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Mathematics declaring the glory of God

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This article discussed the question 'Does God speak through the language of mathematics?' For centuries, mathematicians with different religious backgrounds would have answered this question in the affirmative. Due to changes in mathematics from the 19th century onwards, this question cannot be answered as easily as it used to be. If one regards mathematical concepts as creations of the human mind, it is difficult to argue that mathematical formulae exist in a divine mind. The article argued that there were traces of the divine in mathematics. Six kinds of traces were explained: (1) the existence of indisputable truth, (2) the existence of beauty, (3) the importance of community, (4) rational speaking about infinity, (5) the discovery that speaking about unseen and abstract objects is reasonable and (6) the unreasonable effectiveness of mathematics. In practice, traces (1), (2) and (6) are probably the most convincing.

Intradisciplinary and/or interdisciplinary implications: This article is very much interdisciplinary as it combines mathematics and theology, especially the philosophy of mathematics and systematic theology.

Keywords: philosophy of mathematics; general revelation; truth; beauty; infinity; unreasonable effectiveness.

Introduction

This article is about how traces of the divine can be found in the language of mathematics. The title alludes to Psalm 19:1: 'The heavens declare the glory of God', which is part of the Jewish and Christian Bible.

Obviously, mathematics is some kind of language (Livio 2009:239–241). Mathematics is often called the 'language of nature', which goes back to a saying by the Italian astronomer Galileo Galilei (1564–1642) (Mukunda 2015:347). Isaac Newton called his famous work on physics *The Mathematical Principles of Natural Philosophy* because he was convinced that natural philosophy has to be expressed in the language of mathematics.

The question to be investigated in this article is as follows: *Does God speak through the language of mathematics?* Two centuries ago, it would have been easy to argue for a positive answer. Due to changes in mathematics and the growing influence of atheism, today's answer has to be different from the answers given two centuries ago. In this article, I will first explain the changes in mathematics and their implications for the question to be investigated. Secondly, I will discuss six examples of indications of divine elements in mathematics. I am writing from the perspective of a mathematician and Christian theologian. Thus, I will focus on doctrines of the Christian faith although some implications will also hold for other faith systems.

In this article, I will not treat mathematical theistic proofs such as Gödel[1] or Meyer (1987). I do not think that mathematics alone can say anything about God's existence. Mathematics is a formal construct, and as such it does not say anything about the real nature of things.[2] Instead I will argue that mathematics provides an opportunity to discover some properties that are usually associated with God. I will list several aspects of mathematics that I regard as traces or hints leading one to reflect upon God and divine attributes.

This article develops some ideas that I presented in two previous articles (Kessler 2018, 2019). In particular, I take into account some reactions to these articles.[3]

1.Gödel noted his proof on two pages in 1970 but kept it secret until his death, see Bromand and Kreis (2013:483–491).

2.See Poincaré's statement: 'The object of mathematical theories is not to reveal to us the real nature of things' (Poincaré 1905:211).

3.In Kessler (2018), I argued that 'God becomes beautiful … in mathematics'. This article received a response by Smit and De Heide (2021), in which they criticise that I did 'not discuss in detail the current state of research in the field of philosophy of mathematics' (p. 3). Their observation is correct. Because I wanted the article to be readable for non-mathematicians, my presentation of the mathematical foundations was a bit (too) simplistic. In this article, I am making up for what I deliberately omitted in Kessler (2018).

When the answer seemed to be straightforward

Mathematics and the mind of God – before the big changes

In the past, strong links between mathematics and the divine have always been assumed; see, for example, the historical study Koetsier and Bergmann (eds. 2005). For many, mathematical knowledge used to be 'an aspect of spiritual knowledge, knowledge in the mind of God' (Hersh 1997:236). Jonas (1966) and Livio (2009) raised the same question: 'Is God a mathematician?'[4]

In the Classic Greek tradition, theology and mathematics were close to each other (Phillips 2009). Pythagoras (ca. 570–510 BC) was convinced that numbers and formulae had an inherent spiritual meaning, and his school at Croton was 'more a religious brotherhood than an academy' (Phillips 2009:5). Pythagoras and Plato both regarded mathematics as a spiritual path leading to the divine, but they came to different conclusions. For Plato (428–348 BC), mathematical studies were a preparation for the contemplation of the divine principles, whereas for the Pythagoreans *mathematics actually was God* (Livio 2009:28).

