Our Phenomenal Universe

Resolving the Mind-Body Problem

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Abstract

Many philosophers argue that the mind-body problem is unresolvable, that there are irreconcilable differences between the physical world and the way the mind experiences it. Several others argue that the problem represents an incompleteness of the Galilean view, which conceptually divides the world into two models (physical and consciousness). Recent debates have centered around a proposal to radically alter the physical model to account for the mind-body relationship. However, critics argue that the general approach is flawed and that the specific proposal results in a 'messy' and highly complex model with inconsistencies with well-known phenomena. This paper, first, critically examines the argument that the general approach is flawed. Then this paper argues that the proposal is much broader than necessary and that the aspects required to resolve the mind-body problem are already present in the physical model. This results in, I argue, a resolution to the mind-body problem without increased complexity for either model or the aforementioned inconsistencies.

Statements and Declarations

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1. Introduction

The Galilean revolution divided the world into two distinct conceptual models, the physical model and that of consciousness. Since then theories of emergence have been developed to explain the relationships between the physical brain and the conscious mind. These theories show how nearly all aspects of consciousness including subjective experiences are explainable in terms of the physical model (e.g. neurological structures) (Feinberg & Mallatt, 2020). However, as Feinberg and Mallatt (2020) concluded there remains what Levine (1983) referred to as the 'explanatory gap' when it comes to an explanation for *phenomenal experience* (a.k.a the mind-body problem, the hard problem of consciousness). Phenomenal experience relates to the qualitative aspects of experience, such as how pain feels (Tye, 2021; van Gulick, 2022). Attempts to deconstruct phenomenal experience into a set of irreducible elements has not yet reached a consensus (Tye, 2021). However, there is a general consensus that the set of irreducible elements of phenomenal experience (p-elements) includes qualia (e.g. pain, taste, redness) and elements related to structural aspects such as space, time and self (Tye, 2021; van Gulick, 2022). The common modern view maintains that the irreducible p-elements belong solely to the consciousness model. However, the irreducibility of these p-elements prevents them from being emergent (Revonsuo, 2009), leading many philosophers to argue that the explanatory gap will never be resolved.

One opposing view is what Cutter (2022) refers to as 'anti-modernism'. This view, championed by Shoemaker (2003), Kalderon (2007) and Allen (2016, ch. 9), asserts that the Galilean physical model is incomplete and should include irreducible p-elements (a.k.a. secondary qualities, irreducible phenomenal properties). However, Cutter (2022) argued that the explanatory gap is not resolved even if p-elements are included in the physical model. Although this general argument is disputed in section 2, Cutter's (2022) other arguments provide compelling reasons against adopting anti-modernism.

The anti-modernist approach (like that of emergence in general) seeks to make the consciousness model a higher-order abstraction of the physical model. That is, the approach implies that the physical model should model reality in its entirety, with the consciousness model providing only higher-order concepts, based on the physical model's concepts. Given that all conceptual models are mental constructs this is a valid approach but as Cutter (2022) explains, it does come with costly trade offs. Specifically, added complexity for the physical model. As long as aspects of consciousness can be explained by relationships between existing elements of the physical model (as with established theories of emergence) there is no such tradeoff. However, the anti-modernists' proposal to add p-elements to the physical model does introduce complexity. Essentially, this would undo some (or all) of the benefits of having defined these two separate models (see section 2).

Fortunately, making the consciousness model a higher-order abstraction of the physical model is not the only way to resolve the explanatory gap. Another obvious approach would be the idealists approach of making the physical model a higher-order abstraction of the consciousness model but this would likely have similar tradeoffs. Instead, this paper offers an alternative which avoids complicating either model. This alternative drops the presumption that either model is a complete model of reality. Instead, both models are simply considered to be models of the same underlying system (reality), with the physical model abstracting away qualitative aspects (e.g. how pain is felt) and the consciousness model focusing on them. The basic idea behind this approach is that when the world was conceptually divided into these two models, some fundamental aspects of reality were included only within one or the other model. This would result in some aspects of the physical and/or consciousness model not being explainable by the other model - hence the explanatory gap. This fits with the basic anti-modernist's assertion, expressed by Shoemaker (2003), that the physical model is incomplete. However, I argue that it need not be complete because although phenomenal experience cannot be explained by either model, it can be explained by considering both models and their relationship.

