

Perceiving is Believing: The Critical Role of Consciousness

Craig Philpot*

*Independent Researcher. Carlisle, Ontario, Canada.

*Corresponding author(s). E-mail(s): crackpotphilosophies@gmail.com

Abstract

Instead of being an “explanatory gap” for emergentism, phenomenal consciousness may be the key to reality’s existence. Whether they are the definition and rules for the Standard Model or the axioms of linear algebra, reality’s fundamental axioms must be established before it can exist. However, the mechanism that establishes such axioms is unknown and until it is identified, reality’s true nature will remain a mystery. This paper’s hypothesis suggests that reality’s fundamental axioms are established by the elements of phenomenal consciousness. Their unique ability to make perceived propositions into self-evident axioms (the perceiving-is-believing effect) is not a useless trick but a necessary step in the emergence of reality. Higher-levels of consciousness emerge from physical reality but the elements of phenomenal consciousness are seen as initiating emergence. Physical structures are, therefore, networks of phenomenal consciousness elements, thus explaining their relationship with phenomenal consciousness. This has broad implications, from eliminating the “explanatory gap” to artificial intelligence not becoming self-aware as a consequence of complexity. Also shown is how this accounts for the emergence of logic and mathematics, including linear algebra, calculus and integer numbers. The hypothesis does explicitly what the scientific method’s reliance on observation does implicitly, it establishes conscious experience as the arbiter of truth. The aims of this paper are to contribute to the conversation about the relationship between consciousness and reality and highlight a potential path towards a theory-of-everything. To this latter aim, the complementary nature with modern physics, particularly quantum information theory and the Copenhagen interpretation, is shown throughout the paper.

Keywords: Emergence, Explanatory Gap, Phenomenal Consciousness, Quantum Information, Philosophy of Mathematics

1. Introduction

Modern physics is, essentially, the search for the fundamental axioms of reality, where fundamental axioms (which include rules of inference) are the truths from which all other truths can be derived. With particle physics, the fundamental axioms include the definitions and rules for the elements of the Standard Model. For quantum information theory, the axioms define what quantum information is and rules that govern it [1], such as the law of conservation of quantum information [2, 3]. Unlike theories of modern physics, this paper’s hypothesis, the Critical Role

of Consciousness hypothesis (CRC), does not propose what the fundamental axioms of reality are but instead what mechanism establishes and maintains them. Understanding this mechanism could lead to deductions about the fundamental axioms of reality, helping to expedite the development of a theory-of-everything. The CRC is, therefore, not a competing theory of modern physics but a complement to theories of modern physics. For example, where quantum information theory asserts that the universe is fundamentally a network of relationships [1], the CRC suggests the nodes of the network are elements of phenomenal consciousness (P-elements).

The CRC is based on the idea that every system has a set of fundamental axioms which define the system itself and which cannot be established by the system. This premise applies even to seemingly natural systems like mathematics [4, 5] (e.g. Peano axioms in number theory). Although this premise is shared by postmodernism [6, 7], this paper's focus on the mechanism for establishing axioms, and not on the motivation behind said mechanism, leaves the postmodern debates on literature, culture, and politics out-of-scope, apart from an implication regarding consistency of fundamental axioms for all people. Rather than a focus on moral implications, the focus here is on the practical implications. Specifically, that a set of fundamental axioms must be established before any aspects of reality can emerge, including physical reality, logic and mathematics. So, even if the universe is fundamentally a mathematical object, as some hypotheses suggest [8, 9], reality still cannot exist until the axioms of mathematics have been established.

The CRC is an attempt to answer two questions that are unanswered by modern physics and emergentism: (1) how are the fundamental axioms of reality established; and (2) what is the relationship between physical reality and phenomenal consciousness. The link between these questions is reality's need for axioms and the ability of phenomenal consciousness to establish self-evident axioms. Some theories suggest the justification of phenomenal consciousness is evolutionary advantage [10, 11] but its true purpose may go beyond that. Phenomenal consciousness may serve a critical role in the emergence of reality.

2. Discussion

The next two sections are brief discussions related to the premises of the CRC, which are:

1. Reality cannot exist without the establishment of its fundamental axioms.
2. Consciousness, using the elements of phenomenal consciousness (EPC), has the unique ability to establish self-evident axioms.

2.1 Fundamental Truths of Reality

For aspects of reality including physical reality, logic and mathematics to exist, their fundamental axioms must be established. Some theories partially answer this question by suggesting one aspect of reality generates the axioms for another, such as consciousness emerging from physical reality[12-35] or physical reality emerging from mathematics [8, 9, 36].