To give an example of the close link between mathematics and theology some centuries ago, we look at the beliefs of some important mathematicians of the 17th century, the start of the scientific age and of modern mathematics. In the Europe of the 17th century, it was quite common to believe in the Christian God, and this is also true for the most brilliant European mathematicians of the 17th century. It is, of course, debatable that mathematician was most important at a given time; for example, Stewart (2017) selects 25 mathematicians throughout history. Nevertheless there are good reasons to regard the following six persons as the most important mathematicians of the 17th century: (1) René Descartes, France (1596–1650), who invented analytic geometry; his compatriots (2) Pierre de Fermat (1607–1665) and (3) Blaise de Pascal (1623–1662), both of whom (among others) laid the foundation of probability theory; (4) Sir Isaac Newton, England (1642–1726) and (5) Gottfried Wilhelm Leibniz, Germany (1646–1716), both of whom invented calculus independently of each other and (6) Jacob Bernoulli, Switzerland (1654–1705), after whom the 'law of large numbers' is named. It is interesting to note that five of them saw a strong connection between their mathematics and their Christian faith. (We do not have a statement from Fermat on this.)

Descartes provided two theistic proofs in his *Meditations* (Descartes 1976). Pascal provided a famous 'wager' in which he gives a probabilistic argument for choosing to believe in God (discussed in Heller 2018:42–44). Newton himself believed strongly in a Designer who worked through mathematical laws (Davies 1992:76). 'The most beautiful system of sun, planets and comets, could only proceed from the counsel and dominion of an intelligent and powerful Being' (Newton, quoted in Livio 2009:114). According to the Leibniz specialist Martin (1960), Leibniz regarded mathematical theorems as 'primarily and continuously thought by God', and when a mathematician discovers them, 'this knowing is a repetition of the primary divine knowing' (quoted in Hersh 1997:126). Bernoulli was a strong Calvinist and reflected on the theological implications of his discoveries in probability theory (Heller 2018:48–55).

In a world where mathematical truths were seen as part of the divine mind, it was easy to argue that God reveals himself through mathematics. The quotation from Edward Everett (1794–1865) gives a poetic description of this viewpoint:

> In the pure mathematics, we contemplate absolute truths which existed in the divine mind before the morning stars sang together, and which will continue to exist there when the last of their radiant host shall have fallen from heaven. (quoted in Hersh 1997:9)

Similar statements are known from mathematicians with a different religious background. For example, the remarkable Indian mathematician S. Ramanujan (1887–1920) once noted: 'An equation means nothing to me unless it expresses a thought of God' (quoted in Kanigel 1991: pos 221).

Discovery of non-Euclidean geometry and its implications

As the above examples show, the validity of Euclidean geometry used to be regarded as indisputable and was often taken as an analogy for certainty in theological issues. 'Geometry served from the time of Plato as proof that certainty is possible in human knowledge – including religious certainty' (Hersh 1997:137). This reasoning was challenged by the discovery of non-Euclidean geometry in the 19th century by Gauss (Germany), Lobachevsky (Russia), Bolyai (Hungary) and finally Riemann (Germany).

The angle-sum theorem teaches that the angles in a triangle add up to 180°. This theorem was often used as an example of an absolutely certain statement. For example, Descartes (1976:59) claimed in the fifth meditation that the existence of God is as certain as the fact that three angles of a triangle are equal to two right angles. Spinoza regarded this theorem as indubitable (Hersh 1997:121). David Hume noted that Euclidean geometry was as solid as the rock of Gibraltar (Livio 2009:151), and for Kant, who regarded the concept of space as a priori, the space was indisputably Euclidean (Kant 1966:88; Livio 2009:152).

