THE NEUROPHENOMENOLOGY OF CONSCIOUSNESS: UNCOVERING THE HARD PROBLEM

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In this essay, I will explore the hard problem of consciousness and its implications for guiding neuroscience. Firstly, I will explicate how the zeitgeist of the twenty-first century is inevitably guided by philosophical assumptions in scientific disciplines such as cognitive neuroscience, while presenting how this field has fundamentally neglected the phenomenological discourse implicit in its assumptions of consciousness. Specifically, I attempt to show that the hard problem has an explanatory gap between associating the relationship of phenomenological aspects of experience to physical aspects of the brain, as described by David Chalmers. Then, I will describe the pitfalls of prior neurophilosophical models based on "neural correlates". Subsequently, I will examine novel models that may fulfill Chalmers' remedy of exploring the substrates of experience, which can be invariably tied to the brain. A systematic analysis of these novel models will be provided while assessing their strengths and limitations in order to push further toward closing the explanatory gap. Building on the strengths of these models, whilst bearing in mind their limitations, altered states of consciousness will be explored in the penultimate section to understand how phenomenological experience can be manipulated to produce changes in the brain. I conclude by providing directions from which the hard problem can be approached with the appropriate discourse between phenomenology and neuroscience.

"This is the way science works: Begin with simple, clearly formulated, tractable questions that can pave the way for eventually answering the Big Questions, such as 'What are qualia,' 'What is the self,' and even 'What is consciousness?'"

- V.S. Ramachandran

Introduction

It has been argued that consciousness is one of the greatest mysteries known to mankind. The hard problem of consciousness raised by David Chalmers has hindered finding any promising inquiry into understanding this phenomenon. I claim that the reason for this hindrance is due to the disconnect between implementing objective phenomenological accounts of qualia and non-reductive neuroscientific explanations for how the brain gives rise to experience. In an era of broadened cognitive neuroscientific understanding, age-old questions regarding consciousness and the mind-body relationship are essential to quantify. However, many of these neuroscientific approaches have neglected the phenomenological perspectives proposed by Husserl and Merleau-Ponty, who emphasize that the essence of experience cannot be reduced to discrete neural and computational processes. Neurophenomenology has been sensitive to this discourse – or lack thereof – and has aimed to address the hard problem by integrating these fields.[1] In this essay, I shall argue that the hard problem of consciousness can follow new approaches that move past prior assumptions of neuroscience by considering a phenomenology that can be transformed into an objective neuroscience. This approach follows Chalmers' prescription for crossing the explanatory gap between the experiential and neural substrates of consciousness. I do not claim at any point that the hard problem can be 'solved'. Instead, I propose that neurophenomenology can elucidate novel approaches to the hard problem that expand our conceptualization of consciousness by filling in the gaps between experience and the brain.

Background on the Neurophilosophy of Consciousness

The hard problem is one of the most perplexing philosophical questions in philosophy of mind. In consequence, this has led to a halt on current neuroscientific investigations of

[1] Francisco J. Varela, "Neurophenomenology: A Methodological Remedy for The Hard Problem," *Journal of Consciousness Studies*, no. 4, 1996, pp. 341-343.

consciousness. In *Facing Up to The Problem of Consciousness*, David Chalmers discerns between the easy and hard problem of consciousness. In the former account, it is considered easy because one can simply categorize a variety of states of consciousness into discrete states such as wakefulness, rest, arousal, and so forth. Whereas the latter view of the hard problem of consciousness holds that these simple distinctions break down due to *qualia* or the subjective feeling of experience that is unique to the individual. Qualia are the subjective, ineffable properties of how things feel to an individual such as the sensation of "redness" in an apple. Chalmers writes:

"The methods of cognitive science are well-suited for this sort of explanation, and so are well-suited to the easy problems of consciousness. By contrast, the hard problem is hard precisely because it is not a problem about the performance of functions."[2]

The central issue of the hard problem is that there is an *explanatory gap* between experience and the physical properties that may govern them. This view is one that is invariably tied to the philosophy of neuroscience, since the physical properties associated with consciousness are those that can only be traced to the nervous system. Opposing views state that a brain is not necessary for consciousness. However, this argument is dubious, considering that if one were to remove segments of the brain, then varying levels of consciousness would disappear with it. With that being said, neuroscience is guided by philosophical assumptions. When neuroscientists attempt to tackle consciousness, their framework is intentionally or inadvertently influenced by the hard problem. Therefore, the hard problem is ultimately an issue that pertains to the philosophy of neuroscience.

