Epistemological Limits and Quantum Realities: A Kantian Analysis of QBism and Relationalism

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Abstract
This article explores the relationship between Kantian epistemology and QBism, a modern interpretation of quantum mechanics. QBism reconceives scientific objects not as independent entities but as phenomena synthesized through the observer's active role. It emphasizes the interdependence of knowledge and observation, rejecting the notion of a pre-existent, absolute reality. Much like Immanuel Kant's assertion that the *thing-in-itself* lies outside human cognition, QBism denies ontological status to the unobservable or unexperienced, grounding objectivity in intersubjectivity: the shared cognitive structures of human agents.

Within this Critical framework, I address an objection raised by Carlo Rovelli, who critiques QBism for anchoring reality to the observer, claiming it risks falling into idealism by positioning the subject outside nature. Rovelli defends a relational view, situating the observer within the world as describable by the same physical laws that apply to all objects. In response, I argue that the QBist observer represents a universal human subject, not a single determinate agent and that intersubjective agreement ensures objectivity without collapsing into solipsism.

A brief introduction to quantum mechanics

Quantum mechanics is the physical theory that describes reality on a subatomic scale. Formulated during the first half of the 20th century, it is imbued with a series of concepts and paradoxes that make it profoundly counterintuitive compared to our everyday experience. The fundamental idea of the theory, which develops around the concept of granularity, has its roots in the work of Max Planck. In 1900, Planck realized that energy is not distributed continuously but in discrete "packets": quanta. Einstein later extended this concept to explain the photoelectric effect, alongside the hypothesis that light

itself is composed of these quanta – photons. However, the real revolution brought about by quantum mechanics lies not only in the quantization of energy but in the way it redefines fundamental concepts such as position, causality, and the nature of particles, thereby reshaping our broader understanding of natural reality.[1]

A famous example of the counterintuitive nature of quantum mechanics is the effect of quantum superposition: a particle can exist in multiple states simultaneously. This is exemplified in the well-known double-slit experiment (or, in a more "popular" version, Schrödinger's cat paradox). When a photon is directed at a plate with two slits, without being observed, it behaves like a wave, passing through both slits simultaneously and creating an interference pattern. However, if one observes which slit the photon passes through, the interference pattern disappears, and the photon behaves like a particle, passing through only one of the two slits. In this sense, the act of observation appears to influence the physical state of the particle, introducing an element of uncertainty: it is impossible to know both a particle's precise position and its velocity simultaneously, a principle formalized by Heisenberg as the uncertainty principle.

How is it possible for a particle to be in two places at once, or for the mere act of observation to alter its behaviour? The answers to these questions depend on how one interprets quantum phenomena. The most traditional interpretation – the Copenhagen interpretation, developed by Bohr and Heisenberg – suggests that the so-called collapse of the wave function[2] occurs when a measurement is made, with this collapse selecting one of the possible states and giving the particle a definite reality. In other words, quantum reality is "indeterminate" until it is observed. The main difficulty with this interpretation lies in its implication of an active role for the observer, assigning ontological significance to the act of measurement.[3] If our intervention determines physical

[1] For more accurate historical reconstructions than the one synthetically presented here, see Carlo Rovelli, *Helgoland* (Milano: Adelphi, 2020); Carlo Rovelli, *La realtà non è come ci appare* (Milano: Raffaello Cortina, 2014); Michel Bitbol, "Kant et la mécanique quantique," in *Ouvrir la logique au monde*, ed. J.-B. Joinet and S. Tronçon (Paris: Hermann, 2009), 89–110; Paolo Pecere, "La meccanica quantistica tra positivismo e realismo: origini e sviluppi di una controversia," in *Il libro della natura. II, Scienze e filosofia da Einstein alle neuroscienze contemporanee*, ed. Paolo Pecere (Roma: Carocci, 2015), 45–67; Werner Heisenberg, *Physics and Philosophy: The Revolution in Modern Science* (New York: Harper & Brothers, 1958; reprint, New York: Harper Perennial Modern Classics, 2007).

[2] The wave function is the mathematical description of a quantum system, generally denoted by the Greek letter psi (Ψ).

[3] Hence the famous "measurement problem": see, for example, John S. Bell, "Against Measurement," *Physics World* 85 (1990): 33–40.

reality, how can we justify the existence of the world in the absence of observers?

