THE ASYMPTOTIC BOX*

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An asymptote is a goal that can probably never be reached, and if reached, cannot be crossed. If crossed, there may be no return. There are at least six asymptotes that apply to our universe. A box has six sides. Consequently, we can use the metaphor that our universe is an asymptotic box. The six asymptotes of the natural world that apply to our universe are birth, death, the speed of light, absolute zero, gravitational collapse limit, and the superforce. There is also an asymptotic box of scientific reasoning. The paper will define the asymptotes and then discuss various consequences.

Introduction

The May 2003 issue [1] of *Scientific American* had a feature article with a cover title of "Infinite Earths in Parallel Universes Really Exist." This article was summarized in the Contents with the following statement.

> Not only are parallel universes—a staple of science fiction—probably real, but they should exist in four different ways. Somewhere out there our universe has a twin.

The four different types of multiverses are based upon these four conceptual frameworks: too far away to see; unique application of cosmological inflation; different quantum states; and, different laws of physics. A duplicate or two of each of us may be living in one of these parallel universes. And all of this is *real*!

The purpose of this paper is to take an opposite approach to the *Scientific American* article, as well as many other attempts that violate the laws of physics without evaluating the overall consequences of such an approach. Like Leibniz [2] and Candide [3] believed, "this is the best of all possible worlds." What we have is as good as it gets. We just do not understand our world enough to realize that. The basis for taking such a position does not ignore the developments of physics the past 200 years, but accepts the fact that our existing laws of physics predict asymptotes that we cannot physically exceed. In fact, all four of the approaches used in the *Scientific American* article acknowledge that an asymptote has been violated.

An asymptote is a goal, an objective, a threshold, a destination, or a convergence that seems unreachable. Asymptotes are walls that confine us. Some asymptotes are imaginary. They are barriers that we have defined for ourselves. Other asymptotes are real and cannot be passed. Asymptotes are a mathematical construct that may be defined [4] in two different ways. The

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meanings of asymptotes will become clearer as we explore some specific examples. No mathematics or equations will be used.

Asymptotic Box of the Natural World

Based upon my studies [5, 6] in theoretical physics about the design of the universe, the universe in which we live is bounded by six natural asymptotes. Since a box has six sides, it could be said that we live in an asymptotic box. Fig. 1 is a schematic of what is meant by the asymptotic box of the natural world.

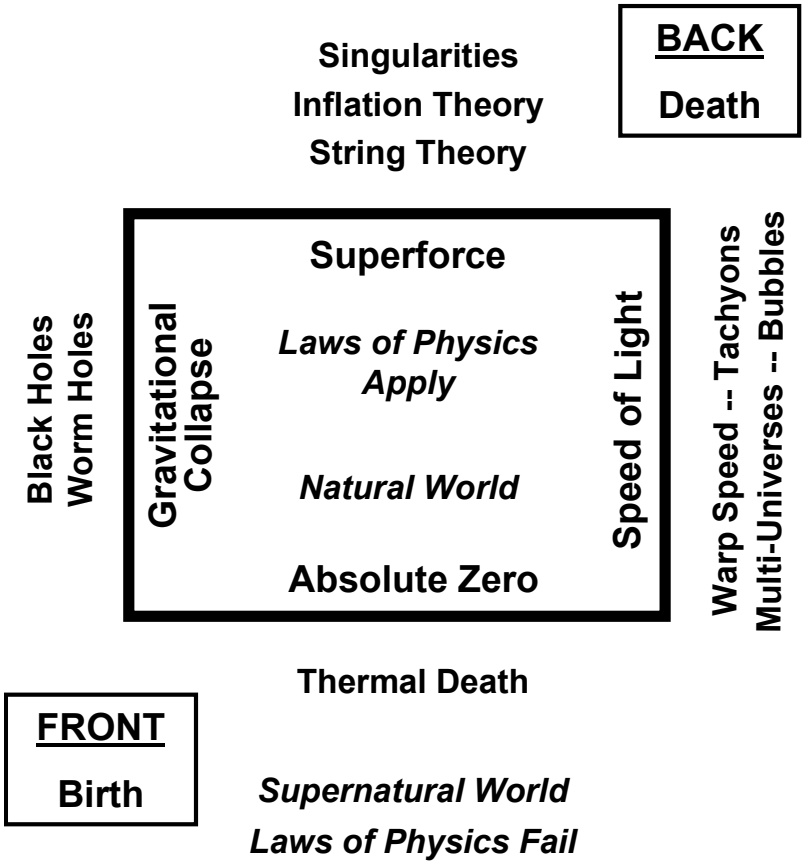

Figure 1. Symbolic view of the asymptotic box of the natural world.

