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Paradox of the duplication of physical information

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A thought experiment demonstrates that physicalism about consciousness entails a paradoxical duplication of physical information. Moreover, objective existence acquires the status of a physical property. To avoid this paradox, one requires a concept of objectivity in which individuation is finite and incomplete. Finite individuation requires objective uncertainty and is thus corroborated by the contemporary sciences. Finite individuation and objective uncertainty prevent existence from becoming a physical property, thus defeating physicalism about consciousness and resolving the paradox.

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Problem statement: duplication of physical information?

Suppose there is an observer who knows that an object exists. The observer's knowledge includes a description of the object, which would allow other observers to recognize it and which contains the same physical information for all observers. Further, suppose that another observer observes the brain (or whatever the relevant supervenience base of a state of knowledge is) of the first observer. Then, assuming that mental states are for all empirical purposes brain states, the second observer obtains the same physical information from the study of the first observer's brain as from the study of the object, although the two may forever be causally disconnected. Indeed, suppose the first observer contemplates an actually existing table from her first-person perspective without having any causal connection with the object. For example, suppose she is sitting with her eyes closed and recalling the table. The second observer observes her relevant brain state, which is a supervenience base for the intentional content. For the purposes of this thought experiment, the first observer is the brain state while the second one observes this brain state. At this point, it does not matter whether the observers have different access to qualia, emotions, or any other experiential content. What matters is that both have cognitive access to the same physical information about the table, assuming that the mental state is the brain state at least in the sense that there is no empirically observable difference between the two. Therefore, the second observer obtains the information about the table from the brain state of the first observer as long as the latter thinks about the table. Notice that the second observer does not need to study the brain–environment correlations because the brain state already contains the relevant information about the object.

This capacity to obtain information about the table from the brain state of the first observer is paradoxical because it requires a duplication of physical information in the world. If additional observers are involved, the duplication becomes multiplication. The paradox consists in the apparent ability of one physical fact (the brain state) to convey information about the existence of another, although there seems to be no physical reason for that. The actual discovery of this duplication of information would, therefore, mean the discovery of correlations between physical events, which are not mediated by any causal interaction. For example, anyone could learn everything an initial observer knows about this particular table without having access to the table itself but only to the first observer's brain. However, one needs only to assume that there is an observable physical supervenience base of a conscious state for such a paradox to arise.

Let us now consider how this approach to consciousness differs from the traditional physicalist story of supervenience. The difference is subtle and yet significant. To use Jackson's expression, physicalism claims that it tells a complete story about the world while using only physical descriptions (Jackson, 1998, p. 9). First, physicalism requires supervenience, possibly of the strong variety: "A strongly supervenes on B just in case, necessarily, for each x and each property F in A, if x has F , then there is a property G in B such that x has G , and necessarily if any y has G , it has F " (Kim, 1984, p. 165). The relationship between supervenience and physicalism is not without controversies, including those regarding the differences between types of supervenience (see Bennett, 2004; Moyer, 2008). More importantly, supervenience cannot fully define physicalism because it cannot ensure that only physical objects exist or that they produce mental qualities (see an excellent review of this topic in Wilson, 2005). The above thought experiment suggests that this is because of a fundamental problem with physicalism: There is no supervenience base from which the external observer acquires information about physical states of affairs that the respective conscious state contains in the first-person perspective. Let us consider this in detail.