When an aspect (such as phenomenal experience) is unexplainable by either model it may still be explainable by considering the relationships between the models. For example, the laws of physics could be contained solely within the physical model but relationships within the underlying system (reality) could cause these laws to govern what is phenomenally experienced. Such relationships can expose elements of the underlying system that are partially expressed in each model. Once identified these elements can be wholly incorporated within one of the models (as suggested by anti-modernists) or their partial expressions can be linked via a relationship between the models.

This paper takes that latter approach by, first, showing how p-elements are already partially expressed in the physical model. Meaning p-elements are included in both models but are simply conceptualized differently within each model. Then, this paper shows how this existing partial expression of p-elements is sufficient to realize the goals of anti-modernism. Meaning, the physical model need not be extended since it already contains the aspects of the anti-modernists' proposal necessary to resolve the explanatory gap. By resolving the explanatory gap without altering either model, the models are spared any additional complexity and no inconsistencies with current theories are introduced.

2. Anti-modernism

Anti-modernism grew out an idea put forth by Shoemaker (2003) and built upon by Kalderon (2007) which asserts that the excluding of qualitative aspects from the Galilean physical model is the source of the explanatory gap. Kalderon (2007) argues that (qualitative aspects of) colors are not mere mental effects but are mind-independent properties of physical objects and should be included in the physical model. Although Kalderon and others focus on the p-elements of color (and frame the debate as a 'color-body' problem) their arguments are, as Cutter (2022) points out, understood to be generalizable to all p-elements. Kalderon's proposal is basically to extend the physical model to fit the evidence - to account for the existence of phenomenal experience by adding its irreducible elements to the physical model. Cutter (2022) offers several compelling arguments against anti-modernism, including a general argument that challenges the basic idea that adding p-elements to the physical model could resolve the explanatory gap.

> [W]e can conceive of zombie worlds—worlds physically like our own, but devoid of experience—we can also conceive of chromatically enhanced zombie worlds—worlds physically like our own, and in which material surfaces are imbued with colors, but where no one experiences these colors (or anything else). (Cutter, 2022, p. 7)

The argument is based on the premise that the ability to 'conceive' a chromatically enhanced zombie world without any associated experiences implies that phenomenal experience would not emerge from such a world. I argue that the act of conceiving this world is the act of imagining it (in the so-called mind's eye), which is itself a phenomenal experience (though not as vivid as actually being in such a world). One cannot add imaginary color to an imagined world without experiencing the imagined color. For example, one cannot conceive of a pink elephant through any means other than a phenomenal experience of imagination. This means that Cutter's (2022) explicit premise that one can conceive of worlds without an associated experience is not necessarily true.

One could argue for Cutter's (2022) position by suggesting that the mind's eye acts as an outside observer and that phenomenal experiences of the imagination do not imply there would be a phenomenal experience within the world. By conceptualizing the mind's eye as an outside observer, the mind's eye takes on the role of a subject that is outside of the zombie world's physical reality. However, as Cutter (2022) pointed out, the idea that consciousness is an outside subject is precisely the point of contention between the modern view and anti-modernism. In effect, this stance presupposes the modern view and so cannot be used to invalidate the anti-modernist view; It only shows that the modern and anti-modern views are incompatible.

