

Research Article

A Phenomenological Approach to Quantum Mechanics

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Here I consider how we might incorporate our direct experience of the world to better interpret the paradoxical nature of quantum mechanics, including the measurement problem. I begin by noting that the concrete nature of the world, which we encounter in our experience, appears to be absent from the abstract formalism of quantum mechanics. In the paper, I reason that seeking this concrete nature within quantum mechanics points us toward a fundamental stuff of reality that is a holistic, unified ground of potentiality. And borrowing positions associated with Bertrand Russell, I also argue that this fundamental ground is the basis for conscious experience. I proceed to discuss how this framework is different from similar approaches referred to as dual aspect monism. I then consider how this ground of aware potentiality provides the basis for the world's causal powers and supports our experience of volition, as well as sheds light on the measurement problem in quantum mechanics.

1. Introduction

Quantum mechanics provides a successful theory of the subatomic domain, but the measurement problem remains mysterious. What explains the transition from the wave function, which characterizes the quantum domain in terms of potential states entangled together, to the observed experimental outcomes? And what does the answer tell us ultimately about the ontological nature of the quantum world? No consensus view has emerged, and the various proposed interpretations generally clash with most of our common-sense views of the world. In addition, they tend to propose radical descriptions that are unobservable, perhaps even in principle.

In this paper, I'll introduce a phenomenological approach to the quantum measurement problem. Accepting the Schrödinger equation as a correct characterization of a quantum system based on

copious laboratory experiments, I wish to focus on how our direct experience of the world might guide us toward interpreting the transition between the quantum formalism and the observed outcomes. I'll begin by framing what I believe to be a question generally overlooked in the literature: what happens to the concrete nature of the world in the quantum domain? By concrete nature, I mean stuff we encounter in the physical world that cannot be characterized by formal or mathematical descriptions.

This might seem like an odd question. The job of physics, we might think, is to describe the behavior of the world in terms of formal or mathematical rules, which we can then test. And in the classical domain, we need not concern ourselves with some deeper understanding of the world's stuff; it is sufficiently evident when we encounter the hardness of rock or a jolt of electricity. But our experiences cannot access the quantum world the way we do with the classical. The quantum formalism appears to accurately characterize quantum behavior, but it is highly abstract and does not describe things with which we have acquaintance. Instead, it describes a complex web of entangled states of particle positions or other properties, weighted by probability. The concrete nature of the world appears to vanish as we enter the quantum domain. I suggest that bringing attention to this puzzle may help us progress in our understanding of quantum mechanics.

In the first section of this paper, I'll attempt to address the mystery of the missing concrete ingredient by bringing together three philosophical arguments. First, after framing the question, I'll follow Heisenberg, who has argued that the quantum formalism points us toward something like an Aristotelian notion of *potentia* or potential matter underlying the subatomic particles of the quantum domain. Second, I borrow from Ismael and Schaffer's (2020) recent argument that the entangled relations that characterize quantum entities suggest a common ground that coordinates the probabilities given in the formalism. Bringing these two arguments together suggests a quantum ground characterized as a field of unified potentiality that influences quantum systems. And the third argument adds to this mix Russellian monism, which includes the view that the intrinsic aspect of the world has a phenomenal nature. This reasoning leads us to the position that the quantum ground, the fundamental stuff of the world, is a field of aware potentiality. And the nonlocal nature of this quantum ground suggests a version of cosmopsychism, the position that consciousness pervades the universe and that the different kinds of conscious experiences are aspects of this cosmic mind. In Section 3, I compare this framework with similar approaches termed dual aspect monism, the view that a fundamental reality provides the basis for the mental and physical aspects of reality. In Section 4, I argue that what I propose has resources to support real volition and that the measurement

problem can be understood as the holistic quantum ground in some sense “selecting” the appropriate response to the experimenter’s probing. I offer a conclusion in the final section.

2. Where is the Concrete Nature of Matter within Quantum Mechanics?

The core practice of science, arguably, is to build a theory for explaining the world through mathematical description and structure. The tendency to focus on mathematical formalism has, of course, paid high dividends. However, the world is arguably more than just mathematical formalism. Our experience of the world reveals that it has a concrete nature, or some sort of stuff or substance that can’t be fully characterized by abstract formalism. This point is arguably evident from our direct experience of the world, but it generally receives little attention in science, perhaps because of its metaphysical nature. But metaphysics is a proper area of inquiry for philosophy, and I will argue that our direct experience is relevant for this type of question.