Birth. The front of the box is represented by *the asymptote of birth*. Our birth began with a whimper, but the birth of the universe began with a so-called big bang. Big bang is a euphemism for *creation event*. The Einstein field equations of general relativity predict the birth of the universe. What happened before birth? We do not know because the event is out of the box. Birth is measured at time zero. What happened before time? The answer is outside of the box.

Death. The back of the box is represented by *the asymptote of death*. Death could symbolize either the death of the universe or our own death. The death of the universe is hard to fathom even with the Einstein field equations. An asymptote in mathematics is a line, a curve, or a plane that can be approached but not reached. People have near-death experiences and return. Mere mortals do not totally die and return. Life occurs in the box. When we die, we are out of the box. As far as we know, death is measured by our last moment in time. Birth and death are familiar asymptotes. The other four may not be as well known.

Speed of Light. The right side of the box is represented by *the asymptote of the speed of light*. Nothing can go faster than the speed of light. The age and size of the universe is determined by the time it takes light to travel from as far as we can see with telescopes. The exact age of the universe is not precisely known. The speed of light is a critical element of Maxwell's equations, which control communications. No signal can be sent faster than the speed of light. Relativity assumes that the speed of light is constant. Some recent theories [7] have assumed that the speed of light can vary, even by extreme amounts. However, these theories appear to be based upon conditions outside of the box. Light is a definite asymptote.

Gravitational Collapse Limit. The left side of the box is represented by *the asymptote of the gravitational collapse limit.* This asymptote is more popularly known as the horizon of black holes. Black holes are predicted by the Einstein field equations. As matter collapses, a point is reached where the gravitational attraction is so strong that light cannot escape from the black hole. We cannot see a black hole. We cannot get out of a black hole. Black holes actually seem to be like asymptotic boxes. Based upon current accepted physics, it is even possible to prove [8] that we may live in a black hole. The horizon of a black hole is an asymptote. Worm holes are hypothetical tunnels through the asymptote.

Absolute Zero Temperature. The bottom of the box is *the asymptote of absolute zero temperature*. Temperatures can go no lower than 0° Kelvin or Rankine, the absolute temperature corresponding to Centigrade and Fahrenheit scales, respectively. Scientists have measured temperatures at thousandths of a degree, but not zero. There is no thermal gradient outside of the box. The laws of thermodynamics and thermal death are associated with this asymptote.

The Superforce. The top of the box is *the asymptote of the superforce.* Many predictions [9] have been made about a superforce. Even though no specific formula has been accepted, one possibility has been identified [10, 11]. The superforce is where the forces of nature converge on a finite magnitude. Most scientists do agree that the so-called Planck scale does present a threshold where an asymptote occurs at a probable superforce. The most recent technical details on the superforce asymptote are given in a companion paper [12].

The Meaning of the Asymptotic Box. The six asymptotes occur in pairs. Birth and death are time related. The speed of light and gravitational collapse are measurements of space. Absolute zero and the superforce depend upon matter. The asymptotic box is dependent on our basic units of matter, time and space.

We live in a universe controlled by laws. These laws are referred to as physical laws or the laws of nature. Nothing would work if we did not know these laws. Automobiles, airplanes,

electronics, clothes, books, lights, food, heating, air conditioning, and our very bodies depend upon the laws of nature to function. Even predictions require laws. The laws of nature apply within the box. The laws of nature do not apply outside the box. Because physical laws exist within finite asymptotes, there are no infinities in nature. We cannot know or predict with certainty what is outside the box. The inside of the box is natural; the outside of the box is supernatural by definition.

It would appear that only three things may move back and forth from inside the box to outside of the box. The first is God and his house. God can be inside or outside of the box. God can violate any law of nature. God may be considered to be the *Seventh Asymptote.* It could be said that the *Bible* is God's lab report on the asymptotic box. The second thing that can move in or out of the box is imagination. Science fiction thrives on this freedom of movement. No law of nature or of God is sacrosanct for the dreamer. The third thing that can move beyond the boundaries represented by asymptotes is mathematics. Mathematicians have created tachyons that can go faster than the speed of light. But, tachyons cannot go slower than the speed of light. Tachyons must stay outside of the box. The atheist could say that all three things that move in or out of the box are based upon imagination.

