

WHAT MATHEMATICS CAN TELL THEOLOGY

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The image of the universe that science confronts us with is a state of constant evolution. Since Darwinian natural selection became successfully synthesised with Mendelian genetics into the current paradigm of evolutionary biology, an important role in the genealogy of life and man has been attributed to chance. The biological evolution involves not only chance encounters between biological organisms, but also mutations, that is, random changes in genetic material. The role of chance is additionally enhanced by the favoured interpretation of quantum mechanics according to which probabilities seem to lie fundamentally in the nature of things, and so are not only a measure of our ignorance. Michael Heller's book entitled "Philosophy of Chance" can be seen as an attempt to shed a light on the question of whether chance as we discover it in the physical world presents a real theological problem. Heller suggests that it does not, and argues that presenting the problem in the form of the alternative: "the world is either governed by God or by pure chance" is a new form of Manichaeism in which "pure chance" takes on the role of anti-god.

* Heller, Michael. *Philosophy of Chance: A Cosmic Fugue with a Prelude and a Coda*. Cracow: Copernicus Center Press, 2013.

For those who are interested in the relationship between science and religious faith Michael Heller does not need much presentation. The 2008 Templeton Prize laureate was concisely described as “a cosmologist and Catholic priest who has developed sharply focused and strikingly original concepts on the origin and cause of the universe. He engages a wide range of sources in mathematics, philosophy, cosmology, and theology, allowing each field to share insights that may inform the others without any violence to their respective methodologies”.¹ The last phrase could accurately characterize also the spirit in which “Philosophy of Chance” was written. But before we come to ‘how it should be’, it would be instructive to recall some classic examples of how things can go wrong in the relation between science and religion.

The classical case is of course the reception of Darwin’s Theory of Evolution by natural selection, which Heller addresses. The theory has been strongly opposed by those who, among others, quite understandably, feel somehow unease at any suggestion that they might have something in common with gorillas (even though there has been growing scientific evidence that they do). Reasons why many people do not want to accept insights of modern biology are not genuinely scientific, but motivated by usage of religious texts for purposes they were not written for. Heller reminds us that it was Saint Augustine of Hippo who has already exposed at length, some 1600 years ago, that there can be no such thing as a wholly literal (in the sense later endorsed by fundamentalist movements), and at the same time consistent, reading of Genesis.² And it is maybe worth observing that in fact the literal sense as understood by the Church is something quite different than the fundamentalist one. The literal sense is the meaning conveyed by the words and discovered by exegesis, following the rules of interpretation.³

¹ <http://www.templetonprize.org/previouswinner.html#top>

² St Augustine of Hippo, “De Genesi ad litteram.” See for example *I*, 19, 39 and *II*, 9, 20. Apart from Augustine and Thomas Aquinas we could mention here also names like Philoponus, Giordano Bruno, Spinoza and Caesar Baronius.

³ See *The Catechism of the Catholic Church*, 116.

Heller goes on explaining that this form of resistance to scientific evidence, motivated probably by the fear that the evidence can undermine one's religious convictions, has adopted new forms: labelled in a scientific-sounding way "Creation Science" or "Intelligent Design". "Creation Science" puts God the Creator in opposition to pure chance, which is seen as irrational. In "Intelligent Design", Heller diagnoses, the opposition is directed not so much at the theory of evolution itself, but at scientific naturalism, i.e., the methodological rule stating that in explaining the natural world through science we should refer only to natural causes. The movement cherishes complex phenomena in nature, but instead of exploring them, as genuine science would do, it says the phenomena cannot be explained by natural causes or by chance, due to "irreducible complexity". The complexity is suggested to be a trace of "Intelligent Design". Both "Creation Science" and "Intelligent Design" are examples of pseudo-science: so constructed that no one can say what a counter-example for the theories would be (the Popper's Criterion). Their aim is not an active exploration of the world, but a defence of an agenda outside of science.

The ideologies inflict much harm to the public debate between science and religion. In popular understanding the theological doctrine of Creation has become associated with "Creation Science" or "Intelligent Design" and, in consequence, with anti-scientific backwardness. If the main idea of "Intelligent Design" were true, each time science made progress in exploring the complex phenomena cherished by the ideology as inexplicable people who believe in God, as well as their faith, would be exposed to mockery. But at least maybe God would be seen as more and more intelligent (inversely proportional to the size of the gaps in his 'intelligent' plan)!

Heller's main argument in the book is that chance is not irrational, and therefore it is our prejudice, and not a real theological problem, that puts the theory of evolution at odds with the revelation. To develop his argument Heller presents philosophy of chance in historical perspective. The common perception that what happens regularly seems to be rational, and what is exceptional not, was formulated and settled in philosophy by Aristotle. Aristotle believed that chance breaks causal chains and thus

destroys rationality at its basis. For him “it is obvious why there can be no science of such a thing, because every science has as its object that which is so always or usually, and the accidental falls under neither of these descriptions” (Metaphysics, XI, 1065a)⁴. But Aristotle was in this point clearly wrong.

In our basic intuition we speak about chance when we are faced with an event which is very unlikely and yet happens. The little probability is related to the sense of surprise that we usually associate with the notion of chance. But when we think about it more closely, we see that we tend to mean by chance every event occurrence of which we are not sure in advance. Heller sketches how human scientific understanding of chance and probability has transformed throughout centuries, and gradually lost its tinge of irrationality. The long way began with collections of observations and anecdotes related to medicine, theological considerations on predestination and the relation between human freedom and grace, and ethical speculations of Spanish casuists based on probabilistic argumentations. Further progress was motivated by will to order rationally one’s convictions which inspired enquiry about relations between evidence, estimation of probability and decision making, and puzzles related to gambling.