Rather than conceiving this world to test anti-modernism the scenario can be logically analyzed. To imbue material surfaces with color is to add p-elements to the world. Phenomenal experience is a composition of p-elements but one, perhaps, which requires certain types of p-elements. For example, a phenomenal experience may require the p-elements of space, time, self and possibly at least one qualia. If true, no phenomenal experience would emerge from the chromatically enhanced zombie world but one would be formed if the right types of p-elements were added. In simple terms, if all elements necessary to realize phenomenal experiences were included in the physical model then by definition, phenomenal experiences would be explainable in terms of the physical model.

However, this assertion only supports the general idea that including p-elements in the physical model could resolve the explanatory gap. There remains the challenge of determining how to incorporate the p-elements into the physical model such that existing relationships within the physical model are preserved and the proper relationships with p-elements are established. Cutter's (2022) more detailed critiques about the specific proposed changes to the physical model are compelling, including exposing contradictions with well-known phenomena.

Furthermore, Cutter (2022) argues that even if these contradictions were resolved the costs outweigh its benefits. Cutter (2022) argues how the proposal results in a radically altered, 'messy' and overly complicated physical model. Such alterations could necessitate the re-evaluation and potentially a reformulation of existing theories across modern physics (to express them in terms of a radically altered physical model). Rather than risking such an immense cost this paper offers an alternative approach to resolving the explanatory gap. As will be discussed, this alternative does not alter the physical model and it avoids the contradictions with the well-known phenomena identified by Cutter (2022).

3. Formulation of physical models

The physical model relates to the quantifiable truths of reality. This is most obvious with Wheeler's (1989) quantum information theory (the so-called it-from-bit theory), which models reality as fundamentally being a set of quantifiable true/false propositions. It is also implied by the way all theories of modern physics are formulated - as quantifiable assertions and predictions (e.g. mathematical formulas). These quantifiable assertions and predictions, effectively, conceptualize reality as a set of quantifiable truths. The validity of this presumption is evident by modern physics' predictive excellence. In terms of physical models, without quantifiable truths reality is uninterpretable and essentially meaningless.

However, as Kant argued, no physical model can fully account for the existence of quantifiable truths (Tasi, 2001). This limitation relates to the nature of physical models and applies to all physical models including those of modern physics (Tasi, 2001). In fact, as will be discussed, even the most comprehensive physical model theoretically possible, a so-called theory-of-everything (TOE), would be incapable of fully accounting for the existence of quantifiable truths. Although a full ontological accounting of quantifiable truth is beyond the scope of this paper, the implications of this missing account are shown to relate to the elements of phenomenal experience (p-elements), in such a way that resolves the explanatory gap.

Reality's truths include everyday truths, such as being in a room while reading a scientific paper, to the low-level truths that govern quantum systems. High-level truths, such as being in a room, come from lower-level truths, such as the truths of being surrounded by walls. Furthermore, being surrounded by walls comes from lower-level truths such as those that define what a wall is, which comes from even lower-level truths right down to the axioms of vector spaces. For modern physics this deconstructive nature of truths is an important quality. It is the basis for the reductist effort which has resulted in many submodels within the physical model (e.g. cosmic, biological, molecular, atomic, quantum). These submodels describe physical systems from the cosmic to the quantum scale. The ultimate goal of these reductionist efforts is to develop a model consisting of fundamental physical truths. Fundamental physical truths are a set of truths from which all other physical truths can be derived. Such a model would be a TOE, capable of modeling all physical systems at any scale of existence (from the quantum to the cosmic).

Proposed models for developing into a TOE include the Standard Model, quantum information theory and Tegmark's (2008) mathematical universe hypothesis. However, even a TOE has its limits; Despite how many physical truths could be derived, some truths would relate to the contingent propositions of the model. These are the propositions that define the model itself. For example, the Standard Model's contingent propositions define its elements and the rules that govern them. Even a TOE cannot prove its own contingent propositions and they cannot be proven by another physical model. This is because, as Kant argued, either approach entails a self-referencing paradox (Hirsch, 1996; Tasi, 2001), which as detailed by Wormell (1958) is unresolvable. A TOE's contingent propositions can only be confirmed (as contingent truths) experimentally. For a TOE, its contingent truths would represent fundamental physical truths. Therefore, even with a TOE, fundamental physical truths are necessary but unaccounted for.