Other interpretations attempt to resolve these paradoxes without resorting to a "collapse" of the wave function. The many-worlds interpretation, for instance, posits that all possibilities described by the wave function are realised in separate parallel universes, with each possible outcome of the measurement occurring in one of these worlds, thus eliminating the need for a collapse. In this view, quantum mechanics does not require an observer to "determine" reality; however, it does imply a multiplicity of worlds, which amounts to assuming the existence of something unobservable. Conversely, according to the hidden variables interpretation, an electron has a single position, and there is no superposition of states. This hypothesis, supported by Einstein, who believed nature to be strictly deterministic,[4] was strongly criticized by John Bell.[5]

A viable alternative to these positions is provided by the relational interpretation. According to Carlo Rovelli, the state of a particle is not determined by the system itself but by the relationship between the system and its observer. In other words, there is no possible or conceivable state without a relationship. The wave function does not describe a standalone situation but rather how a physical object might manifest to another physical object – us. Physics already has an inherently relational character, which becomes particularly evident in quantum mechanics. Every element can only be defined as such in relation to another element. It is the concept of relation that grounds that of a thing, not the other way around: a thing does not have properties inherently ascribed to itself but possesses certain properties only in interaction with one or more objects. If those properties do not manifest to something or someone, it is as if they do not exist.

The relational perspective of Rovelli undoubtedly invites objections. For instance, it is unclear how the concept of relation can ground that of a thing, given that, conceptually, a relation already presupposes the idea of two distinct objects. However, the strength of the relational interpretation lies in its ability to render quantum paradoxes conceivable, not by adding assumed theoretical elements but by altering the philosophical framework of reference – the way these phenomena are considered in relation to the concept of reality itself. By

[4] See Albert Einstein, Boris Podolsky, and Nathan Rosen, "Can Quantum-Mechanical Description of Physical Reality Be Considered Complete?," *Physical Review A* 47 (1935): 777.

[5] See John S. Bell e Alain Aspect, "Introduction: John Bell and the Second Quantum Revolution," in *Speakable and Unspeakable in Quantum Mechanics: Collected Papers on Quantum Philosophy*, xvii–xl (Cambridge: Cambridge University Press, 2004). For a clear and synthetic overview of the various interpretations of quantum mechanics, see the recent article by Sean Carroll, "What Does Quantum Theory Really Mean?" *Nature* 638 (2025): 31–34.

acting directly on the latter, the relational approach also indirectly influences how experimental results are understood. Even the QBist perspective, despite being based on a different viewpoint, adopts the same method.

What's QBism?

QBism shares with the relational perspective the idea that the wave function encodes information. However, unlike the relational view – which, based on the concept of relation, considers the observer as just another object in the world – QBism assigns centrality to the fact that the observer is "us." In other words, whereas for Rovelli physics has a relational nature without any special contribution from the subject, for QBism it has instead a status relative to our knowledge. The core idea is that physics is relative to our way of knowing; it "describes what we know about the world."[6] In this sense, QBism adopts an epistemic approach in which the wave function does not describe an objective, independent reality but represents the state of belief of an observer about the world.

The name QBism itself reflects two key elements of this interpretation. On the one hand, the 'qubit' is the fundamental unit of quantum information used in quantum computing: while a classical bit can take the value of 0 or 1, a qubit is characterized by its ability to exist in a superposition of both 0 and 1. On the other hand, QBism is a shorthand for Quantum Bayesianism, as it builds on the Bayesian interpretation of probability, which holds that probabilities are not objective properties of reality but rather reflect an agent's knowledge and degree of belief. In line with this perspective, quantum probabilities are not intrinsic properties of physical systems but express the degree of confidence – or subjective belief – that an observer has regarding the possible outcomes of an experiment. It should be noted that this epistemic conception is not new in physics but is already present, for example, in statistical mechanics: probability is always relative to the information available to the agent. Thus, probability does not exist as an external object but rather takes shape as an evaluation made by a subject. This is what is called *subjective probability*. In this sense, the QBist interpretation applies the same perspective to the wave function as the 'subjectivist' Bayesian probabilist applies to probability.[7] The radical break of QBism with the usual way of thinking about science does not, therefore, lie in the interpretation of the mathematical apparatus as a calculation of probabilities but in the subjective interpretation of these probabilities.