The mature mathematics of chance started in the year 1933 with the axiomatization given by Andrey Kolmogorov in *Grundbegriffe der Wahrscheinlichkeitsrechnung*. In the classical theory of probability as such there is nothing that would correspond to our feeling of surprise, expectation, or coincidence. The intuitions can be found in our interpretations of the theory: subjective (epistemic) and objective (ontological) interpretation. In the former, probability is a measure of our ignorance, in the latter, a measure of indetermination really occurring in the nature of an event. But even if we can not reduce probability only to our ignorance, and we accept that there are objective sources of probabilities, chance, Heller explains, does not destroy the order of nature. Nature apparently very often uses a strategy of cooperation between physical laws and chance.

⁴ Trans. by Hugh Tredennick.

Through the book “Philosophy of Chance” run some big themes that continue to fascinate Heller. One of them is the question of philosophical and theological environment conducive to the development of sciences. The world of the Ancient Greeks found it hard to keep a balance between irrational and extremely rationalistic. The inflexible metaphysical doctrines such as “the same causes lead to the same effects”, as observed by Maxwell, do not find confirmation in science. A similar rigidity haunts the thinking of those who wade in logical contradictions of God’s omnipotence understood as ability to do anything. The God of Peter Damian, Al-Ghazali, Ibn Hazm and al-Razi is first of all the Will. He can change even mathematical truths, what is right and wrong depend only on his wish and not on an objective order of things. He is not obliged to reveal to us what is true, he is able at his wish even to annihilate himself and he can order us to practise idolatry. This absolutist ruler, the Only Cause, rules an atomistic kingdom where there is no rhyme or reason: no connection between events, no cause and no effect—apart from His Majesty the Will. But where everything is a miracle, where all things have only one explanation, nothing can be really explained and the scientists gradually leave.

But God the Almighty can mean also the one who governs and sustains everything in his providence through *potestas ordinata*. The God of Maimonides, Al-Farabi, Ibn Sina, Peter Lombard and Aquinas cannot act unreasonably, is just and good and there are things he would never do. This God allows initiative in his realm, his providence does not exclude freedom of choice, fortune and chance; he is not the only cause. Because his power is ordered and his decisions rational, good and unchanging, it makes sense to try to decipher the Mind of this God. Because he is free, merely logical analyses of his creation lead nowhere. We have to observe the way the world is in order to work out the Mind.

One can see Heller’s passion for mathematics, and for what Eugene Wigner famously called “The Unreasonable Effectiveness of Mathematics in the Natural Sciences”. For Heller the fact that the structure of the universe remains in such an efficient correspondence with mathematical structures ought to be a subject of deep philosophical reflection. He asks

with delight: is it not wondrous that real quantum processes are obedient to some abstract mathematical operations? And mathematics itself changes: the field of its applications ceases to be a domain of ordered structures and becomes, in Heller's words, "a boiling ocean of dynamic structures" that can serve to model non-linear dynamic processes occurring in nature. Algebraization of the classic theory of probability, and then, as a consequence, its generalization by means of the non-commutative von Neumann algebras, contributed to the mathematical structure of quantum mechanics. With properties that are quite surprising from the point of view of our habits of thought, so strange and breaking through the barriers of prejudice, and with all the interpretational difficulties that quantum mechanics poses for us, it can be modeled with mathematics! The discovery of Free Probability opens entirely new possibilities and indicates connections of probability with Noncommutative Geometry. But the noncommutative sets (under some additional assumptions) are characterized by the effective indiscernibility of their elements which poses the question whether we are not witnessing the coming of a new, post-Cantorian mathematics? Heller goes on asking what if the fundamental physical level is ruled by a noncommutative version of probability theory?, and answers, that our understanding of physics and of the world will need to be rebuilt. If noncommutative mathematical theories will force a revolution in the fundamentals of mathematics, the changes will reflect not only in the philosophy of physics, but in philosophy in general. The existence of noncommutative probability has lots to say to the physicists and philosophers. For example, that the classic theory of probability ought to be treated just as all other mathematical theories, and not as "precedent, explicative ontology" in relation to the laws of physics, and not as a meta-tool to speculate about the multiverse.

In this passion, the ability to ask questions and listen to different answers, we find marks of a true thinker and scientist. It is not easy to be really competent in mathematics and cosmology, philosophy and theology at the same time, and invite others to undertake serious intellectual endeavour in searching for balanced judgements. There is always a need for authors who prefer to leave questions open rather than to give ideological

answers. Michael Heller is one of them, and in this sense he is also an apologist of the religious faith of the best sort.

Augustine admonished the faithful to listen to well based evidence given by mathematicians and astronomers, if necessary purge personal faith from misconceptions about the revealed truth, and be careful not to use the Scriptures in vain. Aquinas established a paradigm of apologetics: he gathered all the treasures of human thought he had access to and incorporated them in, at his time, a revolutionary system, in which all truths, among them presence of chance in the world, would find a place and demonstrate that it is not unreasonable to believe in the Christian revelation. Priests – scientists, among them Michael Heller, teach us, that if the Church will be given at some point another Augustine or another Thomas, no doubt the new giant will have the same passion for truth, the ultimate things and discussion as the two had. But he, or she, will read far more than Augustine and Aquinas, study far more than their writings, and know about the natural world much more than they ever knew. And both Augustine and Thomas would be the first to be happy about it.