Although nothing in the physical model can account for fundamental physical truths, inferences about what accounts for them can be made from the physical model. Being a prerequisite for the physical model, fundamental physical truths can only be accounted for by entities fundamental to the physical model. Since, by definition, the physical model encompasses everything that is quantitative, these entities must be non-quantitative in nature. In general, the nature of an entity that is fundamental to a model cannot be expressed by the model. However, their effects can be expressed within the model, as properties of the model's entities that they affect. In this case only one effect is known, the existence of fundamental physical truths. In order to represent this effect a property would need to be an indicator of existence. Furthermore, because the effect comes from entities external to the physical model, the property would need to indicate existence in its own right. That is, the property alone would be sufficient to affirm existence, without any other quantifiable indicators. This property could belong to any truth, fundamental or not. This is because a non-fundamental truth represents a set of underlying fundamental truths, including effects they are subject to. Therefore, the property would be associated with truths and would indicate if a truth existed in its own right. Such a property does exist; it is the property of being self-evident. That is, the property of being self-evident is a representation of the entities' known effect. Therefore, the following can be inferred about any entity that accounted for fundamental physical truths; They are non-quantitative in nature and make truths self-evident.

Therefore, given the physical model's need for fundamental physical truths, the physical model implies the existence of non-quantitative entities which establish self-evident truths. Furthermore, these entities, which account for fundamental physical truths, would be fundamental to all *physical entities*, where physical entities are any truth expressed by a physical model. Physical entities are any physical truths including the existence of physical objects/structures and their properties. Often these are conceptualized as physical systems and their state(s).

As identified and reflected upon by such influential philosophers as Descartes (1991) and Levine (1983), establishing self-evident truths is the defining quality of p-elements.

> One might say, it makes the way pain feels into merely brute fact.
> (Levine, 1983, p. 357)

This defining quality is the source of common expressions like 'seeing is believing'. Essentially, phenomenal experiences function to make propositions self-evident (Levine, 1983; Descartes, 1991). In fact, a qualitative experience is both sufficient and necessary to make a proposition genuinely self-evident (Levine, 1983; Descartes, 1991). For example, one self-evidently believes they are in a room iff they qualitatively perceive walls around them. Such a truth is a higher-level truth based on lower-level truths which are established by the qualitative aspects of the experience's p-elements. For example, the p-elements of self and space along with quali for the color of the walls could establish lower-level truths to make the proposition of being surrounded by walls self-evident. Without any p-elements there is no qualitative experience and subsequently no self-evident propositions (Levine, 1983; Descartes, 1991).

Since qualitative experience is necessary to produce a genuinely self-evident truth, the aforementioned non-quantitative entities that establish self-evident truths must be qualitative in nature. Having a qualitative nature is the definition of a p-element (Tye, 2021; van Gulick, 2021). Therefore, these aforementioned entities, which are fundamental to all physical entities, must be definitionally equivalent to p-elements. That is, for all intents and purposes these entities are p-elements. Meaning, p-elements are fundamental to physical entities. This deduction is the key to resolving the explanatory gap. To affirm its validity it is deduced again but starting from the way scientific models are developed rather than formulated (see section 5). But first, its compatibility with ontological philosophies is assessed.

4. Nature of reality

No particular ontological philosophy is inferable from the preceding analysis. The key deduction, that p-elements are fundamental to physical entities, is compatible with both realism and idealism. For idealism, instead of consciousness as a whole giving rise to reality, p-elements would establish fundamental physical truths and consequently all physical truths. With this philosophy p-elements would be seen as the fundamental elements of reality and fundamental to all physical states. For example, the physical state of being in a room would be the direct consequence of a set of p-elements that included space, self and various qualia. Despite p-elements, which are part of consciousness, being fundamental to physical entities, this is shown to be compatible with an emergent nature of consciousness (see section 7).

