the book of nature is written thonyc

http://thonyc.wordpress.com/2010/07/13/the-book-of-nature-is-written-in-the-language-of-mathematics/

The Renaissance Mathematicus

NOTES

The Pythagorean school, originating in ancient Greece, believed that natural numbers are the building blocks of the universe, and that "everything" could be expressed in terms of ratios of natural numbers. The discovery of irrational numbers effectively discredited this line of thinking, and the primary application has since been in the concept of harmony in music theory.
Pythagorean harmony theory permeates the history of Western science and philosophy all the way up to Newton, with many scholars such as Newton himself, Tycho and Kepler being advocates.
The point has also been made that the arithmetic of the natural numbers is a very small part of mathematics.

Plato advocated geometry. He challenged mathematicians to provide a geometrical description of the movement of the heavens, pointing out the so called Platonic Axiom; that heavenly bodies move in perfect, uniform, circular motion.

The Greek astronomers following Plato's injunction, developed very ingenious geometrical models to generate uniform circular motion for the planets whose apparent movements are anything but circular or uniform, culmination in Ptolemy's theory of epicycles.

This is much closer to a model of the real world written in the language of mathematics, but it is still a model.

According to Duhem, a 19th century French historian and philosopher of science, it is thought that nobody actually believed that the deferents and epicycles of Ptolemaic astronomy were real, they are just a mathematical model to "save the phenomena". This leads to a split in the description of the heavens into cosmology that describes what is really there and mathematical astronomy that is just a useful fiction for calculating the position of planets to do things such as astrology.

Model, simulation, reality

For Aristotle, Knowledge is thus a priori, descriptive and teleological (the final cause) and mathematics is definitely not scientia (knowledge)

"One cannot expect mathematical accuracy in the study of nature since it is concerned with matter."

the mathematical sciences, astronomy and geometrical optics a la Euclid, for Aristotle these are mixed sciences and have a different and lower status to real knowledge delivering scientia. Physics is the name that Aristotle gave to the study of nature and Aristotle's physics is scientia and it is qualitative, descriptive and definitively not mathematical.

the works of Aristotle became known in Europe and were made compatible to Catholic theology by the work of Albertus Magnus and Thomas Aquinas. The knowledge hierarchy on the mediaeval university was first theological knowledge then Aristotelian philosophy, mathematics played no role and the mathematical sciences were only fictive in the sense of Plato.

This was the situation that ruled as Galileo started to use the book of nature topos.* In his argument with the Aristotelians and the theologians Galileo was operating at a disadvantage. Theology based on the Bible and the works of the Church Fathers was certain knowledge. Aristotelian physics was knowledge but mathematical astronomy was not knowledge and mathematical physics was a contradiction in terms. The mathematical sciences were not knowledge delivery systems.

Galileo tried to challenge the system with what was, in essence, a theological and not a scientific argument. He proposed that God had written two books the Bible and the Book of Nature. The Bible was the word of God and so had to be interpreted by theologians whereas the Book of Nature is written in the language of mathematics and therefore must be interpreted by mathematicians.

he claimed that the Bible, that is the word of God, was open to interpretation and therefore variable whereas the Book of Nature was unambiguous and therefore when read would deliver an indisputable truth. This of course is in terms of modern philosophy of science a disaster but Galileo was not really interested in philosophy of science he was interested in proving himself right and his critics wrong.

His argument which he never published, he was almost certainly aware of its weaknesses, was that his telescopic observations had refuted the Ptolemaic astronomy therefore as the Book of Nature was unambiguous the Copernican astronomy must be true! Unfortunately there was a least one other model, the Tychonic, that had not been refuted and so Galileo's conclusion was not logical. In reality there were several models competing for acceptance. How could he claim to know "the truth?"

Galileo did not introduce mathematical physics. Various areas of the study of nature had been being mathematised since a least the middle of the 14th century and this tendency had already reached a highpoint in the works of Kepler and Simon Stevin before Galileo had published a single word on the subject.

replacement of the Aristotelian descriptive and qualitative physics with the quantitative mathematical physics may have continued at the same rate in the 17th century, even without Galileo.

Christoph Clavius, one of Galileo's friends, supporters and teachers, in the last quarter of the 16th century had started to translate Euclid's Elements into Aristotelian syllogisms in order to demonstrate that mathematics is as truth transporting as syllogistic physics.

Newton's Mathematical Principles of Natural Philosophy, was cast in the form it has, propositions deduced logically from axioms, in order to give it the status of an Aristotelian scientia.

Comments:

Aristotle had a limited view of the relevance of mathematics to physics. He was on Galileo's side of things in another way, however, since he did insist that a true cosmology was about how the universe actually was and wasn't just a matter of saving the phenomena. (a model)

To judge by the Timaeus, if I remember it correctly, Plato seems to have inclined to the view that a geometrical explanation of reality was desirable but hedged his bet a different way by talking about likely stories.

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