Hence, what does QBism precisely think about state superposition? Since ψ is not real, superposition does not occur physically. Likewise, collapse is not

[6] Carlo Rovelli, *Helgoland* (Milano: Adelphi, 2020), 75. Translated by me.
[7] See Bruno de Finetti, *Filosofia della probabilità* (Milano: Il Saggiatore, 1995), 63.

real either, as no physical change takes place: ψ merely represents what we know about the system. There is only a change in the probabilities assigned by the agent.

The core idea is that it makes no sense to ask what happens inside the Schrödinger's box when we cannot observe it. QBism refrains from providing an image of the world where observation is impossible. The question of whether the cat is alive or dead (or both) when unobserved is ill-posed because it implicitly assumes, on the one hand, the possibility of a third-person perspective on the world – one that could simultaneously observe both the agent interacting with the cat/photon and the state superposition and subsequent collapse – and, on the other hand, the existence of an external world independent of experience. However, this independence cannot be demonstrated, since assuming an external perspective beyond one's own is logically impossible, whether as a species or as individual agents.

As will be discussed later, in QBism, reality is not so much objective as it is intersubjective. At the heart of the QBist perspective lies the awareness that all that is meaningfully expressible coincides with what is observable, and that questioning what lies beyond the observable is futile. At most, we can compare the information available to different subjects, as well as our own information against empirical evidence.

In other words, the role of the observer in QBism is not limited to recording a given reality but extends to influencing the very definition of what is real. This approach, however, does not imply a form of solipsism or the absolute privateness of the observer's viewpoint.[8] The relativity of the latter does not entail the idea that each observer has secret or exclusive access to reality. On the contrary, QBism emphasizes that, while every observer has a personal perspective, there is an intersubjective agreement that enables human beings to share their experiences and construct a common understanding of the world. This intersubjective agreement, however, does not eliminate the dependence of reality on the agent who observes it: the very idea of a world as it is without agents is considered meaningless.[9] Even the awareness of the existence of other viewpoints falls within the horizon of human knowledge and is relative to it.

This interplay between subjective perspective and intersubjective agreement raises a fundamental question about the nature of realism in QBism.

[8] See Christopher A. Fuchs, "Introducing QBism," in *New Directions in the Philosophy of Science*, ed. Maria Galavotti et al. (Cham: Springer, 2014), 35–52, and Michel Bitbol and Laura De la Tremblaye, "QBism: An Eco-Phenomenology of Quantum Physics," in *Phenomenology and QBism* (London: Routledge, 2022), 215–266.

[9] See Ulrich Mohrhoff, "Bohr, QBism and Beyond," *arXiv preprint arXiv:1907.11405*, 2019.

Rather than advocating an absolute or detached realism, QBism aligns with a form of empirical realism – one that is grounded in the subject's experience while acknowledging its inherent limitations. According to Mohrhoff, this perspective has roots in Immanuel Kant's transcendental philosophy, which situates knowledge midway between empiricism and idealism.[10]

Kant and Qbism

Kant's epistemological perspective, introduced in the *Critique of Pure Reason*, is founded on the idea that knowledge is only possible through subjective structures that make reality experienceable. The dichotomy between phenomena and noumenon is based on the intuition that space and time, as well as the categories of the intellect, are pure *a priori* forms – not elements of the external world but subjective, universal, and necessary conditions that make experience possible. The transcendental subject, therefore, is the knowing agent, the universal viewpoint that filters and structures perceived reality. In this perspective, reality is not something objective in itself but is what is experienced through the limits and capabilities of the subject:

> What may be the case with objects in themselves and abstracted from all this receptivity of our sensibility remains entirely unknown to us. We are acquainted with nothing except our way of perceiving them.[11]

This stance is a form of empirical realism: external objects exist, but their being manifests only through our experience.[12] Objective reality is not denied but is always mediated by the structure of human knowledge. This implies that any discourse about reality, no matter how rigorous, remains intrinsically tied to the human perspective. In QBism, the laws of quantum mechanics do not describe an independent and objective reality but represent the way a rational agent assigns subjective probabilities to the outcomes of future experiments. In this sense, QBism acknowledges that we can never escape the role of the subject in knowing the world: reality emerges as a network of probabilities reflecting the observer's involvement. Just as Kant highlighted the impossibility of accessing the noumenon, QBism denies the existence of an objective and independent reality that can be described outside the observer-

[10] See ibid.