But this theorem does not hold in non-Euclidean geometry. The sum of the angles in a triangle can be more than 180° (elliptic or Riemannian geometry) or less than 180° (hyperbolic geometry).[5]

4. Jonas' (1966:92) answer is a distinct 'no'. Livio (2009:252) leaves the question open.

5. See Figure 41 in Livio 2009:155.

This discovery led to a re-thinking of the foundations of mathematics. The famous French mathematician and physicist Henri Poincaré (1854–1912) made the consequences very clear:

> *The geometrical axioms are therefore neither synthetic à priori intuitions*[6] *nor experimental facts*. They are conventions. Our choice among all possible conventions is guided by experimental facts; but it remains *free* … (Poincaré 1905:50)

The new situation was that the mathematicians would offer different sorts of geometry from which the physicists had to choose the geometry, which would be most appropriate for studying the physical world. This new situation challenged the understanding of mathematics as a divine science.

> The fact that one could select a different set of axioms and construct a different type of geometry raised for the first time the suspicion that mathematics is, after all, a human invention, rather than a discovery of truths that exist independently of the human mind. (Livio 2009:159)

At this point, it became obvious that intuition alone is not sufficient for mathematical certainty. Cantor's set theory was a candidate for the foundation of mathematics. But then paradoxes in the set theory were discovered by Zermelo in 1899 and by Russell in 1901 independently of each other. This finally led to three different schools of thought on how to lay a good foundation for mathematics: logicism, formalism and intuitionism (Shapiro 2000:107–197). It turned out that each of these three major schools has its deficiencies; none can fulfil the promises of their inventors. Intuitionism is almost dead, and Gödel destroyed 'all hope for a consistent and complete axiomatization of mathematics' (Mendelson 1987:175).

Actually, the question of the foundation of mathematics has no clear answer to this day (Hersh 1997, Shapiro 2000). As a consequence, the vast majority of working mathematicians do not spend too much time on the question of foundations.

Pragmatic Platonism afterwards

Although Platonism is no longer considered an up-to-date epistemology or philosophy of science, it is still alive among working mathematicians. A crucial question to mathematicians is 'is mathematics created or discovered?' In 1940, the renowned British mathematician G.F. Hardy (1877–1947) wrote about the 'mathematical reality', admitting that there is no sort of agreement on the nature of this reality (Hardy 2001:123). Hardy (p. 123) believed 'that the mathematical reality lies outside us, that our function it to discover or *observe* it'. Similarly, the German-Austrian logician Kurt Gödel (1906–1978) argued in 1944:

> Classes and concepts may … be considered as real objects … It seems to me that the assumption of such objects is quite as legitimate as the assumption of physical bodies and there is quite as much reason to believe in their existence. (quoted in Shapiro 2000:10)

A small survey done by Pamela Aschbacher, the spouse of an American mathematician shows that this is probably the thinking of most working mathematicians. Aschbacher (2015:17) asked the colleagues of her husband whether math was something like an unseen star, out there to be discovered, or something created by us. Except in one case, she received the answer: 'Oh, it's definitely the "truths" of the world waiting to be discovered' (p. 17). This attitude is also implicit in mathematical parlance, because most mathematicians would say: 'I *discovered* this mathematical law'. The underlying assumption is that it was already there.

Harrison (2017:481) writes that 'virtually everyone in (the mathematical) community assumes a realist interpretation of ontology'. This statement 'virtually everyone' might be a bit too strong. For example, the American mathematician Reuben Hersh (1927–2020) does not share this realist interpretation and quotes several mathematicians on his side (Hersh 1997:182–232). Actually Hersh strongly objects to the fact that mainstream mathematicians still stick to Platonism: 'Why do mathematicians believe something so unscientific, so far-fetched as an independent immaterial timeless world of mathematical truth?' (Hersh 1997:11).[7] 'The trouble with today's Platonism is that it gives up God, but wants to keep mathematics a thought in the mind of God' (p. 135).

