary biologists: Jean-Baptiste Lamarck, Georges Cuvier, and Geoffroy Saint-Hilaire. A good account of Charles Darwin's theory of natural selection is followed by a description of the reception of this work in Great Britain, America, Germany, and France; in many cases, the theory was altered by the influence of other concepts (e.g., Lamarckism). Once the work by Gregor Mendel on the inheritance of characteristics in peas was rediscovered in 1900, "genetics" was rapidly established in Britain and the United States; it was established more slowly in Germany and France.

The prominence of Naturphilosophie in Germany and surrounding countries is described. Morange makes an excellent connection between his discussion of reproduction and the topic of Naturphilosophie by referring to the work of Caspar Friedrich Wolff, a biologist who was an early adherent of this way of thinking. Morange describes the origins of Naturphilosophie, and the influence of ideas in biology. Many German scientists were influenced by this philosophical school; it was a stimulus in the formulation of cell theory. Erik Nordenskiöld shows that Johannes Peter Müller progressed from speculative ideas about biology to making important contributions in many areas of biology. He supervised many graduate students who became important biologists.

The last three chapters, which address developments in the twentieth and the twenty-first centuries, are not only valuable for the historical descriptions, but also as a survey of biology as it is practiced today. The first chapter describes the emergence of biochemistry, immunology, microbiology, and our understanding of the nature and treatment of cancer. The "rediscovery of Mendel's laws and the rise of genetics" (p. 256) and the "rise of molecular biology" (p. 264) receive the extensive attention one would expect. Morange is clearly in his element here; biologists of all stripes will benefit from reading this chapter.

The chapter that follows describes the development of population genetics. This leads, aptly, into the topic of the modern evolutionary synthesis—the extended evolutionary synthesis is not mentioned. This is followed by an excellent summary of the various topics within ecology. Morange then describes the origins

and methods of ethology; he includes the contributions of the three 1973 Nobel Prize winners: Karl von Frisch, Konrad Lorenz, and Nikolaas Tinbergen. The burgeoning field of behavioral ecology, related to the last two topics, is not addressed. In the reflective part of the chapter, the author comments, among other topics, on holism and emergentism, global warming, and the responsibility of biologists.

In the final chapter, Morange takes us on a tour of the developments that start with the science described in the previous two chapters and end in the present century. "Structural biology" (p. 331) is advancing our knowledge of nucleic acids and proteins. The relationship between the modern evolutionary synthesis and molecular biology leads to topics such as evolutionary developmental biology ("evo-devo"), epigenetics, and human genome sequencing. The contributions to human genome sequencing of Craig Venter are acknowledged, but the work of Francis Collins at the National Human Genome Research Institute is not. In the last pages of this chapter, and in the Conclusion section of the book, Morange gives numerous opinions on the topics he has covered.

Biologists will enjoy reading this book for the many insights and opinions it presents. They will appreciate reading about the history of their discipline from a French point of view. The English translation of this French book reads well; however, the footnotes and references need to be more suitable for the English-language readership. The footnotes, especially those intended to provide links to further reading, often refer to French-language books or journal articles; it would not be difficult to find many English language equivalents. Some of the French books listed as references are available in English translations. In the Preface, the author states that readers "should consider this book a first version, which their critical input will help improve" (p. xx). One would hope that the author and Princeton University Press will address this last critical comment about the book, for the book has the potential of being a valuable textbook for students.

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Geology

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READINGS ON EVOLUTION AND THE NATURE OF SCIENCE: One Christian's Perspective by Keith B. Miller. Morgantown, PA: Mastof Press, 2022. 224 pages. Paperback; $20.00. ISBN: 9781601268129.

Keith B. Miller has dedicated his career to conducting paleontological and geological research and teaching at a public university. In addition to his many contributions to the geoscience literature and his activity in professional societies, he has contributed multiple provocative articles that advanced faith and science dialogue, many in *Perspectives on Science and Christian Faith*. *Readings on Evolution and the Nature of Science: One Christian's Perspective* is a collection of sixteen of Miller's articles published between 1993 and 2018 and one previously unpublished manuscript. The articles are clustered among five sections that represent the foci of Miller's writing and public address.

In The Nature of Science section, Miller addresses misunderstandings of science held by the public. He describes how misconceptions have been promoted by traditional young earth creationists and intelligent design advocates who have great contemporary influence on churches, seminaries, local school boards, and state legislatures. In footnotes to the first article, "The Similarity of Theory Testing in the Historical and 'Hard' Sciences," Miller reveals that the integrity of historical science (such as geology and paleontology) was debated in the development of Kansas science education standards. Drawing from the philosophy of science and using examples from geology, he defends historical science as not different from "hard" science in its predictive and explanatory power.