Let us adopt Jackson's definition of physicalism: "Any world which is a minimal physical duplicate of our world is a duplicate simpliciter" (Jackson, 1998, p. 12). It is reasonable to assume that any sufficiently complex mental state is at least partly intentional and at least partly "about" a certain state of affairs, even if this state of affairs is another mental state. Treating the aboutness relation generously, one can accommodate cases of delusions and other deviations from the faithful reflection of reality. The subsequent discussion accommodates such cases as well. In the classical physicalist story, the supervenience base must be causally connected to the object of intention, independently of whether the mental content is externalist or internalist. Lacking such a causal connection, there is something about a mental state that one cannot possibly know from the supervenience base. For example, there must be a causal connection between the table an individual contemplates and the brain state responsible for this contemplation. If the individual has a hallucination and the table is not there, a causal connection between previous experiences of tables and the present brain state must remain. This physicalist story, which may appear to be common sense, implicitly informs the mainstream empirically oriented discussions of conscious states (see, for example, Graziano, 2019). As the above thought experiment shows, however, the story has a problem. The causal linkage between the object of intention and the supervenience base of the conscious intentional state cannot simply record the information about the object of intention within the supervenience base. In fact, it is not the supervenience base but a combination of the supervenience base and the causal linkage with the object that records the information. Alternatively, the information may reside in the causal regularities responsible for the causal connection, if such regularities exist. Scratches on a table are signs of its long history, but one cannot learn about this history from the scratches themselves; rather one must learn the processes of their emergence. Therefore, to avoid the absurdity of acausal information transfer, the supervenience base of any conscious state must include everything. This makes the supervenience story empirically irrelevant because no empirical conclusion is possible from the knowledge that the whole world is now the supervenience base for a conscious state. One may object that this argument freely uses the intentional concept of information in an extensional context, but then so does the physicalist, insisting that the observer learns everything about the carrier of information—the conscious state—from the respective physical one.

The information to be duplicated is twofold: the description of the object and the fact of its existence. The second observer not only learns that the first one thinks of a table. If the first observer thinks of the table as existing, this part of information is also available to the second observer. If the first observer is not sure whether the table under a given description exists, the second observer also knows about this uncertainty. Without this second component, there is no duplication of physical information in the sense of information about actually existing objects. One may be tempted to suggest, as a way of avoiding (if not resolving) the paradox, that this second component be somehow excluded. However, it seems impossible to construct the thought experiment so that the first observer simply thinks of a table without ascribing to it an ontological status of an existing or imaginary object. As argued below, this makes the paradox of duplication a problem of construing objectivity or, to be more precise, the difference between appearance and reality.

The duplication paradox as a problem of objectivity. It is useful to look at this situation from the perspective of the first observer. Here, the knowledge that the table exists (under a description) implies two things. First, there is a positing of a table as existing

out there. This external existence imposes a constraint on subjective experience: The table is being observed “under a description”. The positing of the object as existing entails a certain arbitrariness in the choice of the description under which it is being observed. The respective constraint on the expected experience can be weaker (a fleeting thought about tables in general) or stronger (a detailed observation of a specific table that must be repaired). In any case, this constraint restricts the expectations of the observer regarding his or her experience and thereby reduces the subjective uncertainty about it. It would, therefore, be appropriate to call this constraint a “constraint on expected experience”.

Such constraints are, to varying degrees, intersubjectively valid, that is to say, common for different observers. The intersubjective validity of a constraint means “communicability”: another observer must be able to reproduce the experience of the constraint from its description. The strength of the constraint and its intersubjective validity jointly measure the engagement of the observer with the external reality. Now if the first observer is herself an objectively describable physical object, there can be an observer who obtains the content of the first observer’s thoughts from the supervenience base of the relevant state of knowledge, belief, or perception. If this is the case, all constraints on experience become intersubjectively valid. This can be seen as the duplication paradox from the point of view of the first observer whose subjective experience is translated into physical information. Such a translation may not be a particularly paradoxical situation per se. Indeed, if successful, it will produce a physicalist description of a conscious state. However, the duplication paradox is the cost to be paid for this hypothetical “objectification” of the subjective.

An ontological interpretation of the duplication paradox. The paradox has the following ontological interpretation. If the supervenience base of a conscious state is observable, there is a description of a physical state that contains information about the existence of this state itself as well as other objects. This makes existence part of a physical description. Existence becomes a piece of physical information. This ontological implication of physicalism can also be reversed: If one denies that existence is a piece of physical information, one also avoids the duplication of physical information.

Subjectivity in the duplication paradox. This ontological interpretation allows us to define the duplication paradox as an expression of the subjective—the elusive, self-referential “something” that somehow is us, including the author of these words. Exemplified by all possible qualia, emotions, and thoughts, the subjective makes the duplication paradox even more paradoxical: If one can describe the supervenience base of a conscious state, there exists a physical description that implies the existence of its referent. Such an outcome is clearly undesirable.

Objectivity and the limit on individuation

At the heart of the paradox lies objectivity, that is to say, the independence of objects from conscious observation of and knowledge about them. The following discussion demonstrates that the duplication paradox is essentially a paradox of objectivity.