However, this does not address the general problem of what establishes the fundamental axioms of reality. Reality cannot generate its own fundamental axioms because its existence is predicted on them [4, 37]. Another partial answer is that our reality is a virtual reality [38] with axioms established by the reality in which our simulation is running. But even if our reality is a nested virtual reality, it does not explain how the fundamental axioms for the primary reality are established. The only way for the fundamental axiom to be established is for them to be self-evident. This suggests that reality, which requires fundamental axioms, is reliant on a mechanism that establishes self-evident axioms.

2.2 Establishing Truths as Self-Evident

Where do the fundamental axioms of reality come from? The scientific method's insistence on confirmation-by-observation associates truth with observation. Even thought experiments are based on past empirical observation [39] and are generally subject to the scientific method's confirmation-by-observation. This is consistent with an aspect of observation being the source of self-evident truths.

Unfortunately, due to the scientific method's reliance on observation for verification, it is not scientifically possible to confirm if observation makes truths self-evident. However, there is anecdotal evidence found in the English language which links conscious experience to understanding [40]. For example, "do you see what I'm saying?" equates to "do you understand what I'm saying". There are even common expressions that explicitly equate a conscious experience with believing, such as "seeing is believing" [40]. Furthermore, philosophers such as Descartes and Levine reflect on the ability of the elements of phenomenal consciousness (e.g. qualia) to produce fact [41, 42].

One might say, it makes the way pain feels into merely brute fact [42 p. 357]

The ability of the elements of phenomenal consciousness to establish self-evident axioms is a premise of the CRC, albeit a scientifically unverifiable one. However, the general acceptance of the scientific method's reliance on observation, along with the anecdotal evidence discussed, suggests that this ability may be self-evident for many people. The establishment of axioms as self-evident may be the purpose of phenomenal consciousness, and its defining feature.

2.3 The Critical Role of Consciousness Hypothesis (CRC)

The premises of the CRC are:

3. Reality cannot exist without the establishment of its fundamental axioms.
4. Consciousness, using the elements of phenomenal consciousness (EPC), has the unique ability to establish self-evident axioms.

Rationales for each of these premises was covered in previous sections. The second premise could be considered a functional definition of consciousness, where consciousness is that which establishes self-evident axioms. The CRC follows from these premises and states:

The elements of phenomenal consciousness serve a necessary role in the emergence of reality by establishing its fundamental axioms.

With the CRC, reality is modeled as an axiomatic system. However, since axioms are a product of the elements of phenomenal consciousness (P-elements), it is these P-elements, not axioms, that are the fundamental elements of the CRC model. It is beyond the scope of this article to enumerate the P-elements. It is sufficient to understand these include qualia (e.g. pain, taste, redness) and non-qualia elements such as space, time and self. Although the definition of qualia continues to be debated [43], the details are not important for the discussion herein.

The CRC does not address questions like how consciousness came to be, how it creates P-elements or why it creates the types of P-elements that it does. Asking such questions would be like asking a quantum physicist what created the elements of the Standard Model and why those elements and not others. At best, the response would be, because those are the ones that work for our reality [36]. The CRC does, however, offer a model whose fundamental elements, unlike the elements of the Standard Model, are self-evident, at least to some. Even a physicist who believes 3D space is a perceptually-limited view of Hilbert space, still believes in the perception of 3D space.

The challenge for the CRC is in confirming whether phenomenal consciousness is an incidental byproduct of reality, merely reflecting reality's truths, or if it serves a crucial function by establishing the truths without which reality would not exist. The next few sections explore the sorts of axioms P-elements could establish for physical reality, mathematics and logic to emerge.

2.4 Physical Reality

When someone looks around and sees four walls, a floor and a ceiling, they believe they are in a room. Although informed by their conscious experience, this belief is not representative of the kinds of fundamental axioms established by P-elements. The distinguishing property of fundamental axioms is not that they are self-evident, but that they are not based on any other axioms. Higher-level beliefs can appear just as self-evident as the fundamental axioms on which they are based. The belief of being in a room is based, in part, on the definition of a room, which is a rule of inference. Similarly, the belief in each wall is based on the definition of a wall. The function of P-elements is not to establish these higher-level beliefs, but to establish the fundamental axioms of reality. Such axioms include those related to space, specifically the axioms of the vector space R^3 . These particular axioms are established for most, if not all, conscious experiences. As mentioned, space and self are P-elements and it is these particular

ones that provide the spatial axioms. Other P-elements, such as redness and pain, establish axioms related to vision, touch and even the axioms necessary for concepts like bad and worse. Once the P-elements have established sufficient axioms to describe the elements of the Standard Model, physical reality can emerge. Starting with quantum elements, then atomic elements, then molecules on up to observer embodiments. It is these observer embodiments, which include neurological structures, that are responsible for higher-level beliefs such as being in a room.