[11] Immanuel Kant, *Critique of Pure Reason* (Cambridge: Cambridge University Press, 1998), A42/B59.

[12] See Nicholas Stang, "Kant's Transcendental Idealism," in *The Stanford Encyclopedia of Philosophy*, ed. Edward N. Zalta and Uri Nodelman (Stanford, CA: Metaphysics Research Lab, Stanford University, Spring 2016 Edition).

observed relationship. It should be noted that this might give the impression that QBism turns the entire empirical world into something inaccessible, much like the Kantian noumenon. However, this is not actually the case: reality is not unknowable in itself, as the noumenon is. Rather, what is known is fully real, but its reality does not exist independently of experience – it unfolds and is continuously redefined through intersubjective processes. In both cases, what we call "reality" is never an absolute given but is mediated by interpretative frameworks (in Kant's case, pure forms and categories; in QBism, the probabilistic structure of experience).

Even the concept of objectivity takes on a new meaning. Whereas for Kant objectivity derives from the universality of human cognitive structures, in QBism objectivity emerges from the intersubjective sharing of probabilistic rules. For Kant, objectivity is guaranteed by the fact that all human subjects structure their experience through the same *a priori* forms of intuition and categories of understanding, which universally determine the way empirical objects appear to us. In contrast, QBism rejects the idea that objectivity stems from a fixed, universal structure imposed on experience, considering objectivity as emerging dynamically from the shared use of quantum probabilistic rules. The laws of quantum physics do not describe an independent world but provide a universal framework within which agents can coordinate their expectations about how the world behaves. From this difference, however, it might seem that QBism implies a purely instrumentalist or subjectivist stance, as if, unlike Kant, it simply collapsed all principles into the category of regulative principles, serving only as heuristic guides in scientific inquiry. This is not the case, as QBism acknowledges structural constraints that shape an agent's experience of reality.[13]

According to its main proponents, QBism does not deny the existence of an external reality; rather, it posits a form of "participatory realism"[14] in which reality is co-constructed through the interaction between the agent and the

[13] This claim aligns with Fuchs' discussion in *On Participatory Realism*, where he explicitly rejects the idea that QBism is merely an instrumentalist or subjectivist stance. While QBism emphasizes the role of the agent in constructing reality, it also acknowledges the existence of objective structural constraints. In particular, Fuchs refers to the Born Rule as a *normative* rather than a purely subjective principle, emphasizing that it functions as a necessary consistency constraint in the agent's probability assignments (given a wavefunction for a particle, the Born rule expresses the probability of finding it at a certain position). This suggests that, unlike Kant's purely heuristic regulative principles, QBism retains certain structural elements that shape experience in a way that is not arbitrary or reducible to personal belief. Moreover, Fuchs draws on Einstein's distinction between subjective and objective factors, arguing that QBism fits within a *realist project* by recognizing a shared structure governing interactions with the world. See Christopher A. Fuchs, "On Participatory Realism," *Philosophy of Science* 84, no. 1 (2017): 113–134.

[14] See ibid.

world. In this sense, while the principles of quantum mechanics function as constraints guiding an agent's expectations, the actual experience of an event – such as observing a live or dead cat – reflects a concrete reality for the agent. As Fuchs clarifies, "For the QBist, the real world, the one both agents are embedded in – with its objects and events – is taken for granted. What is not taken for granted is each agent's access to the parts of it he has not touched." [15]

Therefore, QBism does not reduce all of reality to mere heuristic rules but maintains a balance between subjective belief and empirical fact, ensuring that experience is neither an arbitrary construct nor a direct reflection of an independent world, but rather a structured interaction between observer and phenomenon.

In this context, we aim to assign to the epistemic view offered by Critical philosophy a status that can be described as functional-operational: the Kantian *modus operandi* proves conceptually useful when applied according to its general and central idea. By abandoning a static and literal interpretation of Kantian doctrine, it becomes possible to make it fruitful in other contexts. As Bitbol notes in his article *A Cure for Metaphysical Illusions*, "no serious use of the evolution of the doctrines can be made if they are considered from the outset as immutable claims of truth": Critical philosophy must be conceived as a conceptual tool, rather than as "a closed system of thought".[16] This approach was developed by the Neo-Kantians, who recognized the possibility of modifying and replacing *a priori* forms with other structures.