The received wisdom and its shortcomings. As Debs and Redhead note, objectivity “is, curiously, both much debated and neglected within philosophy of science. It is much debated in the sense that it is often highly contested, yet its relative neglect is evident in that no single definition of the term dominates, even as a foil for critique” (Debs and Redhead, 2007, p. 159). Still, one approach can be deemed relatively dominant: objectivity as

symmetry or invariance with respect to transformations that are deemed “unphysical”, that is to say, observer-dependent. Weyl is the classical reference in this regard: “Objectivity is invariance with respect to the group of automorphisms” (Weyl, 1982, p. 132).

The classical example of objectivity as symmetry is invariance with respect to a coordinate change: The physical meaning of a description of an object should not depend on the choice of coordinates. Another one, historically directly connected with Weyl’s conception (Ryckman, 2003, p. 77; see also Ryckman, 2009), is the gauge invariance of the electromagnetic field: The theory is invariant with respect to a certain formal transformation, which does not represent a physical change (see the concept of theoretical symmetry in Healey, 2007, Ch. 6; also Ismael and van Fraassen, 2003). This approach inspired Nozick’s conception of objectivity as invariance: A “fact” is objective when invariant with respect to “admissible transformations”, and the more invariant, the more objective (Nozick, 2001, p. 79; see also Earman, 2004, p. 1233, where Earman endorses a modest version of Nozick’s proposal). Kosso summarizes this way of thinking about objectivity: “By separating the ephemeral effects of perspective from the enduring reality, symmetries are a key epistemic tool, facilitating the step from appearance to reality” (Kosso, 2003, p. 414). Ontic structural realism inherits this invariance-based notion of objectivity: What makes structures real is their invariance because, to quote Max Born, “[t]he feature, which suggests reality is always some kind of invariance of a structure independent of the aspect, the projection” (Ladyman and Ross, 2007, p. 189). Debs and Redhead criticize the all-too-easy equation of invariance with objectivity, noting the inability of the former to account for many nuances of the latter (Debs and Redhead, 2007, p. 66). However, they agree with the basic intuition behind Weyl’s definition and develop an invariance-based account of objectivity (Debs and Redhead, 2007, p. 72).

Still, the connection between objectivity and symmetry is far from obvious. Denoting a purely formal change, symmetry or invariance is a property of theories and models rather than of objects or the relation between observers and objects. Such theoretical symmetry entails invariance with respect to certain variables and can thus be read off the description, independently of the existence of the object of the description. Consequently, one must postulate what is real before claiming a particular symmetry to be a sufficient or necessary condition for the reality of something. As mentioned above, gauge symmetry is widely considered an example of symmetry based on which one can identify objective (physical) as opposed to merely theoretical transformations. However, the breaking of gauge symmetry does not reduce the objectivity of the respective phenomenon. In fact, Pierre Curie famously attributed physical information exactly to asymmetry: “Asymmetry is what creates a phenomenon” (Curie, 2003, p. 312).

To generalize, symmetry does not constitute a sufficient condition of objectivity because it does not, prima facie, imply the existence of the respective object. Even when “more” symmetry means a greater objectivity of description in some sense, this increase in objectivity does not happen because of symmetry. For example, the general covariance of general relativity makes general relativity “more symmetric” than special relativity, yet general covariance is not sufficient for the theory to be true. Indeed, one requires empirical content as well. An analysis of intertheoretic reduction further highlights the problems of defining objectivity as a property of the descriptions of objects. According to the classical definition of reduction by Ernst Nagel:

A reduction is effected when the experimental laws of the secondary science (and if it has an adequate theory, its theory as well) are shown to be the logical consequences of

the theoretical assumptions (inclusive of the coordinating definitions) of the primary science. (Nagel, 1961, p. 352)

One may suggest that reduction to more fundamental theories renders descriptions more objective. However, the classical example of the reduction of thermodynamics to statistical mechanics reveals that this is not the case. Statistical mechanics can arguably predict and explain all that thermodynamics can and more, which means that the former constrains the expected experience to a greater extent. In fact, a more detailed description of anything would deliver this effect, and yet this greater precision cannot be equated with a greater objectivity because there is no guarantee that intersubjective validity increases as well. For example, in the Davis Wine Aroma Wheel, the “woody” fragrance is further differentiated into “resinous”, “phenolic”, and “burned”. However, this refinement does not help an individual who is incapable of identifying the woodiness of wine in the first place. Obviously, statistical mechanics is not a mere classificatory refinement of thermodynamics, but if it is, in some sense, more objective than thermodynamics, this greater objectivity cannot be explained by the fact that it contains all the predictive power of thermodynamics. Intertheoretic reduction does not contribute to intersubjective validation: It does not make constraints on experience more independent from the circumstances of observation and thus more accessible for other observers.