While evolution is the volume's overarching theme, in the second article Miller examines science's nature as applied to the public debate over anthropogenic global warming. He recognizes widely held misconceptions of science that fuel the rejection of controversial theories such as climate change and evolution. These include misunderstandings of fact and theory and the misconception that "unproven" theories should not become the basis for public action. To demonstrate the importance of scale and context in theory making, Miller presents actual data sets

revealing patterns of global environmental change at different scales and timeframes. Incidentally, those climatic patterns up to 2012, the year of the article's original publication, have persisted since with increasingly observable and negative consequences. Finally, Miller considers the widespread rejection of scientific consensus motivated by religious, economic, political, or philosophical interests.

Two articles in this section focus on evolution as science, written to scientists and science educators likely holding an evolutionary view. In "The Misguided Attack on Methodological Naturalism," Miller rejects the intelligent design (ID) movement's claim that methodological naturalism (MN), the presupposition that limits science's purview to natural phenomena, is effectively the denial of the existence and action of God. Miller identifies that MN originated as an attempt by a Christian philosopher to limit science from transgressing upon questions more appropriately pursued by the arts, theology, and philosophy. "Ironically, by rejecting methodological naturalism, ID advocates have ended up supporting the very scientism that they claim to want to fight against" (p. 26). The article continues with a critical overview of the ID movement and perceived implications for science practice and education. While located in the Evolution and Theology section of the book, this article pairs well with "Design and Purpose within an Evolving Creation," in which Miller addresses claims about MN and evolutionary science by Phillip Johnson (1940–2019) and the ID movement. **Miller's** article was originally contributed to *Darwinism Defeated?* (Vancouver, BC: Regent College Publishing, 1999), a book that captured the debate between ID-anti-evolutionists and evolutionary creationists following the publication of Johnson's provocative *Darwin on Trial* (Downers Grove, IL: IVP, 1991). This section concludes with Miller's *PSCF* article, "Doubt and Faith in Science and Religion" (*PSCF* 70, no. 2 [2018]: 90–100), examining how both doubt and faith are relevant, even necessary, in both paths for pursuing truth.

Articles in the Evidence for an Evolving Creation section provide compelling examples of transitional forms and ancestral relationships in the history of life. Two serve as direct responses to claims that the Cambrian "explosion" is fatally problematic for evolutionary theory because so many different forms appeared so suddenly upon the first appearance of invertebrate groups (the Cambrian Period is dated between 542 and 490 million years ago). Miller describes the difficulty of assigning founding species early in life's history to taxonomic groups and provides examples of metazoans older than the Cambrian showing a progressive, rather than sudden, increase in body plan complexity. Miller presents a well-illustrated and well-referenced overview of the Precambrian fossil record. He argues that the "explosion" extended over 20 million or more years, preceded by at least 40 million years of increasing complexity among soft-bodied metazoans.

"Common Descent, Transitional Forms, and the Fossil Record" is a clearly written and amply illustrated defense of evolution, highlighting different groups of mammals living on Earth over the past some 250 million years and their probable tetrapod ancestors. Miller "climb[s] down the tree of life" to demonstrate how increasingly older ancestors of living mammal groups become more difficult to distinguish from the oldest ancestors of other groups. "Countering Common Misconceptions of Evolution in the Paleontology Classroom" is written for college-level instructors, including an innovative cladogram construction exercise involving dinosaur taxa to demonstrate how evolutionary relationships are determined. Miller emphasizes that presenting scientific concepts in their historical context is an effective way to counter mistaken views that students bring to the classroom.

The nexus of Evolution and Theology is addressed with four articles (including one described above). In "Theological Implications of an Evolving Creation," Miller explains that the evolutionary history of life is consistent with creation's integrity, enormity, and goodness; the immanent and progressive nature of God's creative activity; and the image of God in creation. "An Evolving Creation: Oxymoron or Fruitful Insight?" returns to the nature of science and theology, with an emphasis on exploring ways to diminish the conflict view of science and faith. The section's final article, "God, Evolution, and Becoming Man" was written for seminarians and describes the fossil record of hominins (modern humans and closely related extinct species), demonstrating potential evolutionary relationships using paleontological, genetic, and inferred behavioral comparisons. Miller

comments on implications for the meaning of *imago Dei* and our understanding of body and soul.

The Problem of Evil section opens with the theological implications of natural hazards. Miller questions if natural catastrophes are a consequence of the Fall described in Genesis 3, satanic manipulations of nature, or generally reflect God's judgment on sinful humankind. Considering the testimony of the Psalms and other biblical narratives, he concludes that post-Fall creation is good. As well, the geologic record reveals that severe natural events occurred with regularity before the Fall. Disturbances we perceive as hazards are essential to the maintenance of natural systems (the natural order). Past attempts to control hazards, such as wildfire suppression, coastal modifications, and flood control often make those hazards worse. Biblical concepts of environmental stewardship can be applied in order to live in harmony with creation.