Some, such as advocates of ontic structural realism, will argue against characterizations that involve anything beyond relational or structural descriptions (Ladyman et al., 2007). But I believe the claim that abstract descriptions such as mathematical equations are not sufficient to account for the world’s concrete nature is the stronger position. Ultimately, things must bottom out where the structural or relational descriptions refer to some relata or fundamental stuff (Van Fraassen, 2006). Similarly, increased attention has recently been focused on Bertrand Russell’s arguments that the structural and relational characterizations of science fall short in revealing the intrinsic aspect of the world (Russell, 1927).

The different interpretations of quantum mechanics are based on the formalism of quantum mechanics. The various interpretations all represent, in different ways, our attempts to bridge the formalism that describes the wave function to the outcomes of experiments.¹ However, the various alternatives generally provide descriptions that clash substantially with our experiences of the world. The history of science suggests that this need not be fatal, but the difficulty with building more empirical support for one interpretation or the other suggests that our hold on these interpretations should remain tentative. In this paper, I aim for an interpretation that is congruent with our lived experience.

From the perspective of our experience, we have good reason to believe our world has a concrete aspect. Thus, I'll proceed by trying to fit the notion of the world's concrete aspect within an overall quantum interpretation (not necessarily within the current formalism). And once we do this, we might consider whether such an approach has additional virtues over other interpretations.

Of course, the question might be raised whether attempting to frame the problem of quantum mechanics this way is in some sense putting one's thumb on the scale in the direction of favoring a particular interpretation or some class of interpretations at the outset. For instance, requiring that our interpretation include some notion of a concrete aspect might be intolerable to those with anti-realist commitments. Such a goal arguably clashes with Bohr's insistence that we simply can't characterize quantum systems between measurements in terms of definite particle positions and properties. That said, as I've tried to argue, our direct experience of the world gives us reason to expect a worthwhile interpretation to include some reference to the aspects of our world that can't be boiled down to abstractions.

3. A Quantum Ground of Aware Potentiality

In this section, I'll consider three lines of reasoning that I believe help us move toward an interpretation that includes a concrete aspect, which will facilitate a view more congruent with our experience than most interpretations. I'll combine these three strands of thought in a way that leads toward a view we might characterize as a quantum ground of aware potentiality. Further, the nonseparable nature of this ground leads us toward cosmopsychism, the position that the universe as a whole is conscious and all conscious organisms are aspects of this cosmic mind. While this view is well outside the mainstream, I will argue it has a number of virtues, chiefly that it provides resources to support key aspects of our experience that other interpretations do not.

Potentiality

What happens to the world's concrete aspect as we enter the quantum domain? We have some sense of the concrete with entities such as metal gears, electromagnetic waves, or planets, described in the mathematical equations of classical physics. What does the formalism of quantum mechanics describe? It describes the behavior of a web of entangled possible states of various properties such as spin or position of subatomic particles.

If we reason that this concrete aspect persists in the quantum domain and that it has an intimate relationship with the standard formalism, a straightforward step is to consider that the probable states within the wave function represent what we might call potential stuff. That is, the question concerning what quantum mechanics is about suggests something in the direction of probable states of matter. Heisenberg (1958) proposed something very much like this. In his words:

All the elementary particles are made of the same substance, which we may call energy or universal matter; they are just different forms in which matter can appear. If we compare this situation with the Aristotelian concepts of matter and form, we can say that the matter of Aristotle, which is mere 'potentia,' should be compared to our concept of energy, which gets into 'actuality' by means of the form, when the elementary particle is created. (Heisenberg 1958, p. 160)

Here, Heisenberg described potentia as a substance that is ontologically prior to the subatomic particles described by the quantum formalism. Thus, in the same way that atoms are ontologically prior to molecules, and subatomic particles such as electrons are ontologically prior to atoms, Heisenberg suggests yet another level. However, unlike the other characterizations (subatomic particles, etc.), this description involves a domain of potential where the various possible states are entangled in a way that suggests a more unified underlying entity.

Heisenberg proposed this notion of potentia within the context of the Copenhagen interpretation, the dominant interpretation at the time, which characterized quantum systems in terms of superposed possible states that "collapsed" into actualized, observed states on measurement. Heisenberg (1958) proposed that these descriptions of possible states between measurements represented potential matter. While Heisenberg's proposed direction has some advocates such as Stapp (2017) and Kastner et al. (2018), it has gained little traction among most physicists, perhaps because it adds little to the more orthodox interpretation, aside from positing a kind of quasi-substance that can't be observed or detected.

