The Unreal Universe

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1 Overview and Reasons for Writing

The realness of reality is an inquiry appropriate to philosophy. The realm of science is reality as we perceive it. Science, therefore, mirrors all the limitations of perception. How can we identify and remove perceptual constraints from science, or at least, understand their manifestations? *The Unreal Universe* answers this question through an exploration into the overlap among seemingly unrelated domains of knowledge ranging from spirituality to science. The Eastern spiritual philosophies and modern neuroscience hold nearly identical views on reality. These notions of reality are the key to understanding certain aspects of modern physicsin a quantitative way. The book examines the philosophical foundations of physics and exposes the interconnections among different branches of human knowledge.

Before exploiting of these interconnections, we need to understand the nature of knowledge. What is knowledge? Is it the product of our logic and deduction? Does it also include the concepts and assumptions that our logic operates on? How about the objects and space we see, the sounds we hear and everything else we sense? Where does knowledge stop and reality begin? It turns out that knowledge and reality are not distinct. Reality is merely a representation in our brain, a convenient mapping of our sensory inputs. This is how cognitive neuroscience treats reality. This is also how Eastern spiritual philosophies view reality. Because sensory inputs give rise to reality through our cognitive process, all limitations in the chain from sensing to cognition have measurable and predictable manifestations on our reality. And because reality is the input to physics, its theories have this manifestation built in. What are the limitations of perception and cognition in physics? How can we disentangle them from its theories? These questions and their answers form the subject matter of *The Unreal Universe*.

Many branches of philosophy, especially the Eastern spiritual schools of thought, appreciate the distinction between the absolute reality and our perceived picture of it. It is the quantitative application of this philosophical notion of reality in physics that sets *The Unreal Universe* apart from the other books dealing with the philosophy of science. The philosophical view of reality is becoming a scientific awareness through neuroscience. Once the scientific insight of reality as a representation of sensory perceptions, as opposed to a philosophical statement that nothing is real, percolates to physics, what is explored in this book will become part of our basic knowledge. We will clearly see the role of sensing and perception in physics and its theories. This ancient philosophical wisdom rediscovered in a scientific context is the backbone of this book. The amazing accuracy of the ancient spiritual writings inspires a respectful appreciation that our repository of spiritual knowledge may have other clues with potential, and hitherto unsuspected, direct relevance to modern sciences. From this perspective, *The Unreal Universe* is a book on applied spirituality.

The insights in this book, though presented as logical deductions, are, in fact, accidents of circumstances. My proclivity for questioning everything (reality included) and my background in

physics played a role in embarking on this knowledge adventure. My interest in the workings of the brain was further stimulated by my professional research in neural signal processing and brain machine interface. The first inspiration to contemplate on the unrealness of reality itself came from a deceptively simple statement from the BBC Reith lecture series, "The Emerging Mind" that reality is a representation of our sensory inputs. What we perceive as reality is an incomplete and possibly distorted representation of an underlying physical reality. How deep this insight runs and how it was articulated in different branches of philosophy is the initial part of the book. How it can be quantitatively applied in physics is the rest of the book.

Once it was identified, this distinction between the perceived reality and the ultimate physical causes behind it helped me understand how physics is limited by our perception, why space and time behave the way they do and why the speed of light is so fundamental in our reality. Everything began to fall in place like a jigsaw puzzle, both in science and philosophy. It is this excitement in rediscovering and bridging large domains of knowledge using this new found insight that I strive to share with my readers. To the best of my knowledge, nobody has applied a philosophical or spiritual notion of reality to understand physics (or physics to understand spirituality) in such a direct fashion.

2 Outline and Chapter Plan

The Unreal Universe is organized in four parts. The first part looks at our notions of time and space using interesting examples from neuroscience and physics. Moving on to the philosophy of reality, it briefly discusses the Zen and Hindu lines of thinking and shows how their view is mirrored in modern sciences. The second part examines the interplay between reality and physics. It starts with a conceptual recap of modern physics and answers the question why light is so important in our space and time. The concluding third part summarizes the various ideas presented in the book. It winds up with a collection of interesting tidbits about physics, philosophy, evolutionary biology and neuroscience, which may inspire the reader to think further along the general theme of the book—accepting no assumptions without questioning, and doubting everything, including reality. The fourth part is an appendix where the ideas in the third part are presented with technical details. The chapters in the four parts are briefly described below.

Part I Perception and Reality

According to cognitive neuroscience, our perceptual experience of reality is only a distant and convenient mapping of our sensory inputs. Sound is a mapping of auditory inputs, and space is a representation of visual inputs. How space and time are "unreal" from this point of view is the subject matter of the first part of the book. It examines the unrealness of reality and looks at the philosophical basis of physics and knowledge. The most important message of this part is how the modern scientific realization of the nature of reality as a representation of our sensory inputs was known for thousands of years in philosophy. This interplay between ancient philosophy and modern neuroscience is further highlighted in the chapters examining the ingredients that make up reality.

