The relationship between mathematics and the physical world has been investigated since the era of ancient philosophers. According to Plato the physical reality is based on "forms", perfect abstract objects being the essence of perceivable real objects. Such a view is not far away from the very tempting Tegmark's Mathematical Universe Hypotesis [1], where physical reality is an external mathematical structure, independent of anything invented by humans. According to this hypotesis, it seems that the mathematics relevant to physics has to be rather discovered somehow in Nature than invented. But discovering mathematics is not the same as discovering e.g. a new plant in the rain forest, where we are getting always a discovered piece of Nature, a "real thing".

Mathematics discovered in Nature would be usually different from the "real thing". For example, Euclidean geometry could be easily "discovered" and even experimentally "validated" with simple carpenter tools like plumb-bobs and spirit levels. But Euclidean geometry, if "discovered" or "invented", may serve only as an approximation to the real space geometry. Therefore, the mathematics that we may discover in Nature is rather a simplification or approximation of the hypotetical mathematical structure of the Universe. Moreover, there is no way to distinguish what was discovered from what was invented by humans as an "approximation of reality" or a "model" from the very beginning.

In the present author's humble opinion, the mathematical structures used to describe physics are always nothing more than models prepared in abstraction of the reality, i.e. invented by humans, inspired by Nature and effective by design, so to say. A mathematical structure itself, external or not, consisting by definition of a set of abstract entities and relations between them, a kind of "software", is not enough to represent Nature, not even to mention to be Nature. What lacks is the underlying unknown "hardware", or an unknown "medium" in view of [2]. But nevertheless, mathematics always was, and also would be, reasonably effective in natural sciences.

References