Essay Title #5

"Given that every theory has its limitations, we need to retain a multiplicity of theories to understand the world." Discuss this claim with reference to two areas of knowledge.

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When a theory operates under its context, limitations that reduce the scope of which the theory can be applied are introduced. The nature of our world is very complex, especially when we try to apply and understand theories, as it includes both the external world and the world considering human interactions. To what extent do we need to retain a multiplicity of theories to understand the world? In mathematics, we do not need a multiplicity of theories in order to understand the world, while in economics, we do. In economics, there is a need to honor multiple perspectives while in mathematics, the field is fixed and insists on objectivity.

In general, we do not need to retain a multiplicity of theories in mathematics. A mathematical theory is knowledge presented as a mathematical model that is based on axioms, statements that are taken to be true, so the field is fixed and insists on objectivity. A good example to illustrate this point is the theory of Euclidean of geometry, whose five axioms limit its application to the normal physical world we see every day. Namely, "a straight line may be drawn between any two points, any terminated straight line may be extended indefinitely, a circle may be drawn with any given point as center and any given radius; all right angles are equal, and for any given point not on a given line, there is exactly one line through the point that does not meet the given line". [1] When we get up every morning, we look into the mirror and know that the image in the mirror is exactly our appearance at the moment as a result of typical Euclidean reflection; we run in a straight route instead of a curved one from the dorm building to class when we are late, because the shortest route between two points is the line segment between them according to the theory of Euclidean geometry; particles in the three-dimensional space move in a chaotic pattern, but still, their routes can be described using a series of three-dimensional coordinates; thousands of satellites coordinate their positions to Earth by calculating the relative motion vectors in space, also following the rule of Euclidean geometry. We have enough knowledge for technological needs even if we only use the theory of Euclidean geometry.

On the other hand, theories of non-Euclidean geometry are much more unconventional, so that they are not useful in terms of helping us to understand the world. In hyperbolic geometry, a type of non-Euclidean geometry where a line bends out like a hyperbola, states that, in a two-dimensional space, when point A is not on line L, there are infinitely many lines passing through A that don't intersect line L. Take a piece of paper and imagine drawing out or thinking about the previous statement. How awkward is this theory? And therefore, why would we even retain these extra theories while the theory of Euclidean geometry is straightforward and almost self-evident when applied to the physical world?

Nevertheless, retaining a multiplicity of theories can, in some rare cases, help in the process of understanding the world. In my extended essay, I looked at a non-Euclidean transformation: inversion. When a point A is reflected in the circle of inversion with center O and radius r, the image A' is on ray OA and the equation $OA \cdot OA' = r^2$ is satisfied. In fact, inversion can to a much better extent illustrate ideas that are implicit in the theory of Euclidean geometry. In the classic problem of the Shoemaker's Knife, we are looking for the distance of the numbered circles' centers to the diameter of the semicircle. From the figure below, we can see that it seems as though there are no obvious patterns. However, upon inversion, images of other circles stack below and on top of circle 2, it becomes evident that the distance we are looking for is simply some multiple of the circle's radius. This way, we see that a problem that would require a

sophisticated Euclidean approach can be easily explained with the non-Euclidean transformations.
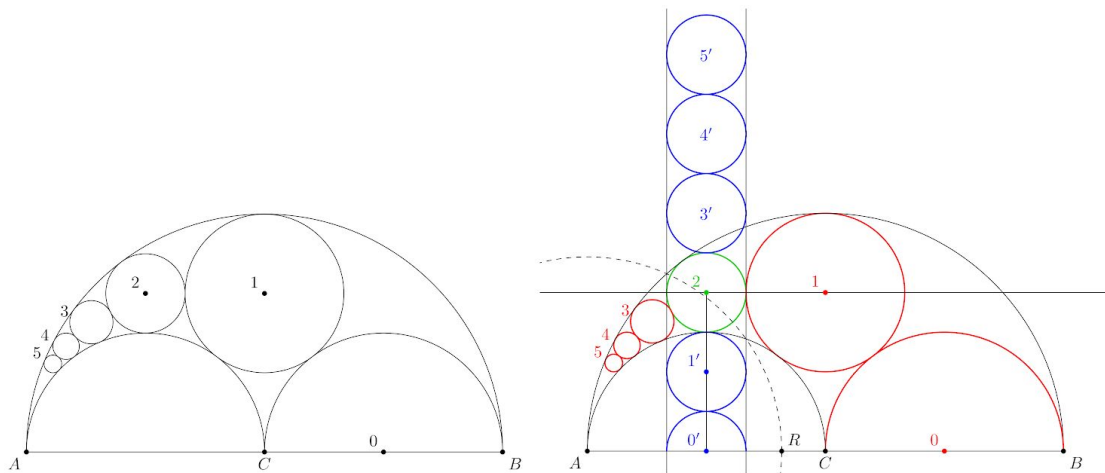
So far, we know that in the area of knowledge of mathematics, retaining a multiplicity of theories is not necessary as applications of dominant theories are enough to understand the world. But sometimes, a multiplicity of theories can help to illustrate complex ideas that are difficult to understand using dominant theories and thus assist the process of understanding.

