The Observer Effect, Radical Skepticism, and Consciousness

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Intro

There is a claim made by some quantum physicists that the reality of quantum particles, that they collapse under observation, means that our perceptions, and thus our understanding of the world, are inherently flawed.[1] The contention is that the *true* reality, of quantum physics, is nothing like what we see, and thus our perceptions are merely a projection, an illusion, a simulation, or otherwise not real.[2] That we cannot trust what we experience and must instead admit that our perceptions and understanding of the world are not just imperfect, but totally wrong, because what we experience is not *really* reality. That there exists some other layer of reality beyond our reach that constitutes a *more real* representation of the universe than what we as conscious, observing beings can access.

I contend that this is a form of radical skepticism in the same vein as Cartesian or Humean skepticism.[3] This essay aims to show that quantum radical skepticism presupposes a particular conception of what it means to be an observer that, while intuitively appealing, cannot reasonably be applied to quantum physics. From this point I work through a potential understanding of what it is to observe that avoids radical skepticism, and attempt to build an understanding of consciousness that follows from this notion of observation. The position I land on falls under the category of what David Chalmers calls panpsychism.

The Observer Effect and Radical Epistemic Skepticism

The story of the observer effect in quantum physics is something like this: a quantum particle exists in a state of probability with no set properties until an observer looks at it, at which point the particle collapses into a concrete state and its properties are set. Thus, the world as we know it doesn't exist until *we observers* look at it.

The quantum radical skeptic says that because we cannot directly observe quantum particles, due to the fact that observation of them affects their state, it is in principle only possible for us to see what they become under observation. Further, even in measuring the properties of a particle we cannot get a full picture of its state, because some of its state has been changed in the very process of measuring it. Thus, the claim may go, there is another, *deeper,* reality in the quantum world that is unknowable to us. This foundational reality is what our world is built on, and thus our perceptions of the world are inherently flawed, relegated to a useful but fundamentally untrustworthy interpretation of reality.

I find this radical-skepticism-prone understanding of the observer effect unsatisfying. I believe it presupposes an untenable conception of what it means to be an observer. But in order to establish this we must figure out: what exactly *is* an observer, and how does it take part in the observer effect?

What is an Observer?

It is my contention that there is some vagueness in our understanding of what an observer is, and that if we can unwind the possibilities of what it means to be an observer then we can better understand the radically skeptical position.[4]

So what do we mean when we say "observer?" Here I will discuss what I call the *common sense* interpretation of what it means to be an observer.

The Common Sense Observer

I think it is safe to say that most people, when confronted with the term "observer," would say that it means something like: a *person* who *sees* something.

This may seem obvious to the point that it might not be worth mentioning, but in the context of the observer effect and quantum physics it is not given that this is the most appropriate understanding. Nonetheless I think it is safe to say that most people, when listening to philosophers or quantum physicists, tacitly understand this to be what "observer" means.

Epistemic Radical Skepticism and the Common Sense Observer

The claim of the radically skeptical quantum physicist is that quantum fields do not collapse into a certain state unless they are being observed. The next step, given the common sense conception of the term "observer," is to conclude that we (*people* who can *see*, and thus observe) must see something for it to exist in the concrete sense that we all understand. If a *person* does not *see* something, it is no more than unrealized quantum potential, which we fundamentally cannot experience first hand.

The radically skeptical quantum physicist claims that, due to this effect, what we understand as a concrete state is in fact an incomplete representation of the more fundamental quantum world. Their claim may be: quantum physics tells us the world works in a way that our eyes are in principle incapable of seeing, and so our knowledge of the world is inherently flawed. "Observer" means "*person* who *sees* something," and no person can directly see quantum particles and fields, only what they become under observation.

In accepting the common sense understanding of observation we have already conceded a conflation of "observation" and "sight," but this may be fine so long as we can come to understand how observation through sight may work, given the observer effect.

Observation Through Sight

In order to have an understanding of observation through sight we will have to decide what it means to *see*. An explanation that I believe most people are familiar with might be: when we see something it is because light photons hit a surface, for example a wall, bounced off of it and made their way to our eyes, where the light affected the photoreceptive parts, which sent a signal to our brains so that we consciously saw what the light had illuminated. In the spirit of the common sense notion of observation that we have identified, I believe this brief definition captures well enough what many people understand *seeing* to be.

But there is a problem: in this understanding of what it is to see, and thus observe, there is a person seeing something, but it is not really the wall they are seeing, it is *the light*. Further, the wall does not know, so to speak, that the light that previously hit it has gone into our eyes. Likewise, the light itself, other than having its wavelength and frequency modified by bouncing off the wall, does not "know" that it hit a wall and then went into the eyes of a conscious observer.[5] Light propagates in a mechanical manner, as light must.

It is unclear how conscious observation through sight links back to the quantum world to trigger the collapse of the quantum field being observed, so that it may settle into a concrete state that we are able to perceive. It is not at all obvious how the act of seeing light can leap out of our consciousness, or eyes, and directly affect this quantum world, which is otherwise totally inaccessible to us. It makes intuitive sense that observation is *seeing*, but when applied to the observation effect the result is not just unintuitive, but opaque.

The Observer Effect and the Unseeable

Even more difficult issues arise when we notice that many parts of the universe have no conscious beings to see them, yet those unobserved things still behave in a way that establishes that they are something other than unrealized quantum potential.

Take, for example, the centre of the Earth. The Earth contains liquid hot magma. We know this at least in part because magma bubbles up to the surface sometimes. But, there are presumably no observers in the centre of the Earth, nor could there be given the immense pressure and heat.[6] Since there are no observers in the centre of the Earth, there should be no way for what is down there to go from a state of unrealized quantum potential to magma as we know it, and if this is the case, then it seems very strange to imagine that a mass of quantum probability has somehow interacted in such a way as to make magma predictably push its way to the surface of the earth.

