Kurt Gödel's Mathematical and Scientific Perspective of the Divine: A Rational Theology

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Abstract:
Kurt Gödel had a profound rational theology. Gödel was not only a theist, but a personalist and a believer in the afterlife. I will explore his philosophical stance through exchanges with Albert Einstein and others to understand how such a foremost mathematician and physicist held such views. I will also address Gödel's ontological argument.

Kurt Gödel, the preeminent mathematical logician of the twentieth century, is best known for his celebrated Incompleteness Theorems; yet he also had a profound rational theology worthy of serious consideration. "The world is rational," (Wang, 1996: 316) asserted Gödel, evoking philosophical theism, "according to which the order of the world reflects the order of the supreme mind governing it" (Yourgrau, 2005: 104-105).

Gödel's Incompleteness Theorems are an "extraordinary comment on the relationship between the mission of mathematics and the manner in which it formulates its deductions" (Mazur, 2006: 3-4). They have been interpreted as a limitation on rationality, since a possible semantics for the results is that, in any axiomatic and consistent system capable of doing arithmetic, there are truths that cannot be proved within the system. This has very profound philosophical implications that shattered the hopes of many a previous mathematician and philosopher, including thinkers of the stature of David Hilbert, Bertrand Russell, and Ludwig Wittgenstein. Frustration notwithstanding, "[Gödel's] works on the limits of logic have inspired awe, respect, endless development and speculation among mathematicians, and indeed among all theoretical scientists" (Davis, 2002: 22).

Among the theoretical scientists influenced by Gödel was his friend Albert Einstein. Between the years 1940 and 1955 they developed an intimate relationship as colleagues at the Institute for Advanced Study in Princeton. According to colleague Oskar Morgenstern, the co-founder of Game Theory, when Einstein had lost enthusiasm for his own work, he went to his office "just to have the privilege of walking home with Kurt Gödel" (Wang, 1996: 57). Indeed, according to Institute colleague and physicist Freeman Dyson (the discoverer of combinatorial proofs of Ramanujan's famous partition identities), Gödel was "the only one who walked and talked on equal terms with Einstein" (Dyson, 1993: 161). However, I would argue that Gödel's intellect was in many ways subtler than Einstein's, in philosophy and perhaps even in physics.

God and Gödel

As his correspondence with Burke D. Grandjean attests, Gödel was a self-confessed theist, going as far as developing an ontological argument in an attempt to prove the existence of God. He chose the framework of modal logic, a useful formal language for proof theory, which also has important applications in computer science (Blackburn, de Rijke & Venema, 2001). This logic is the study of the deductive behavior of the expressions 'it is necessary that' and 'it is possible that,' which arise frequently in ordinary (philosophical) language. However, according to his biographer John Dawson, he never published his ontological argument for fear of ridicule by his peers.

An important aspect of Gödel's theology – one that has been greatly overlooked by those studying his works – is that not only was he a theist but a personalist; not a pantheist as some apologetic thinkers may portray him. To be precise, he rejected the notion that God was impersonal, as God was for Einstein. Einstein believed in "Spinoza's God who reveals himself in the harmony of all that exists, not in a God who concerns himself with the fate and actions of men" (Einstein, 1929). Gödel in turn thought "Einstein's religion [was] more abstract, like Spinoza and Indian philosophy. Spinoza's god is less than a person; mine is more than a person; because God can play the role of a person" (Wang, 1996: 152). This is significant since a god who lacks the ability to "play the role of a person" would obviously lack the property of omnipotence and thus violate a defining property universally accepted as pertaining to God. Therefore if God existed, reasoned Gödel, then He must at least be able to play the role of a person. The question for Gödel was how to determine the truth value of the antecedent in the previous statement.

A relevant issue in Gödel's discussions on the Divine with Einstein is his mention of "Indian philosophy." Gödel considers Spinoza's concept of God and the "Indian" concept to be in the same category, which is not a correct understanding of these notions. Spinoza's stance on God is impersonal, akin to Śankarācārya's monism (c. 788-820 CE). Unfortunately, although familiar with such Indian theological view, Gödel was apparently unaware of the philosophical conclusions of Rāmānujācārya (1017-1137 CE) and Madhavācārya (1238-1317 CE), who would also reject Spinoza's god. The rejection comes not because they deny God's presence in all that exists, but because such view is considered subservient to one in which a personal relationship with the Supreme can be established and nurtured. Taking omnipotence seriously, "playing the role of a person" is one of God's unlimited potencies which these sages do not compromise in their theology.