"'And God Saw That It Was Good': Death and Pain in the Created Order" addresses the question of "natural evil" that leads to unbelief when unresolved, "as it was for Darwin, himself" (p. 198). Miller reviews traditional and novel approaches to theodicy. Recognizing that crucified Christ participates in the suffering and death of his creation, Miller proposes that "physical death, pain, and suffering are opportunities for the expression of Christ-like character" (p. 205). Miller draws insights on the problem of evil from J. R. R. Tolkien's *Silmarillion* and *Lord of the Rings* in the section's final essay.

Science as Christian Vocation is an article co-authored with Ruth Douglas Miller, "Staying on the Road Less Traveled: Fulfilling a Vocation in Science." The Millers encourage students and early career scientists to look to their faith, in its teaching and traditions, to motivate and guide their work in ways that glorify God and further his kingdom.

Throughout, Miller is keen to avoid the sacred/secular dichotomy, believing that God "has a claim on all aspects of our lives" (p. 1). Professors at some Christian colleges are required to write a "faith and learning" paper in order to achieve tenure, an onerous task for those not used to engaging theology in their professional work. Here, Miller has written seventeen such papers while employed by a "secular" university! Science educators can benefit from reading Miller's work to develop a sound understanding of the purviews of science and theology applicable to topics such as origins, climate change, and public health. I assigned multiple articles found in this volume as reading in several of my college courses. Remarkably, Miller was often three to five years ahead of resurging interest in many of these topics among evangelical scholars. Rather than republishing separate articles with modest overlap in material coverage, Miller might have organized the material into a unified text that could reach a wider or more targeted audience. Perhaps that's next?

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History and Philosophy of Science

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PIERRE GASSENDI: Humanism, Science, and the Birth of Modern Philosophy edited by Delphine Bellis, Daniel Garber, and Carla Rita Palmerino. London, UK: Routledge, 2023. 416 pages. Hardcover; $160.00. ISBN: 9781138697454.

Pierre Gassendi (1592–1655) is one of those names in the history of science whose contribution remains only vaguely understood or remembered. A French Catholic priest, philosopher, mathematician, humanist, and astronomer, Gassendi's advocacy of a theologically re-worked ancient atomic theory of matter was a significant factor in the demise of late medieval Aristotelian conceptions of informed matter. Gassendi was also highly influential in reviving ancient Epicureanism, the hedonist moral philosophy from which modern utilitarianism traces its origins. Advocating a theologically modified form of Sextus Empiricus's ancient skepticism—in which we have knowledge only of observable appearances rather than of metaphysical essences—Gassendi shaped the way modern scientific knowledge came to be understood. Gassendi was thus a key figure in the emergence of modern empiricism, which brought him into prominent conflict with Descartes.

This is a beautifully researched and presented volume by thirteen fine Gassendi scholars. The contributions are divided into three parts: Gassendi's Epicurean Project, Its Genesis and Its Sources; Gassendi the Polemist; and Gassendi's Science and Philosophy in

Context. Further, for a book of niche historical interest, the writing is delightfully clear and accessible. However, for theologically interested readers of *Perspectives in Science and Christian Faith*, this volume has a glaring—yet also illuminating—problem. It is theologically blind.

For the academic specialist in Renaissance studies and early modern science, this volume is eminently solid. The editors and the contributors are all highly credentialed academics who are well respected in Gassendi scholarship circles. The detailed engagement with primary sources, the density of notes and bibliographies, and the scholarly rigor of all contributions are highly impressive. The specialist reader is going to have their understanding of Gassendi incrementally expanded with some interesting new details brought to light, and some existing evaluations in the literature carefully modified and improved. Even so, there are no significant new discoveries in its very carefully researched pages. The great merit of the book is not as a must read for Gassendi specialists, but as an accessible and rich guide for the nonspecialist.

The editors and contributors all seek to demonstrate how important a thinker Pierre Gassendi was. The nonspecialist reader can learn from this book's pages what a powerful influence this remarkable priest and humanist had in his own world, and how that influence remains deeply with us to this day. His influence on significant streams in early modern philosophy, mathematics, science, and theological thinking is deep and lasting. A knowledge of Gassendi is necessary for thinkers interested in understanding the roots of contemporary science and its relation to Christian faith. If you do not know much about Gassendi, I highly recommend reading this book.

Gassendi's legacy is his formative role in modern empiricism, modern hedonic ethics, and modern atomistic materialism. In these domains, Gassendi's influence is remarkably deep. Any good scholarly work that opens our eyes to what he did for us is valuable for helping readers understand the assumption-framing sources of the life-world we now inhabit. But theologically, what Gassendi did for us is more complex than any contemporary historian of modern science can be expected to unpack.