It seems we must believe that the fields of quantum uncertainty in the centre of the Earth still behave like concrete matter as usual; they still push fields of un-collapsed quantum-proto-magma to the surface, where observers can see them and cause them to be set into the magma that we recognize. This case seems to push our notion of the observer effect to absurdity; are we to believe that the magma we see at the surface of the Earth is "real" so to speak, but that somewhere below it is a field of quantum

possibility, not yet collapsed into being, that produced it?[7] How far must we go beyond our direct observations to get to something that is a field of quantum possibility? At what point does our observation stop working, so to speak?[8] Answers to these question are not forthcoming.

Further, if the unobserved fields of quantum potential at the centre of the Earth act just like actual magma, pushing magma upwards to the surface through heat and pressure, then how can we say there is even any difference between the world we can observe and the other world of quantum uncertainty? If there is no behavioural difference between the two, and we can only ever directly observe the world of collapsed quantum particles that we understand, then we have made a distinction between two states of being that doesn't actually make any difference; they both act the same. This runs counter to the radically skeptical quantum physicist's claim that our observed reality is not real enough, and that the world of quantum potential is the more fundamental version of existence that we cannot access. Instead, the two are the same except that there is one, the world of unrealized quantum potential, that we cannot directly observe.

Everything Opaque

The common sense notion of observation becomes even more bizarre if we take the next logical step in this line of reasoning and note that no one can directly observe the inside of any opaque object. I can see the outside of a baseball, for example, but I cannot see the cork, rubber and so forth inside. It seems absurd to claim that the inside of a baseball, which is not being observed, is in a state of un-collapsed quantum fields of potential, floating inside a shell of observed, and thus collapsed, baseball skin. How could a baseball, which requires a certain density and elasticity in its core, work the way it does if its unobserved insides are a field of unrealized quantum potential? Do we have to assume that the baseball was created in a process where the inside of it was first exposed to observation, so that it was realized into a particular configuration that no longer requires direct observation? Does the observation of the outside of the baseball pass through to the inside of it? These simple questions create a host of issues for the radically skeptical quantum physicist's claim that observation creates the reality we know.

We may go down these rhetorical lines of questioning and decide that, yes, an observed object does stay collapsed into its state after being observed once, or that observation does pass through matter. But, this seems to make unobserved fields of quantum potential impossible if we are around to observe anything at all. Suddenly, even things we don't directly observe are in a concrete state, and so the radically skeptical quantum physicist's claim that our knowledge of the world is incomplete misses the mark; our understanding of the world, even of parts of the world we don't directly observe, is accurate given that everything around us essentially has to be in a concrete state that we are familiar with, understand, and can have knowledge about. If observation works in this indirect way, then when I turn my back to a tree I am not releasing it from the shackles of the deterministic world into the more fundamental quantum world, I am just seeing a tree and then not seeing it while it remains in a concrete state.

Observation Through Non-sight Senses

We could widen our notion of observation to include hearing, smelling and so on. This, I think, goes against the common sense notion of observation, which most would consider to be just visual observation. But, if pressed I imagine most would agree that hearing, smelling and other senses are a form of observation, even if they aren't quite as intuitively understood to be observation as visual observation is.

With these extra senses we can imagine that perhaps the sound waves bouncing off a baseball travel to our ears, just as light bounces off an object into our eyes, so that the baseball is being observed by someone hearing the crack of the ball. Likewise, we could say that someone who can't hear or see the baseball could smell the ball if they were close to it and were familiar with the smell of a baseball, and thus observe it through olfactory senses.[9]

Although including non-visual senses in the observer effect seems fairly reasonable in principle, we begin to stretch the notion of observation into something unintuitive. I can hear a bat hit a baseball, but presumably cannot hear a ball sitting still on the grass; once a baseball, hit by a bat, is aurally observed, does it revert to quantum uncertainty once it lays still on the grass? If I am blindfolded in the presence of a baseball that I have not observed and am unaware of, but I am aware of the wind blowing around me, is the air surrounding the baseball and I collapsed into a concrete state, but the baseball not? How much air around me is being observed? What happens when air I have observed contacts the unobserved baseball?

Instead of finding answers, strange questions about the radical skeptic's understanding of the observer effect pile up when we add more senses.

Unconscious Observation

We could take one further step in service of the common sense notion of observation and claim that one need not be immediately aware of their observation of something for it to affect the quantum state of it. We could claim that we can, subconsciously perhaps, hear or smell or otherwise feel the inside of a baseball, so that it is being observed by us without us being immediately aware of the observation.

While I won't say that this is in principle not possible, it pushes our notion of observation into ludicrous territory that barely resembles anything common sense. We would have to assert that for something to collapse from quantum uncertainty into a set state that it must be observed by a conscious being, but in the case of particles that are not immediately in our field of observation, the observation *must be* unconscious. If this is what it takes for the common sense notion of observation to work under quantum physics then it is a very peculiar state of affairs; we need consciousness *for* observation, but not consciousness *in* observation. This relegates consciousness to a cursory and ineffectual requirement, included only for the sake of our belief that only traditionally conscious beings can observe.[10] It also runs counter to the very value of the common sense notion of observation, that it is an intuitive and agreeable understanding of what it means to observe.

Non-conscious Observation

If I do not know that I am somehow observing the inside of the baseball, it seems *something* in the universe must "know" that the observation is happening in order for quantum particles to collapse, and that might as well be the inside of the baseball. At this point we have reached an inversion of consciousness: I unconsciously observe the inside of a baseball, while the baseball is in some manner consciously aware of my observing it, attributing agency to an inert object while relegating my conscious perception to the backseat behind my unconscious observations. This is decidedly backwards from what I imagine anyone means when they try to elucidate what observation is.

