Science and Spiritual Quest 2008, pp.11-19

Epistemology of the Exact Science(s): Mathematical Knowledge *vis-à-vis* Spiritual Knowledge

Héctor Rosario
Department of Mathematical Sciences
University of Puerto Rico, Puerto Rico

Abstract

This manuscript explores epistemologies of mathematical and spiritual knowledge. It embodies a critique of the categorical error in mathematics that logical truth is absolute in its inferred unification of mind and spirit. I validate trans-rational approaches toward spiritual truth as distinct from the truth statements of mathematical logic.

1. Introduction

In 1930 the preeminent logician of the 20th century, Kurt Gödel, presented results stemming from his doctoral dissertation at the second conference on Epistemology of the Exact Sciences in Königsberg. Gödel startled the audience with what came to be known as Gödel's First Incompleteness Theorem. This result, coupled with the Second Incompleteness Theorem presented in 1931, is sometimes referred to as Gödel's Theorem. Unfortunately, it has become one of the most (mis)quoted mathematical results in philosophical and religious discourse. Logician Torkel Franzén has aptly demystified these misconceptions in *Gödel's Theorem: An Incomplete Guide to Its Use and Abuse* [1]. The misunderstanding primarily springs from applying technical terms in mathematical logic – like "formal system" and "incomplete" – to similar terms in colloquial language. This is further aggravated by a misplaced faith in mathematical knowledge as absolute and eternal. Such mentality worships logical truth as divine and numbers as uncreated entities. This is the Pythagorean religion to which many mathematicians adhere. Nevertheless, mathematical knowledge, as well as knowledge about the physical word, is insufficient in the pursuit of spiritual knowledge.

[Gödel's Theorem] has become one of the most (mis)quoted mathematical results in philosophical and religious discourse.

2. Definitions

To advance my thesis I must clarify what I mean by "spiritual knowledge," but first allow me to clarify other terms. Epistemology is the branch of philosophy concerned with the nature and limitations of knowledge, whereas "exact sciences" refer to mathematical or deductive sciences. To paraphrase Tarski – the other great logician of the 20th century – every mathematical science is a deductive science and every deductive science is a mathematical science [2]. Thus, an epistemology of mathematical sciences attempts to understand the processes of knowledge acquisition within those realms.

Spirituality, on the other hand, is concerned with matters regarding the purpose of humans as entities with unique relationships to the Divine. Spirituality also implies a separation between body and spirit. An epistemology of spirituality, or a spiritual epistemology, attempts to describe the ways in which spiritual knowledge is obtained. Both the mathematical sciences and spirituality aim at the acquisition of knowledge, and both attempt to predict the outcome of events provided certain conditions are met. But the nature of those two types of knowledge is distinct. Let us examine them more closely.

Spirituality, on the other hand, is concerned with matters regarding the purpose of humans as entities with unique relationships to the Divine.

Spiritual knowledge is defined herein as absolute and objective knowledge about who we are and what our relationship with other entities is, in particular, our relationship with a Higher Being. In addition, knowledge that allows us to realize the meaning of existence as eternal spiritual entities, knowledge that allows us to transcend suffering, and knowledge that allows us to understand death, will be considered spiritual knowledge in this discourse. The effects of this knowledge on its possessors are seen in the qualities these individuals develop, like humility, compassion, tolerance, truthfulness, and forgiveness. The degree to which these qualities are present in an individual show the degree of that person's spiritual advancement.

An opponent may concede that under this definition, mathematical knowledge is not spiritual since the cultivation of virtues or the exploration of the afterlife are independent of mathematical activity. Yet, I am interested in having colleagues consider that they might be in illusion if they think that either mathematics or

science will reveal to them spiritual realities, or that such knowledge will make them more humble, tolerant, and forgiving – not as mere accidents – but as the mathematical sciences' reason for being.

3. The Pythagorean religion

Princeton mathematician Edward Nelson – a devout Christian – has labeled the Platonic view of numbers as the "Pythagorean religion," asserting that Plato's understanding and appreciation of mathematics was heavily influenced by the Pythagoreans [3]. Yet, "like an underground religion, it is observed in private and rarely mentioned in public" [4].