While it is taken to be a given in the modern scientific age, questions concerning the mind-brain relationship are worth reconsidering in order to truly evaluate the pivotal role they have

[2] David J. Chalmers, "Facing Up to the Problem of Consciousness," *Journal of Consciousness Studies*, no. 3, 1995, pp. 202.

on understanding the mind. We cannot take for granted the assumptions that have brought the scientific age to where it is today. I shall argue that it is a precondition for understanding consciousness to appreciate that there is a relationship between the mind and brain. The antithesis of this relationship would be Cartesian dualism, in which the mind is disembodied from the brain. Once we establish a basis for why there is a direct mind-brain relationship, we can understand what gaps have been missing in our neuro-phenomenological conceptualizations of the hard problem in order to better address it.

I purport that most neuroscientific theories have fallen short in their attempts to understand the mind-brain relationship in the hard problem as a result of trying to cross the explanatory gap. They neglect the overall assumption implicit in this phenomenology that experience does not account for why the brain gives rise to it. These theories have attempted to link brain regions or neural networks to experience, however consciousness and the properties of experience are far more complicated than what can be reduced to structural or functional elements. In contrast to relatively simple sensory and motor distinctions that can be made about the mind-brain relationship, most views about the neuroscience of consciousness are ultimately unsubstantiated. I will advocate for novel neurophilosophy models that attempt to overcome the hard problem by studying the largely unexplored substrates of experience. Then, I shall qualify their relationship to the brain. By understanding the advantages as well as limitations of these models, we can bridge together philosophical and neuroscientific explanations to provide a new paradigm. This paradigm will bring together our conceptualizations of consciousness toward having a more comprehensive understanding of the hard problem.

Limitations to 'Neural Correlates' of the Hard Problem

One view in the philosophy of neuroscience that David Chalmers has been critical of is Crick and Koch's model of the

Neural Correlates of Consciousness. They purport that binding occurs when two pieces of information in experience are bound together with the same underlying mechanisms as experience. Namely, Crick and Koch hold that the frequency and phase of the neurons firing correspond to similar timings of presented stimuli. Hence, they claim that neural mechanisms correlate with experience.

Chalmers contends that this view still begs the question of 'why oscillations give rise to experience?' If Chalmers' supposition that there is still a disconnection between what occurs at the neural level and what happens phenomenologically is correct, then we need to account for *why* the brain gives rise to experience. When there are neural responses to experience, it is not as though one can directly perceive these neural changes. Similarly, top-down inferences made by the brain cannot directly explain how it forms experience. All that is known is that changes in the brain co-occur with changes in experience, however correlation does not imply causation.

More specifically, Crick and Koch have based their understanding of the neural correlates of consciousness by attempting to resolve the binding problem. The binding problem has multiple interpretations. To clarify, it can be broken down into two variants: the segregation problem and the combination problem. In the segregation problem, the question is 'which neural mechanisms within our brain sort through the properties of an object such as colour and shape to form discrete categories?' Whereas in the combination problem, the question is 'how do object properties combine to form a unique experience?', or in Crick and Koch's model, 'how do object properties that combine together in the brain form a unique experience?'[3]

While Crick and Koch's question probably points more to the combination problem, regardless of which interpretation one

[3] Antti Revonsuo and James Newman, ""Binding And Consciousness". Consciousness and Cognition," *Consciousness and Cognition*, no.2, 1999, doi:10.1006/ccog.1999.0393.