If this is what we are stuck with, an almost incomprehensible common sense notion of observation, forced into an alien shape in order to make it align with the behaviour of radically skeptical quantum physics, then it seems reasonable to suggest that the common sense notion of observation is worth discarding from the context of quantum physics. We might as well take this line of reasoning to its logical conclusion, for there may be other more radical notions of observation that aren't forced into the half-measure of requiring a common sense understanding. But, there is still at least one avenue left to explore.

Observation Through Physical Contact

There is the possibility that observation can happen through physical contact. This seems straightforwardly obvious, since we can be consciously aware of something by sensing it through touch, and thus actively observe it. In this way the keyboard I am typing on right now is being observed by my fingers, and thus is collapsed into a concrete state, despite that I am not looking at it while I type.

But, we arrive almost immediately back to the problem that the keyboard must somehow *understand* that it is being touched by a conscious being, and not, for example, by a pen that has rolled off the desk onto it. How could the keyboard "know" that the quantum particles in my fingers are part of a conscious entity capable of observing? If observation is what brings the keyboard into being, then a pen touching it by circumstance should not allow for it to come into existence, but a touch from me should.

This seems like a serious point of friction between our common sense notion of observation and the observer effect: I am conscious, and I know I am touching the keys, but the keyboard is presumably not, and does not know anything.

A Strange Observer with No Knowledge

I believe we have reached an impasse here. We have exhausted all of the common sense aspects of observation that I can think of, and yet the radically skeptical quantum physicist can still claim our observations are inherently flawed due to the wildly divergent nature of the world as we observe it and the arguably more fundamental quantum world. After all, radical skepticism contends that doubt or uncertainty about our perceptions discredits all knowledge derived from them, and the quantum world

of uncertainty and potential is fundamentally out of reach of our observations, while also being the underlying foundation for all matter in the universe; thus our knowledge of the world is incomplete, inaccurate, or otherwise lacking in a radical manner.

Meanwhile, our analysis of the common sense notion of observation has led us to the absurd conclusion that the observer, who is necessary for reality to exist as something other than quantum potential, must play less of a role than the object being observed; the object being observed must itself somehow "know" it is being observed, while still requiring the conscious observer for its existence as something other than quantum potential. A peculiar state of affairs.

Responses to the Quantum Radical Skeptic

We have analysed the common sense notion of observation and the strange conclusions we come to when it is applied to the context of quantum physics, but there is still a problem: knowledge is in principle impeded by the radically skeptical quantum physicist's claims. The foundation upon which our universe rests, the probabilistic world of quantum physics, is in principle unknowable to us because we cannot directly observe it, regardless of how we understand observation to work. Since our knowledge of the world is based on observation, and we cannot observe the foundational nature of our universe, we must not have any knowledge.[11]

Here I will make two responses to the radical skeptic. The first is based on the work of Michael Williams and Michael Hymers, who show that the seemingly intuitive nature of the radical skeptic's arguments are in fact based on presuppositions that don't hold under scrutiny. The second response points out that the quantum radical skeptic makes a fundamentally anthropocentric argument that clashes with some of their other claims, and suggests that we need a different understanding of observation, and thus consciousness, if we are to make sense of our epistemic relationship with quantum physics and the world.

Unnatural Quantum Doubts

Michael Williams, in *Unnatural Doubts*, argues that radical skepticism requires tacit presuppositions to get off the ground. Specifically, it requires the epistemologically realist doctrine of foundationalism, which holds that propositions and beliefs have intrinsic epistemic status if they are perceptual in nature. This is a contentious theory that we need not accept, especially if it brings radical skepticism in tow.[12]

Williams' offers contextualism as an anti-skeptical candidate. Contextualism holds that no belief or proposition has any intrinsic content or epistemic priority outside of any context. In a particular context certain beliefs will be held as presuppositions that shape the direction of inquiry and allow or disallow certain objections, so that some beliefs and propositions are fixed from criticisms in a particular context.

For example, in chemistry we know that if free radicals of sodium and chlorine come together they react to form sodium chloride. It is clear that we know this, otherwise chemistry would have no predictive value.[13] The radical skeptic's claim is that we cannot believe our eyes when we see this reaction, that there is doubt inherent in our observations, and thus our supposed knowledge has no foundation. The radical skeptic's claim requires us to take on the unnatural presupposition that all context must be wiped away for us to build from an observational foundation up into knowledge.

What Williams' contextualism shows is that the skeptic may make skeptical arguments, but they do so within a context of foundationalism. When we say that sodium and chlorine come together to make salt, we say this with the understanding that certain rules of chemistry are presupposed. If the radical

skeptic retorts “How do you know that sodium and chlorine are *really* reacting to make salt if your eyes can be deceived?” we have just traded the context of chemistry for the epistemically questionable context of foundationalism.[14] Despite the radical skeptic’s claim to be working from a clean slate, they too are contextualists: the context of their epistemic claims is the narrow doctrine of foundationalism.

Here we can see how the radically skeptical quantum physicist’s argument mirrors that of other radically skeptical arguments: we claim to have knowledge of the world through our observations, but our observations are inherently tinged with doubt, either because we are dreaming, somehow deceived, or due to the fact that we cannot directly observe the quantum world. This argument is foundationalist in the manner described above: we must build our knowledge up from the foundation of observation, but observation of the world can be doubted, thus all claims of knowledge are unreliable. Here the contextualist approach provides a counterpoint: the context of foundationalism does not need to be presupposed to build up to knowledge, thus we need not question every observation with deep doubts, quantum or otherwise.[15]

Physical Foundationalism

There is another way in which the radically skeptical quantum physicist presupposes a foundationalist epistemic view: the world we can observe, the deterministic world of standard physics, has at its foundation the indeterministic and probablistic world of quantum physics. Thus, all of our knowledge of the world is moot; what we think is consistent, predictable physical behaviour is, underneath it all, unpredictable and unknowable.