For Pythagoreans – inventors of numbers and other curiosities – numbers are uncreated: the source of all that is in the world. But if numbers are uncreated, then they are divine, and thus on a par with God in the polytheistic pantheon of mathematics. As a monotheist, Nelson rejects this idea. Suppose now that numbers are created by a Higher Being. Then their nature and existence are dependent on the will of their Creator, who could have created them differently. He finds this absurd. "What other possibility is there? Simply that numbers do not exist – not until human beings make them" [3]. "Why do we mathematicians, makers like poets and musicians, describe what we do as discovery rather than invention? This is the Pythagorean religion" [3].

"Why do we mathematicians, makers like poets and musicians, describe what we do as discovery rather than invention? This is the Pythagorean religion."
- Edward Nelson

4. Epistemology of mathematics

How mathematical knowledge is obtained is a highly debated topic far from being resolved. A primary reason for the debate lies in the conflicting philosophies of mathematics. There are three competing views in the philosophy of mathematics, with an emerging fourth that attempts to reconcile those three. Any ostensible epistemology of mathematics must conform to one of these philosophies, since mathematicians tend to be passionate (albeit covertly) about their views, which casts a shadow over the allegedly objective nature of their discipline.

Platonic (Classical) view

This predominating view is generally attributed to Plato, although as intimated earlier, it goes back to the Pythagorean Brotherhood. It boasts among its most faithful believers the likes of Bertrand Russell and Kurt Gödel. In this classical view, mathematical objects have a pure existence in a Platonic world of ideas. Humans can only access that knowledge, but never create it, since Platonists believe that mathematical objects exist independently of the human mind. For instance, there are many theorems in classical mathematics where one demonstrates – by contradiction – that the assumption that all objects fail to have a property is false, and hence there must exist at least one object with the property, even if there is no method for constructing that object [3]. This faith in the existence of mathematical objects with no idea on how to construct them led to the rise of a contending philosophy of mathematics: intuitionism.

Platonists believe that mathematical objects exist independently of the human mind.

Intuitionist view

During the late 19th century, L.E.J. Brouwer launched an attack against the classical view of mathematics and demanded that it was not enough to claim that an object existed, but that one needed to be able to construct such an object. David Hilbert vigorously assailed this position – masquerading as a formalist – and a long debate ensued. According to Nelson, both Brouwer and Hilbert, along with their followers, failed to understand a short result of Gödel's from 1933, in which he showed that the intuitionist view was just an extension rather than a restriction of classical mathematics [3]. Gödel proved that "what Brouwer really did was extend classical mathematics by the creation of two new logical operators: the constructive *there exists* and the constructive *or*, stronger than their classical counterparts" [6]. But unfortunately, Gödel's result continues to be ignored by many a philosopher immersed in this dispute.

Formalist view

To the formalist, a mathematical formula does not denote anything in particular. It is simply a string of symbols that follow a strict set of rules. A mathematician's job is to construct proofs – or concatenate formulas – that speak of nothing but themselves. Here semantics is sharply distinguished from syntax. This distinction propelled the development of mathematical logic since George Boole by making it possible to surmount difficulties that Aristotelian logic was inadequate to confront.

> *"Formalism denies the relevance of truth to mathematics."*
> *- Edward Nelson*

As intimated above, David Hilbert portrayed himself as a formalist, although he seems to have adopted this view as a way to combat Brouwer's intuitionism. This in no way diminishes Hilbert's great contributions to the advancement of knowledge in the foundations of mathematics, but his thoughts on Georg Cantor's Set Theory are revealing: "No one shall expel us from the paradise that Cantor has created for us" [6]. Although Hilbert attributes creation to Cantor, his religious and romantic wording closely resembles that of a classicist. Besides, Hilbert appears to have faith in mathematical truth, something irrelevant to the formalist. I quote from Nelson,

