The Unreasonable Societal Implications of Theoretical Mathematics

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***Abstract*—**

I. Introduction

Theoretical mathematics has been a essential subject throughout history, with significant implications for society both from art, curiosity and applications.

Since the dawn of civilization, mathematics has been deeply integrated into the human mind, even as the perception of objects might subjectively change. For example, the categorization of colors varies significantly between Western languages and Russian [1], and even the ancient Greeks did not distinguish between blue or green in their color lexicon [2]. On the other hand, counting is fundamentally equivalent in all languages. Some indigenous languages possess distinct terms for numbers ranging from 1 to 5. For instance, among Eskimos and native Australians count 11 as 'two hands and a toe', and other gestures for higher numbers [3]. However, these numerical systems tend to lack the structural efficiency required for counting larger quantities or powers, which suggests that they may not be optimal for handling more complex arithmetic tasks [4].

An important breakthrough in history from basic counting to more advanced abstraction is when ancient Egyptians invented a number notation and utilized geometry, basic algebraic manipulations and fractions to compute volumes of pyramids and taxes [5]. It is also clear that had some insight of quite complicated geometrically identities. In fact, there is controversy among scientists regarding whether the Egyptians had knowledge of π and the golden ratio ϕ while constructing the Great Pyramid of Giza, despite lacking the tools to explicitly state their numerical values [6].

This was a inspiration and further inspired by the old Greek school philosophy. For the first time, was appreciated as an abstraction and curiously. Thus, foundational logic rules and axioms where introduced into geometry by Euclidian (300 B.C.), i.e,

1) A straight line segment can be drawn joining any two points.
2) Any straight line segment can be extended indefinitely in a straight line.
3) Given any straight line segment, a circle can be drawn having the segment as radius and one endpoint as center.
4) All right angles are congruent.
5) If two lines are drawn which intersect a third in such a way that the sum of the inner angles on one side is less than two right angles, then the two lines inevitably must intersect each other on that side if extended far enough. This postulate is equivalent to what is known as the parallel postulate.

For reference, see [7]. This facilitated analytical proofs, ensuring consistency and validity in mathematical reasoning. By enabling the generation of new knowledge through logic and proof, it became a significant step in theoretical mathematics.

However, Gow [3] notes that Greek numerical methods remained cumbersome for higher arithmetic, arguing that the development of mathematical progress was hindered by inefficient notation.

Around the same era, Chinese mathematicians developed a theory of additions, subtractions, and division based on the use of counting rods, which proved to be highly efficient. This innovation was crucial for the advancement of Chinese civilization. For any arithmetic problem, the rods were applied, and the knowledge was utilized by engineers and administrators for tasks such as calculating land area, transferring money, and distributing goods among people [8].

This was later optimized by the Hindu-Arabic mathematicians numeral system, which is now known as the numbers $0-9$ we used today invented in the early 770s, which proved to be essential to develop a consistent theory of arithmetic operations, including decimal numbers [9]. This concept was quickly adopted by professional mathematicians, including Al-Khwarizmi (ca. 780–850) at the 'House of Wisdom' in Baghdad, which is renowned for its development of algebraic theory for solving quadratic equations of the form $ax^2 + bx + c = 0$, where a, b, and c are positive integers, produce accurate tables for $\sin(x)$ and $\cos(x)$, and lastly big tables describing the movement of the sun, the moon and the five known planets [10].

II. Mathematics for stimulating intellectual mind

- For some it may be because we humans tend to like puzzles and games. Even my grandmas enjoy playing Scrabble and sudoko and more. But while this is essentially basic structures and have basic applications, is this evolved from human creativity.

III. Mathematics as an Art form

Beauty of mathematics, but why does this

- The beautiful symmetries that happens in theoretical mathematics.
  - Unexpected connections between mathematical fields.
  - Unexpected simple results, arriving from a complex theory
- Is it egoistic that theoretical mathematicians train for years and years, just to construct some weird symmetry only they find interesting.
  - Only appreciated by the ones with enough patients to learn the hidden rules
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IV. Mathematics as an application

- Time lag before the applications
  - The history of how abstract algebra was the only branch where "pure" branch with no applications. But then we found extreme applications in cryptography.

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