decides to follow the outcome is still the same: a disconnect between explaining the relationship between the brain and experience. One method that Crick and Koch have used to overcome this is by demonstrating a relationship between the way the visual cortex maps properties of objects in the brain and the same way that those objects are represented physically. This includes motion, colour, and texture. They support this by noting the representation of certain brain regions or clusters of neurons that reproduce those properties in the environment.[4]

One problem with this view – as hinted at by Chalmers – is that because something looks the same and corresponds to a similar process does not explain how it is the same. One illustration of this is what I would refer to as the "*green-screen metaphor*". A green-screen is a technique used in film whereby an individual moves across the background of a green screen and the screen is transformed into digital scenery completely different from its rudimentary green environment. Hence, the green-screen metaphor reveals that this technique captures one's motion fluctuation patterns with precise accuracy. However, this is not sufficient evidence for demonstrating that one is really in the same environment that appears on the screen. In the same regard, similar appearing fluctuations that can be observed in the brain when one is engaged in a task does not account for the entire spectrum of experience. Instead, neuroscience must be approached by starting at the level of phenomenological experience and then directly build upward to the brain.

Chalmers proposes that one of the most optimal strategies that researchers can use to deal with the hard problem is to isolate the substrate of experience. In this account, researchers must find a way to quantify experience as a physical system in the same terms that are used for understanding the inner workings of the brain. In contrast, many researchers such as

[4] Francis Crick and Christof Koch, "Towards a Neurobiological Theory of Consciousness," *Seminars in the Neurosciences* 2, 1990, pp. 268-272.

Daniel Dennett take the approach of what Chalmers calls 'denying experience'. Dennett writes:

"Like other attempts to strip away interpretation and reveal the basic facts of consciousness to rigorous observation, such as the Impressionistic movements in the arts [sic] and the Introspectionist psychologists of Wundt, Titchener and others, Phenomenology has failed to find a single settled method that everyone could agree upon".[5]

Although proponents like Dennett do not necessarily deny the existence of experience, they overlook the significance of it as a tool for understanding consciousness. Although the phenomenon of consciousness does not have any prevailing tools to measure it, this does not necessarily refute its importance or capacity to be understood. It is an argument from ignorance to state that what cannot be readily measured cannot be understood. Experience is comprehended insofar as any sentient being can report it; thus it must occupy space in some predictable capacity.

Notwithstanding that, Chalmers resists this view and states that a full theory of consciousness requires an explanatory bridge to be crossed. Finding such an approach where the substrates of experience can be explained, while crossing the explanatory bridge between experience and the physical systems governing them should be the endeavor of neuroscientists – who are ultimately guided by these philosophical assumptions of consciousness. As we have seen, relying on neural 'correlates' of consciousness will not do any justice to crossing this bridge, nor will denying experience. I will argue in the next section that finding novel frameworks that start with the substrates of experience and then connecting them to the brain are necessary for crossing this bridge.

[5] Daniel Dennett, *Consciousness* Explained, (New York: Little Brown & Co, 1991), 44.

Alternative Neurophenomenological Frameworks

Now that we have established the necessity for researchers to find a way to cross the explanatory bridge according to Chalmers' standard of isolating the substrates of experience, where do we turn to? One candidate of such an approach is *Integrated Information Theory (IIT)*. IIT approaches consciousness by understanding the properties of experience: existence, composition, information, integration, and exclusion. Then it attempts to map these properties onto the brain in the hope of finding a process responsible for these experiences. What sets IIT apart from other neuroscience models of consciousness, including the Neural Correlates of Consciousness model previously discussed, is that it does not attempt to make assumptions about experience based on the brain. Rather, it first attempts to comprehend the more difficult undertaking of experience. Subsequently, it tries to reveal a direct relationship between those aspects of experience and the brain. In contrast, brain representations are already relatively easy to observe with the advent of neuroimaging and controlled lesion studies.