Other philosophies, including realism, assert that reality's existence is not contingent on consciousness. Nothing in the previous analysis implies otherwise. In fact, reality could even exist without p-elements. However, without p-elements providing fundamental physical truths, reality would be in an indeterminate state. That is, without p-elements reality could exist but only with potential states, not any well-defined states. In quantum physics, reality is often modeled as being indeterminate whereby it has only potential states (Everett, 1957; DeWitt, 2015; Myrvold, 2022).[1] Quantum interpretations offer explanations for why reality is modeled as indeterminate but perceived to be well-defined by observers (Everett, 1957; DeWitt, 2015; Myrvold, 2022). Furthermore, the ontological claims of the most established interpretations assert that reality does in fact exist in these indeterminate states.[2] A full ontological account of indeterminate states is beyond the scope of this paper. It is sufficient to understand that the assertion that reality is indeterminate without p-elements is as compatible with realism as interpretations of quantum physics are. Therefore, the assertion that p-elements are fundamental to physical entities does not imply a particular ontological philosophy and is compatible with idealism and realism.

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[1] Quantum's probability wave equation is used to model reality as indeterminate (Everett, 1957; DeWitt, 2015; Myrvold 2022). This equation does not compute well-defined states, only probabilistic ones (Everett, 1957; DeWitt, 2015; Myrvold 2022).

[2] Only hidden variable theories make the ontological claim that reality never exists in an indeterminate state (Myrvold, 2022).

5. Development of scientific models

The deduction (from section 3) that *p-elements are fundamental to physical entities* can also be derived from the way models of modern physics are validated. That is, from how a model's contingent propositions are confirmed and become contingent truths. All scientific models are developed based on the scientific method and its insistence on confirmation by observation (Hepburn & Andersen, 2021). Within the bounds of scientific inquiry there are two sources of truth: mathematics (including logic) and observation (Hepburn & Andersen, 2021). With mathematics this includes things like mathematical proofs and logical deductions (Hepburn & Andersen, 2021). However, all mathematical and logical truths are based on a set of axioms.[3] These axioms were, and continue to be, confirmed by observation - both scientific and otherwise (Engels, 1976; Hirsch, 1996). Therefore, ultimately all contingent truths of scientific models are confirmed by observation.

Although measurement devices can stand in for a conscious observer, their validation must ultimately trace back to a conscious observer(s). This is because only a validated device or a conscious observer can validate a device. So, the primary validated device(s) in any lineage (of validated devices) can only be validated by a conscious observer. Such lineages can be long and complex with the related conscious observations far removed from the scientific experiment. For example, a device may be accepted as valid based on inductive logic such as that it came from an assembly-line where a percentage of the devices (or their design) were validated. This not only links the device's validation to that of the other devices but pulls in the principle of uniformity of nature. This principle underlies all inductive logic and is based on countless conscious observations (Hume, 2011). The role of the conscious observer is to extract truths from an experience, truths that are expressed qualitatively within the experience. That is, observers identify self-evident propositions within a phenomenal experience. By giving conscious observers this role, the scientific method establishes phenomenal experience and consequently p-elements as the arbiters of truth.

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[3] Mathematics is ultimately based on the axioms of elementary mathematics (Hirsch, 1996; Horsten, 2023). Logical axioms are its rules-of-inference, which are implicit in the syntax of a logical statement.

A scientific model's contingent truths are, therefore, associated with p-elements, the p-elements related to their validation. Meaning, p-elements are represented in every scientific model as its contingent truths. The contingent propositions of a theory go beyond its explicit propositions. They often appear in abstract forms such as mathematical formulas or logical statements. As discussed, mathematical and logical truths ultimately trace back to observed truths. Therefore, mathematical formulas and logical statements are, essentially, an abstract way of expressing their underlying observed truths. Since observed truths represent p-elements, this essentially is a way of modeling p-elements. Therefore, scientific models model p-elements as contingent truths, which are expressed as propositions, mathematical formulas and logical statements.