While this proposal may move us toward something like a real substance, it raises a difficult question: what does accepting this notion of potentia entail for our understanding of the quantum wave function? As it happens, the wave function inhabits a kind of "space" very different from our more familiar space of 3 dimensions. Wave function space is sometimes termed configuration space, which is generally understood to possess $3 \times N$ dimensions, where N is the number of particles in the system.

Wave function realists, such as Albert (2013), Ney (2020), and North (2013), argue that we should understand this configuration or wave function space as an ontologically prior space, fundamental to our more derivative 3-dimensional space (or 4-dimensional spacetime). However, the property of entanglement means that no quantum system is truly isolated from its environment. Thus, the dimensional size of this configuration space becomes three times the number of particles in the universe.

Thus, accepting that probabilities within the wave function indicate something like real potential compels us to consider a field or ground fundamental to our familiar 3-space, characterized by a high-dimensional “space” of potentiality. But with respect to our present purposes, this proposal also leads us toward a highly abstract and exotic entity, quite distant from anything we might experience directly (or perhaps even imagine). Because it instantiates into real states on measurement (according to the standard interpretation), we have no means to detect it. While this view conceivably leads us in the direction of a real substance, it arguably does so at significant cost. Further, wave function realism has its critics, who prefer to avoid the step of theorizing such an entity with an arguably exotic nature (Emery, 2017; Monton, 2013). Thus, we apparently fall short of an interpretation that fits with our aim of including the concrete aspect of the world.

A Holistic Quantum Ground

To go forward with a notion of the wave function as a description of an underlying field or ground of potential in a high-dimensional space, I submit we might consider whether anything else about the wave function suggests something ontologically fundamental to our spatiotemporal order. Recently, Ismael & Schaffer (2020) have advanced an argument relevant to this question on the nature of ontology based on the quantum property of non-separability. They note that quantum mechanics reveals non-separability in the sense that nature “allows spatiotemporally separated entities to have states that cannot be fully specified without reference to each other” (p.1). This entanglement between quantum states has been empirically confirmed through the correlations between such observed quantum states. Evidence of correlations between two things often leads us to infer a causal relationship between them. Thus, if two things, A and B, are correlated, we might be inclined to think A affects B or vice versa. However, general relativity rules out simultaneous causal effects between spatiotemporally separated objects. In addition, nothing in the wave function formalism suggests a particular causal direction between the correlated entities that might indicate how a manifestation of

one quantum state leads to the manifestation of the other. The relationships between various quantum states are expressed in terms of correlations only. Ruling out causal links operating through spacetime between entangled states, Ismael and Schaffer raise another possibility: a source of the correlation common to possible quantum states. And this source they describe as a common ground that “coordinates the randomness” between the possible states.

I prefer to characterize this metaphysically prior ground as coordinating the probabilities (rather than randomness) associated with a given quantum system, because I believe ‘probabilities’ is a more neutral term than ‘randomness.’ (I’ll say more about this later.) This suggests that the probabilities associated with various possible states of observables are coordinated with respect to other possible states. This quantum ground is somehow managing the probabilities associated with possible outcomes in a coordinated, and therefore, holistic fashion. But within the context of the earlier discussion, this suggests an inherently unified and integrated field of potentiality, ontologically prior to the relatively derivative entities described by quantum formalism. And Ismael and Schaffer also note that this quantum ground is consistent with the proposals advocating wave function realism.

I suggest Ismael and Schaffer’s proposal of a quantum ground that coordinates the probabilities in quantum systems strengthens the case for considering Heisenberg’s notion of *res potentia*, as well as the view of wave function realism it appears to entail. However, I am not inclined to think that some notion of a quantum field of potentiality entails the anti-realist characterizations that Heisenberg favored. That is, perhaps we might sidestep some notions such as quantum superposition or wave function collapse, generally associated with the orthodox interpretation that Heisenberg preferred.

But that said, it is still difficult to see how the view developed so far squares with anything in our experience. While we may have additional reason to accept something substantial and ontologically deeper associated with the wave function, this theoretical entity remains highly abstract, something we have no way of observing or detecting.

Russellian Monism and the Intrinsic Aspect of Matter

Earlier, I mentioned Bertrand Russell’s argument that structural or relational characterizations of scientific descriptions fall short of revealing an intrinsic aspect. The intrinsic aspect generally refers to a fundamental property or element that is not constituted through its relationship with other properties or objects. Thus, the structure and relations used to describe the physical world must

ultimately have some relata that provides the basis for the relations. Perhaps the intrinsic nature of the world is the missing concrete element of quantum mechanics.

