

Fate of Complex Science: *Ad hoc* science and falsifiability

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From astronomy to biology including Earth Science, all sciences belong to complex science. As a tool of research, mathematics, statistical mechanics, classical mechanics, thermodynamics, quantum mechanics, and electromagnetism are used for bottom-up approaches. On the other hand, more comprehensive approach is possible by the top-down view, or panoramic view to understand the most critical variable(s) among plenty of variables.

A working hypothesis is the only method to make it possible to have deeper understanding with time to reach the truth of phenomenon. Combination of methods between bottom-up and top-down approach is the most essential process to tackle with super-interdisciplinary researches, such as planetary formation theory, research for the origin and evolution of life. To improve the working hypothesis, we must realize the concept of falsifiability proposed by Carl Popper (1902-1994). His concept is that a theory in the empirical sciences can never be proven, but it can be falsified. The well-known example is “black swan”. For example, there is the hypothesis that all swan is white. The observation of 100 of white swan cannot prove all swans are white. Even if 10,000 swans are all white, still hypothesis cannot be proven. Instead, the discovery of one black swan can kill the hypothesis. Falsifiability (=testability) is a key to improve the working hypothesis.

Although falsifiability is one of the best method to move the complex science forward, a large number of researchers cannot understand this principle, and “Ad Hoc Science” is rather being prevailing. This may be due to over-competition caused by the evaluation using citation number to get permanent position.

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