Theories of modern physics, atomic physics, chemistry and biology explain the emergence from quantum elements to observer embodiments. Whereas, the emergence of higher-level beliefs, and consciousness in general, is covered by theories of emergentism, which have been around for over a century [12-35]. Normally with emergentism, physical reality is presupposed and the creation of consciousness is explained as an emergent property of complex physical structures. However, there exists an ‘explanatory gap’ in trying to explain how phenomenal consciousness emerges from the physical brain [42]. Theories that this gap will eventually be closed are called weak emergence [19, 20] or emergence1 [17, 25, 26]. Contrary theories, that the gap will never be fully resolved, are called strong emergence [19, 20, 27, 34, 44], emergence2 [17] or radical emergence [24, 26]. Revonsuo summarizes the view of those who believe this gap will never be resolved:

Supporters of strong emergent materialism point to the fundamental differences between the subjective psychological reality and the objective physical (or neural) reality. The former includes qualitative experiences that feel like something and exist only from the first-person point of view; the latter consists of physical entities and causal mechanisms that involve nothing subjective or qualitative about them and exist from the third-person point of view or objectively. Nothing we can think about or imagine could make an objective physical process turn into or “secrete” subjective, qualitative “feels.” It is like trying to squeeze wine out of pure water: it is just not there, and there can be no natural mechanism (short of magic) that could ever turn the former into the latter [44, p. 30].

This ‘explanatory gap’ is avoided with the CRC because, although higher-level functions of consciousness are based on physical structures, P-elements are not. There is no attempt to “try to squeeze wine out of pure water” [44, p. 30], P-elements lay at the very base of emergence. The P-elements establish the fundamental axioms of physical reality, which leads to physical structures. Therefore these physical structures are, essentially, a network of P-elements. An observer’s phenomenal consciousness is simply the P-element network defined by their embodiment and is therefore the result of emergence. For example, the phenomenal experience of a headache results from a P-element network that includes the P-elements for pain, self and space. The idea that the physical world is fundamentally a network of relationships is not new but is the basic proposition of quantum information theory [1]. The CRC simply adds the

assertion that these relationships are between P-elements. This assertion provides the explanation for how reality's fundamental axioms are established and how phenomenal consciousness emerges.

The fundamental question of how the P-elements are created is not answered; But these elements no longer create an 'explanatory gap' and instead serve to explain reality's existence. Where other theories of emergentism presuppose physical reality and fail to explain the creation of phenomenal consciousness, the CRC presupposes the P-elements and explains the creation of physical reality and the emergence of phenomenal consciousness.

The CRC's explanation for the emergence of physical reality and consciousness relies heavily on existing theories of emergence, modern physics and other branches of science. These existing theories deal with the complexity of mapping the CRC's model of reality (as an axiomatic system) to the more common models of physical structures and consciousness. The explanations for the emergence of mathematics and logic do not suffer from this same model mismatch, as these are often viewed as axiomatic systems. The next few sections discuss the emergence of mathematics and logic, which provide the foundation for discussions of time and modern physics.

2.5 Mathematics

The "unreasonable effectiveness" of mathematics to predict the natural world [45] has led to ideas that physical reality emerges from mathematics [8, 9, 36]. The CRC offers the alternative explanation that physical reality and mathematics emerge from the same fundamental axioms, which are established by the P-elements.

If P-elements establish the axioms of $\mathbb{R}^3$ (see section 2.4) then shouldn't linear algebra be self-evident? Why isn't the Pythagorean theorem self-evident? Like all mathematical theorems, the Pythagorean theorem is a derived axiom (specifically a derived rule of inference) not a fundamental axiom. That is, it is the combination of a set of rules of inference expressed as a new axiom. This is made evident by mathematical proofs, which validate a theorem by exposing an equivalent set of self-evident axioms. The Pythagorean theorem need not be self-evident because it is not one of the fundamental axioms of $\mathbb{R}^3$ and therefore not directly established by P-elements. P-elements only establish the most fundamental axioms of mathematics, from which derived axioms lead to the various branches of mathematics including linear algebra, calculus, and integer mathematics.

There is no realm where the set of all integer numbers exist as individual elements [6] but instead P-elements create the potential for all integer numbers. For positive integer numbers, this is done by establishing the axioms necessary for the number 1 and the rule of inference that is integer addition. This rule of inference is recursive, meaning it can be applied to the axioms/numbers it

generates. Since the recursion is boundless the set of potential numbers is infinite. Additionally, new rules of inference, such as multiplication, can be derived from these axioms and others like those of the vector space R^2 (a subspace of R^3 established by the P-element space). For calculus, the rule of inference for division is also recursive, leading to the potential for boundless subdivision. This leads to the concepts required for calculus such as limits and infinitesimal values. The set of all possible numbers is like the set of all possible shapes or objects, the P-elements establish the axioms necessary for them to exist but only a subset exists at any given moment.