Here too I think a contextualist approach applies. We need not presuppose that our understanding of standard physics has a fuzzy quantum foundation for it to function as knowledge. In the macro context that we can all observe, the presupposition is that of standard physics, and it is in this context that much of our knowledge of the world works. But, in the context of quantum physics there is an understanding that standard physics does not apply. The quantum world is unpredictable and unobservable, but when we zoom out to the world we all experience, we need not take those quantum considerations as presuppositions in our epistemic context to have knowledge.

It is worth noting that context here is not just theoretical and philosophical fancy, but a scientific necessity. As Shankar writes: “What about common sense, which says that billiard balls and baseballs travel along definite trajectories? How did classical mechanics survive for three centuries? The answer is that the wave nature of matter is not apparent for macroscopic phenomena since [the reduced Planck constant] is so small.” (*Principles of Quantum Mechanics*, pg. 112) Knowledge is by necessity different when we do quantum physics than when we do classical physics. The physical context of what we study, tiny quantum particles or macro baseballs, determines whether the predictive act, and thus our knowledge, is probabilistic or deterministic.

For example, when a pool ball is struck we can predict what hole the ball will go into, assuming we know where it was struck, how hard, etc. That is to say, we have knowledge of standard physics that

can be used to predict the movement of pool balls. This knowledge is seated in the context of classical physics, where certain laws and rules *must be* presupposed. Questioning whether our pool balls will *really* move in the way we predict because there is actually very many quantum particles that make up the pool balls, and those quantum particles behave in ways that aren't consistent with classical physics, does not change our knowledge, but instead changes the context. One context for quantum physics, another for classical physics, without a single, pivotal foundation for both to be built from.

I think we have made a good case that quantum radical skepticism draws on the same arguments that Agrippa, Descartes and Hume built their radical skepticism on; foundationalism, which forces our observations to be the sole basis of all of knowledge, is presupposed as the context for all epistemic inquiries, dooming them to fail even when other contexts are vastly more appropriate.

But, I contend that there is still something unusual going on with the quantum radical skeptic's use of observation as an epistemic tool that demands further analysis.

Quantum Anthropocentrism

In the discussion of quantum mechanics and the observer effect it seems there is a conflation of the common sense notion of observation and some other notion of observation that must be particular to quantum physics. This common sense understanding of observation leads to the ego-centric conclusion that you or I *specifically and directly* create reality.[16]

This leads to tension in the radically skeptical story about the observer effect: the very observation of the universe that "reality" (whatever we make of that term) depends upon is also exceedingly inaccurate, a mere shadow of the true reality of quantum potential and uncertainty. We are in principle part of the universe (we are after all made of quantum particles ourselves) but it is a universe that we don't and can't understand first hand, despite our direct effect on it and inclusion in it. Our senses are inaccurate identifiers of what the underlying quantum world is *really* like, and are only good for survival, not knowledge.[17] While I wouldn't say these points are necessarily contradictory, there is something peculiar going on.

This anthropocentric view puts us (and perhaps all traditionally conscious entities) at the helm of the universe, defining reality, and puts far more primacy onto us as humans than is necessary or reasonable.[18] The fact that this anthropocentric understanding of observation also, paradoxically, leads us to radically doubt the very reality that we apparently create and are part of is another strike against the common sense notion of observation, by my estimation.

I contend that this anthropocentric understanding of the observer effect, combined with the foundationalist presuppositions that the quantum radical skeptic shares with all radical skepticism, weakens these radically skeptical claims. Knowledge is inherently contextual, not foundationalist, and the observer effect becomes absurd if we try to apply it in such a way that only traditionally conscious beings such as ourselves can take part in it.

What is an Observer, *Really*?

We have analysed the conception of "observer" that I believe epistemic radical skeptics in quantum physics tacitly use and we found that we must tie ourselves in knots to make sense of how a traditionally conscious observer could affect the world, even the quantum world, in such a drastic and fundamental way. We have also highlighted the foundationalist underpinnings and anthropocentric nature of quantum radical skepticism.

But, we still haven't decided *what an observer is* exactly. Our intuitive understanding is that an observer is someone, like us, who can see and otherwise experience the world, but in the context of quantum physics this understanding is clearly flawed.

Further, according to the radically skeptical quantum physicist, their radically skeptical claim is not merely a thought experiment, it may be argued it is a *scientific fact* about the universe. This sets the quantum radical skeptic apart from their philosophical counterpart; it might not be logically consistent, but if it happens it happens, logic or not.

Science and Observers

We must then turn to science, and refer to the writings of those familiar with quantum physics. Richard Feynman, in the *Lectures on Physics*, has this to say while discussing the double slit experiment (emphasis added):

> 'To our electron apparatus we add a very strong light source… We know that electric charges scatter light. *So when an electron passes, however it does pass, on its way to the detector,* ***it will scatter some light to our eye, and we can see where the electron goes***.
>
> …
>
> Here is what we see: every time that we hear a "click" from our electron detector… we also see a flash of light either near hole 1 or near hole 2… *From this observation we conclude that* ***when we look at the electrons*** *we find that the electrons go either through one hole or the other.*
>
> …
>
> That is understandable. *When we do not see the electron, no photon disturbs it, and* ***when we do see it, a photon has disturbed it***.
>
> …
>
> *If it is true that* ***whenever we "see" the electron*** *we see the same-sized flash, then* ***those electrons we see are always the disturbed ones***.'

