

Limits to rationality and physical theories

Krunoslav Pisk

Ruder Bošković Institute, Zagreb, Croatia

and

IUC, Dubrovnik, Croatia

Our civilization has chosen numbers as an instrument for understanding the Universe. Numbers are a tool which we use when comparing our theories (numbers are the out comes of our calculations) to experimental facts (numbers are the outcome of our measurements). Numbers are not only the essence of calculus (arithmetics), but they are imbedded in almost all mathematical structures (e.g. group theories, vector spaces, tensors, different equations, geometries ...). Physical theories are based on different mathematical structures (mostly on more than one). In the history of philosophy, mathematics and physics we recognize a strong correlation between the level of mathematical thought (or abstract reasoning) and human understanding of the Universe (in philosophy in the past or in physics in modern era). We illustrate by known examples (Zeno paradox, Chaos theory, Quantum mechanics) not only the development of abstract reasoning (which we call rationality), but also some obvious limitations of our reasoning applied to explain the world. Some of the limitations have been removed in the course of history, some have been understood, but some still persist (e.g. Quantum mechanics).

Recently, an intensive discussion on possible consequences of Gödel's incompleteness theorems on our (future) understanding of the Universe, have been taking place. Despite the fact that the theorems are an important contribution to the theory of axiomatic formal systems and imply some logical limitations, we do not see the arguments for their having an impact on physical theories. Moreover, we argue that the structure of the Universe, and the very existence of the human intuition are reasons enough for us to conclude there are no-limits to rationality, when physical theories are considered.