As rightly noted by Hersh (1997:42), the working mathematician usually oscillates between Platonism and formalism:

> The working mathematician is a Platonist on weekdays, a formalist on weekends. On weekdays, when doing mathematics, he's a Platonist, convinced he's dealing with an objective reality whose properties he's trying to determine. On weekends, if challenged to give a philosophical account of this reality, it's easiest to pretend he doesn't believe in it. He plays formalist, and pretends mathematics is a meaningless game. (Hersh 1997:39f.)[8]

This attitude could be called 'pragmatic Platonism' (Kessler 2019:51).

Hersh has a different view in mathematics. He sees mathematics as part of human culture and history and regards mathematics as a 'socio-historical reality' (Hersh 1997:17), comparable, for example, with institutions like the Supreme Court.

My own position

I think that Livio presents a well-balanced answer to the question of whether mathematics is created or discovered.

> *Our mathematics is a combination of inventions and discoveries*… Humans commonly invent mathematical concepts and discover the relations among those concepts. (Livio 2009:238, 242)

A mathematician might invent a mathematical concept like a 'prime ideal'or a 'crossed-product order' (Kessler 1994).

6.This was Kant's position presented in 1781 in his *Kritik der reinen Vernunft*. 'Geometrie ist eine Wissenschaft, welche die Eigenschaften des Raums synthetisch und doch a priori bestimmt' (Kant 1966:88).

7.See similar remarks on Hersh (1997:13, 236), etc.

8.This illustrative description is also quoted in Livio (2009:225).

But once the concept and its axioms are in place, the mathematician is bound by this chosen concept. It is a bit comparable to the writing of a novel. An author can freely choose a character for a book, but once the character is chosen the author has to stick to it. The axioms of a mathematical object can be freely chosen, invented, but then the theorems about this object are discovered.

Without digging deeper into the ontology of mathematics, I just want to state that I have much sympathy for Popper's model of the three worlds. There is the physical world (world 1), the mental or psychological world (world 2), which is our inner world, inaccessible from outside and there is a third world (world 3), consisting of 'the products of the human mind' (Popper 1980:44) such as concepts, languages and theorems. At the moment when Fermat made public the formula, which was in his mind (world 2) and became later known as 'Fermat's Last Theorem', this formula could be discussed and analysed by the mathematical community as part of world 3. Singh (1997) tells the story of these discussions.

Already in 1918, the German logician Gottlob Frege (1848–1925) published a similar idea in his essay *Der Gedanke*:

> That seems to be the result: Thoughts are neither things of the external world nor conceptions. A third realm must be recognised. (Frege 1986:43)[9]

A thought in Frege's sense is something, which is either true or false.[10] What Frege called 'a third realm' – the term 'Drittes Reich' got a totally different meaning two decades later! – was later turned into 'world 3' by the Austrian-British philosopher Karl Popper (1980:157). At first glance, Popper's world 3 might look a bit Platonic (Hersh 1997: 220), but there are important differences. World 3 is a human creation, that is, it consists of the products of the human mind, whereas the Platonic ideal forms were regarded as eternal.[11]

Please note that the conclusions in the next section do not presuppose the existence of world 3. I hope that my arguments will also convince readers who do not share my view on the ontology of mathematics.

How can one detect divine elements in mathematics?

How can it be argued today that God speaks through the language of mathematics? Although a pragmatic Platonism is still alive among mathematicians, I will not build on it in the following section, because I think that mathematics is a combination of inventions and discoveries, see above.[12]

9. Original quote: *'So scheint das Ergebnis zu sein: Die Gedanken sind weder Dinge der Außenwelt noch Vorstellungen. Ein drittes Reich muss anerkannt werden'*. Translation done by www.DeepL.com.

10. *'nenne ich Gedanken etwas, bei dem überhaupt Wahrheit in Frage kommen kann'* (Frege 1986:33).

