Commonly Shared Foundation of Mathematics, Information Science, Natural Science, Social Science, and Theology

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Abstract

Through a simple thought experiment, this paper shows that there must be a shared foundation of mathematics, information science, natural science, social science, and theology. The thought experiment is to ask a volunteer to write down an arbitrary real number between 0 and 1 with many digits. For example, 0.19823765010367129462…. would be one of such numbers. Then we analyze this experiment result by asking five simple questions: Is the real number a random real? Can the observed real number be produced by a computer? What laws of physics govern the real number creation process? How to predict which number the volunteer choose to write? What is the meaning of the real number creation actions? Without answering these questions, this paper proves that these five questions are fundamental to mathematics, information science, physics, social science, and theology respectively. These five lines of questioning are universally applicable for all human choices. Because these five lines of questions are closely related with each other, we conclude that there must be a commonly-shared logic foundation for mathematics, information science, physics, social science, and theology.

1. Introduction

The concepts of human free will and consciousness have been fascinating to people for thousands of years. However, this paper will argue that the human consciousness is a shallow concept with narrow interests among biologists and physicians while the human free will is a profound concept with broad interests from mathematics, artificial intelligence, quantum physics, social science, arts, laws, sports, philosophy, to theology.

For example, most books in Library of Congress are simply about human choices from history, economics, politics, finance, military, sports, paintings, music, performing arts, to religion. There is rare to see one concept that could have such broad and profound impacts on human knowledge. However, there are few books outside of anesthesia talking about human consciousness in the world.

In order to create a scientific theory for the human behavior, this paper attempts to set the right scope of the scientific theory of human choices. Setting the right scope is critical, because if the scope is too narrow, many questions would become unanswerable, and if the scope is too broad, it is harder to focus on what is really important.

What is the nature of human free will? Philosophers have debated this important question for thousands of years without reaching a definitive conclusion. Understanding the nature of human free will is crucial to many theories in social science [1-3] and modern physics [4]. Recently more physicists [5-6], biologists [7-8], and mathematicians [9-10] have joined the researches by bringing scientific approaches and tools from different research areas.

In this paper, we propose a simple thought experiment to show that there must be a common logic foundation for the mathematics, computer science, physics, biology, social science, the legal system, and theology. The thought experiment reveals the possible physics explanation for the human free will and a unified physics theory for the social science.

This paper concludes that the correct scope of a scientific theory of human choices is a fundamental physics theory of human free wills, which provides the theoretical foundation for natural science, social science, and theology.

2. Random Numerical String Experiment

Let's start with a simple physics thought experiment called the random numerical string experiment. In an isolated physics laboratory, a volunteer is asked to write down an arbitrary real number between 0 and 1 with many digits.

The number consists of a long string of digits, which starts with "0." and follows by arbitrary digitals from 0 to 9 at the choice of the free will of the volunteer. For example, 0.19823765010367129462… is one of such string. The resulting string is a real number between 0 and 1 with many digits.

Because the above experiment can be performed under the most stringent requirement of any physics laboratory, an unknown physics theory must be able to explain and predict the outcome of the experiment. The central question of this paper is to define experimentally what the unknown physics theory could be.

While these numerical strings are very simple and easy to create, they are remarkable in some ways. For example, a simple 110-digit string is able to uniquely identify every cubic Angstrom of the entire observable universe. A simple Most of these long numerical strings are so unique that they must appear in the human history for the very first time, because the chance of creating two long identical random strings is infinitesimally small.

The similar argument can be extended into the spacetime of the observable universe. The diameter of the observable universe is about 93 billion light years, or $5.4x10^{53}$ Planck length units while the lifetime of the observable universe is about 13.8 billion years or $7.9x10^{60}$Planck time units. Therefore, a simple 222-digit string is able to uniquely identify every Plank unit of the spacetime of the observable universe. In other words, if the volunteer is creating a random real number longer than 222 digits, the real number most likely appears in the history of the observable universe for the first time.

Another remarkable property about these random digital strings is that all books in Library of Congress and all digital contents on the internet can be encoded by a long digital string.

Assuming the volunteer is able write down a digit per second, given sufficient foods and other suppliers, the volunteer is expected to be able to write down a numerical string with 5 million digits in about 3 months.

Then we ask five simple questions: Is the real number a random real? Can the same real number be generated using a computer? What laws of physics govern the real number creation process? How to predict which number the volunteer choose to write? What is the meaning of the real number creation process?

In next section, we will explore these five questions in details in order to reveal the common logic foundation.

3. Five Important Questions

In this section, we will analyze these five questions in details and speculate the possible answers starting with mathematics.

3.1 Is the real number a random real?

Before answering the question, we need to review some basic mathematics of the random real numbers. A random real number [11] is a string of random digits that has no description shorter than the string itself via a universal Turing machine. In the algorithmic information theory [11], the randomness of the digital string can be measured by the Kolmogorov complexity. There are several interesting properties regarding the random real number.

(1) The set of real number can be divided into two sets: the deterministic and random real numbers. The deterministic real numbers have small Kolmogorov complexity while the Kolmogorov complexities of the random real numbers are about the size of the digital strings.

In our thought experiment, for an arbitrary N digit real number between 0 and 1, there are 10^N possibilities. Most of these 10^N numbers are random reals. In other words, deterministic reals like the rounded number of the inversion of $\sqrt{2}$, $\sqrt{3}$, e , π are rare.

(2) For an arbitrary N digit real number between 0 and 1, it is impossible to tell whether one specific number is a random real number or not. The Kolmogorov complexity of an arbitrary string cannot be proven by any formal logic system. The result is known as Chaintin incompleteness theorem [11], which is an extension of the famous Godel incompleteness theorem [12] in mathematics.