In this regard, it is essential to emphasize that any comparison between QBism and Kantian transcendental idealism should not be interpreted as an endorsement of a rigidly orthodox vision of Kantian thought. The Kantianism of QBism diverges significantly from Kant's rigid systematization of knowledge. For instance, whereas Kant postulates a well-defined architecture of cognitive faculties – distinguishing between the pure forms of sensibility, the categories of the understanding, and the role of reason – this conceptual framework should not be assumed as an immutable ontological structure but rather as a *heuristic model* designed to elucidate the constraints of human cognition. A contemporary perspective, including that of QBism, does not

[15] Christopher A. Fuchs and Blake C. Stacey, "QBism: Quantum Theory as a Hero's Handbook," in *Foundations of Quantum Theory*, ed. Ernst M. Rasel et al. (Amsterdam: IOS Press, 2019), 133–202.

[16] Michel Bitbol, "A Cure For Metaphysical Illusions: Kant, Quantum Mechanics, and the Madhyamaka," in *Buddhism and Science*, ed. B. Alan Wallace (New York: Columbia University Press, 2003), 125–145.

necessarily adopt Kant's specific distinctions as fixed but retains the fundamental idea that all knowledge is mediated by conceptual filters.

Indeed, as contemporary reinterpretations of Kantian thought suggest, the true epistemological breakthrough of Critical philosophy does not lie in the precise delineation of faculties or categories but in the recognition that our access to reality is always mediated. Whether these mediating structures are described as Kantian *a priori* forms, as *symbols* (Cassirer), or as mathematical conceptualizations (Cohen), the fundamental insight remains unchanged: knowledge is always perspectival and bound to the cognitive structures of the knowing subject. QBism aligns with this vision by emphasizing the participatory role of the agent in the construction of reality while simultaneously rejecting the idea of an underlying noumenal world that is fundamentally inaccessible. In contrast to Kant's strict separation between *phenomenon* and *noumenon*, QBism reconfigures this distinction in terms of the limits of epistemic access rather than as a metaphysical dualism. In this sense, QBism indirectly reinterprets Kantian insights in a non-orthodox and flexible manner, treating the transcendental perspective as an adaptable framework rather than as a rigid metaphysical doctrine.

That's why, in the conceptual architecture of Neo-Kantian thought, the interpretation of the Kantian transcendental is not configured as the imposition of rigidly structured categories but rather as a critical methodology oriented toward exploring the foundational conditions of knowledge. For example, from this hermeneutic perspective, Kant's commitment to a deterministic ordering of natural laws does not constitute an obstacle to identifying structural correspondences with the epistemological framework of QBism. Although Kant conceived empirical physics as necessarily subject to *a priori* principles – among which determinism stands out – the Neo-Kantian interpretation prioritizes the epistemological function of the noumenon as a limiting concept rather than as an assertion of metaphysical nature. From this interpretative standpoint, the apparent contradiction between Kantian determinism and the radical indeterminacy inherent in quantum mechanics does not undermine the shared fundamental critical stance: both positions reject the possibility of meaningfully describing a reality entirely independent of the constitutive constraints of experience. The tension between these two approaches rather represents a fertile moment of transformation in the ongoing dialogue between transcendental inquiry and scientific research, where the limits of knowability do not mark the end of investigation but instead continuously redefine its methodological and conceptual horizons.

Furthermore, the idea of the functionality of *a priori* forms and Critical philosophy was advanced by Hilary Putnam: each *a priori* should be

considered relative to a specific mode of mental activity and corresponds to its presuppositions.[17] How, then, can the fundamental intuition of Critical philosophy be applied to modern science, and particularly to physics?