The contributors demonstrate that Gassendi was a very attractive person and thinker, and one cannot help but like him when reading about his life, his scholarship, and his astonishing intellectual and scientific achievements. But any close look at Gassendi cannot fail to notice both how theologically embedded his work is, and also how inexorably his work leads us away from Christian theology itself over the following two centuries. This "leading away" is, where recognized, assumed to be obvious "progress" in this volume. Gassendi's Christian empirical skepticism, his theologically adjusted form of Democritean atomism, and his complex integration of Epicurean hedonism with Catholic virtue ethics are all remarkable feats of theological innovation. These innovations are latent in the intellectual milieu of seventeenth-century Europe, but it is Gassendi who is the genius who is able to winsomely articulate them. Harnessing forces that have been at work in the Western theological, natural philosophy, and Renaissance mind for some time, this humble man of great learning and astonishing output manifests the intellectually reforming spirit of his times. But the currents are more powerful than this one man. Gassendi could not have known its outcome, but his writings are a significant part of a new movement that firmly takes us out of medieval Christendom and into the secular, and eventually post-Christian, scientific age. The Whigs have labeled this adventure "Progress," but the "Death of God" has been integral to it, which Gassendi himself would no doubt have been horrified by. And the process itself is more difficult to understand than any blithe secular optimism or merely positive historical objectivity can account for.

Given how Renaissance and early modern European natural philosophy grew out of Western Christendom, the manner in which it gave birth to a nineteenth-century science that broke entirely free from Christian theology is hard to explain and complex to evaluate theologically. Anti-religious Progressives of the nineteenth century are clearly the heirs of Gassendi in their atheistic skepticism, agnostic empiricism, calculative hedonism, experimental and mechanistic instrumentalism, and materialistic atomism. Yet not only "they," but "we" Christian naturalists who accept the validity of Thomas Huxley's domain demarcation between science and theology are Gassendi's heirs.

Gassendi raises significant "science and religion" questions for us today that this volume of tightly historical accounts has no interest in. But it is not even that simple, for underneath the contributors' theological indifference is the influence of Gassendi's non-essentialist view of knowledge—in which one can know only observable facts, never essential meanings. Guiding their every evaluation is the assumption that where our modern scientific life-world follows trajectories that trace back to Gassendi, in those trajectories, Gassendi was right. There is no critique of "us" in such a "history"; this idea makes the volume more of a self-congratulatory hagiography of present post-Christian naturalistic prejudices than anything else.

All the really interesting theological questions about our knowledge of nature that Gassendi throws up, are simply not present. The contributors never consider what a world-shaping metaphysical innovation this new philosophy of matter is. The idea that Aristotelian hylomorphism (where all physical beings are matter-and-form composites) might have gotten something right never comes up. Hylomorphism—today totally displaced by Gassendi's atomism—holds that intelligible qualities, such as purpose and essence, are integral with physical being's material and efficient causalities. But contemporary sciences—and particularly the life sciences—are trying (ironically?) to understand a world without purpose or intrinsic meaning (what then is a mind and a cosmos for? asks Thomas Nagel). What if there really are purposes and essential meanings embedded in nature that we can to some degree know? We cannot follow up those possibilities if we are determined to stick with Gassendi's purely atomist philosophy of matter. And the idea never comes up in this book, that Descartes—though, indeed, totally whipped by Gassendi's skeptical and non-essentialist critiques—may yet have grasped something true about the nature of intelligibility (rational and essential truths) that cannot be explained by an entirely external and phenomenological epistemology. The supposedly objective and merely positivist historical scholars in this volume are all firmly on Gassendi's side.

The glaring problem with the book—at least to a Christian interested in "science and religion"—is that it has absolutely no interest in what theological lessons we might learn from better understanding the life and thought of Pierre Gassendi. The book never asks what Gassendi's atomist, hedonist, and epistemic legacy means for theology and science today. But readers who ask those questions will be better equipped to so do by reading this very fine work of (alas, theologically and metaphysically eviscerated) modern historiography about the life and thought of Pierre Gassendi.

Reviewed by Paul Tyson, Senior Honorary Fellow with the School of Historical and Philosophical Inquiry, University of Queensland, Australia.

DOI: https://doi.org/10.56315/PSCF12-23Rasmussen

WHO ARE YOU REALLY? A Philosopher's Inquiry into the Nature and Origin of Persons by Joshua Rasmussen. Downers Grove, IL: IVP Academic, 2023. 304 pages. Paperback; $30.00. ISBN 9781514003947.

In this text, philosopher Joshua Rasmussen attempts to understand the nature of human persons (Part One) and their origin (Part Two) through a study of human consciousness. While his book is an exercise in philosophical analysis, he offers reflections on the plausibility of his arguments in light of recent findings in psychology and theoretical physics.

In the first two chapters, Rasmussen establishes the framework for his analysis. Of particular significance is his use of introspection to argue against reductionist accounts of consciousness. By introspection, he means attention to first-person experience of the data of consciousness, such as thoughts and feelings (pp. 8–10). Such attention shows that the best explanation of consciousness will be one that accounts for the reality of mental states. Since we can have what Rasmussen calls a direct, introspective awareness of mental states, we can know these states are real (pp. 30, 40).