1. **Mother of Sciences**
   In the opening chapter, the philosophical foundations to our knowledge are introduced. These foundations are assumptions in most cases. Some of the assumptions, especially the ones in physics, are not difficult to spot. Others that pertain to the nature of reality itself are far

trickier to appreciate. These elusive assumptions include the existence of time and space, for instance. The realness of reality is not merely a philosophical issue; it is a subject matter of cognitive neuroscience as well. Once the issue of reality gets back to the realm of science, it becomes something that physics has to describe. Physics, in turn, is erected on the philosophical assumptions on the existence of time and space. This overlap among seemingly distinct domains is reflected in the chapter flow of the book.

2. **Nature of Time**
   We can logically accept the virtual nature of time because we have no direct sensory mechanism to sense or perceive it. Despite this glaring absence, we do have a strong sense of time that plays a crucial role in every conscious decision we make in our lives. In this chapter, we argue that the reason for the existence of time is our knowledge of our finite life-span. We illustrate this argument by mapping the history of the universe to forty-five years. This mapping also shows how our physics of the universe is an ambitious extrapolation from a very short span of knowledge to incredibly long time scales. Physics has multiple notions of time—Newton's constant time and Einstein's malleable time. The difference between these notions of time is indicative of its unreal nature. Time is unreal the same way as mathematics is unreal; they are both products of our intellect. And philosophically, they can both be thought of as formal languages.

3. **Unreal Space**
   Unlike time, space does have a sensory correlate. Our perception of space is the end-result of our most precious sense, namely sight. For this reason, the unreal nature of space is not as obvious as that of time. In this chapter, we take a quick look at how sight works from the perspective of neuroscience. In particular, we study the cases where tiny physiological defects manifest themselves as drastic disorders in visual perception. How sight creates space is analogous to how hearing creates sound. Sound is not the intrinsic property of a vibrating body, but our cognitive representation of the air pressure waves our ears sense. In an exact parallel, space is our visual reality, or the cognitive representation of the light inputs to our eyes. It is no more real than sound or smell. Or time.

4. **Pillars of Reality**
   Discussing the nature of reality has the curious effect of casting doubt on its realness. In this chapter, we look at the many pillars on which reality rests. Our senses provide the inputs to the brain, which creates a cognitive model that we think of as reality. The cognitive model heavily depends on the other "software" running on the brain, namely consciousness, language and memory. In the absence of consciousness, reality has little significance. Similarly, if the brain does not have a language apparatus to process thoughts, reality cannot be created. Memory is the last essential support to our sense of reality. What does it mean to say something happened if nobody can remember it? An interesting and important aspect of the brain is that it always tries to create a reality that best fits the sensory inputs, resolving any possible sensory conflicts.

5. **Philosophy of Reality**
   The suspicion, or the conviction, that reality is not all that real existed in some branches of philosophy, both Western and Eastern. In this chapter, we take a quick look at these philosophies. The Indian and the Zen spiritual lines of philosophy view our senses and mind

as actual impediments to an intuitive understanding of the absolute reality behind our experiences. Western philosophy, on the other hand, treats the nature of reality and knowledge as the formal lines of metaphysics and epistemology. Western philosophy also provides the basis of scientific realism in modern physics.

Part II Reality and Physics

The physics part of the book starts with a conceptual description of three aspects of modern physics, the special theory of relativity, particle physics and cosmology. Looking at reality as a cognitive model distorted by the finite speed of light yields a compellingly simple understanding of the special theory of relativity. It also provides simple explanations for a host of astrophysical and cosmological phenomena at vastly different time and length scales. All these explanations are presented in this part with no mathematics or technical details, but with the help of numerous diagrams and examples.

6. **Physics Primer**
   In this first chapter on physics, we look at three branches of modern physics. These are (1) the special theory of relativity dealing with objects at high speeds, (2) particle physics dealing with very small length scales and (3) cosmology and astrophysics, dealing with various phenomena in our universe. The common thread binding these different branches is that they all deal with physics beyond the ranges of our senses. Extrapolating physics from our reality to what lies beyond our senses involves deep philosophical assumptions. This chapter uncovers the philosophical basis of modern physics. It shows how scientific realism is the philosophical stance adopted in modern physics and how another stance is possible. This new stance is based on the notion from neuroscience that our reality is our brain's creation, almost identical to the Zen and Hindu view of the world.

7. **Why the Speed of Light?**
   Once we adopt the philosophical stance of reality as our brain's creation, we can understand why the speed of light figures so prominently in our physical theories. The theories of physics are a description of reality. Reality is created out of the readings from our senses. Our senses all work at the speed of light. Thus the sanctity accorded to the speed of light is a feature only of *our* reality, not the absolute, ultimate reality which our senses are striving to perceive.