> It is to construe each object of science as the focus of a synthesis of phenomena rather than as a thing-in-itself. Accordingly, it is to accept that the very possibility of such objects depends on the connecting structures provided in advance by the procedures used in our research activities. Something is objective if it results from a universal and necessary mode of connection of phenomena. In other words, something is objective if it holds true for any (human) active subject, rather than reflecting intrinsic properties of autonomous entities.[18]

When considered in these terms, the perspective of Critical philosophy can be applied to any object of science, which ceases to be conceived as an "pre-existent underlying absolute reality".[19] As Bitbol observes, a conception of science founded on this assumption is fully viable today. The QBist interpretation, then, serves as a clear contemporary example of this way of conceiving physics. QBism and Kantianism, in fact, assess the relationship between subject and reality in similar ways. For both, the concept of the agent on the one hand and the transcendental subject on the other constitute the condition of possibility for knowledge: the physical structure of the observer's world is relative to the observer themselves. Moreover, like Kantianism, QBism does not reject the idea of an objective reality but grounds this objectivity in the notion of intersubjectivity. In Kantian terms, this intersubjectivity corresponds to the universality and generality that characterize the transcendental subject. The Kantian subject is defined as transcendental not only because it possesses perceptual and intellectual structures that mediate the world but also because these very structures are shared universally across all members of the human species, repeating themselves in each determined subject.

Although QBism does not refer to pure *a priori* forms or representational schemas, its epistemic approach can be fundamentally described as Neo-Kantian. Where QBism asserts the conceptual emptiness of the question of whether the cat is alive or dead when unobserved, Neo-Kantianism emphasises the vacuity of asking how objects exist independently of a subject who perceives them through *a priori* forms. These two claims share a central

[17] See ibid.
[18] Ibid.
[19] Ibid.

element: the recognition that any description of reality depends on the agent's mode of knowing.

The concept of experience becomes, in both QBism and Neo-Kantian perspectives, a process that grants reality to the concept of an object – that assigns it an ontological status – in such a way that the epistemological and ontological levels converge. A "thing" – identified either with a particle in quantum mechanics or with an entity perceived through Kantian sensibility – becomes such only when it is experienced: what is not experienceable lacks a proper ontological status. The thing-in-itself lies outside human cognition and is therefore unknowable: any attempt to make assertions about it goes beyond the limits of meaningful discourse, as our conceptual framework is bound by the conditions of experience. Similarly, QBism emphasizes that questioning what lies beyond what can be experienced – beyond what can be known and observed – takes us outside the realm in which our concepts and representations have applicability.

However, it would also be incorrect to claim, for example, that data *do not exist* before being experienced. This is not the position adopted by Kant or by QBism. Such a claim would reflect an idealist response, which tends to equate reality with thought, positioning everything external to thought as devoid of effective existence. Instead, the Critical and QBist positions simply emphasize the importance of acknowledging the impossibility of an external perspective separate from the human one. About such unexperienced data, it is impossible to affirm anything: neither its existence nor its non-existence. At most, it can be observed that, subjectively, for the human species, a certain datum cannot be defined in ontological terms until it is apprehended. Yet this statement is far removed from asserting that an unexperienced object has no reality in the external world. In this latter case, the idea of a world independent of human cognition remains, alongside the idealist view that thought is the origin of reality.

Neither Kant nor QBism, however, questions the existence of a foundation of reality common to all experience. There is nothing that can be affirmed about this world independently of the mediation of the human *modus cognoscendi*. While recognizing the existence of an external world independent of the observer, one must, in other words, "insist that the ontology of this world is such that it puts constraints on the information-gathering capacities of the observer on epistemology".[20]

Moreover, the Kantian thing-in-itself, which is unknowable, can in a certain sense be found in a different form in the QBist perspective. For Kant,

[20] Amit Hagar, "A Philosopher Looks at Quantum Information Theory," *Philosophy of Science* 70, no. 4 (2003): 752–775.

the notion of the thing-in-itself indicates the idea of a reality independent of human knowledge. In a neo-Kantian interpretation of the transcendental discourse, ontology and epistemology coincide. In this sense, what lies beyond our epistemic capacities cannot be known, nor can anything meaningful be said about it. The thing-in-itself serves as a limiting concept that marks the boundaries of human knowledge, indicating what cannot be an object of experience. Precisely because it exceeds our epistemic capacities, it lacks a proper ontological status. Reality is such only as far as it appears in a certain way, as an experience. In the QBist perspective, the thing-in-itself can be likened to the unobservable. The inaccessible refers to the idea of a world beyond human experience – like the cat in the closed box – about which the knowing subject can make no determinations. Similarly, in recognizing the limits of our knowledge regarding the thing-in-itself, Neo-Kantianism highlights, much like QBism, the pointlessness of assigning a reality status to what exceeds the phenomenal.