It should not be surprising that the axioms of physical reality and mathematics should be found in P-elements. After all, our understanding of each was derived from conscious experience, including the observation of scientific experiments and logic. And as we will see in the next couple of sections, axioms of logical reasoning are themselves established by P-elements. The purpose of these last two sections is to illustrate the distinction between fundamental axioms, which are established by the P-elements, and axioms which are established by observer embodiments or mathematical proofs. By limiting the responsibility of the P-elements to fundamental axioms, the CRC does not conflict with established branches of science, such as neurology or quantum mechanics. Instead, it complements them by adding a layer below mathematics and theories of modern physics. A layer that does explicitly what the scientific method's reliance on observation does implicitly, it connects scientific models to the self-evident truths established by conscious experience.

2.6 Logic

The purpose of logic is to derive new axioms from existing axioms. Once logic has derived new axioms, those axioms can be used to derive yet more axioms. But logic cannot generate its first axiom until an initial set of axioms, including at least one rule of inference, has been established. To illustrate how each component of a deductive argument relates to P-elements, consider the following deductive argument.

I am in Ontario, Ontario is in Canada, therefore, I am in Canada.

The components of a logical argument are: two premises, one conclusion, and one rule of inference. In the example argument, the premises are “I am in Ontario” and “Ontario is in Canada”, the conclusion is that “I am in Canada”. The rule of inference, which is implied by the format of a logical argument, is a rule of containment; Specifically, that if A is contained in B and B is contained in C then A is also contained in C.

An argument is valid iff the conclusion must be true when the premises are true. In other words, iff the rule of inference is an axiom. This means the conclusion is an axiom iff the rule of inference and the premises are axioms. The CRC asserts that all axioms come directly or

indirectly from P-elements, meaning the premises and the rule of inference for any true conclusion stem from self-evident axioms established by P-elements. Given that physical reality, and our conceptualization of it, stems from P-elements (see section 2.4) it follows that the premises stem from them as well. What is left to explain is how the rule of inference relates back to P-elements.

In this example, the rule of inference is based on a property of vector space. As discussed in section 2.4, the axioms of vector space, specifically $\mathbb{R}^3$, are established by the P-elements of self and space. People accept the above example's rule of inference because they can consciously perceive it through visualization or other conscious experience. With the CRC, logic is seen as emergent from P-elements, for without P-elements to establish an initial set of axioms, logic would have no axioms or rules of inference on which to build upon.

2.7 Inductive Logic

Inductive logic is distinct from deductive logic in that its rules of inference, and consequently its conclusions, are not absolute. Inductive arguments have a quality of *strength* rather than validity. Where, given true premises, strong arguments have a high probability of a true conclusion but not certainty. For inductive logic to exist there must be at least one rule of inference that is probabilistic. Furthermore, since the product of absolute axioms is another absolute axiom, there must be at least one fundamental axiom that is probabilistic. Therefore, for consciousness to provide the axioms necessary for inductive logic there would need to be at least one fundamental axiom established by a P-element that is probabilistic.

Perceiving is believing in absolute terms when it comes to P-elements unrelated to time. Across time, however, uncertainty emerges. Conscious experiences related to time, such as regret, recall-memory, fear, and hope, expose the axioms of a fixed past, experienced present and uncertain future. This uncertainty is expressed in adages like “you never know what the future holds”, in quantum's uncertainty principle [46] and in quantum's probability wave equation [47]. Even scientific theories of time being eternal do not suggest that the perception of time is of a deterministic future. Instead they deal with the axioms of the past, present and future by: first, distinguishing the perception of time from eternal time and referring to it as an illusion [48]; then by introducing concepts like parallel universes to account for alternative futures [8, 36, 49, 50, 51] The lack of certainty for predictive logic comes from the axioms of an uncertain future, which comes from the P-element time.

Not all forms of inductive logic are so obviously related to time as predictive logic is. However, all inductive logic is based on the principle of the uniformity of nature, which is based on experiences across time [52]. Therefore, the P-element time could be the source of uncertainty for all types of inductive logic.