I suggest that the notion of quantum ground we've been exploring, established in a "space" outside our spatiotemporal order, is a promising candidate for this notion of an intrinsic element. The inherently holistic nature of its influence likely makes structural characterizations impossible. Further, Heisenberg's proposal of ontologically prior potentia suggests something truly fundamental at the basis of quantum systems.

However, if we consider this quantum ground as the intrinsic aspect of the world, Russellian monism also provides reasoning to suggest it as the basis of conscious experience.² Russell argued that the only sort of intrinsic element that we have real knowledge about is phenomenal experience, which we access directly without any abstract reasoning. Thus, Russellian monism leads us to consider that the intrinsic aspect (as well as the concrete aspect) of the world possesses consciousness. Advocates of Russellian monism note that this approach manages to fit consciousness into the physical world while avoiding the radical emergence that physicalism seems to require or the problem of causal closure that dualism faces. Thus, we are led to consider that matter and consciousness are intimately linked at the world's fundamental level.

However, here I am applying Russellian monism in a way that deviates from more common paths taken. Russellian monism has led many who study the mind-body problem to consider the possibility that even subatomic particles, such as electrons, possess some rudimentary degree of consciousness (Goff, 2017; Seager, 2006; Strawson, 2009). However, they must then confront the combination problem: how our more familiar conscious experiences somehow emerge from complex combinations of barely sentient particles. The approach I advocate avoids this problem and takes the quantum ground as the world's fundamental entity. Here, the key problem is explaining how diverse conscious experiences arise from a more fundamental conscious ground via some process of decombination. I submit that biological structure plays an important role; however, space limitations prevent me from tackling this question in more depth.³

But let's return to the claim within Russellian monism on the nature of consciousness. How are we to consider the intrinsic aspect of matter to be consciousness or the base of conscious experience? Our conscious experience clearly depends on the collection of various sensory stimuli we are having in any given moment. Beyond that, our experience depends on a host of other conditions that might be influenced by how much coffee we've consumed or how much sleep we got the previous night. And of

course, the nature of conscious experience for any living organism hinges critically on the biological nature of that organism, which can arguably be described in great detail using structural language. Overall, conscious experience appears to be extremely dependent on many factors that might be understood within a structural or relational framework.

However, there is arguably something that all various conscious experiences have in common: what we might call a background awareness. That is, any conscious organism arguably possesses an awareness through which the myriad experiences can occur. Thus, while our conscious experience, or that of any biological organism, likely depends on a wide range of factors, there is the deeper aspect—the background awareness itself—that is not dependent on the structural or relational aspects. However, we’ve noted that our physical descriptions of the world lack any sort of intrinsic aspect. Thus, given our inability to characterize the world’s intrinsic aspect, advocates of Russellian monism argue that we have little reason not to make use of the only intrinsic element we have knowledge of, especially given the steep challenge of fitting consciousness into the physical world (the hard problem).

However, our previous discussion suggested an ontologically deeper level of reality than particles. I propose that the appropriate level for applying Russellian monism is the ontologically prior quantum ground we have been considering. Putting all of this together suggests something concerning the deeper aspect of quantum mechanics that arguably fits within how we experience the world. The emerging picture here is a quantum ground that provides the foundation for both the subatomic particles that constitute our world and conscious experience. Recalling our earlier characterization of a ground of potential, we might describe this fundamental ground as an underlying field of aware potentiality. In addition, its nonseparable nature entails that it is the ground for the universe as a whole; thus, we are led to consider a mind-like field at the base of the universe.

If this reasoning is correct, then the answer to our question concerning the concrete aspect of the world is this underlying quantum ground as the base of phenomenal properties. As we’ve discussed, we can describe this entity as a real (foundational) substance beyond the abstract formalism of the wave function. Of course, this ontologically deeper field is still beyond our direct experience. But we can now understand our conscious experience as an aspect of the more fundamental ground. While we may not have direct access to this most fundamental level, we are nevertheless making progress on something that fits within our experience.

Further, linking Russellian monism with the notion of a high-dimensional space we discussed earlier provides additional support for taking seriously wave function realism. Recall that a chief difficulty with wave function realism is its dependence on an astronomically high number of dimensions. However, an enormous number of dimensions is required to support a reality that allows a fundamental level of entanglement within the universe, which we might describe as a field of highly integrated information. As it happens, the influential theory of consciousness known as Integrated Information Theory argues that consciousness requires a very high level of integration (Oizumi et al., 2014; Tononi et al., 2016). Thus, the extraordinarily high number of dimensions in wave function space, due to its highly integrated nature via entanglement, arguably provides the right kind of base to support a fundamental ground for phenomenal experience.