Certainly, Gödel was also unaware of the philosophy of Caitanya Mahāprabhu (1486-1534 CE), who follows Ramanujācārya and Madhavācārya in the essential points. However, the detailed description and practice of divine love in service of *puruṣottama* – devotional service to the Supreme Person – given by Caitanya Mahāprabhu and his followers arguably make this a subtler and more revealing theology than those presented by his predecessors. In it Gödel would have found his theological conclusions realized in completion five centuries earlier.

Gödel's Philosophy of Physics

In physics, Gödel's contributions are well-known. However, physics was not a detour Gödel took to amuse himself, but rather an essential part of his philosophical fabric. In 1949 Gödel expressed his ideas in an essay that in Einstein's own words, "constitutes […] an important contribution to the general theory of relativity, especially to the analysis of the concept of time" (Schilpp, 1949: 687). Unfortunately, even with Einstein's high estimation of Gödel's work, modern physicists have been wont to discard Gödel's ideas, trying (without success) to find an error in his physics (Yourgrau, 2005: 7-8). Gödel's unsuspected solutions to the field equations of general relativity, solutions in which time undergoes a peculiar transformation, made the discussion of time-travel respectable in scientific circles. In fact, Gödel concluded that time travel is indeed theoretically possible, rendering time, as we know it, meaningless. Time, "that mysterious and seemingly self-contradictory being," as Gödel put it, "which, on the other hand, seems to form the basis of the world's and our own existence," turned out in the end to be the world's greatest illusion (Yourgrau, 2005: 111). For Gödel, time was a crucial philosophical question, but I am unaware of any direct connection Gödel might have made between time and God. However, his belief in the afterlife might give some insight into how he understood the relationship between them.

Gödel expressed his belief in the hereafter in the following terms, "I am convinced of the afterlife, independent of theology. If the world is rationally constructed, there must be an afterlife" (Davis, 2002: 22). "His arguments were, as always, rationally based on the principle that the world and everything in it has meaning, or reasons. This is closely related to the causality principle that underlies all of science: Everything has a cause, and events don't just 'happen'" (Casti & DePauli, 2000: 87).

Mathematics, Science, and Faith

An ultra-rationalist like Gödel was a theist, a personalist and a believer in the afterlife, and appealed to reason as his witness. Atheists and agnostics usually portray their philosophy as rational, discarding the theist conclusion as a mere psychological refuge of the ignorant or self-deceiving. Nevertheless, ultra-rational thinkers like Gödel, Leibniz, and Descartes have reached the theist conclusion. Is there an apparent disconnect between rational thinkers and rational thought, or is it that the theists' view is the rational conclusion, even if often embraced by fanatics in unimaginably irrational ways?

An objector may argue that science and mathematics are outside the realm of faith, where theology may belong. However, a closer look at the foundations of physics and mathematics, as well as to the history of these subjects, seems to yield a different conclusion. This closer look reveals a delicate membrane that conjoins these experiences: Faith. This is the greatest common denominator of science, mathematics, and theology.

Consider the nature of axioms in any formal system, including mathematical systems. Once the axioms have been chosen, the accepted rules of inference can potentially be entered into a computer to verify the validity of any argument, but the axioms themselves

are arbitrary. For instance, the now-indispensable Axiom of Choice has troubled many mathematicians since it was formulated by Ernst Zermelo in 1904. In addition, the elimination of the parallel lines postulate in Euclid's rendition of geometry has given rise to other geometries. One of these geometries, hyperbolic geometry, finds an important application in the theory of relativity.

Axioms may be useful, but there is no inherent truth in them. Changing them alters the system and the true sentences produced by such a system. If we consider that at present all that mathematicians have are "axiom systems for which no one can give a convincing demonstration of consistency," the situation turns even more discouraging (Nelson, 2002: 5). Certainly, this is not the way most mathematicians do mathematics, but the belief that one should at least be able to theoretically place any mathematical statement within the framework of a formal system is sacredly held by the majority of mathematicians.

Furthermore, many thinkers believe that mathematics is the most certain means of acquisition of knowledge, the consecrated pinnacle of intellectuality. "This misperception leads to such embarrassments as the pseudo-Euclidean form Spinoza gave to his *Ethics*. These writers are too pedestrian in their view of mathematics and yet they give us too much credit" (Nelson, 2002: 5). "Why do we mathematicians, makers like poets and musicians, describe what we do as discovery rather than invention? This is the Pythagorean religion" (Nelson, 1995: 3). According to Edward Nelson, most mathematicians are devout followers of this religion, although they attribute it to Plato, born over fifty years after Pythagoras' death.