11. The British mathematician Penrose also speaks about three worlds. But in his case, the world containing mathematics is closer to the Platonic realm (Penrose 1991, Livio 2009:2f.).

12. Note that in Kessler (2019:51), I referred to pragmatic Platonism as one of the four gateways to spirituality. This is because my approach there was purely phenomenological. I have not discussed to what extent these gateways could be justified theologically or philosophically.

I do argue that some features of mathematics hint at divine attributes. I am not saying that one can detect God within mathematics, but that one can at least find traces of the divine. Reflections by mathematicians on their work (like in Cassaza et al. 2015) and the empirical study Witz (2007) provide some empirical evidence for the fact that one might detect divine elements in mathematics.

Mathematics shows that there is indisputable truth

Let us start with a personal remark by the journalist Masha Gessen. In her work on the mathematician Grigori Perelman, she also shares her own experiences with math clubs in the former Soviet Union. 'To a Soviet child, the after-school math club was a miracle' (Gessen 2009:21). The ordinary school system followed the ideal of uniformity and taught the doctrines of the communist party. By contrast, the math clubs encouraged individuality and creativity. One could argue with others, and statements could be proved! Each student could receive merits by solving a math problem, regardless of his or her gender, ethnic background, political conviction or whatever. '(I)t felt like love, truth, hope and justice all handed to me at once' (p. 22). Gessen mentions four transcendentals – love, truth, hope and justice – which we consider to be divine attributes, at least in the Jewish-Christian tradition. Thus, mathematics obviously can lead to the discovery that there are transcendentals.

Most importantly, in mathematics, one can learn that there is an indisputable truth. A mathematical formula is either true or false. Every mathematician would agree that Fermat's Last Theorem actually was true even before Andrew Wiles proved it in 1994 (Singh 1997). There is no need for Platonism to share this point of view. It is the belief in the objectivity of mathematical discourse, without committing to the belief that mathematical objects exist in a Platonic realm (Livio 2009:243).

The detection of indisputable truth might lead people to look for the source of truth, which is linked to God, at least according to monotheistic religions (see, e.g. Job 28:23 in the Jewish-Christian Bible, Jn 14:6 in the New Testament).

Mathematics shows that there is beauty

In 1907, the British mathematician Bertrand Russell (1872–1970) wrote 'Mathematics, rightly viewed, possesses not only truth, but supreme beauty – a beauty cold and austere' (Russell 2014:49). His compatriot Hardy stated in 1940 that beauty is the first test for mathematics, because 'there is no permanent place in the world for ugly mathematics' (Hardy 2001:85). In 1952, the German mathematician Helmut Hasse (1898–1979) lectured on 'mathematics as science, art and power' (Hasse 1952). There he declared that beauty leads to mathematical truth (:19). He further stated that truth is a necessary condition for real mathematics but is not sufficient. There must also be beauty and harmony (:26). Sir Michael Atijah (1929–2019) was a strong advocate for beauty in mathematics.[13] He was convinced that mathematicians 'serve two masters, Beauty and Truth' (Atijah 2015:29; see also Atijah 1973). In the above-mentioned survey, Aschbacher also asked her husband's colleagues why they were drawn to mathematics. A typical answer was 'drawn towards it by its beauty and elegance' (Aschbacher 2015:18). Heller (2018:229) regards mathematics to be 'the most beautiful product of human rationality'. Zeki et al. (2014) report on a 'beauty competition' in which mathematicians rated formulae for beauty. The winner was the so-called Euler's identity (Kessler 2018:4–5). More information about the aesthetical dimension of mathematics can be found in the collective volume (Sinclair, Pimm & Higginson 2006) or in the special issue (*Journal of Humanistic Mathematics* 2016). Mathematical beauty can be found in the result itself, in the proof of the result, or as a guide to the right formula.