For example, all theories based on quantum's probability wave equation are implicitly contingent on the axioms of probability theory, a theory related to the p-element time.[4] Therefore, quantum's wave equation models the p-element time. Similarly, the p-element space is modeled in any theory that includes logic contingent on the axioms of vector spaces. For example, the p-element space is modeled as logical statements such as: A is contained in B and B is contained in C therefore A is contained in C. Although these abstract ways of representing a p-element obfuscate a model's dependency on the p-element, the p-element is nevertheless represented in the model. By being modeled as contingent truths, p-elements are modeled as fundamental to any physical entities inferred by the model. This matches the deduction from section 3 that p-elements are fundamental to physical entities.

6. Phenomenal models

P-elements are therefore (partially) modeled in both the physical and consciousness models but are simply conceptualized differently in each. For the physical mode p-elements' qualitative aspects are abstracted away and they are conceptualized as the self-evident truths that they establish. For the consciousness model the qualitative aspects are modeled as qualia and structural aspects of phenomenal experience (Tye, 2021; van Gulick, 2022). The physical and consciousness models can, therefore, be seen as two ways of modeling the same entities (p-elements) within the same system (reality).

[4] To deal with systems involving time, mathematics had to be expanded to include probability theory (Hirsch, 1996).

This can be expressed in modeling terms as reality containing a set of p-elements. However, phenomenal experience is not merely a collection of p-elements but a set of *related* p-elements (van Gulick, 2021). That is, it is a p-element network (p-network). The relationships within a p-network must exist in reality. This would extend the model of reality to that of a p-network.

A model which included p-networks and the set of irreducible p-elements would be a fully-comprehensive physical and consciousness model. For the physical model, the contingent truths of a TOE would be represented by the irreducible p-elements (which account for fundamental physical truths). For the consciousness model, given a TOE, theories of emergence would account for all aspects except phenomenal experience (Feinberg and Mallatt, 2020), which would be covered by the p-network. This assertion is summarized by a hypothesis I call the Phenomenal Universe hypothesis (PUH), which states that: Reality is a network of p-elements. The PUH summarizes the relevant analysis so far and will be used in the next section as a model for resolving the explanatory gap.

For the physical model, which models p-elements as contingent truths, a p-network is a network of truths. Therefore, reality can be seen as a network of truth propositions. This is essentially equivalent to quantum information theory which models reality as a network of true/false propositions (Wheeler, 1989). False propositions would simply be reinterpreted as contradictions to a true proposition. Furthermore, the subset of propositions within a p-network that are of a mathematical nature would themselves constitute a set of related propositions. Such a set of related propositions, being of a mathematical nature, would constitute a mathematical object (Lane, 1996). Therefore, when considering only propositions that are of a mathematical nature, reality can be considered a mathematical object. This is the basic assertion of Tegmark's (2008) mathematical universe hypothesis (MUH). However, the details about reality's structure described by the MUH are not assumed here. The PUH complements these theories by providing a compatible physical model that is fundamentally linked to the consciousness model.

7. Explanatory gap

As Feinberg and Mallatt (2020) concluded, theories of emergence explain all aspects of consciousness apart from phenomenal experience. This missing explanation is what Levine (1983) referred to as the 'explanatory gap'. Theories that this gap will eventually be closed are called weak emergence (Bedau, 1997) or emergence1 (Searle, 1992; Feinberg, 2001, 2012). Contrary theories, that the gap will never be fully resolved are called strong emergence (Bedau, 1997; Chalmers, 2008; Clayton & Davies, 2008; Revonsuo, 2009), emergence2 (Searle, 1992) or radical emergence (Feinberg, 2001; van Gulick, 2001). 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.
> (Revonsuo, 2009, p. 30)

If phenomenal experience is emergent then Revonsuo's argument would suggest that physical reality must contain the ingredients for phenomenal experience (i.e. p-elements). This aligns with the assertion that p-elements are fundamental to all physical entities. This assertion was deduced twice in the preceding analysis (see sections 3 and 5) and is the basis for the PUH.