Moreover, faith plays a vital role in science as well. When considering the nature of energy and matter, the laws of physics are taken as axiomatic. Certainly, if we *believe* "the world is rational" and imbued with inherent order, as Gödel did, then taking the laws of physics as axiomatic might be acceptable; yet, as in theology, faith remains a preliminary step to understanding.

Many scientists would argue that even though they cannot completely (or partially) explain the origin of the universe – or the origin of life, or the nature of consciousness, or the nature of time – the answers would certainly not involve God. They have placed their faith in their cognitive processes and in their colleagues. They submit to those authorities; but faith they have, nonetheless.

If we define faith as "belief based on the authority of the information source," be it Scripture, scientists, a friend, a teacher, a digital picture, a DNA test, our own cognition and experiences, or even politicians (for the really insane), we will realize that faith plays an essential role in the development (or destruction) of knowledge. Why is it acceptable in science and mathematics to have faith, not only in the axioms or laws of nature, but also in the peer-review process and the causality principle, while faith in the religious realm is viewed as superstitious at best? As Gödel states, "Religions are, for the most part, bad, but religion is not" (Wang, 1996: 316).

George Berkeley had already questioned this attitude in 1734. In *The Analyst* he wrote:

> Whether Mathematicians, who are so delicate in religious Points, are strictly scrupulous in their own Science? Whether they do not submit to Authority, take things upon Trust, and believe Points inconceivable? Whether they have not their Mysteries, and what is more, their Repugnancies and Contradictions?

Perhaps, not being a mathematician himself, Berkeley was considered "too pedestrian" in his view of mathematics, which accounted for the dismissal of his ideas. To counter similar objections, rational theists have tried to justify their beliefs by submitting to the accepted rules of inference. However, one may argue that "[i]nferential arguments are employed in a case where the existence of the thing to be inferred is considered of doubtful character" (Sinha, 1999: 5). Yet, as remarked by Ludwig Wittgenstein, a philosophical antagonist of Gödel's, those who want to provide an intellectual basis for theism furnish arguments in favor of the existence of God, although their actual belief is not based on the argument itself (Davis, 2002: 22). Besides, the experience of the divine might well be one of the limitations of rationality.

Gödel's Ontological Argument

Gödel's ontological argument, like most ontological arguments, is based on St. Anselm's eleventh century work *Proslogion*. Anselm defines God as "that thing which nothing greater can be thought" (Small, 2006: 16). He asserts that even the atheist would agree that God's existence is possible, but that such existence is simply a contingent falsehood. (Small, 2006: 16). Just as Michelangelo must have envisioned his David before metamorphosing marble, the atheist might argue that he can conceive of a world in which God exists even if that world is not the true world.

In the seventeenth century, René Descartes, using an analogy with Euclidean geometry, followed in St. Anselm's footsteps. In the *Fifth Meditation*, Descartes furthers the claim that "there is no less contradiction in conceiving a supremely perfect being who lacks existence than there is in conceiving a triangle whose interior angles do not sum up to 180 degrees. Hence, […] since we do not conceive a supremely perfect being – we do have the idea of a supremely perfect being – we must conclude that a supremely perfect being exists" (Oppy, 2002). (Ironically, in non-Euclidian geometries the interior angles of triangles do not sum up to 180 degrees.)

In the eighteenth century, Gottfried Leibniz, co-creator along with Isaac Newton of the Calculus, attempted to improve Descartes' argument. He asserted that Descartes' argument fails unless one first shows that it is possible for a supremely perfect being to exist. Leibniz argued that, since perfections cannot be analyzed objectively, it is impossible to demonstrate that perfections are incompatible – and he concluded that all perfections can co-exist in a single entity, namely, God (Oppy, 2002).

This is the intellectual and historical framework Gödel used to devise his ideas. He admired Leibniz and attempted to improve on his ontological argument. Some have questioned the validity of the underlying modal logic, while others have objected to his set of axioms and definitions. That is all they can do to the Gödelian argument since they

cannot find fault with his flawless reasoning. Some objectors adhere to Immanuel Kant's position, who in the eighteenth century argued against ontological arguments in general stating that existence is not a predicate. That is, existence is not a property of individuals in the same way being blue or strong is; hence, existence cannot be proved (Small, 2006: 18). Perhaps the argument holds in propositional logic – the underlying logic of mathematics – but the argument certainly fails in modal logic.