When people experience beauty in mathematics, they might start wondering about the source of this beauty. The feeling might be comparable to arriving at the top of a high mountain, enjoying the beauty of the view. At such moments one is reminded of Psalm 19:1: 'The heavens declare the glory of God'.[14] Such a feeling might also come to one experiencing the beauty of maths. It is the 'shuddering before the beautiful' (Chandrasekhar 1987:541), an emotion similar to spiritual emotion called 'mysterium tremendum' by the German theologian Rudolf Otto (1936:12). This 'mysterium tremendum' contains elements of awefulness and overpoweringness (*majestas*) (:14, 20).

Mathematics shows that there is beauty and glory, and the Bible links these attributes to God (e.g. Psalm 19:1, Isaiah 33:17, cf. Von Balthasar's seven volumes on the glory of God, Von Balthasar 1984).

Mathematics shows the importance of community

Because human beings are social beings, there are many human activities demonstrating the importance of community. And each science has its own scientific community. But I think that the previous aspect of mathematical beauty (3.2) has an interesting side effect.

Mathematics is a product of a community contributing together to create beauty. Usually, a piece of art or a symphony is the product of an individual. And in the case of a cathedral where many people have contributed at different times (632 years for the Cologne Cathedral!), they at least have to work at the same location. In mathematics, an invisible community consisting of many people in different places and at different times jointly contribute to the beauty of mathematics. In the case of Fermat's Last Theorem, it took 358 years (Singh 1997).

In his personal account, Boas (2015:256) stresses the communal aspect of mathematics: 'After sitting at the feet of these gurus for a year, I was a lifelong convert to the religion of mathematics'.

This communal contribution to beauty has interesting counterparts in Jewish-Christian theology. The Song of Songs in the Jewish Bible has also been interpreted as a metaphor for a marriage between God and His people. This metaphor is taken up in the New Testament calling the church 'Christ's bride' (Eph 5:31–32, 2 Cor 11:2). Note that this metaphor does not refer to a mystic union between God and an individual; the whole community of believers is involved. According to this Jewish-Christian metaphor, God is looking for community.

In addition, there is the Christian doctrine of the Trinity. According to this doctrine, there is already community within God; thus community could be considered a divine attribute, at least in Christian theology (see the wonderful icon The Trinity, painted in 1410 by Andrei Rublev).

Mathematics shows that one can speak about infinity in reasonable terms

There has been a long dispute about the understanding of infinity (Hilbert 1925). Is there an actual infinity? The German mathematician Georg Cantor (1845–1918) provided a new understanding of infinity by demonstrating that there are infinities of different sizes (Hilbert 1925:167). For example, the set of integers and the set of rational numbers are both infinite and countable, but the set of real numbers is infinite and uncountable, thus 'much larger' than the set of rational numbers. Cantor introduced transfinite numbers in order to distinguish infinite sets of different sizes.

This discovery shows that it is reasonable to speak about infinity, thus demonstrating that speaking about an infinite God is not senseless per se.

Studying different degrees of infinity might also show the mathematician that there is something, which is provably higher than him or herself. We only know a subsection of all infinite sets, and this is not only because our IQ might be too small, but because the structure of the system of thought has limitations.[15] Thus the mathematician might come to the conclusion that there is somebody higher than him or herself (see Rm 1:20).

Mathematics shows that reasoning about unseen and abstract objects can make sense

In her essay, Victoria Harrison argues that 'realism about mathematical objects can provide a model for thinking about realism within theology' (Harrison 2017:479). From a strictly empirical point of view, talking about God does not make much sense. Experiences might be interpreted as God

13.Some of Atijah's talks are still available on YouTube.

14.Actually, in the Alps, there are several summit crosses quoting Psalm 19:1.

15.I thank my former colleague Prof. Albrecht Beutelspacher, Giessen, for drawing my attention to this; see his e-mail 8 August 2020.

speaking or acting, but our senses 'cannot provide direct knowledge of God' (p. 490). Theology shares this deficiency with mathematics because mathematical knowledge cannot be generated by our senses. Mathematical formulae are not part of the physical world. Still, mathematical language has proven to be meaningful and rational. This might serve as a hint that talking about theological objects like God might also be meaningful and rational.