4. Dual Aspect Monism

The approach I've been developing can be classified under dual aspect monism. According to Mørch (2024), this framework claims that “reality consists of one fundamental kind of stuff, but that this stuff has two different aspects throughout, a physical aspect and a mental or protomental aspect” (p.48).⁴ Mørch includes as an example pansychism (panprotopsychism), which holds that the fundamental building blocks of our world are sentient (protosentient). However, Atmanspacher & Rickles (2022) present the view that the fundamental stuff within dual aspect monism is psychophysical neutral between the physical and the mental, and they give special weight to Spinoza as an original contributor to this approach. The position I advocate is that the most fundamental stuff is a ground of aware potentiality, which provides the basis for both the mental and physical aspects of the world.⁵

Most dual aspect frameworks associated with quantum mechanics arguably posit a psychophysical neutral base. For example, Bohm (2005) and Bohm & Hiley (1993) have argued, similar to Ismael and Schaffer (2020), that the particles which constitute our world are fragments of an ontologically deeper, holistic quantum ground. Such particles were ultimately guided by a quantum potential, characterized by “active information,” through a process of unfoldment from the “probability flux” within the ontologically deeper “implicate order.” Bohm noted that this deeper ground “is neither mind nor body but rather a yet higher-dimensional actuality, which is their common ground and which is of a nature beyond both” (Bohm 2005, p. 265). However, Bohm may have eventually shifted

his opinion, as Hiley & Pyllkkänen (2022) cite an interview with him suggesting that this deeper ground is “self-aware” (p.441).

The dual aspect framework presented by Atmanspacher & Rickles (2022) is the product of years of effort on the part of Atmanspacher and his colleagues focused on joint work between the physicist Wolfgang Pauli and the psychologist Carl Jung (Atmanspacher, 2012; Atmanspacher & Zurich, 2015). Drawing on Pauli and Jung’s collaboration, Atmanspacher and his colleagues claim that the aspects of mind and matter are based in a psychophysical neutral and holistic base. In recent work, Atmanspacher and Rickles (2022) have incorporated the work of various physicists, including Bohm and Hiley, for an ambitious and comprehensive case for their version of dual aspect monism.⁶

These approaches, which posit an underlying base that possesses resources of a neutral or mental nature, appear to be capable of addressing the quantum measurement problem in ways that avoid explanations invoking a “collapse of the wave function.” These frameworks instead posit an inherently holistic and nonlocal fundamental reality that plays a role during acts of quantum measurement. Atmanspacher & Fach (2007) note that “measurement can be viewed as an intervention decomposing a system constituting an inseparable whole into locally separate parts.” However, Atmanspacher and his colleagues also note that the measurement in the local system has a back-action or influence on the more basic holistic reality. And in the most recent work of Atmanspacher and Rickles (2022), this framework supporting bi-directional interaction between different domains is used to support a sense of meaning consistent with Jung’s notion of synchronicity.⁷

My own thinking diverges from Atmanspacher and others with respect to the status of the phenomenal nature of fundamental reality. As touched on earlier, Atmanspacher and his colleagues took much of their inspiration from Carl Jung, who considered the unconscious mind a central part of his work. Also, Atmanspacher and Rickles noted that Jung was influenced by Kant, who famously held that our knowledge of the world cannot go beyond surface phenomena. However, the nature of consciousness is notoriously problematic concerning what is and isn’t conscious. We do not have access to the conscious states of others (animals and humans different from ourselves). Assuming some version of dual aspect monism is correct, how can we assess the phenomenal nature of the world’s fundamental stuff?

An attraction of the view that fundamental reality is psychophysically neutral is that it (presumably) possesses the resources for all conceivable opposing qualities. “The basic undividedness of reality implies that it is neutral with respect to any distinction, including that of mind and matter”

(Atmanspacher & Rickles, 2022, p. 155). From earlier discussion on quantum mechanics and the intrinsic aspect of matter, we reasoned that this basic stuff is a holistic ground of potentiality, or the potential stuff for the particles that constitute our world. But we also noted that the world's most basic or intrinsic stuff is arguably characterized as the relata that ultimately grounds the relational descriptions of the physical world, and we know of nothing that possesses this property except our own awareness, from which we experience our world. This reasoning, borrowed from Russellian monism, suggests that the most basic stuff of reality is awareness itself.