The next four chapters build upon this realist account of the contents of consciousness by attending to thoughts, perceptions, intentions, and values. In each case, Rasmussen concludes that the best way to account for the existence of these mental states is by changing our orientation from a "mindlessness frame" to a "mind-first frame" (p. 123). So, for example, introspection reveals that thoughts are real, but are not the same as, nor are they simply reducible to, brain states (pp. 57–59). Likewise, introspection reveals that the elements necessary for a free choice—i.e., agency, intention, and options—are present in

acts of willing, and that the reality of these mental acts is confirmed insofar as they affect material states (p. 116). In summary, the existence of these various mental states requires a mental context, which is the mind. But since mental states also change, there must be a constant that anchors the mental context, and that anchor is what Rasmussen means by a person. "Qualities in consciousness depend on the existence of *someone* with a mind" (p. 142, emphasis mine).

There is much that is relevant in these chapters to those interested in how science might inform philosophy of mind. In his analysis of thoughts, Rasmussen notes physicist Alex Rosenberg's objection to the existence of a mind (p. 74). Rosenberg's critique provides Rasmussen with an example of how science can help philosophy clarify the question. In this case, the question is what kind of material must exist for thoughts to exist. Introspection reveals the need to posit some "material" that cannot be accounted for only by reference to the data of physics. In his analysis of the will, Rasmussen notes that recent studies in neuroscience have found evidence that conscious acts precede the quantifiable brain activity associated with those acts, thus supporting the notion of a free will. Another study found that conscious acts have a significant effect on the brain without contradicting physical laws (pp. 118–19). These and other studies confirm that mental acts, such as conscious intending, affect material states, such as brain activity.

In the final two chapters of Part One, Rasmussen explains the integration of these conscious acts in terms of what he calls the "conscious substance theory." In short, a person is a substance that unifies both mental and material aspects, such that the causal operator is neither a mental nor a material bit, but rather is itself a *capacity* of the conscious substance. Furthermore, this conscious substance explains the *unity* of the person (p. 172). On the one hand, a person can be understood only insofar as the conscious states of that person are affirmed as real. As real as these states are, however, they are all just various parts of what makes a person. The nature of a person is not these parts, but rather is the substance that unifies all these parts. Rasmussen here presents what is perhaps his most interesting example of scientific research relevant to understanding his theory of the person. Physicist Carlo Rovelli explains that matter is best understood as informational, not spatial. This allows for the possibility that both minds and bodies are just different aspects of an underlying quantum field (p. 165), a possibility to which he returns later in the book.

In Part Two, Rasmussen attempts to explain the origin of persons by delineating the conditions for its source (chaps. 9–11) and then explaining what might fulfill those conditions (chaps. 12–13). First, he argues that anything capable of generating a conscious substance must itself be conscious (p. 207), it must be a unity that integrates conscious acts (p. 216), and it must be identical over time (pp. 231, 233). Then, Rasmussen employs a notion of emergence to explain the origin of persons in light of these three conditions. He considers and rejects both "weak" and "incongruent" notions of emergence that would simply reduce consciousness to third-person, mindless bits of matter (pp. 240, 243). Consciousness must be the result of "strong" emergence of a sort that he calls "substance emergence," meaning that the material from which a conscious substance emerges must itself have the capacity for consciousness. Substance emergence is not incongruent, since the substance in question is congruent with conscious acts; nor is it weak, since the emergent content of consciousness (e.g., a mental image) is not logically predictable based solely on the conscious substance from which the content emerges (p. 246).

The book's argument culminates in chapter thirteen, in which Rasmussen posits what he calls the "source substance" as the origin of persons. The source substance is *fundamental*, such that it does not emerge from any prior substance; it is *conscious*, giving it the capacity to generate consciousness; it generates things according to principles and patterns that are *intelligible*; and it is the substance out of which *persons* emerge. Rasmussen attempts to show the plausibility of the theory in several ways. First, the "informational theory of matter" based on the work of Rovelli (see above) makes sense if the source of all matter is itself a conscious substance and the informational states that constitute matter are themselves the contents of consciousness belonging to the source (pp. 256–58). Rasmussen then explains how a mind-first (as opposed to a mindless) ontology has the advantage of not requiring multiple kinds of substances to explain matter, since a source substance that is conscious can generate both mental and material aspects

of reality. Rasmussen sees further support for this possibility in recent psychological studies of perception, which understand "particles" to be properties of conscious beings (pp. 260–61). He notes also that a mind-first notion of reality makes sense given that the world is not fundamentally chaotic, but rather is intelligible. Finally, the existence of persons is more plausible if the foundation from which persons emerge is itself personal. Rasmussen concludes the book with a consideration of what he calls the "destruction problem." If mindless matter (which includes the body) cannot construct a conscious substance, then by symmetry the absence of mindless matter cannot destroy a conscious substance. Therefore, persons can exist even after the body associated with that person ceases to exist (p. 277).