The unreasonable effectiveness of mathematics

The sections above dealt with mathematics only, looking for traces of the divine in the pure world of mathematics. This section will also look at the physical world and how mathematics is used to describe it. Physics Nobel laureate Eugene Wigner (1902–1995) once said: 'The miracle of the appropriateness of the language of mathematics to the formulation of the laws of physics is a wonderful gift which we neither understand nor deserve' (quoted in Livio 2009:3). Wigner dubbed this 'the unreasonable effectiveness of mathematics' (4). Livio (2009:203) points out that this unreasonable effectiveness has two aspects. There is an *active* aspect when natural scientists develop a mathematical tool to describe a phenomenon they have observed. It is quite plausible that mathematical reasoning can lead to new knowledge about the physical world through this process.

But there is also a *passive* aspect, which is quite mysterious. In the history of science, it has happened several times that abstract mathematical theories were developed for pure mathematical reasons and later on were successfully applied to the natural sciences. Just to give three examples: Firstly, the complex number i as a root of (–1) was invented in order to solve algebraic equations; nowadays it is heavily used in physics and electrical engineering. Secondly, the so-called Riemannian geometry was introduced by Riemann in a brilliant lecture in Göttingen on June 10, 1854; half a century later, the physicist Albert Einstein used the Riemannian geometry to formulate his general theory of relativity. Thirdly, the 'story of knot theory demonstrates beautifully the unexpected power of mathematics' (Livio 2009: 217). The mathematical theory of knots was born in 1771; today it has significant applications in quantum field theory and in studying DNA.

The issue of chance was long seen as a theological problem. How can the existence of chance be combined with a rational and omniscient God? In his book on the *Philosophy of Chance*, Polish cosmologist and theologian Michael Heller argue that chance is not irrational and 'does not destroy the mathematicality of the world' (Heller 2018:152). 'The world turns out to be mathematical … also in its own random and probabilistic behaviours' (p. 79). Heller (p. 143) also refers to the 'effective' characterisation of the physical universe by mathematical structure, even in the area of probabilities.

Einstein raised the question: 'How is it possible that mathematics, a product of human thought that is independent of experience, fits so excellently the objects of physical reality?' (quoted in Livio 2009:1). It is hard to give a rational explanation for this 'unreasonable effectiveness of mathematics'.[16] Wigner called it a 'gift'. It could also be called a miracle, which brings us to theology again.

Creation theology as understood in the Judeo-Christian tradition offers an explanatory model for the phenomenon of 'the unreasonable effectiveness'. God created the world with wisdom (Pr 8:22–31) and He created human beings in His own image (Gn 1:26). Thus, human beings are enabled to discover the laws that God put into His creation. I am not saying that the study of mathematics will automatically lead people to believe in creation theology. But obviously, one can find traces in mathematics that might point to the Creator-God.

Conclusion

The question of this article was 'Does God speak through the language of mathematics?' Being a mathematician and a Christian theologian, I am convinced that the answer should be 'yes'. But I am also aware that the evidence for this answer is not as obvious as it was several centuries ago. The changes in mathematics made it necessary to rethink the evidence for this answer. We have learned that mathematical objects are created by human beings. Thus, it is not possible to argue that mathematical formulae exist in a divine mind. However, I think that there are hints in mathematics that seem to point towards attributes of God.

I have mentioned six traces of the divine: (1) the existence of indisputable truth, (2) the existence of beauty, (3) the importance of community, (4) rational speaking about infinity, (5) the discovery that speaking about unseen and abstract objects is reasonable and (6) the unreasonable effectiveness of mathematics. I think that each of these arguments has a certain weight, but I do not think that they have the same weight. If one looks at the current discussion, arguments (1), (2) and (6) are probably the most convincing.

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16. Livio (2009) lists some attempts to explain this effectiveness.

Data availability

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Disclaimer

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