> Formalism denies the relevance of truth to mathematics. But, one might object, mathematics works – the evidence is all around us. Does this not imply that there is truth in mathematics? Not in the slightest. Suppose we find a primitive people, or an advanced people, but a people with a worldview utterly alien to ours, who have an herb that is quite effective for a certain illness. They explain its efficacy in terms of the divine action of the *shuki* on the body's *okrus*. We find that the herb is equally effective in our society. How much evidence does this provide for belief in the *shuki*? None at all. The syntax is correct; the semantics is irrelevant. So it is with mathematics. It works. But this is no evidence whatsoever that the religion of mathematics has any truth in it [3].

Humanistic view

The last view, first expounded by Philip Davis and Reuben Hersh in *The Mathematical Experience* over two decades ago – and by William Byers in the recently released *How Mathematicians Think* – attempts to harmonize the other three views by taking into account the human aspect of mathematics. Regardless of whether mathematical truth is objective or not, the fact remains that – as far as we know – only humans have the capacity to develop it, enjoy it, and understand it. Therefore, any philosophy of mathematics, according to them, must deal with the creative processes involved in the doing and understanding of mathematics. That might have something more revealing to teach us about the human condition itself. Nevertheless, I have come to the conclusion that the humanistic approach is contained in formalism – not as portrayed by Hilbert – but as espoused by Nelson. For instance,

However much amplification the following description of truth may require, truth is a correspondence between a linguistic formulation and reality. My claim is that there is no Platonic reality underlying mathematics; mathematicians prove theorems, but the theorems are not about anything. This is how mathematics differs profoundly from science. Mathematicians no more discover theorems than the sculptor discovers the sculpture inside the stone. But unlike sculpting, our work is tightly constrained, both by the strict requirements of syntax and by the collegial nature of the enterprise. This is how mathematics differs profoundly from art.

"My claim is that there is no Platonic reality underlying mathematics; mathematicians prove theorems, but the theorems are not about anything."
- Edward Nelson

To deny the cogency of the Platonic notion of truth in mathematics in no way deprives mathematics of meaning. In mathematics, meaning is found not in a cold, abstract, static world of Platonic ideas but in the human, historical, collegial world of mathematicians and their work [6].

5. Epistemology of spiritual knowledge

I regard knowledge as either spiritual or non-spiritual. Non-spiritual knowledge may be subtle – like understanding the intricacies of mathematical logic – or it may be gross, like learning how to exploit other humans. Yet what is common between the subtle and gross forms of non-spiritual knowledge is that they aim at gratifying either mental or physical desires that go beyond the basic psychological or biological needs. Spiritual knowledge, on the other hand, aims at understanding our existence as eternal souls – not out of curiosity – but as a natural urge of being human.

Spirituality is better seen in a mystic light. Mysticism, from the Greek word *mystikos* (an initiate), is the pursuit of a direct experience with the Divine. It seeks awareness into the mysteries of life and death, happiness and sorrow, truth and untruth. Zoroastrians and Hellenistic Greeks, Jews and Romans, Christians and Muslims, Mayans and Incas, Hindus and Buddhists – and probably every religion in the world – have had mystical elements in their fold. I am not claiming that the practice of these different traditions will foster the same experiences or that their

ultimate goal is identical. I am simply noting that they have certain practices that attempt to access the spiritual realm by using the mind and body in specific ways. These might include meditation, music or dance, among others. Mystics, although they respect rational discourse, are open to realities that transcend the rational mind. In mathematics, however, the rational mind remains the ultimate criterion by which knowledge is judged. Granted there are many divergent conclusions that mystical traditions have between one another, but the root of these contradicting views lies not in the unreliability of the mystic path as a legitimate medium for the transmission of spiritual knowledge, but in the receivers themselves.

Spirituality is better seen in a mystic light.

Consider the following analogy. If someone watches the evening news with an improperly tuned TV or with a considerable amount of static in the signal, that person might miss important words, like nouns or connectives. If the person is questioned about a particular piece of news that was transmitted during that time, he can only give incomplete information or guess the missing words, potentially altering the facts. However, for one with a properly tuned TV, only dishonesty may separate him from correctly transmitting the information. Certainly, the problem worsens if one takes into account psychological factors in the processing of information.