There is some ambiguity in what Feynman wrote. At times he says that when *we see* a particle it changes from behaving like a wave to behaving like a discrete particle. But at others it is clear that he uses the term “see” (in quotations) to refer to the fact that it is not *us* seeing the particle that matters, but the light used to interfere with it. It is not us consciously observing the electrons that makes their wave function collapse, *it is the light that affects it so that it stops behaving “wavy” and starts behaving “lumpy.*” We see the *results* of this disturbance, we do not cause it.

The key here is that *passing through the light* may be what causes the wave function to collapse, not that *we personally* looked at the electrons. I think it is easy, though, to see how different interpretations of the observer effect have been drawn.[19]

Science and Consciousness

Then where does consciousness fit in to all this? Feynman, in a later section titled “Philosophical Implications,” has this to say:

> The problem has been raised: if a tree falls in a forest and there is nobody there to hear it, does it make a noise? … We might ask: was there a sensation of sound? No, sensations have to do, presumably, with consciousness. And whether ants are conscious and whether there were ants in the forest, or whether the tree was conscious, we do not know. Let us leave the problem in that form.

This is understandable from Feynman’s point of view; the scientific project since Galileo has been about objective measurement. When we bring the notion of consciousness into science it seems there is nothing to measure, and so we “leave the problem in that form.”

It seems likely that the traditional notion of consciousness, and thus the common sense notion of observation, does not play a role in the observer effect. I must agree with this conclusion; I believe that my analysis of the common sense notion of observation has shown that traditionally conscious observation causing wave function collapse leads to absurd results, and Feynman’s explanation of the double slit experiment shows us that it is the light interacting with the electrons that causes their wave function to collapse, not the scientist consciously seeing the electrons pass through the slits.[20]

While I propose that traditional understandings of consciousness are not necessarily involved in the quantum observer effect, I disagree that we must “leave the problem in that form.” I contend that even though the traditional understanding of consciousness is not directly involved in the collapse of quantum particles, there may still be a connection between quantum physics and consciousness.

The Hard Problem and the Harder Problem

Consciousness, as Chalmers put it, is the hard problem. We can look at matter in the world all we want, but we cannot find consciousness, we can only experience it individually, subjectively. Likewise, there is a deep peculiarity in physics and science more generally: we know that quantum particles behave in fundamentally unpredictable ways, but we don't know *why* a particle may go through one slit over another. We can only know, after the fact, that a particle did go through one or the other slit.

Science can tell us the *way* quantum particles tend to behave, but as for deciding *why* they behave that way, science has no approach. Newton and Feynman seem to be in accordance in asserting "*Hypotheses non fingo*" about this deeper why.[21] This is arguably an even harder problem than that of consciousness, for with conscious experience we at least each have our own undeniable perspectives to work from. With the unpredictable world of quantum physics we have nothing more than behaviour, and statistical, non-deterministic behaviour at that.

Here I think there is a deep parallel: two hard problems, each of them seemingly unassailable by science. There must be a connection.

Building A New Understanding of Observation and Consciousness

I strongly believe that we must build an alternate understanding of what is to observe, and thus what it is to be conscious, to get some footing on these problems. I hope to lay out what a radical interpretation of observation, and thus consciousness, may look like, given the failings of the common sense notion of observation and the fundamentally inaccessible nature of the quantum world.

Observation Through Quantum Interaction

The previous line of reasoning leads us to another possible conception of what "observation" means that we have been skirting around: that observation in the context of quantum physics is the physical interaction of quantum particles. That is, when we see the wall, the wall does not somehow know that it is being observed by the traditionally conscious observer that is me, it only knows, in the sense that its particles were affected by some light waves/particles, that it was contacted by light, and may thus be collapsed from a field of quantum possibility into a set state.

This may seem like a bizarre statement, because now we have *no* traditionally conscious observer. Instead, the observation is being done by what we would consider non-conscious quantum particles interacting physically. But, the idea that quantum particles observe one another is consistent with experiments like the double slit experiment.[22] As we learned from Feynman, it is *light disturbing the electrons* as they pass through the slits that makes their wave function collapse from a destructive pattern into the constructive pattern of discrete particles. If observation causes this collapse, then we ought to consider that particles can observe.

What Matters to Consciousness?

Here I would like to discuss how we understand consciousness. Generally, philosophers and scientists take consciousness to be subjective experience, the impressions of qualia: colour, sound, touch and so forth. From this understanding of consciousness comes the hard problem: I experience qualia, but in scientific, objective measurement of the brain and body, there is no qualia to be found. We can see the state a person's brain is in when they purport to be experiencing certain qualia, but *why* certain brain and body states are correlated with one's subjective experience seems an intractable problem.[23]

Closely linked to our understanding of subjective experience is the notion of choice and free will. This problem seems to be considered a side problem to the hard problem; we are conscious, and generally think of ourselves as having free will, but whether or not we have free will is a distinct, though related, issue. The discussion of free will involves consciousness in that we assume a prerequisite of free will is consciousness, but the hard problem comes first; consciousness is subjective experience, but whether a conscious being has free will can be considered regardless of how we understand the origins of subjective experience.

Consciousness as Agency

Here I would like to offer an alternative interpretation of what matters to consciousness: the primary quality of consciousness is agency. I contend that we may have had our understanding of consciousness backwards; it is not subjective experience that defines consciousness, with choice and free will falling out of consciousness as a distinct phenomenon and problem. It is the *ability to choose* that defines consciousness, with subjective experience falling out of this ability to choose, so to speak.

I am conscious, and happen to be able to choose how my body, the collection of quantum particles under my purview, moves, but in order for me to be able to make choices about how my body moves I must have some sort of subjective experience of the world in order to make those choices; without the experience of the *context* of our surroundings and ourselves, there isn't a choice to be made. We must have knowledge to make choices, and there must be context for knowledge to operate, so we have subjective experience to provide context for choice.