Rasmussen intends the book to be accessible to the lay person while maintaining the interest of the specialist, and he partially succeeds in both respects. Some readers might be encouraged by Rasmussen's repeated assertion that it's hard work to ask and answer these deep questions, as well as by his assurances that it will be worth the effort to go where few have dared to tread, though others are just as likely to find these refrains grating and condescending. Those skeptical of Rasmussen's conclusions will appreciate his willingness to take nothing for granted, including his own existence. The result, however, is that the book wades into debates that are unlikely to help the casual reader follow the argument. Those less interested in the baroque concerns of contemporary analytic philosophy can follow the trajectory of the book's argument by reading only the introductory and summary portions of each chapter.

All readers will be served well by the book's most significant contribution to the study of consciousness, which is Rasmussen's insistence upon the indispensable role of attention to the data of consciousness. Much discussion in modern philosophy of mind not only ignores these data but also actively dismisses them, resulting in what philosopher Bernard Lonergan called the "truncated subject." Rasmussen is to be commended for his effort to understand human consciousness through his relentless attention to its contents.

Unfortunately, the effort is severely hampered by a conflation between knowing and looking that permeates the book. Rasmussen's theory of the nature and origin of persons would be immensely strengthened if understanding (i.e., intellect in action) were to be distinguished from adequate seeing, and if the real (i.e., verified intelligibility) were to be distinguished from that which is adequately seen. Then his theory of the person *qua* conscious substance could be affirmed as real even though it cannot be seen. Furthermore, the emergence of such a substance could be understood by analogy with the paradigmatic instance of emergence, that is, the emergence of the act of understanding out of acts of perception. If readers are unable to complement Rasmussen's argument with their own grasp of these distinctions, they are likely to either reject the book's foundational assertions about the reality of their own conscious acts or simply trust Rasmussen that his conclusions are correct. Thus, in the opinion of this reviewer, the book will best serve the reader, casual or specialist, who is able to evaluate the cogency of Rasmussen's argument without relying on the ocular version of knowing that permeates it.

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Social Sciences

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GENERATIONS: The Real Differences between Gen Z, Millennials, Gen X, Boomers, and Silents—and What They Mean for America's Future by Jean M. Twenge. New York: Atria Books, 2023. 560 pages. Hardcover; $32.50. ISBN: 9781982181611. E-book; $16.99. ASIN: B0B3Y9RSFP.

> Thinking without comparison is unthinkable. And, in the absence of comparison, so is all scientific thought and scientific research.
>
> —Sociologist Guy Swanson, 1971

Certainly, the ideas behind Swanson's observations guide the work of San Diego State University psychologist Jean M. Twenge, who has published scores of peer-reviewed empirical studies comparing the responses of different birth cohorts (generations) on the same social survey questions over time. Although limited to the United States here, her empirical research mostly compares present attitudes to past ones and compares different generations to each other in the same time frame. She has long been thinking with comparisons.

Twenge's previous book, *iGen* (2017), drew on publicly available data from four major social surveys to argue convincingly that social media heavily influenced Gen Z (composed of people born between 1995 and 2012), often to their physical and psychological detriment. In her sequel, Twenge seeks to widen the scope and the audience for such research and even purports to predict the future of America. Even if the science of comparing generational cohorts will fall short in predicting the future (as seems likely), readers will benefit from learning about typical traits of different generations or birth cohorts in the United States.

Generations compares six generations of Americans: the Silent generation (born 1925–1945), Baby Boomers (born 1946–1964), Generation X (born 1965–1979), Millennials (born 1980–1994), Generation Z (born 1995–2012), and Polars (born 2013–present). Each of the substantive chapters (chaps. 2–7) focuses on a single generation and contrasts its members' average responses on a wide array of social survey questions from twenty-four datasets with a combined number of 39 million respondents. Most readers will be able to identify family, friends, and neighbors from each generation that exemplify some of the attitudes that Twenge labels as distinctive.

Twenge constantly uses charts to show differences between generations and average attitudinal shifts over time. While the book is hefty and full of statistics and charts that can occasionally overwhelm the reader, the prose is mostly lively and sprinkled with humor. The overall impact is to convince the reader that generational cohorts do tend to share outlooks. My copy is studded with post-it flags marking places in the text where her observations surprised me or nailed down something I had only vaguely sensed before. As a member of Generation X, for instance, I was surprised at how many traits identified by Twenge resonated with my own life experiences, and I suspect other readers will have similar "aha" moments for their generation. They can also gain a new appreciation for how other generations have impacted American society.