Another consideration against the neutral non-mental base is that it appears to face something like the hard problem that perplexes physicalist approaches. How are we to proceed to uncover the process of decomposition of the psychophysically neutral domain to the mental? And while applying a phenomenological approach, which requires that we incorporate our direct experience into the inquiry, how are we to make sense of a neutral substance distinct from mental or physical properties? In the following section, I'll discuss another reason why the underlying base is likely conscious: a conscious ground has the resources to support volition or free will, which of course is something we also appear to experience directly.

5. Probabilities, Dispositions, and Choice

But what, if anything, does this sort of framework have to say about real volition? Conventional scientific theories generally suggest that the world's behavior is based ultimately on mathematical laws or randomness and therefore not hospitable to genuine choice. But let's consider here the nature of a fundamental ground characterized as aware potentiality. Without some notion of volition, we might describe this aware ground as witnessing streams of various instantiations from potentiality with no ability to choose or favor a direction of the manifestation. On the other hand, an aware ground of potentiality endowed with some will conceivably has the capacity to favor or direct the nature of the manifestations. An advantage for the latter case is that it provides us with a possible explanation for how aspects of mind and matter emerge from the fundamental domain. It is considerably more difficult to conceive how a fundamental ground that is psychophysically neutral (and therefore not conscious) splits into its mental and physical aspects. Perhaps a vast field of aware potentiality is inclined to favor manifestations of a wide range of experience because it values them. It is difficult to see how such explanations are available to a protomental ground.

We might question how a quantum ground having the capacity to choose squares with our borrowed reasoning from Ismael and Schaffer (2020). They argued that the property of quantum entanglement between entities points to the presence of a common ground “coordinating the randomness” of the system in an inherently holistic way. However, I prefer the more neutral term ‘probabilities’ to ‘randomness,’ as the latter term arguably puts its thumb on the scale, ruling out ‘choice.’ If the fundamental ground is aware potentiality endowed with choice, then perhaps its influence consists in choosing in some sense the experimental outcomes.

Establishing a notion of will has utility in the context of the quantum measurement problem. A quantum measurement can be understood as an intervention within the context of a greater holistic reality. Thus, the relevant system under inquiry includes not only a set of particles, but the entire laboratory setup and the choices of the experimenter, which involve the experimental design and the decision on which variables to observe. The physicist John Wheeler made explicit reference to the experimenter’s choice leading to an actualized outcome from a sea of possible outcomes. Given this, we can understand that the act of measurement imposes a relationship between the entity under investigation and the measurement apparatus. Thus, the intervention of measurement impacts the holistic ground associated with the entire system, rooted beyond the spatiotemporal, and this results in a “choice” from the more fundamental reality.

This interpretation shares something in common with the physicist Henry Stapp’s view. Stapp (2017) also accepted Heisenberg’s proposal that the wave function points us toward a description of the real potentia and described the outcomes of quantum experiments as the results of a mind-like Nature “choosing” the outcomes observed in response to the choices on the part of the experimenter. Thus, incorporating the notion that the most fundamental level of reality possesses not only consciousness but the capacity of choice provides us with a possible answer to the measurement problem. However, Stapp (following Heisenberg) also retains the overall orthodox framework of quantum superposition and “collapse” of the wave function on measurement, which the dual aspect approaches have avoided. The resources possessed by the ontologically deeper entity we have been considering suggest possible explanations for the source of the probability values within the wave function.

Understanding that the link between a foundational ground of pure potentiality and nature’s choice is important. As I’ve argued, while we can’t access this ground within our conscious experience, we can view our experience as an aspect of it. Similarly, we can understand that our direct acquaintance with choice or will indicates a capacity that is derivative of the more fundamental field. Understood this

way, the inherently probabilistic nature of quantum mechanics is not seen as a strange and exotic entity, but rather something that fits coherently into our experience of real choice. James (1911) argued similarly that our own direct experience seemed to be a reasonable way to understand a broader notion of will in nature. In his words:

...the concrete perceptual flux, taken just as it comes, offers in our own activity-situations perfectly comprehensible instances of causal agency....If we took these experiences as the type of what actual causation is, we should have to ascribe to cases of causation outside of our own life, to physical cases also, an inwardly experiential nature. In other words, we should have to espouse a so-called 'pan-psychic' philosophy. (p.218)

James argued that if direct experience of our own volition is our only window into the nature of true causation, then we may have grounds for attributing such agency more broadly throughout our physical world. Importing this reasoning into the framework we explore here suggests that the quantum ground may be a source of agency as well as phenomenal properties.

