

Analysis of Principle of Scientific Simplicity

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A scientific theory is governed by concepts such as simplicity, beauty, economy, and consistency, and the latter concepts are usually referred to as the principle of simplicity. But this principle is one of the confusing concepts of meaning, and philosophers and scholars differ in its definition, such as what we presented in (The Approach to Science And this is what *منهج العلم والفهم الديني*). and Religious Understanding prompted us to analyze it, and we concluded that it includes two concepts that are subject to the logic of economic thinking.

There is the universal meaning of simplicity, as there is the economic or reductive meaning of it. According to the first meaning, the largest number of different natural phenomena can be explained according to some axes. It is, therefore, an alternative to explaining each phenomenon for its reason since no principle or theory can explain such many phenomena. Just as cosmic phenomena can be explained separately from each other according to various causes and theories without a collector, it can also be traced back to one cause or theory. Then the last assumption may outweigh the multiple causes and theories according to inductive evidence.

For example, Einstein's theory is better than Newton's theory in explaining the solar system's gravity. The reason is that Einstein's theory can explain the different phenomena of this group at once for a specific reason. In contrast, although Newton's theory can explain most of what relativity explains, it needs other additional reasons to explain what it could not explain, such as the anomaly in the motion of Mercury's orbit, and the bending of light. Therefore Einstein's theory is simpler than Newton's theory.

Opposite this meaning, there is another meaning of simplicity that has nothing to do with inductive evidence or the universal meaning, in which simplicity is described as carrying the least possible number of inductive statements and premises according to what is known as Ockham's razor. The simple theory is the one that is free of excess filling, as it has the fewest possible number of statements and premises compared to others, so we called it the economic meaning of simplicity.

This type of simplicity can be represented by the observed value of alpha rays changes in distant galaxies than in the nearby and laboratory galaxies. This value is given by the ratio between the square of the electron's charge, and the product of the speed of light multiplied by Planck's constant, and these three elements are considered a physical constant. Thus, when it is noticed that alpha rays may change their shape from what is familiar to distant galaxies, compact stars, and accretion discs in black holes, either this change occurs due to a change in the charge, the speed of light, the Planck length, or more than one of these constants. The three.

In the mathematical analysis, it was noted that if the speed of light is taken as a constant without change, this will give long and complex mathematical relationships, and therefore according to the principle of simplicity and Ockham's razor, it is reasonable to consider the change due to the speed of light and not other constants.

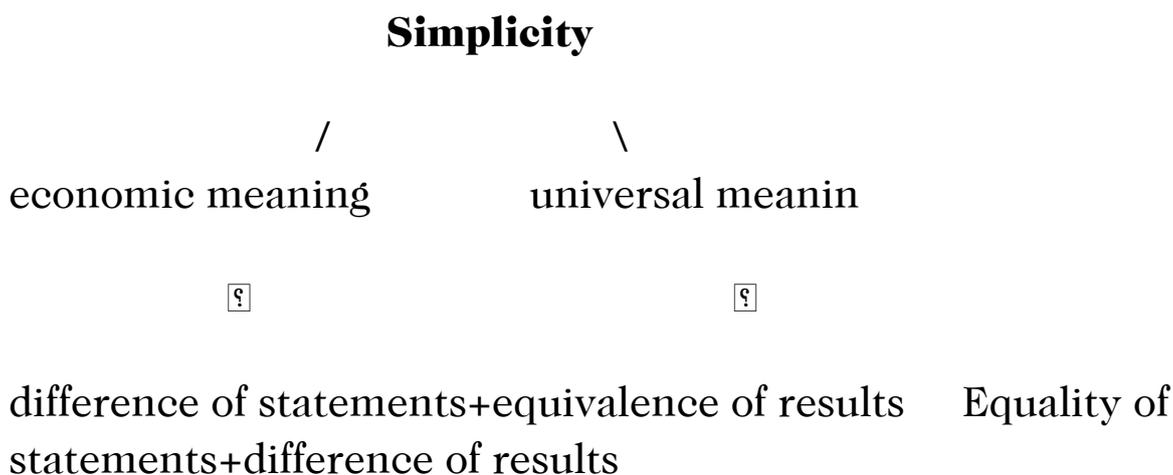
In terms of analysis, the current relationship in the economic sense of simplicity differs from what it is in the first sense of universality. In the universal meaning, simplicity is determined according to the interpretation of many phenomena despite their differences. What is entrusted with simplicity is - in this case - the results that are subject to interpretation. In comparison, it is determined according to the second economic meaning, not by external results and phenomena, but according to the economy in the theory's categories and premises. The theories in this sense can be equivalent in interpretation, but some of