Before returning to IIT and affirming its potential as a desirable model for approaching consciousness with experiential substrates, it is first important to assess whether it is even possible to measure experience. Experience is a phenomenon that is by and large, subjective. In recounting an individual's experience of an event, object, or situation, we must consider that it can only be interpreted from the contextual standpoint of the individual who is experiencing it. If one were hypothetically able to isolate the individual components of an experience, the interpretation of those components could only be accurately considered by the agent who experienced them. For example, if an individual witnesses a family member dying and is saddened by it, in our hypothetical scenario it might be possible to keep track of the intensity of the sadness, the memories one has with the loved one, and the strength of their relationship. However, we could never truly re-experience the death of the loved one as the individual

did, since that would require us to literally become the individual experiencing the event. Similar to how a key only fits into a particular lock, experience can only fit into a particular individual. Therefore, the nature of experience itself is specific to the individual.

This presents a problem for objectively understanding the phenomenal qualities of consciousness. In Chalmers' view, in order to build a model of experience it is a requirement that nothing takes away from qualia. The very nature of this approach is tainted with reductionism. If we only consider a single experience, then it takes away from the collective experiences that shape the interpretation of that single experience. The alternative approach is to consider every single experience, which even if possible, would likely result in a combinatorial explosion of information for the observer of these experiences. With that said, this does not make the pursuit of isolating the substrate of experience entirely hopeless. Accumulating numerous qualities of an experience provides more information about one's experience than what was previously understood. For the sake of clarity, I must emphasize that I am not attempting to present a view that 'solves' the hard problem. My perspective, I believe, simply broadens our understanding of it, and the approach of isolating experiential substrates are one means of doing so. Considering experiential substrates in conjunction with their limitations, we shall now revisit IIT with a more informed understanding in mind.

IIT is constructed of particular axioms, which were mentioned earlier in this section: existence, composition, information, integration, and exclusion. These axioms are considered to be self-evident. Experience always exists, and it always consists of information that is integrated. To refute these axioms, individuals would have to contradict their own experiences that led them to refute it in the first place. More central is the question of whether these axioms are good at predicting anything about consciousness, and moreover, whether they can predict anything meaningful about the brain.

Composition is one of the axioms of the model which states that consciousness is structured, with each experience consisting of a combination of features such as colour, shape and direction. Using mathematical models, the developers of this theory have sought to figure out how elementary properties such as light exist in minimally conscious states, which can then be compared to other states of consciousness to understand their differences.[6] This is one concrete example of how IIT attempts to extrapolate states of the brain from experiential substrates.

While criticisms have emerged against the IIT framework for its panpsychist undertones, there are much more pressing concerns with it. The unit of measurement in IIT, phi, is said to represent a conscious state that can be present in any entity, organic or inorganic. This view is often refuted as panpsychism.[7] This criticism is one that most modern scholars are willing to accept; however, addressing the legitimacy of panpsychism goes beyond the scope of this essay. With that said, I do not believe that panpsychism is central to the underlying principle of the axioms and their relationship to experience. More importantly, this theory is limited in how readily it leaps from phenomenology to the brain. It has not reproduced sufficient evidence that would enable it to move beyond the assessment of basic features of consciousness such as elementary perceptual stimuli. A more crucial approach would be to examine how whole-brain representations can explain more complicated human tendencies such as feelings and beliefs. Only stimuli that occupy perceptual representations are mentioned in the IIT framework, whereas feelings are not. Unlike the perceptual processes that neuroscientists investigate, subjective internal states are mental phenomena that are of particular concern to philosophers. Hence,

[6] Masafumi Oizumi et al., "From The Phenomenology To The Mechanisms Of Consciousness: Integrated Information Theory 3.0". *Plos Computational Biology*, no.5, 2014, doi:10.1371/journal.pcbi.1003588.
[7] Michael A. Cerullo, "The Problem with Phi: A Critique of Integrated Information Theory." *PLoS Computational Biology*, no. 9, 2015, doi:10.1371/journal.pcbi.1004286.

we must turn toward other models that can more readily cross the bridge into more holistic 'neural territory'.