Objectivity outside of descriptions. Let us attempt a different approach to objectivity. Under this approach, objectivity is construed not as a property of the description of an object but as an ontological status attached to the description. This ontological status emerges as an empirical discovery in the process of maximizing intersubjectively validated constraints on experience. This is how it is done.

In the simplest version of the paradox of duplication, the act of description posits an object as existing independently from the act itself. The very notion of “positing” reminds us of Kant’s Position:

If you concede...as in all fairness you must, that every existential proposition is synthetic, then how would you assert that the predicate of existence may not be canceled without contradiction?—since this privilege pertains only in the analytic propositions, as resting on its very character... Being is obviously not a real predicate, i.e., a concept of something that could add to the concept of a thing. It is merely the positing (Position) of a thing or of certain determinations in themselves. (Kant, 1998, A 598, B 626)

This positing produces intersubjectively valid constraints on experience. An object exists under a particular description, which expresses these constraints. However, the existence of the object is not implicit in this description, nor is the objectivity of the description implicit in the description itself. Let us now maximize these intersubjectively valid constraints on experience; that is, let us maximize the objectivity of a description. Take the famous Mary who never saw the color red, although she knows everything science has to say about colors and their perception by humans (Jackson, 1986). This imaginary situation is the starting point of the knowledge argument against physicalism (see Nida-Rümelin, 2002 for an overview). However, we shall use this construction for a somewhat different purpose. Our Mary will have a companion. Let us call him Peter. Peter does not have Mary’s disadvantage and has seen the color red. He also shares Mary’s scientific knowledge. If communicated in a mutually understandable language, an objective description of a red rose should thus be equally accessible for Mary and Peter. However, this description cannot consist in piling together a potential infinity of qualifiers: the color, length, form, and size of petals, for

example. If Peter characterizes the color of the rose more precisely, this will not help Mary learn more about the rose (cf. the above example of wine fragrances). Instead, Peter must characterize the color in terms of wavelengths of the electromagnetic field and perhaps the chemical composition of the petals. If Peter communicates this description to Mary, Mary will be better informed, although still not capable of imagining the red color. This means that Mary can reproduce the red object using the information about the chemical composition of a red petal. The success of the communication between them is possible because Peter refers to theories and facts that Mary has learned from her experience of other objects. These theories describe aspects of reality available to all observers, or a “common referential space” that consists of “things” that are to be discovered everywhere. The reduction to a common referential space maximizes the intersubjectively valid constraints on experience. With or without the experience of qualia, any sufficiently patient and fortunate observer can ultimately describe any object in terms of molecules, atoms, elementary particles, and fields. Indeed, electromagnetic waves are everywhere, not only where red roses are. At the same time, the reduction to basic physics provides additional constraints on the expected experience when compared with phenomenological descriptions of the rose as merely “beautiful”, “red”, “fragrant”, etc.

This reduction of a phenomenological to a more “fundamental”—or, better still, objective—description constitutes an explanation for how this rose can be transformed into some other thing already known to Mary. For example, Mary understands Peter’s message about the chemical composition of the petals as long as she understands the commonality between a petal and other objects whose chemical composition she already knows. Moreover, an explanation of how a petal can be transformed into something else is the description of the petal that Peter can possibly communicate to an interlocutor with whom he shares only the knowledge of chemistry and physics. Communication of this explanation by Peter to Mary creates a common referential space; that is to say, it increases the intersubjective validity of constraints on experience. The discovery of this transformation of things into other things cannot occur without the actual transformation: The observer must become an experimenter. The observer must change and even destroy an object to “reduce” its qualia-based description to another more fundamental one. This fact is crucial for the following discussion: Such an intervention is the cost of the intersubjective validation of constraints on experience. Unlike in intertheoretic reduction, some of the constraints may be “lost” in the process. For example, as our color-deprived Mary very well knows, the qualia of colors are “lost” in this sense. Of course, this loss cannot be deduced from the mere fact of a rose being destroyed in the process of an experiment, yet the following discussion shall convince us of a deep connection between the destruction of objects for the sake of empirical knowledge and the limited accessibility of qualia.