Physicists have designed a theory of the big bang that begins at infinite density and infinite force at a point outside of the box called a singularity. When the big bang first begins with the singularity there are no fixed laws of nature. Everything is violated. When the superforce and the Planck scale are reached at the top of the box, then, a switch is thrown. The big bang suddenly behaves the laws of nature as the big bang enters the box. Why not start at the superforce and the Planck scale with a finite big bang at the superforce asymptote?

One more theory has problems getting into the box. That is string theory, which works beautifully outside of the box, but it cannot get beyond the Planck scale. There is an explanation of why these other theories cannot get in the box. It is because they have ignored the superforce.

Much work has been done with defining asymptotes of the natural world. These asymptotes are called horizons [13]. In addition, "any spacetime containing a horizon also contains a singularity inside." Crossing the horizon leads to a violation of the laws of physics. Supposedly, horizons protect us from observing any of these singularities. This is known as the *Cosmic Censorship Hypothesis*, which has never been proven. Nevertheless, whether called horizons or asymptotes, we live in a bounded universe.

The above arguments are not meant as a pronouncement for or against deriving theories either inside or outside of the box. There is a definite value in working outside of the asymptotes. If concepts are developed concerning issues outside of the box, then some of these concepts may answer issues within the box. Redefinition of the asymptotes or laws of physics may result. We may be better able to appreciate our uniqueness. On the other hand, criticisms may be raised about working outside of the box. If we can not get from here to there, then what is gained? We have problems enough within the box. If imaginations run wild with delusions, then gross extrapolations may seem more real than they are.

The Asymptotic Box of Scientific Reasoning

Even though mathematics can move in or out of the asymptotic box of the natural world, limits are imposed upon mathematical reasoning, scientific reasoning, and on reasoning in general. It is as if an *Asymptotic Box of Scientific Reasoning* confines our thinking. This asymptotic box is shown in Figure 2.

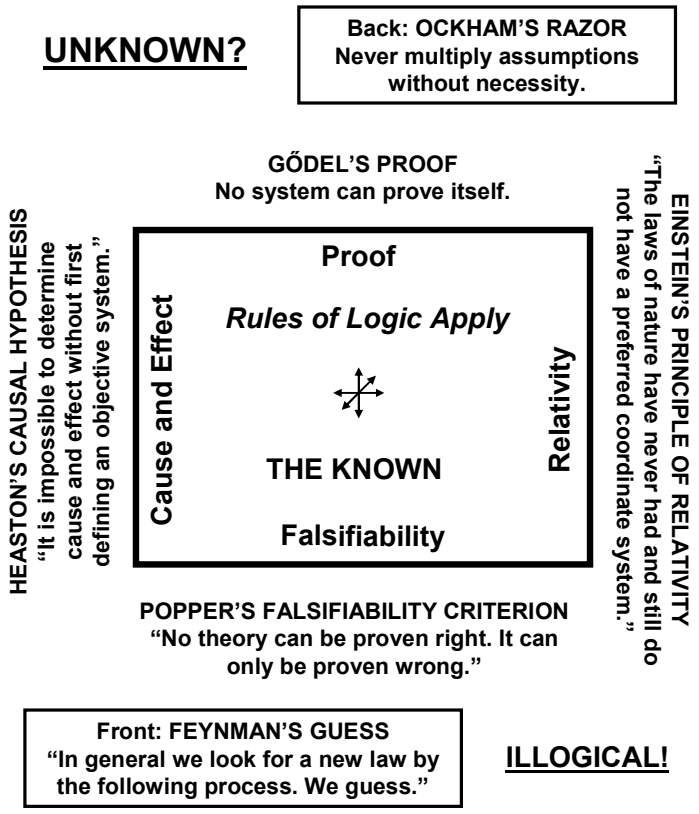

Figure 2. Symbolic description of an asymptotic box of scientific reasoning.

Feynman's Guess. It is very important to understand the concept of the laws of nature to appreciate the rules that scientists use and abuse. An excellent book [14] on this subject is *The Character of Physical Law* by the late Richard Feynman (1918-1988), Nobel Laureate. One of the key statements in Feynman's book is his view on how physical laws are discovered.

> In general, we look for a new law by the following process. First we guess it. Then we compute the consequences of the guess to see what would be implied if this law that we guessed is right.