An alternative model to consider that attempts to tackle the brain from the point of view of phenomenology is the *Operational Architectonic* approach. This view recognizes that the phenomenal level of consciousness must be understood before emphasizing its corresponding changes in the brain. Similar to IIT, it focuses firstly on the quality of experience and subsequently examines its relationship to the brain. In particular, Operational Architectonics is substantiated by investigating how altered states of consciousness such as hypnosis, neurological conditions, and drug-induced states produce changes in experience that can be observed in the brain. The strongest support for this approach is that the structural organization of the brain is *isomorphic* to experience. That is, experiences have a similar structure to that of the brain. One illustrative case for this is observing the effects of lorazepam – a benzodiazepine that alters cognition. This drug has been found to induce changes at the phenomenal level such as a slowness of thinking and cognition, which leads to simultaneous neural changes (i.e. slow brain waves) that are observed through neuroimaging. In other words, changes that happen at the phenomenal level of experience can be compared to changes that happen directly at the neural level and the two are known to share overlapping properties.

One appeal to this approach, that directly links back to Chalmers' concerns of finding a substrate of experience, is that it focuses on the quintessential properties of experience and its causal relationship to the brain. The Operational Architectonic model directly investigates how similarities in experience correspond – or are isomorphic – to brain changes.[8] This means that properties of experience have overlapping properties in the brain. However, this raises the question: how can we know that

[8] Berit Brogaard and Dimitria Electra Gatzia, "What Can Neuroscience Tell Us about the Hard Problem of Consciousness?". *Frontiers in neuroscience*, no. 395, 2016, doi:10.3389/fnins.2016.00395.

the changes occurring at the experiential level are really the same process occurring at the neural level? When we consider the "green-screen" metaphor that I alluded to previously, the underlying changes that we are examining experientially may *appear* similar, but actually be disconnected from their neural counterparts. Regardless of this concern, we can use statistical probabilities to consider what other influences might result in these neural changes. When one examines such probabilities, it may reveal what other factors can influence the experiential substrates. In this regard, the notion that an experience can shape one's neurology with the same patterns is unlikely to have happened by coincidence. If the association between experience and the brain can be described not only by a relationship in the neural correlates model, but also by the *same properties*, then it is likely that the same phenomenon or, at the very least, the essential properties of the same phenomenon are occurring.

Additional support for the isomorphic assembly between brain and experience is the observation that experience is not limitless. While every person has slightly different encounters with the world, the anatomy of the brain is predominantly structured the same way in every human. The universality of the human brain compared to other species suggests that similar experiences derive from similar brains. Considering this in tandem with the Operational Architectonics model, the structure of the human brain person-to-person is devoted to similar cognitive functions that comprise experience. It would be reasonable to assume that consciousness itself – while it cannot be localized to a single brain region – would operate based on the way the brain is structured. Let me falsify this statement by maintaining that this must still be considered an assumption. However, it is a reasonable one that is based on the probabilities of the similarity between each human's brain and their experiences. One example is that vision and motor skills involve very similar neural structures and result in similar experiential outcomes. More specifically, humans have shared experiences of visual illusions and motor patterns that are not present in other species. This

implies that there may be a uniquely human quality that reflects experience derived from the brain.

One way to examine the human qualities that reflect changes in experience is by inducing altered states of consciousness. Studying altered states of consciousness allows us to note how these induced changes in consciousness reflect commonly reported phenomena seen in self-report and introspection measures. If these changes reflect onto other self-reported experiences – revealing qualia – then it can be inferred that these changes are similar. One way to do this is by observing drug-induced states and neurological conditions from which we can extrapolate the changes from each state and their correspondence with the brain. The next section will cover how these altered states directly transform experience, which can provide additional support for the "other side" of the explanatory gap: the brain.