But such an interpretation faces a key question: if true volition exists at the fundamental level of the world, how do we account for the regularities that appear around us with mathematical precision? The version of dual aspect monism I advocate here is a version of cosmopsychism as well as (arguably) idealism. Idealism is generally understood to have difficulty accounting for the regularity in the world's behavior that leads many to characterize our reality as underpinned by laws. A quantum ground along the lines I have proposed must explain the regularities that provide the foundation for innumerable technological applications.

First, we must inquire into our understanding concerning these regularities that characterize the world's behavior. The most common response, arguably, is that the regularities we observe are evidence that the world's behavior is governed by fixed or rigid "laws." However, a more phenomenological approach might recall Hume's argument that our direct experience demonstrates no real access to the world's causal relationships and such relationships can't be characterized beyond the regularities. A phenomenological approach would suggest caution against characterizing the causal powers of the world in terms of laws in a metaphysical sense beyond regularity.

Dispositionalism is an alternative view among philosophers that avoids Hume's regularity theory, as well as the claim that causality ultimately is based on laws. Advocates of dispositionalism argue that the causal nature of the world is well captured in terms of dispositions, tendencies, or potencies (Bird,

2007; Ellis, 2014; Molnar, 2003; Mumford, 2003). An appealing aspect of this approach is that it appears to be a more general way to characterize the behavior of our world than rigid or universal laws. Physical objects (the domain of physics) can be described in terms of dispositions, as can other areas such as biological systems and human behavior, that are generally not amenable to lawlike behavior.

Dispositionalism also fits better within a phenomenological framework than laws of a rigid or mathematical nature. I do notice that I have a greater tendency to become angry during heavy traffic. I am disposed to calmer responses by a short walk in the woods. Dispositions and tendencies are superior to laws in characterizing our experiences, as well as our behavior.

Advocates of dispositionalism generally argue that all (or most) of the world's properties are dispositional in nature. However, a common objection or concern is that such properties must be grounded by something more fundamental, due to the inherently conditional nature of dispositions. Thus, a world characterized by only dispositions appears vulnerable to an infinite regress. Intuition might suggest that some other class of properties, non-dispositional or categorical, is required to provide something fundamental to ground the properties described in terms of tendencies or dispositions.

On this question of what if anything grounds the dispositional properties of the world, we might return to the quantum domain. Andersen et al. (2018) present a dispositionalist view of quantum mechanics, noting the inherently probabilistic and contextualistic nature of the quantum wave function and thus argue that the world is fundamentally dispositional. They also accept Heisenberg's (1958) recommendation that these probabilities depicted in the wave function represent real potencies. Andersen et al. (2018) thus argue that causation within our world is best understood in terms of irreducible tendencies (potencies) contributed from large numbers of influences, rather than more classical frameworks that entail necessity and predictability.

However, as I've argued, accepting Heisenberg's proposal entails accepting that the potentialities at the base of our world ultimately reside in the high-dimensional space of the wave function, outside of our spatiotemporal order. Further, this ground of potentiality as the intrinsic aspect of the world suggests a ground of awareness. Thus, we have reason to believe that the causal powers of the world can be characterized as dispositions or tendencies that are ultimately grounded in aware potentiality.

Yet arguably, this framework may still have difficulty accounting for the regularities in the world's behavior. Can such an approach, where the properties of the world can be characterized as dispositions

or tendencies grounded in a unified field of aware potentiality that is endowed with volition, truly suffice to account for the world's regularities? I suggest an additional step we might take is to see an intimate relationship between 'dispositions' and 'intentionality.' Intentionality, an important concept in phenomenology, can be understood as the way in which mental states are about or directed towards other objects. Mørch (2020) finds a common view among a number of both historical and modern philosophers that the dispositional and intentional share the nature of a directional tendency toward a manifestation.

If we view dispositions and intentionality as intimately linked, we might reason that a fundamental ground of aware potentiality endowed with volition might select intentions that direct manifestations toward a goal or direction, and this provides the basis for the dispositional nature of the world. Importantly, we have direct experience with setting our own intentions, which we hope will influence our behavioral tendencies. Forming intentions such as following a healthy diet, giving to charities, and studying hard in school influences the dispositions that characterize our behavior, provided we place some meaning or importance with the intentions such that we continue to maintain them. If we accept the reasoning behind the notion of a cosmic mind, our own introspection suggests that the stable regularities that characterize our reality could be conceivably based on the intentions of a cosmic mind. Thus, such cosmic intentions are arguably sufficient to support the regularities we observe.