How have generational cohorts come to differ? Twenge's thesis, laid out on pages 4–19, is that technological changes drive generational differences, often mediated by individualism and a "slow-life strategy, with lower birth rates, slower development, and more resources and care put into each child" (p. 18). With lower death rates, longer life expectancies, and technological changes, younger generations can take their time in finishing their education, starting their careers, marrying, buying a home, and having children—if they even decide to have children at all. As Twenge notes, "By 2020, the birth rate for both teens and for women in their early 20s was the lowest it had ever been since records were first kept in 1918—about half of what it was in 1990" (p. 377). The slow-life strategy, ascendant for the younger generations, might be the most important shift described in the book, along with declines in religious belief and behavior.

Even if academic researchers might want to quibble about her use of "technology" as a very broad, catch-all term, it is impossible to dispute that these trends are in motion for the typical members of these cohorts. The effects are evident to anyone who knows college-educated young adults in their twenties or thirties. They are less likely to marry, less likely to have children, less likely to attend religious services, and less likely to hold traditional views of gender identity when compared to previous generations. Cross-national comparisons with Canada and other industrialized countries—as well as more diverse countries—might help clarify the reasons for such generational shifts of attitudes and behaviors.

Furthermore, when the book seeks to predict the future in the final chapter, it feels forced. Twenge herself cites at least three failed predictions made by Neil Howe and William Strauss, the previous gurus of generational analysis (p. 295). Readers thirty years from now should return to this volume to see how well Twenge's predictions have held up. One suspects that we will be surprised by some unforeseen trends.

Notably for the readers of this journal, measures of religious observance and belief show steep declines that began with Millennials (born 1980–1994) and continued with Gen Z (born 1995–2012). This is a troubling trend for anyone who cares about social well-being. As Twenge notes, "Humans have an innate desire to believe in something larger than themselves and to seek meaning in their lives. If religion stops filling this role, something else will step in

to fill it" (p. 504). Twenge cannot help but express a concern for the future of American society here and elsewhere. Christian scholars should join her. After all, our faith is transmitted through the generations. As Psalm 145:4 says, "One generation commends your works to another; they tell of your mighty acts." Are we failing to transmit the story to younger generations? This book compiles extensive evidence that we might be—and that American society might be worse off as a result.

Generations is best understood less as an attempt to advance psychological science and more as a concerned American psychologist's data-studded jeremiad. Twenge compares thousands of data points in order to persuade us to care about the future of American society, which has promoted individualism to the detriment of collective well-being. Those called to love their neighbor would do well to study the trends here and ponder how they can care better for all generations of those neighbors. For those of who us are part of a kingdom that "endures through all generations" (Ps. 145:13), we can learn from Twenge how to reach members of each of the generations alive today while promoting a less individualistic society.

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TECHNOLOGY

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THE DIGITAL PUBLIC SQUARE: Christian Ethics in a Technological Society edited by Jason Thacker. Brentwood, TN: B&H Academic, 2023. 384 pages. Paperback; $34.99. ISBN: 9781087759821.

Questions about the role of digital technologies are becoming increasingly important. In 2014, Luciano Floridi published *The Onlife Manifesto*, arguing that the digital and physical worlds were in the process of merging and that any meaningful distinction between offline and online was shrinking. The advance in digital technology provides fertile ground for academic discussion of digital technologies and their role in human society. Following the popularity of *The Age of AI*, Jason Thacker has quickly become one of the prominent voices in evangelical thought in this area. His most recent contribution is an edited volume, *The Digital Public Square*, which focuses on issues of public theology such as censorship, sexual ethics, hate speech, or religious freedom as they present themselves in the digital milieu. Following Jacques Ellul, Thacker dubs this milieu "the technological society."

The book contains thirteen articles that are divided into three major sections which attempt to articulate a public theology for the technological society. Public theology is a relatively young field. Hak Joon Lee suggests that public theology seeks to engender religious discourse within the context of a pluralistic society by acknowledging the importance of human rights, tolerance, equality, and other democratic values without suppressing the variety of possible expressions of religion.[1] Public theology is a theology done towards, with, and for the general public for the sake of the common good of the society.

The first section attempts to provide the foundation for public theology in a technological society. Chapter 1 sets out a Christian philosophy of technology, chapter 2 advocates for the virtue of patience in online interactions, and chapter 3 charts a middle path between technological optimism and pessimism in US attitudes toward technology. A particular standout is chapter 4, Patricia Shaw's extensive survey of international technology policy in "The Global Digital Marketplace." While, like most policy articles, it is a little dry, Shaw's article is thorough, well sourced, and well organized. Finally, chapter 5 discusses the challenges of free speech in a digital milieu and the limits of policy-based approaches.

The second section of the book includes six articles that address specific issues in public theology with an eye toward specifically digital iterations of these issues. This section covers implications of freedom of speech on digital media (chap. 6), specifically hate speech (chap. 7), content moderation (chap. 8), and pornography (chap. 9). It also addresses the explosion of conspiracy theories and the problem of digital misinformation (chap. 10) and the rise of digital authoritarianism (chap. 11). Finally, the third section offers two articles that articulate the church's role in the technological society in terms of discipleship (chap. 12) and public witness (chap. 13).