How to tune in one's TV – that is, our body and mind – so that it can clearly and unequivocally hear the sound emanating from the soul, is something that must be learned from an experienced guide. Just as a novice surgeon will be ill-advised to perform (and hopefully prohibited from performing) surgery without the guidance of an expert physician, a novice spiritual seeker will be ill-advised to pursue the spiritual path without assistance. But often we are too arrogant or too timid to consider this alternative. Nevertheless, it is wise to look for help.

Spiritual knowledge dawns unannounced. Yet, the awakening of this innate knowledge requires the pursuit of purity, truthfulness, and goodness. Since I was a child, I had the conviction that perfected people existed – people fully aware of the spiritual dimension who were without a trace of lust, anger or greed – even if I never met them. This is where the spiritual epistemology becomes personal, as it is with any philosophical search. It is up to us to search for those pure souls and learn from them as much as we can. We may have one more day to live or fifty years, but death is certain. Therefore, we must utilize our time wisely.

6. Mathematical/scientific knowledge and the spiritual quest

Scientists, particularly physicists, believe there are absolute laws controlling the universe, although they concede that science can only give an approximation to those laws. Classical mathematicians, on the other hand, are more audacious and believe not only that there are laws governing a Platonic universe of mind, but that they can access those truths unequivocally by way of the deductive method. Equating mind with spirit, many mathematicians make the fundamental mistake of taking logical truth as absolute.

Equating mind with spirit, many mathematicians make the fundamental mistake of taking logical truth as absolute.

One may wonder what other legitimate path there is to access absolute truth, if the exact sciences fail to deliver it. I reiterate: the mystic path. We will be at a loss to reject the mystic path, especially for the pursuit of scientific knowledge. Scientific or mathematical knowledge might satisfy some of our intellectual or practical needs, but they will never satiate our need to understand the spiritual dimension. Although the pursuit of scientific and mathematical knowledge can give an indication of spiritual reality to the sincere seeker, this knowledge is ultimately irrelevant in the spiritual quest. A common man or woman, with no specific training in the mathematical sciences, can gain equal access to spiritual knowledge. This is the true great equalizer, not mathematics. The only prerequisite is humility that will lead one to surrender to the Divine or to his devoted adherents.

7. Conclusions

I have shared with you my realizations during the past few years, as I prepared to write for this series of conferences. As a classical mathematician, I was first ontologically inclined. This led me to write on Gödel's rational theology in 2006. As a formalist, I later became epistemologically inclined. This transition was seen in the Vaishnava Ontological Argument last year, which was a parody of my intellectual search. However, as part of my journey for spiritual realization, I have forsaken both of those paths to cultivate profound experiences that transform the way I live and that will impact the way I die. This is the path of the mystic. I invite you to join the experience.

References

1. T. Franzén; *Gödel's Theorem: An Incomplete Guide to Its Use and Abuse*, A.K. Peters, Wellesley, 2005.
2. A. Tarski; *Introduction to Logic and to the Methodology of Deductive Sciences*, Fourth Edition, Oxford University Press, New York, 1994.
3. E. Nelson; "Confessions from an Apostate Mathematician," http://www.math.princeton.edu/~nelson/, 2000.
4. P.J. Davis, R. Hersh; *The Mathematical Experience*, Houghton Mifflin Company, Boston, 1999, p.339.
5. W. Byers; *How Mathematicians Think*, Princeton University Press, Princeton, 2007.
6. E. Nelson; "Mathematics and Faith," http://www.math.princeton.edu/~nelson/, 1999.

About the Author

Dr. Héctor Rosario is an associate professor of mathematics at the University of Puerto Rico, Mayagüez Campus. He obtained his Ph.D. from Columbia University in New York City in 2003. He lives with his wife and children trying to foster a spiritual atmosphere at home.