This goes for me as much as it does the quantum particle; we don't know why a particle goes through one slit or the other, and likewise we don't know why *I* am able to cause a brain state to occur that moves my arm.[24] The answer for both might as well be consciousness. Under this understanding of consciousness, subjective experience is something like an epiphenomenon of the ability to choose; choice necessitates contextual information, and so subjective experience of the world is produced out of the ability to choose.

Consciousness at the Quantum Scale

Here we have reached a possibility that several quantum theorists and philosophers have argued: that consciousness is a fundamental aspect of the universe, and thus a fundamental part of quantum particles themselves.[25] I think if we take seriously the notion that consciousness may be fundamental, and that consciousness may be defined by agency, then we must take seriously the possibility that quantum particles can make decisions.[26]

How Can a Quantum Particle Choose?

Setting aside our traditional notions of what or who can be conscious, if we were to imagine a being that was constrained to the physical limits of a quantum particle, how could it choose? It seems it could either be stuck in a state of quantum uncertainty, trapped in a field of probability where it can't at that moment choose *anything*, or it can collapse into a concrete state when another particle is nearby to observe it and be observed, at which point it can choose a particular position, spin, velocity, etc. The options of what states it can choose to be in are dependent on the other particle(s) it is being observed by, its physical context, but in this limited set of choices we can imagine a very narrow state of consciousness.

As humans, traditionally conscious beings, we have "full" consciousness, so to speak.[27] Many of us can see things, choose to move towards them, touch them, pick them up, smell them, attempt to communicate with them, and so on. We are able to do all these things because of our physical configuration: we have brains, nervous systems, sensory organs, thoughts, memories and so on.[28] A quantum particle has an extremely limited physical configuration compared to us, and thus there may not be much it can choose to do. Nonetheless, the *exact* state it ends up in is chosen from a set of possible configurations. It is here, in a quantum particle's commitment to a set of concrete, collapsed states that I contend a particle is consciously choosing.

There is a clear interpretation given the limited possibilities: a quantum particle is conscious in that it reacts to other quantum particles, changing its state once it is observed by them, and changing their states by observing them as well. A proton knows that there is an electron near it because its state would be different, or even nonexistent (in the sense that it is in a stateless superposition), if there wasn't. Through their exchanges of energy, and the rudimentary qualia they might experience, they observe one another. This observation collapses particles from clouds of quantum potential into something "real": a proton, electron, photon, etc. with a particular set of properties. The properties of a particle are chosen by it in the moment of collapse. Freed from a stateless situation of probability, a quantum particle finds a limited but concrete set of choices it can make.[29]

The result of this conception of observation is somewhat extraordinary: *every* particle in the universe is an observer, with the potential to observe every other particle in the universe.

What About *Our* Consciousness?

I believe that if we take the notion of the fundamental nature of consciousness seriously, then we must also contend with the possibility that our consciousness is in some way dependent on the proto-consciousness of quantum particles. Under a materialist position, our consciousness comes out of the structure of our physiology, brains, nervous systems, and the senses, memories, thoughts and so on that are derived from them. A problem with this line of reasoning is that we cannot find consciousness in any of this structure, we can only experience our own subjective qualia.

If we consider that consciousness may be fundamental, then we can find consciousness within our brains and bodies in the quantum collapses, and thus choices, that occur within us. There is still a more varied and broad consciousness built out of the whole structure, involving memories, thoughts, desires, feelings and so on, but at its base, consciousness is arguably demonstrated by all the particles that make up a person.[30]

I think this understanding of consciousness dovetails well with Stuart Hameroff and Roger Penrose's notion that quantum collapse is a form of proto-consciousness that occurs regularly in the brain, but much less consistently in what we would call inanimate objects. All quantum particles are capable of conscious choice, though the quantum particles in a wall, which have been set into a concrete state and are unlikely to go through collapse, only experience fleeting moments of consciousness as random collapses occur, if at all.

A person, who we would call traditionally conscious, may have a consistent reoccurence of quantum collapses going on in itself, and thus a more consistent state of consciousness derived from the consciousness of its very many constituent particles. A wall cannot choose anything, even if its individual particles make choices every so often, due to the inconsistency of its quantum states and the concrete nature of the vast majority of its particles, but a person can, due to the much more frequent and consistent quantum collapses ongoing in its structure.

Conclusion

This understanding of quantum observation and consciousness, I think, avoids the radically skeptical notion that our understanding of the world is epistemically flawed. What we observe in the common sense is not a false understanding of a universe that is a sea of untapped quantum possibility until we trick it into looking like something we understand, but a reliable representation of a great many particles that are, by necessity of other quantum particles observing each other, collapsed into a consistent state at (almost) all times by being conscious of one another through physical interaction.

The existence of humanity, or any other traditionally conscious being, is not necessary for quantum particles to observe and be observed. The world does not exist in uncertain fields of possibility until *we* observe it, as the radical skeptic claims, but is instead almost necessarily collapsed into a state of concrete being by the existence of other quantum particles. All particles are, at least contingently, very likely being observed by other quantum particles, almost always conscious of some other.

Thus, the world is not uncertain until observed, as if the wall behind me “exists” in a state of uncertain quantum suspension when I am not looking directly at it, because all is being observed by all. Every part of the wall, every particle in it, observes some other particle in it. The universe observes itself and all it contains, *with* all it contains. Humanity is just another type of observer on top of all of the quantum particles that observe even without us here, and we are not a special type of collection of quantum particles that can collapse fields into concrete states with a glance. We choose, and so do quantum particles, and to do so we must both observe.

1 “Collapse” means something like wave function collapse, though some thinkers refer to quantum fields, probability clouds, etc. The general idea is something that changes its state from probabilistic to deterministic under observation.