The existence of a physical entity is a physical state, which is a higher-level truth. A basic premise of the philosophies of science, mathematics and logic is that higher-level truths represent relationships between lower-level truths. For example, mathematics proofs show how a higher-order truth (the theorem) equates to relationships between a set of lower-order truths (e.g. elementary mathematics). Therefore, a physical entity is a network of truths.

With the PUH this is realized by a p-network, which, in the consciousness model, corresponds to a phenomenal experience. Essentially, a physical entity and a phenomenal experience are alternative representations of the same thing, a p-network. Structurally, a physical entity and its associated phenomenal experience would be identical because they are based on the same relationships (those of the p-network). This eliminates the explanatory gap by offering an explanation for the causal link between physical entities and phenomenal experiences. However, rather than one being the cause of the other they have a common cause, the existence of the p-network they both represent. Therefore, instead of consciousness emerging from physical entities, they emerge simultaneously.

8. Subjective experiences

In Cutter's (2022) arguments against anti-modernism he points out contradictions with well-known phenomena related to subjectivity. These arguments show that subjectivity contradicts Kalderon's (2007) main assertion, that physical objects are imbued with irreducible p-elements.

One such phenomena is what Cutter (2022) calls 'arbitrariness' whereby different observers looking at the same object may experience its color differently; where one might see it as green others might see yellowish green or bluish green. This phenomena relates to a basic assertion of neurology, that the relationship between the external objective world and our perception of it is not direct. Instead, the external world affects our neurology which in turn produces our perceptions. This means, it is the structures of the physical brain not the objects themselves that correspond to our phenomenal experiences.[5]

[5] This became an active area of research in neurosciences after Moruzzi & Magoun (1949)'s discovery of the cerebral activating and alerting functions of the brainstem's reticular formation.

With the PUH, a well-defined physical object is a set of related true propositions (a p-network) that define the object's properties. These propositions are dependent on fundamental physical truths and therefore on irreducible p-elements. However, physical objects can exist in states that are not well-defined (as can reality as a whole - see section 4). It is only in forming a phenomenal experience that a physical object is associated with irreducible p-elements and becomes well-defined. Therefore, well-defined physical objects are specific to a phenomenal experience and therefore to an observer. This allows for subjectivity and contradicts Kalderon's (2007) assertion that physical objects are imbued with irreducible p-elements. Thus addressing Cutter's (2022) arguments regarding arbitrariness and subjectivity in general.

9. Summary

The anti-modernism proposal to add p-elements to the physical model may allow phenomenal experience to be explained in terms of the physical model. However, the specific proposal contradicts well-known phenomena and 'radically' alters the physical model (Cutter, 2022). I argue that this cost and these contradictions are avoidable because p-elements are already included in all physical models. In these models, p-elements are modeled as contingent truths which are expressed as propositions, mathematical formulas and logical statements. Despite being conceptualized differently between the physical and consciousness models this establishes a fundamental link between them; A link which is sufficient to resolve the explanatory gap (without alteration to either model).

This link comes from an assertion that was twice deduced: once from the way physical models are formulated then from the way scientific models are developed. This assertion does not imply any particular ontological philosophy but is compatible with both idealism and realism. The assertion is that fundamental physical truths are established by the irreducible p-elements. This links modern physics with the philosophy of consciousness, potentially supporting knowledge transfer between these domains. For example, the identification of lower-level physical truths could help identify the irreducible p-elements and vice versa.

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