Objective existence is discovered as a commonality of observations across a range of experimental setups and individual observers. For this common referential space to be achieved, objective descriptions must function as recipes for the reproduction of experimental outcomes by different observers in different circumstances. Not merely a list of properties or parts of an object, such descriptions must recount the processes that produce the object. The description of colors as electromagnetic interactions, for example, is the basis of a successful communication between Mary and Peter because it is a recipe for the replication of the experience of color.

All sufficiently patient and fortunate observers discover how such a replication can be performed. Their experience validates a general theory, which covers the object, the circumstances of the

experiment, and the measurement instruments. The definition of an object in terms of such a theory includes the conditions of its creation or discovery. For example, once colors are defined in terms of fundamental physics, we know how to reproduce them, and any additional information about the measurement instruments becomes irrelevant. If such a definition is available, it can be used to factor out the unphysical, that is to say, non-objective information.

This construction reveals the *existence* of a common reality accessible to all observers, and it makes an intersubjective consensus about physical facts possible. Can this redefinition (“fundamental description”) implement the idea of objectivity as an ontological status? To answer this question, let us demonstrate that this common reality entails not just common properties of objects but, indeed, an ontological limit on the individuation of objects.

Individuation is incomplete, and objective description is finite.

First, consider the following objection to the very idea of common reality as the foundation of objectivity: While some uniformity of nature may be necessary for scientific discovery, is it not enough for the creation of intersubjectively valid empirical judgments that objects have some common properties? In this case, the world would consist of physical facts, which one could describe with indefinite precision. We would establish the existence of these facts, moreover, under certain descriptions experimentally, which would require some uniformity of nature. This uniformity is, however, an epistemological rather than an ontological requirement. It is merely a cognitive condition for empirical discovery. Although this uniformity might reflect some relational or even non-relational properties, these properties would be part of the objective description of each particular object. They would not need to constitute a Platonic reality “behind” particular objects.

Despite its intuitive appeal, this argument is, however, untenable. According to it, the accumulation of empirical knowledge increases one’s ability to differentiate facts, events, and objects either relationally or non-relationally. This means that new empirical data will, at some point, either contradict any specific theory or else not be covered by any sufficiently general theory, yet objective empirical knowledge cannot be expressed in terms of facts available only to one observer because objectivity means derivability from a general theory. This is an uncomfortable situation. Defined as the communicability of a description as a recipe for replication, the separation between appearance and reality is inconsistent with the unlimited individuation of physical objects. Indeed, if one individuates objects so that no object is like any other, all knowledge becomes idiosyncratic, and the difference between appearance and reality disappears. Suppose, moreover, that a miracle happens and we become fully capable of individuating an object by including within its description an answer to the question of why it exists. The object cannot be replicated because obtaining a copy of it invalidates the assumption that its existence is implicit in its description. This means that the concept of objective existence does not admit simultaneously to complete individuation and objective descriptions as replication recipes.

One concludes that common reality is not merely an epistemic condition for the discovery of natural regularities but an ontological constraint on individuation. This limit on individuation results from a trade-off between two dimensions of objectivity: intersubjective validation and constraints on expected experience. There is a point at which everything about an object that is transcendental to its observed appearance is absorbed into an objective description. This description must necessarily be

finite because only a finite amount of detail about an object is compatible with common reality, as shown above.

Objective uncertainty: a link to scientific practice. The question is how such finite individuation affects the constraints on expected experience. In other words, one requires a connection between the metaphysical demand for a limit on individuation and the practice of empirical science. One needs a mechanism, in other words, which would make finite the amount of physical information carried by this particular rose reduced to the common reality. It seems that science does supply such a mechanism.