2 Simulation theory is invoked in connection to quantum physics and the observer effect often. Nick Bostrom proposed the simulation hypothesis, which states that there are three possibilities about whether humans exist in a simulation, the third of which, if true, means a high likelihood of humans existing in a simulation. Neil deGrasse Tyson said that the simulation hypothesis had "better than 50-50 odds” of being true, though later accepted a counter-argument by J. Richard Gott. Thomas Campbell claims scientific experiments funded by the Center for the Unification of Science and Consciousness are “expected to provide strong scientific evidence that we live in a computer-simulated virtual reality.” Donald Hoffman claims that our senses act as a “headset” that prevents us from directly perceiving the true nature of reality. The last two examples explicitly invoke quantum physics and the observer effect as reason for believing in a simulation.

3 See *Meditations on First Philosophy* by Rene Descartes, and *An Enquiry Concerning Human Understanding* by David Hume.

4 On social media I encountered an enthusiast of Donald Hoffman’s understanding of quantum physics being asked if dogs counted as observers, and their answer was simply “I don’t know.” While I wouldn’t take this person to be representative of quantum physics as a whole, they are at least representative of *some* understanding of quantum physics, while also seeming not to have any explanation of what it means to be an observer. As such I think analysis is necessary.

5 I use quotes around the term “know” to deal with the confusion caused by the radically skeptical quantum physicist’s claims, rather than to denote reference to a word. According to the radical skeptic we cannot know anything about the world due to our inadequate senses, so surely a wall could not know anything either, but *something* must know that observation of the wall is happening. Knowledge is both unobtainable and necessary, and so this confused type of knowledge is demarcated with quotes, to differentiate it from what one might call usual use of the term.

6 Could bacteria, evolved to withstand high pressure and heat, observe what is going on in the centre of the Earth? It may seem a silly question, but it elucidates a clear issue with the common sense understanding of the observer effect: it is totally unclear what is “allowed” to observe. Humans can clearly observe, and bacteria react to their environment, so they are in some sense observing the world, but where the line is drawn between “real” observation and some other type of interaction with the environment seems arbitrary.

7 I placed quotes around the term “real” here because the radically skeptical quantum physicist’s claims make it very difficult to say that *anything* is real, in the sense that we normally use the term. Under most circumstances we would say that whatever is around us is real; the chair I sit on, the house around me, the magma in the Earth, are all real in this sense. The radically skeptical quantum physicist claims instead that the quantum world of uncertainty is the more fundamental *real* reality, but we cannot access it with our limited senses. Thus the magma we observe at the surface of the Earth is real in the traditional sense, but according to the understanding of the radically skeptical quantum physicist it is only “real” in the sense that it is a semi-reliable construction of our mind. The quantum world is *really* real, while our experiences may only be called “real.”

8 A quick remark about these rhetorical questions: normally a rhetorical question is asked when an answer is obvious, in which case the rhetorical could have been replaced with the obvious answer, but here there is no obvious answer.

9 These issues get even more complicated if we imagine a recorder playing the sound of a struck baseball is heard by someone. There are shades of Gettier’s justified and true belief here. If someone aurally observes a recording of a baseball being hit, does the recorder collapse into a concrete state, despite it not being a baseball? The recorder in a state of quantum uncertainty (if we can even call such a thing a recorder) doesn’t “know” that it was heard and understood as a baseball being hit, but it also definitely does not have justification or truth on its side. We can likewise ask if someone who smells a baseball, but does not know what a baseball smells like, has *truly* observed it.

10 I use “traditionally conscious” to describe the kind of consciousness that you and I experience.

11 One might ask, why engage with the radical skeptic at all? Why not just get on with science? Because, if we take the radically skeptical project seriously, then we are totally trapped *within* our consciousness. If this is the case, the hard problem of consciousness becomes the impossible problem; trapped in our consciousness, we are unable to make any conclusions about the universe at all, let alone how our consciousness comes about.

This form of radical scepticism is also difficult to ignore; philosophical radical scepticism may paint a dire picture of our epistemological standing, but at the end of the day we just have to get on with it, as Goff says. But, if quantum physics itself shows, *scientifically*, that our knowledge is in principle baseless, then we cannot simply get on with it; it is unavoidable, not the armchair musings of philosophers. (Continued on next page.)

Finally, there is a deep tension in this radically skeptical claim: if, due to the very nature of quantum mechanics, we know nothing of the world, then we know nothing of ourselves; but, we *do know* our subjective experiences. The unknowable nature of radically skeptical quantum physics is at odds with the undeniable nature of subjective experience.

12 Michael Williams writes: “The assumption that we know about the world ‘by means of the senses’ is simply shorthand for a foundational view of knowledge and justification. This is an example of what I suggested is a recurrent pattern in supposedly intuitive arguments for skepticism: a seeming truism (all empirical knowledge is in some sense dependent on the senses) serves to introduce a contentious epistemological doctrine (all knowledge of the world must be derived from more basic, experiential knowledge).” (*Unnatural Doubts*, pg. 69)

13 As Goff explains of Arthur Eddington: “The crucial point Eddington is trying to convey with his talk of ‘pointer readings’ is that *physics is a tool for prediction*.” (Galileo’s Error, pg. 125) Much of science’s value comes from its predictive value, but it cannot explain *why* things behave in predictable or unpredictable ways, just that they do.

14 There are some fields where foundationalism seems applicable, mathematics and logic being two examples. Without the foundational assumptions from which we build their internally consistent systems, there is no math or logic at all. We must start from somewhere in such systems. Here some argue that math *is* actually a material fact of the world, and we learned math because we observed it as part of the universe, in which case a radical skeptic may assail even knowledge of mathematics. I disagree with this mathematical realism, but that discussion is out of the scope of this essay.