A shared objection

In *Helgoland*, Carlo Rovelli puts forward an interesting objection that summarizes some criticisms directed at QBism. In this paragraph, I consider it appropriate to examine this objection and attempt to respond to it, as overcoming Rovelli's point of view allows for a clearer understanding of the position shared by the Critical philosophy and the QBist interpretation, as well as the connection between the two perspectives.

According to Rovelli, the weakness of the QBist perspective lies in anchoring the concept of reality to the subject's knowledge: in the fact that it bases ontology on epistemology, as already noted, rather than the other way around. This would lead to a form of idealism, insofar as reality would entirely correspond to a subjective content of consciousness. Rovelli writes, commenting on the QBist position:

> QBism anchors reality to a subject of knowledge, an 'I' that knows, which seems to stand outside nature. Instead of seeing the observer as part of the world, it sees the world reflected in the observer. It abandons naïve materialism but ends up falling into extreme idealism. The crucial point is that the observer itself can be observed. We have no reason to doubt that every real observer is also described by quantum theory.[21]

[21] Carlo Rovelli, *Helgoland* (Milano: Adelphi, 2020), 77. Translated by me.

The fact of anchoring reality to a "knowing I" becomes problematic, according to Rovelli, as far as it implies that the subject is seen as an element external to nature. While the relational perspective considers the knowing subject as just another object within the world, QBism views the knowing subject as a subject from which reality is defined. In a sense, for QBism, the agent has a privileged role, whereas physics should provide an account of objective reality, in which the agent describing the world is not only an observer of other objects but also an object itself: a single world that includes the observer and other objects, with its final description encompassing the observer as well. Rovelli argues this position by asserting that an observer can also be observed. In other words, even the observer describing reality can, in turn, be described by other subjects. Thus, the world is not relative to a single observer, as the latter can always become an object of observation to others: reality exists even if I do not observe it.

> If I observe an observer, I can see things that the observer does not see. By reasonable analogy, I conclude that there are things that I, as an observer, do not see. Therefore, there are more things than I can observe. The world exists even if I do not observe it. I want a physical theory that accounts for the structure of the universe, clarifies what an observer is within a universe, and not a theory that makes the universe depend on me as an observer.[22]

This point of view is ultimately based on the intuitive belief that one can reasonably claim, for example, that the city of Milan exists even when I am not physically in Milan. The QBist perspective, however, by asserting that the concept of reality is based on the limited knowledge the subject has of it, aims to express, in my view, a deeper and more nuanced position.

Regarding Rovelli's objection, the Kantian perspective becomes illuminating. It provides the appropriate tools to understand the deeper meaning of the QBist position. The point that Rovelli seems to overlook in his argument is that when a subject is observed and thus becomes, in turn, an object within the nature being described, it is always another agent – a human subject – that carries out the observation. Kant pays particular attention to this adjective: the Kantian transcendental subject is a specifically human subject and, as such, represents all possible agents and all possible descriptions of reality. Similarly, the subject referred to by QBism must be understood as a general subject – not merely as a single, determinate agent. It is an agent with

[22] Ibid.

specific and defined cognitive capacities, common to the human species: this aligns with the fact that, in QBism, experience is the only criterion of reality. However, it is important to note that QBism itself does not offer a definitive stance on whether the agent should be conceived in this general, transcendental sense or as an individual empirical subject. While proponents like Fuchs tend to emphasize the role of a single agent in making probabilistic assessments, others, like Bitbol, have explored a more Kantian or phenomenological reading.[23] In this view, on the one hand, objectivity is based on intersubjective agreement among agents, and on the other, knowledge must be considered limited. It is precisely because the type of epistemic mediation is made up of shared patterns that are repeated in every observer that one can talk about cognitive limits. These limits are such because they are human and general, and the relativity of the point of view must be understood as inherent to the species. From this perspective, a Kantian reading of QBism offers a compelling way to respond to Rovelli's critique: if the agent is understood as a general cognitive structure rather than just a particular empirical observer, then the risk of solipsism and extreme idealism is mitigated. This reading clarifies why the QBist framework, despite its subjectivist formulation, does not collapse into a purely mental construction of reality. In this sense, if the QBist observer is understood analogously to the transcendental subject – thus if one considers that the agent is always a human agent – Rovelli's objection is weakened, precisely because it is based on the idea of a single, determinate observer experiencing the world, and who, as a single entity, would not observe "all that is observable."