While Chaintin incompleteness theorem prevents people from telling whether an arbitrary number from our thought experiment is random or not, it does not prevent people to analyze the randomness of any specific real number generated in our thought experiment.

Therefore, the problem comes down to whether a human being is able to generate an arbitrary real number of N+1digits. After writing down N digits, are we truly free to choice any number from 0 to 9 for the next digit? The answer says something important about the fundamental feature of our brain.

3.2 Can the same real number be generated using a computer?

Since Alan Turning publishing his seminar paper [13] on the computable numbers, there are already many research papers [14-17] and books [18-22] about the relationship among a Turing machine, Godel incompleteness theorem, and the human brain. The question whether the same real number can be generated using a computer is a simplified way to examine the complicated relationships among these three fields.

If the real number is a deterministic real, it has a small Kolmogorov complexity relative to the length of the digital string. Then it can be generated through a Turing machine.

If the real number is a random real, it cannot be generated through a deterministic Turing machine because there is no algorithmic way to encode a random real except using the random real number itself.

An indeterministic Turing machine could generate a random real. However, the number generated by the computer is almost certainly different from the observed real number, because the chance of producing two non-related long random real numbers during the lifetime of the observable universe is infinitesimally small.

3.3 What is physics laws governing the real number generating process?

We shift our attention to physics and biology. Even though we do not how the human brain works, we should at least discuss the physics laws governing the process because there are only about a dozen of fundamental laws of physics governing from the smallest elementary particles to the large structure of the observable universe.

When discussing the working of the human brain, we must separate the concept of consciousness and free will. The consciousness is defined as awareness, and the free will is defined as the process of making choices.

This paper would argue that the human consciousness is a shallow concept with narrow interests among biologists and physicians while the human free will is a profound concept with broad interests from mathematics, artificial intelligence, physics, social science, arts, laws, sports, philosophy, to theology. The importance of human choices is self-evident because most books in the world are about human choices. The free will is a profoundly important concept while the consciousness is a relatively unimportant concept. The fact that a computer is responding to my writing means that the simple computer can have the "consciousness". However, a computer does not have the free will and ability to write an original research article for me.

Current understanding of the biochemistry of human free will and human brain is primitive. However, the fact that even E. Coli bacteria can have consciousness and free wills [23] and can make coherent and effective decisions, means that the complexity of the human brain is not necessary to make decisions. The fundamental nature of the free will has almost nothing to do with the complexity of human brain.

In our thought experiment, the real number generation process tells more about the nature of human free will than the consciousness. Of course, people have to be conscious first in order to make a coherent decision and choices.

The physics process governed by the deterministic physics laws like Newtonian laws of motion can generate the deterministic reals but not the random reals. Therefore, to generate random reals requires the indeterministic physics laws in quantum mechanics. Therefore, some quantum process must be involved in generating the truly random real numbers.

3.4 Can we predict which the real number is being generated?

The social science is about predicting and understanding the human behavior and human choices. The writing down a real number is certainly one of the simplest human behavior.

In order to make predicting about real number being generated, the first thing must be clarify is what physics laws are governing the real number generating process. We reach an important conclusion of this paper that the logic foundation of social science must be physics. To put more precisely,

Logic foundation of social science = Physics theory of human choices.

If the observed real number is not a random real, we might be able to predict it. However, if the observed real number is a random real, we would have no chance to predict exactly which real number being generated. If it also means that the human behavior is fundamentally unpredictable precisely.

3.5 What is the Meaning of the Real Number Generating Process?

The meaning of the real number generating process is directly related with the question of meaning of life, because a person's life consists of a long string of choices. The question of meaning of life is an important theological and philosophical question.

The real number generating process tells us that the human choices are not just about the rational reasoning in mathematics and science. There are irrational aspects of human choices beyond mathematics and science.

The real number generating process reveals a fundamental limitation of rational thinking based on mathematics and science. If the real number is a random real, the rational thinking based on mathematics and science cannot reproduce the observed real number.

The limitation of mathematics and science defines one key insight about theology and philosophy: there is a scientific foundation for theology and philosophy. The limitation of mathematics and science, which can be well-defined by mathematics and science, forms a rock solid of scientific foundation for theology and philosophy. Theology and philosophy start exactly where the mathematics and science end.

Therefore, the physics of human choices must allow rooms for people to make both rational and irrational choices using their own value systems rooted in the theology and philosophy.

4 Universality of 5 Lines of Questioning

Despite its simplicity, the process of creating long numerical strings exemplifies all other human activities. These five lines of questioning are universally applicable for all human choices.

For example, instead of writing digits, the volunteer could write original poems, novels, Solutions to Einstein's field equations, or research articles. Instead of writing, the volunteer also could talk in the nature language. The advances of computer science have proved that all written records and even all human knowledge could be coded in one long numerical string. We can examine any human behavior through these five lines of questioning.

The importance of these five lines of questions is that these questions defining the scope of a universal physics theory of human behavior: the needs of new mathematical tools, the foundation of artificial intelligence, the laws of physics governing human behavior, the neurobiology of human behavior, the physics foundation of social science, and the physics foundation of theology and philosophy.

5 Concluding Remarks

What is the nature of human free will? Philosophers have debated this important question for thousands of years without reaching a definitive conclusion. This paper has shown that a physics theory of human free wills and choices will provide a unified framework for social and natural science.

Although this paper has not proposed a physics theory of human free wills and human choices, the commonly believe by most social scientists that the foundation of

social science is psychology or neurobiology is most likely wrong. A new framework of social science based on quantum mechanics will be published elsewhere is a series of papers [25-32].

6 Reference and Notes

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