them carry premises that are more than necessary compared to others. This is not the case concerning the first meaning. What determines simplicity in the first meaning is the relationship with external phenomena. What defines it in the second meaning is the relationship with the theory's premises or its statements. On this basis, the relationship between the two stakeholders is inverse.

In the universal sense, the categories of the theory may be equivalent, but their consequences are different and unequal, in contrast to what the economic meaning might be. The results may be equivalent, but the theories and their premises are different.

In this case, the categories of universal meaning are the opposite of the categories of economic meaning, as are the results. If one of them is characterized by equivalence, the other will be characterized by difference and vice versa.

The difference and contradiction between the universal and the economic meanings for simplicity can be clarified according to the following graph:



It is noticeable that the universal meaning of simplicity includes the economic meaning and increases it concerning its comprehensiveness as we can retrieve the universal meaning to a kind of economic

simplicity with the addition of comprehensiveness, as we demonstrated in (The Approach to Science and Religious Understanding).

Thus, the universal meaning of simplicity is due to the economic or reductionist meaning. Still, it is more appropriate to take from the economic meaning when there is a contradiction because it is based on inductive evidence.

For example, Newton and Einstein's theory of gravity is one of the theories characterized by two opposing descriptions. Newton's theory is economical compared to Einstein's theory, as it contains three equations compared to fourteen equations for Einstein's theory. Therefore it is simpler than it, but the latter is comprehensive compared to the first because it explains what the first theory did not explain, and therefore it is simpler than it. In this conflict, preference is given to Einstein's theory over Newton's theory. This preference includes Einstein's idea of an equivalence between gravity and inertia, rather than Newton's differentiation between them. Suppose this idea is simpler from an economic point of view. In that case, it is also simpler from a comprehensive point of view, as it can explain the two phenomena of gravity and inertia with one explanation instead of two different explanations. The same is true of the equivalence between gravity and acceleration, as in general relativity. It is added to the case of spatiotemporal contact without separating them as two independent entities. It is also simpler than theories that postulate the aether.

The above can be applied to space engineering, whether Euclidean or non-Euclidean. According to the economic sense, Euclidean geometry is simpler than non-Euclidean, whether at the mathematical or physical level. As for the universal meaning, it was found that non-Euclidean geometry is the simplest, as it can explain more relationships of nature compared to Euclidean geometry. Therefore it is simpler than it in the universal sense.

In this way, the Indian physicist Arvind previously asked in the late

nineties of the last century: Why does nature not use the information tool one bit (zero, one, for example) instead of multiplying it by four molecules with the genetic factor (DNA) to encode life? The answer was that doubling, in this case, is necessary in terms of higher efficiency of information processing, in the sense that there is universal simplicity despite the lack of economy in the premises.

Symbolically, the contradiction between two theories, one economic and the other universal, can be as follows:

$$n1 (a) \approx x + y + z$$

$$n2 (a + b) \approx x + y + z + g + i$$

According to the economic meaning, the first theory is simpler than the second, but it is more complex than it according to the universal meaning, and therefore the second prevails over the first. This means that the universal meaning is closer to the natural world's attribute than the economic sense, and the latter is closer to the attribute of the mind. The universal meaning shows a possibility in revealing nature's nature, which is not mentioned in the purely economic sense.

According to the previous analysis, the theories that search for universal laws want the universal meaning of simplicity. In this way, those searching for simplicity in nature are actual truth. As for the economic type, as we have seen, it is less important than the universal meaning, and some may call it (elegance), and it is said that Einstein said: The men of science should leave elegance to the tailors.

The meaning mentioned above of simplicity applies to philosophical fields and religious understanding.

The reference

<https://www.fahmaldin.net/index.php?id=2567>

<https://www.thephilosophyofscience.com/index.php?id=2637>