Altered States: Experience-Induced Changes

Before understanding altered states of consciousness as an experiential substrate, it is important to first establish a concise definition. Revonsuo and colleagues make an imperative distinction regarding altered states: *primary phenomenal consciousness* and *reflective consciousness*.[9] Primary consciousness is the precept of consciousness that is based entirely on immediate input from external stimuli whereas reflective consciousness encompasses the cognitive processes that interact with primary consciousness to make judgments about stimuli. Clearly, the neuroscience-based models previously discussed by Crick and Koch, IIT, and operational architectonics are all entirely concerned with primary consciousness. However, altered states should also be investigated with reflective consciousness.

[9] Antti Revonsuo et al. "What Is An Altered State Of Consciousness?" *Philosophical Psychology*, no. 2, 2009, doi:10.1080/09515080902802850.

Furthermore, in this definition, states of consciousness are differentiated from the contents of consciousness. States reflect an overall pattern of change to the contents of consciousness, whereas the contents pertain to the emotional and sensory qualities that arise with experience. Hence, altered states of consciousness are distinct representations of the world that can only be compared in relation to waking consciousness. In other words, they reflect distinct patterns of processing information in the world. These patterns can be attributed to a variety of states such as sleep deprivation, hypnosis, meditation, epileptic seizures, psychotic episodes, sensory deprivation, and even minimally conscious states such as vegetative states.

Understanding these distinctions of altered states of consciousness begins to shape the way we conceptualize how consciousness behaves phenomenologically. Altered states contain qualities that are exclusive to experience. By understanding the properties that embody these states, it allows us to see how inducing such altered states can elicit changes in experience that may help shed light on qualia. Although the hard problem is often discussed in terms of the differing qualities of experience *between individuals*, rarely is it tackled from the standpoint of how changes to experience occur *within the individual*. The individual is constantly undergoing new experiences, so the problem can be reframed from the following stance: how do I define *my own* experience as phenomenologically unique to me, when I encounter so many novel changes to my experience?

Altered states can elucidate this question by providing properties of consciousness through self-induced transformations such as hypnosis, meditation, and psychedelics as well as neurological changes such as schizophrenia and temporal lobe epilepsy. By understanding baseline consciousness in relationship to altered states, this provides a metric for understanding the 'ingredients' of consciousness. Even patients with neurological disorders who once lived with a relatively "stable consciousness"

but subsequently underwent a traumatic event that altered their consciousness, can still report these variations in their experiences – an observation that is reflective of changes of consciousness. These changes in experience within the individual allow us to study the properties of consciousness.

In the same vein, one should expect that altered states of consciousness reproduce these properties not only within individuals, but also between individuals. Since experience is isomorphic in that it has a fundamental property that is limited to instances of the brain, the effects of altered states of consciousness should correspond to these states between individuals. One example of this is psychedelic experiences. Often, reports of the experiential effects of specific substances such as LSD or psilocybin contain similar phenomenal characteristics: hallucinations, visualizations of geometric patterns, feelings of unity, thought connectivity, and even perceptions as specific as objects "breathing". On the other hand, meditative states produce feelings described as a loss of self, tranquility, and clear-mindedness. Complications can arise when both states combine into a synergistic interplay of multiple altered states. However, for all intents and purposes, the qualities in altered states overlap between individuals; therefore we can ascribe some sort of ingredient to altered states that are reflective of changes in qualia.

Do these altered states overlap between individuals on a one-to-one basis? Most likely not. Experience is too vastly intertwined with countless factors that cannot all be considered; however, these states can provide a direct window into changes in consciousness, which are reflective of qualia. Indeed, one cannot discount the element of shared experience that occurs following such changes. Many of the individuals who encounter others experiencing such altered states of consciousness resonate with the experiences so deeply that they become integrated into each other's experiences. Support groups for patients with psychotic disorders and group meditation are one instance where individuals have common experiences provoked by altered states

of consciousness. Humans are social creatures, and as such, sharing these experiences shapes the individuals involved. This is not an empirical claim; however, it is one that is legitimized by reports of the shared experiences in conjunct with our understanding of the brain as isomorphic to experience. Thus, altered states provide an understanding of changes in experience that can be observed within individuals and between individuals.