Indeed, if it is true that the epistemic possibilities of the single subject are limited to their particular point of view, what remains for them to observe is

[23] As seen, QBists agree that reality is not an independent structure but emerges through the interaction between the agent and the world. This aligns with the phenomenological perspective of Bitbol and De la Tremblaye, who argue that the subject-object distinction is not fundamental but arises within experience. Their phenomenological reading of QBism suggests that the agent is not merely an observer but a participant whose experience constitutes the very conditions for the appearance of the world (see Michel Bitbol and Laura De la Tremblaye, "QBism: An Eco-Phenomenology of Quantum Physics," in *Phenomenology and QBism* (London: Routledge, 2022), 215–266). In this sense, the agent in QBism *plays* a transcendental role – not as a fixed *a priori* subject, but as a *situated epistemic standpoint* that structures and gives meaning to reality. Although QBism describes quantum mechanics as a "single-user theory," the subject it refers to must be understood in a general sense to avoid both solipsism, where reality collapses into subjective perception, and instrumentalism, which would reduce quantum mechanics to a mere computational tool. While QBists agree that QBism is neither instrumentalism nor anti-realism, as emphasized by Christopher Fuchs, this claim is truly sustainable only if objectivity is conceived as arising from intersubjectivity rather than individual construction. Thus, the agent in QBism should be interpreted as a *generalized epistemic subject*, whose interaction with the world produces reality as a shared and communicable experience.

nothing other than what has been observed by other agents. If, therefore, the observer is understood as human and endowed with certain epistemic capacities, "all that is observable" becomes "all that the human species can observe." From this perspective, imagining a viewpoint that considers the human species as an object, as Rovelli suggests, becomes logically impossible. It is appropriate, in this sense, to emphasize the idea of the possibility of experience. It is certainly true that "if I observe an observer, I can see things that the observer does not see," and thus there is more in the universe than what is accessible to a specific agent, but this does not imply that one can observe a human general subject from an external perspective, seeing things they do not see. In other words, by experience, one must not mean the actual experience of a single agent in a determined context, but *the experience available to the latter as possible* – that is, as potential for a human subject.

The QBist observer, then, is not external to nature, but precisely because they are part of it and cannot step outside of it, they provide a subjective description and cannot do otherwise. This subjectivity must be understood as a universal Kantian subjectivity and certainly cannot be bracketed since a subject may appear as a mere phenomenal object to another subject. If the observer were external to nature, they would be able to see themselves acting in the world. It is certainly true that any single observer can be observed, and that a determinate subject can provide a description of a system that includes another observer, who in turn behaves as an object. Nevertheless, it does not become possible to step outside the human perspective *tout court*, which every single agent describes as partly subjective and largely intersubjective, and to observe the human perspective on the world from a third-person point of view. In other words, the knowing subject experiencing nature cannot simultaneously observe and see themselves observing the world.

What, then, is the role of the determinate agent in QBism and Kantianism? Every single observer possesses, so to speak, a slice of reality. The latter, as in Cubist paintings, consists of the convergence of every slice – subjective and personal. Thanks to universal cognitive structures, the human species composes a common picture that aligns with what is considered objective reality. It is, however, impossible to step outside this picture: the fragments provided by each particular and determinate description constitute a single world, reflected in intersubjective experience. Considering the general observer, or the transcendental subject, as the starting point before any discourse about the world does not mean failing to see them as part of the world, but precisely the opposite. In fact, the very reasoning that includes the agent within nature is formulated by the knowing subject, who remains the only *a priori* guaranteed in any kind of speculation or physical theory. As

Michela Massimi writes in her article *Points of view. Kant on Perspectival knowledge*, "knowledge is never from a God's-eye view, but is instead from a human vantage point," and it is only intersubjective agreement that allows for "providing the shared perspectival standpoint, where individual scientific judgments can be evaluated, proved true, and retained or withdrawn accordingly".[24]

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[24] Michela Massimi, "Points of View: Kant on Perspectival Knowledge," *Synthese* 198, Suppl. 13 (2021): 3279–3296.

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