One immediate point worth noting is that this book has more to do with public theology, and specifically concerns around the freedom of expression, than it

does with digital technology. Many of the articles frame the topics they discuss in the context of a digital milieu—for instance, how companies such as Twitter, Meta, or YouTube should approach the filtering or suppression of hateful, pornographic, or otherwise offensive expressions (chaps. 5, 7, 8, 9)—but the central issues of the book do not arise from philosophy of technology or engineering. They are perennial questions in public theology and policy that are explored in the context of the digital world. While I cannot critically interact with every article, a couple of examples will give the reader a sample of what to expect.

In the first introductory chapter, Jason Thacker attempts to set out a uniquely Christian philosophy of technology. He grounds his approach in the work of Jacques Ellul, Neil Postman, and Albert Borgmann, and argues that a Christian philosophy of technology should reject technological instrumentalism or the idea that "technology," broadly understood, is merely a neutral tool (pp. 7–14). Instead, he argues that a Christian philosophy of technology understands that we interact with technology in complex ways (p. 14), and it seeks to provide "a framework of agency and accountability, alongside expanding our view of technology to see the larger social effects of these tools" (p. 20). However, it is not entirely clear how it does so. Thacker attempts to carve a path between technological instrumentarianism and technological determinism, but he doesn't defend a rigorous account of agency in a digital milieu or clarify when or how digital actors are accountable. This seems particularly significant considering that some scholars argue that machines count as agents in a significant sense—for instance, John Sullins or Christian List. Thacker argues that Christians must adopt a principled pluralism, which is a popular model of social and political interaction among public theologians, and develop a deeper understanding of differculties faced by the technology industry, government actors, and the populace as they engage in a digital public square (pp. 22–23). Given this, it is odd that the book contains no articles written by engineers, developers, or technologists.

Olivia Enos (chap. 11) provides a well-developed account of the ill effects of explicit digital authoritarianism, defined as "the use of digital technology by authoritarian regimes to surveil, repress, and manipulate domestic and foreign populations" (p. 266). She focuses on Russian and South East Asian examples including, but not limited to, China. However, as do many, Enos assumes a strong digital libertarianism as the norm, a position with its own challenges. Digital libertarianism has enabled the rise of what Shoshana Zuboff calls surveillance capitalism. It seems plausible to argue that surveillance capitalism and digital authoritarianism have much in common. If this is accurate, then Enos's digital libertarianism is likely to lead to an alternative version of authoritarianism. While Enos's account of the challenges raised by explicit digital authoritarianism is very good, it does not effectively take account of the rise of similar trends in digitally libertarian nations; this is a significant weakness of her argument.

The Digital Public Square is more about public theology in a world that has embraced the digital than about what it means to live in a digital world, or about a deep consideration of what constitutes a digital public square or a digital community (interesting questions in their own right). It would help for the authors writing on the philosophical and theological side of the discussion to engage in greater depth with a wider array of contemporary sources in the philosophy of technology. The influence of Jacques Ellul is evident. However, Peter-Paul Verbeek is mentioned only once, as is Luciano Floridi. And other prominent philosophers in the discussion such as Don Ihde, Charles Ess, Shannon Vallor, Mark Coeckelbergh or John Danaher are entirely absent.

This book will appeal to those who are interested in public theology. It draws many of its political assumptions from classical liberalism and its theological assumptions from the Reformed tradition. Those sympathetic to these traditions will appreciate this book. Finally, several of the chapters will serve as excellent introductory resources for anyone exploring practical issues of legislation and policy in a digital milieu.

Note

[1]Hak Joon Lee, "Public Theology," in *The Cambridge Companion to Christian Political Theology*, ed. Craig Hovey and Elizabeth Phillips (Cambridge, UK: Cambridge University Press, 2015), 44.

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Letter

Another ASA Fellow Recommends a Favorite *PSCF* Article

I appreciated reading the praises of *PSCF* articles that have influenced ASA Fellows and editors ("Twenty-Five ASA Fellows and Editors Tell of *PSCF* Articles That Changed Their Lives," *PSCF* 75, no. 2 [2023]: 100–118). The article that I found most helpful was not mentioned. It is "Interpreting Genesis One" by Charles E. Hummel, *PSCF* 38, no. 3 (1986): 175–85.

I have recommended Hummel's article to a number of friends who have been influenced by a young earth creation (YEC) reading of Genesis 1. Hummel's article is extremely helpful in viewing the text in its historical, cultural, and literary context. It seems that many who champion a historical-cultural-literary interpretation of scripture neglect such an interpretation when it comes to the first chapters of the Bible. This article helps them to see what the text of Genesis 1 is really saying, so I have recommended it numerous times. It has helped at least one friend to break out of a YEC mindset.

Kirk Bertsche
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"Upholding the Universe by His Word of Power" Hebrews 1:3

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