Gödel's argument, even if sound, does not settle the question of a personal God, which was part of Gödel's ethos. Neither does it address the question of uniqueness, at least up to isomorphism. Nonetheless, even if his argument is not accepted as a proof because of the questionability of the axioms chosen, it still suggests a *via positiva* to understanding the idea of God rationally (Small, 2006: 28).

Conclusion

"However, as Bertrand Russell observed, it is much easier to be persuaded that ontological arguments are no good than it is to say exactly what is wrong with them" (Oppy, 2002). Yet, "[t]hose who find the assumptions of the ontological argument suspicious should ask themselves whether their suspicion is based […] on an unwillingness to accept the conclusion of the argument" (Small, 2003: 25). Likewise, those in favor of the argument should ponder whether they have been lenient in their philosophical rigor. Ultimately, however, existence is independent of belief. We may argue for eternity whether God exists or not and it will not affect God's existence. However, it may affect ours.

We should not be naïve and think we can convince any purportedly rational being to accept theism. In spite of all our efforts in attempting to rationally prove the existence of God, we must agree that we may fail to convince even a single obstinate atheist shrouding his arguments with scientific or philosophical jargon. What is remarkable about Gödel's theological inclinations is that whereas "ninety percent of philosophers these days consider it the business of philosophy to knock religion out of people's heads," said Gödel (Wang, 1996: 152), "he exploited the machinery of modern logic to reconstruct Leibniz's ontological argument" (Yourgrau, 2005: 13).

Blaise Pascal, fundamental in the development of probability theory, might induce them to reconsider their position with his famed wager published in 1670:

> God is or He is not. Let us weigh the gain and the loss in selecting 'God is.' If you win, you win all. If you lose, you lose nothing. Therefore, bet unhesitatingly that He is. (*Pensées*)

Hence, as an exponent of theism, Gödel is sempiternally victorious.

References

P. Blackburn, M. de Rijke & Y. Venema, “Modal Logic”, Cambridge, Cambridge University Press, Theretical Traces in Computer Science, 2001.

John L. Casti & Werner DePauli, “Gödel: A Life of Logic”, New York, Basic Books, 2000.

Philip J. Davis, “A Brief Look at Mathematics and Theology”, Humanistic Mathematics Journal 26, 19-24, June 2002. Quotes follow the paging of the online version available at http://www2.hmc.edu/www_common/hmnj/davis2brieflook1and2.pdf

Freeman Dyson, “From Eros to Gaia”, New York, Penguin Books, 1993.

Albert Einstein, Telegram to New York's Rabbi Herbert S. Goldstein, April 24, 1929.

Barry Mazur, “When is One Thing Equal to Another Thing?” http://www.math.harvard.edu/~mazur/, 2006.

Edward Nelson, “Confessions of an Apostate Mathematician”, http://www.math.princeton.edu/%7Enelson/, 1995.

Edward Nelson, “Mathematics and Faith”, http://www.math.princeton.edu/%7Enelson/, 2002.

Graham Oppy, “Ontological Arguments”, Stanford Encyclopedia of Philosophy, http://plato.stanford.edu/entries/ontological-arguments/, 2002.

Paul A. Schilpp, “Albert Einstein: Philosopher-Scientist”, La Salle, IL, Open Court, 1949.

Bhaswati Sinha, “Nyāyakusumāñjali: Hindu Rational Enquiry into the Existence of God”, New Delhi, Aryan Books International, 1999.

Christopher G. Small, “Kurt Gödel’s Ontological Argument” http://www.stats.uwaterloo.ca/~cgsmall/ontology.html/, 2006.

Christopher G. Small, “Reflections on Gödel’s Ontological Argument”, *Klarheit in Religionsdingen*, edited by Wolfgang Deppert and Michael Rahnfeld, Grundlagen unserer Zeit Band III, Leipziger Universitatsverlag, Leipzig, 109-144, 2003. Available online at http://www.stats.uwaterloo.ca/~cgsmall/Godel.final.revision.PDF/. My quotes follow the numbering of the pages in this version.

Hao Wang, “A Logical Journey: From Gödel to Philosophy”, Cambridge, Massachusetts, MIT Press, 1996.

Palle Yourgrau, “A World without Time: The Forgotten Legacy of Gödel and Einstein”, New York, Basic Books, 2005.