Reasoning starts with a guess. The more educated a person is, the better the chance of a good guess. But, some good ideas and a few good guesses have a way of being born in strange places. Nevertheless, the reasoning process begins with "If…, then…." That is the birth of reasoning, the *asymptote of the guess*.

Ockham's Razor. Every guess, every idea, and every thought is based upon assumptions. Experience has proven that the conceptual framework with the fewest assumptions that achieves a particular result is the most prized. The simplest path to a goal is preferred. William of Ockham (1285-1349) advocated this practice [15] a long time ago. Ockham's razor is the *asymptote of simplicity*.

Heaston's Causal Hypothesis. The causal hypothesis [16, 17] is stated as follows: *It is impossible to determine cause and effect without first defining an objective system*. When a physical scientist "designs" an experiment, the intent is to exclude all extraneous variables. Assumptions are built into an experiment based upon the expectation that the assumptions will permit a predicted experimental result. An objective system, an experiment, is constructed to identify probable cause and effect relationships. Without the experiment, causes and effects are no more than unconfirmed guesses. The causal hypothesis is the *asymptote of cause and effect*.

Einstein's Principle of Relativity. Albert Einstein (1879-1955) is well-known for his special and general theories of relativity. One of the consequences of the formulation of these theories is that "The laws of nature have never had and still do not have a preferred coordinate [18]." In a sense, there are no absolutes in nature. Everything appears to be relative. We may apply this relativity to human communications. Each of us is a separate reference frame with a peculiar background of nature, nurture, culture, education, and beliefs. Whenever we communicate with each other we are comparing reference frames. The *asymptote of relativity* is one of reference frames.

Popper's Falsifiability Criterion. Certain laws of nature appear to have stood the test of time, and are accepted on faith. However, philosophers of science have observed that no law of nature can ever be proven to be absolutely always true. A thousand experiments may agree with the law, but one experiment could prove it wrong. This is known [19] as *Popper's falsifiability criterion*. Feynman [20] succinctly expresses the falsifiability criterion.

> There is always the possibility of proving any definite theory wrong: but notice that we can never prove it right.

The *asymptote of falsifiability* applies to scientific reasoning.

Gődel's Proof. There is another issue of contention with any attempt to derive a theory of everything. This issue is raised by Gödel's proof [21]. Gödel showed with his incompleteness theorem that it was impossible for any system of reasoning to prove itself. It is necessary to go outside of the system, that is, to go outside of the box to prove what is stated in the box. The *asymptote of proof* denies that the asymptotic box can be proven.

Overall Significance. The positions of the asymptotes in Fig. 2 were assigned for the following reasons. Feynman's Guess and Ockham's Razor apply to the development of conceptual frameworks. Heaston's Causal Hypothesis and Einstein's Principle of Relativity relate to the process of testing the conceptual framework. Popper's Falsifiability Criterion and Gödel's Proof evaluate the meaning of truth.

Scientific reasoning begins with a guess and minimizes assumptions as an objective system is defined based upon no preferred coordinate system. No system of thought can prove itself and no theory can be proven right. The asymptotic box of scientific reasoning defines what can be known. The *known* is inside the box. The *unknown* is outside the box. However, the unknown is not necessarily unknowable. The inside of the box expands as more comes to be known. Since the unknown is infinite, the finite known can never completely absorb the unknown. Thus, there can be no theory of everything. Rules of logic apply inside the box. The outside is illogical.

Conclusions

Let us review what has been said above and see where it leads us. In essence, we are seeking the answer to the question, "So what?"

- It appears that we live in an asymptotic box of the natural world defined by recognized laws of physics.
- If we deny the asymptotic box, then does this mean that we deny the laws of physics?
- We also live in an asymptotic box of scientific reasoning, where our reasoning has defined limits on itself.
- The asymptotic box of reasoning essentially states that we cannot prove that we live in an asymptotic box of nature, even though the box is defined by existing laws of physics.
- May we infer then that all science and reasoning can do is to say "If…then…," and proceed accordingly with the rules we have adopted for our objective system?
- If this is so, then, is science any different than philosophy? Is "absolute fideism" not far behind?
- Or, have we trapped ourselves with a *reductio ad absurdum* like Cretans in a self-referencing argument?

The asymptotic boxes of nature and of reasoning pose a dilemma. Science is based upon hidden assumptions that often contradict the conclusions that are articulated. As scientists strive to obtain theories about the boundaries of our universe, it would appear that science, mathematics, logic, philosophy, and maybe even religion must all be recognized for the roles they play in seeking truth.

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