An objective description of an object is a recipe for the experimental reproduction of this object. How does one learn that a particular description is, indeed, such a recipe? Apparently, one does so by conducting an experiment. To be more precise, one could run a series of experiments to validate or invalidate the objectivity claim, that is to say, the independence of a description from a particular point of view. Eventually, such experiments will validate or invalidate a theory describing the common reality. If individuation is finite, one will fail to differentiate between replicas of objects. How then would this affect the expected experience? Such a limit on individuation would appear to the observers as uncertainty, that is to say, as a lack of constraint on the expected experience. However, this uncertainty would derive not from a lack of knowledge about the object to be reduced to the common reality but from the finiteness of information that one extracts in the course of the reduction to a common reality. Quantum physics provides a particular physical realization of such objective uncertainty. Heisenberg describes the situation excellently in his famous “uncertainty paper”:

Thus, a given experiment can never provide precise information on all quantum mechanics variables: rather, it divides the physical variables into “known” and “unknown” (or: more or less precisely known variables), in a manner characteristic for that experiment. The results of two experiments can be derived precisely from each other only when the two experiments divide the physical variables in the same manner into “known” and “unknown” (i.e., if the tensors in that multidimensional space already used for visualization are “viewed” from the same direction, in both experiments). If two experiments cause two different distributions into “known” and “unknown” variables, then the relation of the results of those experiments can be given appropriately only statistically. (Heisenberg, 1983, p. 13)

Heisenberg’s intent was to visualize (to make *anschaulich*, to use the original term) this situation using the matrix mechanics, specifically, the non-commutativity of matrices representing different observables. One can also visualize a fundamental description as a limit to the compatibility of various intersubjectively valid constraints on expected experience. Not all constraints are compatible because the creation of one constraint in the course of experiments may prevent another from appearing. As objects are defined in terms of experimental setups only, it is impossible to circumvent this trade-off between experimental setups. To use the somewhat obsolete metaphor of experiments as disturbances, one experimental setup prevents another from being realized. Further accumulation of empirical evidence does not decrease this objective uncertainty. Instead, elimination and creation of uncertainty balance one another. The parameters of this trade-off define a fundamental description as a point at which there is no empirical difference between the production of the object in the process of the experiment and its discovery as a result of the experiment.

This objective uncertainty is, indeed, a constraint on individuation as defined above. As an elementary example, one cannot measure both position and momentum with indefinite precision. An elementary particle in a certain position cannot be arrested in its motion to establish it as different from all others and thus further individuate it. This microphysical situation transpires at the macrolevel: Peter has to destroy at least one rose to obtain sufficiently precise knowledge about the molecular supervenience base of colors.

To summarize, the common reality as the basis of intersubjective validity is not a common “essence” of things or of their constituent parts but the common manner of objects’ transformations in the process of empirical discovery. The parameters of such transformations constrain individuation and define the trade-off between two aspects of objectivity. For the reasons that follow, this common reality retains its relevance as the basis of intersubjective validation regardless of the amount of empirical information accumulated through experiments. As empirical knowledge grows, descriptions of objects are finitely reduced to the point at which no observable difference exists between the creation of these objects by an experimenter and their discovery by an observer. At this point, an experiment “creates” an object that cannot be further individuated, that is to say, differentiated from identical objects created by other runs of the same procedure. Experimental setups thus fully define physical objects.

Two points are in order here. First, the structure of objective uncertainty constrains the expected experience, and one discovers this constraint only in the course of multiple observations. Its existence can only be statistically tested, which fits the notion of a common reality discovered solely by varying experimental setups. Second, this structure is contingent. It could have been different and perhaps will be different, which means that a fundamental description is only fundamental in a very limited sense, namely, as a statistically discovered limit on individuation.

As an aside, the concept of finite fundamental descriptions may lead to an interpretation of quantum physics that is both realist and free from the ontological baggage of structures and tropes. The latter responds to the need to change the ontology radically in the face of a radically transformed scientific image of the world, in particular to get rid of “things” or substances (such as classically construed particles) as the basic constituents of the universe. These strategies reflect neither the radical change that quantum physics introduced—objective uncertainty—nor the phenomenon of a common reality accessible to all observers. It also fails to reflect the connection between these two. Neither particles nor relations (e.g., symmetries) nor qualities (nor tropes) deliver the commonality of experience that is the basis for the objective description of the world. Nor do these concepts enable us to understand the informational cost of achieving an intersubjectively validated reduction of uncertainty. The construal of fundamental descriptions as a limit on certainty for empirical knowledge does both. However, we shall not explore this hypothesis further at this point.