Now that we have recognized the phenomenological changes that are provoked by altered states of consciousness, it is important to consider how we can measure and observe this relationship in the brain. There are various concerns with using self-report inventories as a methodology for describing experiences with altered states because the subjective elements of experience are difficult to delineate within the parameters of objective science. This appears to be one crossroad where philosophy and neuroscience diverge. However, one way to overcome the challenges of self-reports is by creating a scale that contains distinct measures for feelings, perceptions, and expectations which are in a standardized format to account for all the changes that occur in altered states of consciousness. This allows us to have some objective measure for considering a variety of states of consciousness and the ways in which they influence experience.

Self-report scales can contain properties that allow researchers to objectively study experience. These properties include asking an individual to report feelings, decisions about feelings, beliefs and expectations about a particular event or situation. These measures also allow people to describe traits that they ascribe to themselves and other people in their lives. Abdoli-Sejzi and Pey-Yuh have adapted such a scale for patients with psychogenic disorders, which quantifies their experience of a particular situation and then transforms it.[10] By noting the distinct

[10] Abbas Abdoli-Sejzi, and Pey-Yuh Chan. "A Female Case Study on Altered States of Consciousness towards Providing a Personal Iceberg Metaphor and Family of Origin Map." *IJERED*, no.6, 2014, pp. 62.

properties of experiences and ways to transform them, it not only allows one to discover the substrates of experience, but also provides a priori knowledge of how one can alter pre-existing states of consciousness.

Consequently, these self-report scales cover the phenomenological component of altered states of consciousness; however a neural component is also necessary. One means of studying this is through *event-related potentials* (ERP). Unlike traditional neuroimaging, ERPs allow one to study changes in experience that co-occur with real-time brain activity. ERPs are often monitored while an individual is undergoing a task through a neuroimaging device known as an *electroencephalogram* (EEG). ERP tasks comprise a range of experiences that can be reported and tracked temporally under various altered states of consciousness. These altered states of consciousness can be measured with EEGs in disorders ranging from epilepsy, blindsight and comatose to self-induced states such as sleep and anesthesia. The participant under these altered states can undergo command-following exercises that involve mental processes which can be recorded simultaneously with ERP responses.[11] While this entire procedure has not been tested, the theory behind it shows an isomorphic relationship between experience and neurology – pushing the frontiers of the explanatory bridge further than what has come before.

Conclusion

In this paper, I hope to have reformulated a convincing direction by which the hard problem can be approached through neurophenomenology. While Chalmers has dispelled reductive views of the Neural Correlates of Consciousness, along with denials of the hard problem, further neuroscientific and phenomenological work is still needed to cross the explanatory

[11] Quentin Noirhomme, and Steven Laureys. "Consciousness and Unconsciousness". *Clinical EEG and Neuroscience*, no. 1, 2014, doi:10.1177/1550059413519518.

bridge between experiences and the physical systems that they arise from. Following Chalmers' prescription for isolating the substrates of experience and its connections to the brain, several novel neurophenomenological frameworks have emerged. One framework is IIT, which shifts from phenomenological axioms of conscious experience to the neural postulates that unite them. While IIT has recognized the essential axiomatic properties of conscious experience, it has not produced adequate evidence for how these axioms map onto higher mental processes in the brain. In contrast, the Operational Architectonics framework has found some compelling neuroimaging support for the isomorphic relationship between the structure of experience and the brain under different states of consciousness. In this vein, I have proposed that studying altered states of consciousness and quantifying them experientially, while ascribing them to a nonreductive view of the brain are the necessary steps for bridging together phenomenology and neuroscience. This is a view that may lead to unique and novel inquiry of the mind-body problem that has mystified philosophers from David Chalmers to René Descartes for centuries.

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