Some similar notions were considered by Pauli (however, in the context of his joint work with Jung with respect to a neutral base). Pauli applied Jung's notion of 'archetype' functioning within the neutral base such that it performed regulatory and ordering functions in a way that would guide or correct deviations to maintain consistence with an underlying purpose or meaning.⁸ However, here I prefer the notion of intention, with which we have some conscious familiarity.

Recently, Goff (2023) has explored a view of cosmopsychism that I believe is consistent with this idea of cosmic intention. Cosmologists have noted that the universe appears to be fine-tuned, or implausibly calibrated, to support life. Current explanations on the table for this fine-tuning mystery include versions of theism as well as the multiverse; Goff finds both of these unsatisfactory. As an alternative, Goff suggests that a conscious universe possessing agency may have chosen to develop in ways hospitable to supporting life, in accordance with its own values. Goff does not suggest an all-powerful God that simply creates life populated on worlds, but rather a conscious universe with agency, capable of choosing conditions over vast spans of time that are hospitable to life. This

reasoning suggests that a cosmic mind that values life would choose or favor intentions that support its evolution in the direction of producing life.

Thus, cosmic intention(s), residing in an ontologically prior ground of mind-like potentiality, perhaps provides the basis for the regularities and behaviors that characterize our world. And given the vast scales of time and space regarding the universe, such cosmic intentions would by necessity be stable, perhaps lawlike from our perspective. Cosmic and individual will continue to operate, but within the constraints of the ontologically deeper intentions of nature.

Assuming we are on the right track, what does this imply for the quantum measurement problem? A quantum system under investigation involves not just the system's subatomic particles and their properties, but the underlying quantum ground, an aware and holistic field of potentiality. Quantum measurement, in leading toward the instantiation of a particular state, also impacts this underlying ground, which might be comparable to a 'ripple' within its holistic nature. And this 'rippling' of the underlying reality, in its response to the experimenter's probing, is ultimately managed and constrained in some sense by the 'intentions' held within the fundamental ground of awareness.

6. Conclusion

I began the paper by suggesting we might make progress in understanding quantum mechanics by bringing more attention to the world's concrete nature in that domain. If we insist that a complete theory of quantum mechanics describe this concrete aspect, I have argued that we should consider Heisenberg's notion of *potentia* as an ontologically prior basis of the world's particles. In addition, I have proposed that this base is the fundamental ground of both the particles that constitute our world and conscious experience. And this underlying field of aware potentiality likely also possesses the capacity of volition, which manages the dispositional nature of the world on the basis of its chosen intentions. The measurement problem thus can be viewed as the response in the form of tendencies or dispositions, supported by the intentions of a conscious fundamental reality, on probing the quantum domain.

It is of course important to acknowledge the incredulous stare. For many, a framework invoking a cosmic mind supporting the world's regularities through its intentions will likely stretch things past the breaking point. Perhaps we can quietly allow this admittedly unconventional interpretation somewhere on the table where other interpretations currently sit. However, the nature of these alternatives suggests that a non-radical approach to solving the measurement problem may not be

avoidable. Morch (2024) makes a similar point regarding the problem of consciousness. If we accept this, the radical nature of what I propose is not by itself reason for rejection.

In addition, the interpretation I propose does possess virtues that alternative interpretations generally lack. It manages to avoid extravagant ontologies that have no correspondence with our experience. And as I've discussed, it addresses the question of concrete nature, as well as the problems of consciousness and real volition. Further, perhaps a framework supporting the view that different conscious experiences are parts of a common underlying reality justifies the intuition of deeper meaning or oneness that suggests connection with a deeper whole.

Footnotes

¹ Overviews on the most widely discussed quantum interpretations can be found in Albert (1994) and Ney (2013).

² See Alter & Nagasawa (2015) for a collection of essays on Russellian monism.

³ The emerging field of quantum mechanics has found an increasing number of biological processes to have quantum links (Marais et al., 2018).

⁴ Protomental properties are not themselves mental, but can somehow become mental.

⁵ What I propose could arguably also be filed as a version of idealism, as the fundamental stuff of the world is conscious. But given that it is also a field of potentiality, the basis for the particles which constitute the physical world, the nomenclature dual aspect monism is justified.

⁶ In addition to Pauli and Jung, Atmanspacher and Rickles's (2022) approach draws from physicists Eddington, Wheeler, Bohm, and Hiley.

⁷ Bohm and Hiley (1993) describe similar processes in their framework, however, in terms of unfolding and enfolding between the implicate and explicate orders.

⁸ Pauli's letter that Atmanspacher (2012, pp. 114–115) cites attempts to supplement the process of evolution in a way that doesn't rely exclusively on random processes for mutations.

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