8. **Perception and Special Relativity**
   In this chapter, we look at our perception of moving objects. First, we look at echolocation as an "inferior" sense modality operating at a slower speed. This study will show how the speed of the sense modality influences the perception of motion. From this understanding, we will see that all the strange effects of the coordinate transformation in special relativity can be understood as the manifestations of the finite speed of our senses in our space and time. When it comes to the phenomena that happen well beyond our sensory ranges, we really have to take into account the role that our perception and cognition play in seeing them. The universe as we see it is only a cognitive model created out of the photons falling on our retina or on the photo-sensors of the Hubble telescope. Because of the finite speed of the information carrier (namely photons), our perception is distorted in such a way as to give us the impression that space and time obey special relativity. They do, but space and time are not the absolute reality. They are only a part of the unreal universe that is our perception of an unknowable reality.

9. **Beyond Special Relativity...**
   After showing that special relativity applies to the cognitive model created by the brain, we will ponder over the physical causes behind the model, the absolute reality itself. It may be possible to guess the nature of the absolute reality and work out how we would perceive it. We will show how this line of thinking explains certain phenomena that have been puzzling scientists for a while. These phenomena include symmetric radio jets and gamma ray bursts from astrophysics. We also end up with a conceptually elegant resolution of the twin paradox and the issue of causality violation in superluminal motion.

Part III Summing Up...

After summarizing the various ideas presented so far, the book winds up with a collection of possibly unrelated, but interesting, thoughts. They are presented as a kind of intellectual dessert, which may inspire further thinking.

10. **Last Words**
    Summarizing the thoughts presented in the book, we highlight how the nature of the absolute reality is really beyond our grasp and that the choice of accepting the perception of reality as a true image of reality is indeed a philosophical stance. The alternative presented in the book, namely guessing the nature of the absolute reality and comparing its predicted projection to our real perception, may simplify and elucidate some theories in physics and explain some puzzling phenomena. However, this option is just another philosophical stance against the unknowable absolute reality. We also show how different levels of possibly conflicting views of reality may coexist in our minds, giving us physical theories that are in conflict with each other. General relativity and quantum mechanics are examples of such conflicting theories, which are descriptions of realities beyond *different* limits of our senses. Due to this difference in their origin, their unification may prove impossible, unless we are willing to tolerate more arbitrary assumptions and complex mathematics.

11. **Random Thoughts**
    In this concluding chapter, the reader is presented with a bunch of interesting thought exercises. It includes a game where the book tries to predict the level of reader's faith in a supreme being by testing how left or right-brained the reader is. It also mulls over such desultory topics as the universality of mathematics, the logic of evolution, the nature of gravity, and the shape of Yin and Yang. How every conscious being is at the center of the universe, its own personal unreal universe, is another piece of ancient wisdom that our sciences are now converging to. The book concludes with a discussion on how the concept of God is not in conflict with physics, for there is plenty of room beyond the limits of our knowledge for a plausible God.

Part IV Appendix—Physics Details

This appendix of the book gives technical details of the conceptual picture drawn in the preceding parts. This is the only part of the book that has equations. The equations and their derivation substantiate the claims made earlier and illustrated textually using examples. In addition to the mathematical details, this part also includes a chapter on the future directions and projects that may be taken up by the author or other scientists.

A **Perceptual Relativity**
In this chapter, we compare special relativity to the so-called light travel time effect. This is mathematically rigorous description of the previous chapter, "Perception and Special Relativity." The overlap between the chapters, however, is kept to a minimum by using many examples and a different, more technical level of presentation. This chapter also presents two cosmological features of our observed universe that can be understood in terms of the light travel time effects. These features are the apparent expansion of the universe and the cosmic microwave background radiation.

B **Unreal Astrophysics**
Here we present a unified kinematical model for double-lobed symmetric radio sources and gamma ray bursts in the light of how we perceive motion. Gamma ray bursts can be viewed as an effect similar to the sonic boom in supersonic motion. The auditory world has another effect analogous to the radio sources. The model will show how these two phenomena are related. All the technical details of the model and comparisons between its predictions and observations are presented. The mathematical details are moved to a chapter appendix so that the main body of the chapter can be read without distractions.

C **Future Work**
The chapter on possible future projects is a challenge to any reader who may want to pursue our line of thinking. These are also projects that the author himself may take up either as thought exercises or future books, circumstances permitting. The projects listed are:

(a) Simulation of the observed redshift
(b) Celestial velocity distribution that explains the observed cosmic microwave background radiation (CMBR)
(c) Similarities between black holes and superluminal explosions
(d) Alternate explanations of Michelson-Morley Experiment
(e) Quasi-linear formulation of the light travel time effects
(f) Treating the covariance of Maxwells equations
(g) Integration of special relativity in general relativity
(h) Determination of the dimensionality of "space" in the absolute reality