Generally speaking, we do need to retain a multiplicity of theories in economics. Economics, as a subject in the area of knowledge of human sciences, studies the behavior of human beings in front of scarcity in order to satisfy their needs and wants. One of the most popular and well-accepted theories in microeconomics is the neoclassical theory, which aims at the maximization of benefit. It is bounded by many assumptions, for instance, people have rational preferences between different outcomes, individuals maximize utility and firms maximize profits, and people act independently on the basis of complete and relevant information. [2]

The purpose of economic theory is to pursue truth and try to explain phenomena from a particular perspective, so as long as there is a need to honor multiple perspectives, there is a need to retain a multiplicity of knowledge. The perspective of neoclassical theory, as stated in its assumptions, includes the statement that individuals aim to maximize their utility, indicating an individualistic perspective. On the other extreme, the Marxist economic theory focuses on collectivism, whereas the perspective that gender awareness and disprivileged groups' welfare should be considered as an integral aspect of the society's betterment yields the Feminist economic theory. This theory also focuses on neglected topics in the field of economics like care work and intimate partner violence [3]. And finally, when minds become alert to the environmental exploitation brought by economic development, the Environmental economic theory, which is inherently concerned with environmental issues, comes into existence. The theories in economics reflect the diverse perspectives which indicate the necessity of many theories in economics.

However, it's not really necessary to retain a multiplicity of theories, if a new theory does a much better job in explaining how the world works. The classical theory of value was established by Adam Smith in 1776 when creating classical economics, and it stresses the benefits of trade and

claims that goods should be sold at an objective, fixed price. In the late 19th century, the subjective theory of value was proposed by several economists including William Jevons during an act called the marginal revolution. The new theory suggests that the price of a good should be derived from the marginal utility that consumers find in a good. Let's look at an example of a bottle of Evian water. Based on the classical theory of value, the water will be fixed at $3 regardless of where and to whom it is sold. In contrast, the value of the bottle of Evian water differs according to the subjective theory of value. When the water is sold in France, the place where Evian originates, the price can be as low as $2; when the water is placed in a heavily polluted metropolitan, it can be sold at the price of $6, since high-quality water is scarce, and people are willing to pay; in extreme cases, deals offered by people in desperate need of water can even be higher than $10 dollars. It is clear that the latter scenario is what more likely to take place in this world, and in fact, the classical theory of value was indeed largely displaced by the subjective one. This illustrates the idea that theories can be taken over if there's a much more reasonable theory proposed, and in this case, there is no need to retain a multiplicity of theories.

Meanwhile, retaining a multiplicity of theories might lead to disadvantages. The Chinese economy has been adopting both the Marxist economic theory and the neoclassical theory in the sense that the market in China has been made increasingly free by the government, but the restrictions to the citizens are no looser than before. Other economic systems express all kinds of worries towards the practicability of this kind of experimental mixed-adoption of multiple theories due to the current condition of the Chinese economy. The most notable disadvantage is the increasingly detrimental tariffs US President Donald Trump has imposed during the "China-US trade war", even at the risk of hurting the US economy [5]. By retaining a multiplicity of theories, economists can be confused and harm can be done to the economy. Therefore, for special cases like this, it's not a good idea to retain a multiplicity of theories.

Overall, the necessity of retaining multiple theories to understand the world differs between areas of knowledge. In mathematics, there's no need to retain multiple theories when we understand the world, but sometimes a multiplicity of theories can provide help in the understanding process. In contrast, retaining a multiplicity of theories in economics is almost inevitable as they reflect people's perspectives. However, for some special cases, multiple theories are not retained, if the new one works much better than the old one. It's also not a good idea retain a multiplicity of theories when their coexistence introduces harm to the economy. This way, when an economist has a new perspective, he/she can propose the theory as long as it's good at explaining economic phenomena, while a mathematician has to think about whether his/her theory can, to a much better extent, illustrate ideas before establishing it in the field.

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