15 Here I go beyond Goff who says that radical skepticism, while stripping us of certain knowledge, at least gives us the insight to understand that scientific inquiry is not about absolute certainty. As he says of Hume’s radical skepticism: “You merely have to stop philosophizing and get on with life and these skeptical worries about the external world evaporate like morning mist.” (*Galileo’s Error*, pg. 180) Instead, my position is that we *have knowledge*, so radical skepticism must be wrong. We do not select a starting point arbitrarily because we have to start somewhere, but we start from somewhere appropriate because that is how knowledge fundamentally operates.

16 It is worth noting here that we “create” what we see in the sense that our brain interprets light going into our eyes so that we may make sense of what we see in front of us, but the more radical claim is that reality is in a literal sense *created* by us observing it, due to quantum collapse occurring when a particle is observed; reality would be fundamentally different if we weren’t observing it, in a state of quantum uncertainty unknowable by conscious minds. It is this second sense of reality creation that I speak of here.

17 Here I disagree with Goff (*Galileo’s Error*, pg. 4), and Annaka Harris that “all we have is consciousness” and that our observations are an illusion only good for survival (Nicholas Humphrey, *Soul Dust.*) It seems almost contradictory to contend that our conscious observations are not at least sometimes representative of the very universe from which our observations must be borne. The radical skeptic says that if we were vats in a brain, our experiences would be indistinguishable from the experiences we would have otherwise. I contend that it is just as, if not more, likely that we must have a connection with the universe through this survival mechanism. The connection is knowledge *through* consciousness. Our consciousness is representative of the world precisely *because* it is good for survival. As Michael Hymers writes: “If… we suppose that we are internally related to the world in our experience of it, then we must conclude that we can have no knowledge of our own experience without knowing something of the world around us.” (*Philosophy and its Epistemic Neuroses*, pg. 7)

18 I would say that the geocentric model is to astronomy what the observer effect is to reality in this line of reasoning. We are not at the centre of the universe, nor are we at the centre of reality.

19 Even among established scientists, whether a traditionally conscious observer is involved in a particle’s collapse is not agreed upon. Heisenberg wrote, "The probability function… is suddenly reduced to a much narrower range by the fact that the experiment has led to a definite result… this reduction requires that the so-called interference of probabilities is destroyed by the partly undefinable and irreversible *interactions of the system with the measuring apparatus* and the rest of the world."(*Physics and Philosophy - The Revolution in Modern Science*, pg. 142) Bohr, on the other hand, suggested that collapse was "characteristic of the very concept of observation." (*Niels Bohr as philosopher of experiment: Does decoherence theory challenge Bohr's doctrine of classical concepts?* pg. 80) Sabine Hossenfelder asserts that traditional consciousness affecting wave function collapse is pseudoscience. Quantum physics leads some to draw mystical conclusions, while materialists tend towards the “shut up and calculate” understanding. I hope this essay shows that we need not defer to mysticism, but we should also consider that there is more to quantum physics than just calculations.

20 It seems this must be the case, because simply looking at the double slit experiment would mean no one could *ever* see the destructive interference pattern, only the constructive pattern, for *any* observation would cause the wave function to collapse; the destructive wave function would be visible only when it was unobserved, paradoxically.

21 Here Newton was speaking of the underlying mechanism that generates gravity, but Hume makes the broader point that we can't explain any of the causal relationships of the universe (*Galileo's Error*, pg. 29).

22 Seth Lloyd proposes that quantum particles may be observers, though in a non-conscious manner.

23 As Goff writes: "So long as we follow Galileo in thinking (A) that natural science is essentially quantitative and (B) that the qualitative cannot be explained in terms of the quantitative, then consciousness, as an essentially qualitative phenomenon, will be forever locked out of the arena of scientific understanding." (*Galileo's Error*, pg 21)

24 To be clear, I am not saying that scientists don't understand the mechanics of arm movement. Physiology, biology, etc. tell us that certain brain states, bioelectric signals, and nervous system activity lead to arm movement. The point here is that it is unclear how ***I*** make all of that happen, how my choice makes matter (even the matter that is considered part of me) move and otherwise go through these physiological and biological processes. This could be considered something like a version of the hard problem for agency.

25 There are a number of thinkers who have proposed something like this, Stuart Hammeroff, Roger Penrose and Philip Goff being central inspirations for this essay. But scientists and philosophers such as Max Planck, Galen Strawson, Bertrand Russell, Arthur Eddington and Federico Faggin have also put forward panpsychist theories. This is by no means an exhaustive list.

26 Ediho Lokanga also proposes that quantum particles make choices, in the paper *A Special Relationship between Matter, Energy, Information, and Consciousness* (2020, Pg. 9.)

27 I would not say that humans' form of consciousness is somehow the most complete form of consciousness. But, compared to very limited forms of consciousness, I take our consciousness to be "full" in the sense that it is obvious that we are conscious in the traditional sense. It is less obvious that a bacterium is conscious, even less so a quantum particle, given traditional understandings of consciousness. But, limiting our notion of consciousness to only that of "full" consciousness, our consciousness, is an anthropocentric mistake.

28 I should be clear here that as traditionally consciousness beings, our ability to move is not the only type of consciousness that matters. If my body is rendered immobile I can still choose to think, remember, even communicate, and I am no less conscious as a result.

29 I think an interesting case can be made that the choices available to a quantum particle can be defined explicitly with the Born rule and amplituhedrons.

30 Goff writes: "… mass and charge are incredibly simple forms of consciousness. Moving up a level, chemistry characterizes chemical properties 'from the outside,' but 'from the inside' they are complex forms of consciousness derived from the basic forms of consciousness found at the level of fundamental physics." (*Galileo's Error*, pg. 132)