2.8 Quantum Physics

The probabilistic nature of time and absoluteness of each moment, as discussed in the previous section, are directly reflected by the Copenhagen interpretation of quantum physics (CI). With the CI, the state of the universe is described in terms of probability waves, which collapse at moments of observation [47]. Essentially, the probability wave equation quantifies the probabilistic axioms related to the P-element time. And the collapse of probability waves at the moment of observation reflects the fact that observing a moment implies ignoring the P-element of time, leaving only absolute axioms. With only absolute axioms on which to deduce the state of the universe, the state is interpreted as being absolute and no longer containing probability waves. Despite this compatibility with the CI, the CRC is compatible with competing interpretations and theories of modern physics. Because the CRC does not assert what reality's fundamental axioms are, it is compatible with all concepts including spacetime and parallel universes [8, 36, 49, 50, 51, 53].

When it comes to modeling the state of the universe, the CRC is similar to quantum information theory (QI). Both model the state of the universe as a set of relationships (a network) [1]. With QI, the nodes are not identified and the focus is on their relationships alone [1]. The CRC adds to QI's model of the universe by suggesting these nodes are P-elements. A further complement to QI can be found through a reinterpretation of quantum information, which is described as answers to yes/no questions [1]. If these are reinterpreted as axioms, such that 'yes' is represented by an axiom and 'no' by a contradictory axiom, then physical reality becomes an axiomatic system that is based on reality's fundamental axioms. For QI, these fundamental axioms are those that define quantum information and the laws that govern it. With the CRC, the fundamental axioms are those which are established by P-elements, including that of time. Thus CRC suggests that QI's definitions and rules, such as the law of conservation of quantum information [2, 3], are established and maintained by P-elements.

2.9 Potential Implications

As discussed, the CRC is compatible with quantum physics, particularly quantum information theory and the Copenhagen interpretation. Additionally, the CRC predicts that the ultimate theory-of-everything would be the definition of an axiomatic system with all and only the axioms implied by P-elements. Additional axioms would result in a theory that predicted truths not possible in reality; whereas missing axioms would result in a theory that could not prove all truths of reality. This aligns with the approach implied by the scientific method's reliance on observation and fortifies the assertion that theories should be based on observable phenomena. P-elements, however, are not limited to those measurable by calipers, thermocouples or other scientific instruments [43]. To uncover all of reality's fundamental axioms, all P-elements, including those of emotion, thought and morality, should be philosophically and, to the degree that they can, scientifically analyzed to determine what fundamental axioms they establish.

Another prediction of the CRC is that observers share the same fundamental axioms insofar as they share types of P-elements. This means, the fundamental axioms of reality are arbitrary iff types of P-elements are arbitrary. Given that understanding only exists where there are shared axioms, then the generally universal ability for a person to learn mathematics, and logic, implies that types of P-elements are relatively similar between people. Other animals' inability to reason may suggest that they lack the axioms of causality. Without these axioms there is no distinction between causal and coincidental correlations. This could suggest animals lack a P-element, which humans have. Another explanation could be that they have the fundamental axioms of causality but do not derive axioms from them.

Like animals, AI systems do not reason. Instead, vast amounts of data is used with the expectation that patterns in large datasets will be primarily influenced by causal relationships rather than coincidental correlations. The ability of AI systems to make human-like deductions and even human-like responses [54], is explainable without AI systems having conscious experiences [55, 56, 57, 58]. Rather than self-evident axioms established by P-elements, AI systems are based on axioms established by AI programmers. Furthermore, with the disconnect between P-elements and the axioms of AI systems, the CRC predicts that AI will not develop its own consciousness as a result of computational complexity.

3. Summary

This paper's aim is to answer two questions that are unanswered by modern physics or theories of emergentism: (1) how are the fundamental axioms of reality established; and (2) what is the relationship between physical reality and phenomenal consciousness. The CRC answers both these questions by suggesting that P-elements establish reality's fundamental axioms. These fundamental axioms form the bases for mathematics, logic and physical reality. With phenomenal consciousness resulting from the formation of P-element networks, which are encoded as physical structures and are the result of emergence. These P-element networks are consistent with QI's view that the universe is fundamentally about relationships [1]. Theories of modern physics imply reality is an axiomatic system, by assuming it can be described by propositions, and theorize about what its axioms are. The CRC, on the other hand, tries to explain how an axiomatic reality can exist. For example, quantum information theory asserts the law of conservation of quantum information [2, 3], whereas, the CRC asserts that such a law must be derived from axioms established by P-elements. In this way, the CRC is not a new model of modern physics but may aid in the development of them. If the CRC is correct then analysis of all types of P-elements, with the goal of identifying the fundamental axioms they make self-evident, would be a rational approach to formulating a theory-of-everything.

Statements and Declarations

The author has no relevant financial or non-financial interests to disclose.

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