Objectivity as an ontological status. We began with the idea that objectivity is a two-dimensional ontological status attached to descriptions rather than a property of an object or its description. A description is objective as long as it constrains expected experience and this constraint is intersubjectively valid. No physical quality characterizes an objective description qua objective. Instead, an objective description is a redefinition of an object in terms of experimental access available for all (or all relevant) observers. Thus defined, objectivity requires the existence of a common reality and finite individuation, the epistemic price of which is objective uncertainty. In the next section, I will demonstrate that this construction also resolves the paradox of duplication.

Limits on empirical knowledge and the equivalence of two uncertainties: a solution to the duplication paradox

This section employs the above construction of objective uncertainty in the physical world to eliminate the paradox of duplication. It must be said at the outset that the following discussion has no relation to the so-called “quantum mind” tradition that supposes the co-production of quantum effects by consciously performed measurement, which is an empirically unwarranted interpretation of the von Neumann model of quantum measurement. Generally treated by mainstream science as a misinterpretation of physics, this tradition attempts either to use consciousness as an effectively hidden variable for explaining away the epistemic unease caused by quantum uncertainty or to consider the subjective a product of quantum processes. One effectively claims the discovery of new empirical facts, which are, however, construed in such a way that the respective theories cannot be verified or falsified empirically. In full opposition to this approach, I will demonstrate that two observable limits to empirical knowledge—the subjective side of human experience and objective uncertainty—are actually one.

Finite individuation appears to observers as a trade-off between the precisions of different observations. The reduction of uncertainty about one thing or variable imposes a limit on such a reduction for another. The details of an objectively given common reality define the parameters of this trade-off. This limit on intersubjectively validated empirical knowledge is incompatible with the paradoxical duplication of physical information. To sketch the argument, the duplication is equivalent to the enhancement of a finite objective description with additional information. If successful, the duplication would have decreased objective uncertainty. From the point of view of the observer, however, this would entail an enhancement of the intersubjective consensus beyond what can be achieved by reduction to fundamental descriptions. From an ontological point of view, the limit on individuation implies that existence is not physical information, that is to say, not part of an intersubjectively valid description. This destroys the duplication paradox. It would, however, be interesting to consider this in more detail.

Two uncertainties and their identity. As argued above, subjectivity is ontologically paradoxical because it can only describe itself via knowledge of its own and other objects’ existence. This is the ontological side of the duplication paradox: the physical supervenience base of subjectivity must contain existence as a physical quality. As long as one lacks knowledge of this supervenience base, one experiences subjective phenomena as an epistemic and ontological caesura in the causal order of things, namely, as an irreducible contingency that cannot be explained away. In other words, a subjective phenomenon is something that exists because it is “observed” or “experienced” and, as such, appears to us as excluded from intersubjectively valid explanations (i.e., recipes for the replication of objects of experience).

One faces a dilemma: either existence is a predicate, and physical information is duplicated, or there is an epistemic caesura. In the latter case, the subjective is experienced as fundamentally contingent in the sense that its emergence is not explainable by causal regularities. The philosophy of mind tends to assume that, even if consciousness remains unexplained, this explanatory gap is not an obstacle to other explanations. If the contingency of the subjective is experienced as our inability to include existence into physical descriptions, however, this contingency must pose such an obstacle. It must be part of conscious beings’ uncertainty about the physical world. The argument is as follows.

One already encountered another ontological and epistemic caesura: the reduction of a red rose to the fundamental object led, first, to the destruction of the rose and, then, to the discovery of limits to intersubjectively valid knowledge. Similar to consciousness, these limits ensure that the existence of an object cannot be reduced to a piece of physical information. It is, therefore, tempting to identify the caesura produced by subjectivity with the objective limits to certainty. On the face of it, it is not immediately clear what this identity could mean. Objective quantum uncertainty is an empirically discovered and quantifiable phenomenon. On the contrary, subjectivity is an obstacle to the quantification of experience. Nevertheless, the following construction shows that their identity does make sense. An act of observation posits something as existing under a description, yet the description itself does not imply the existence of the object. The intersubjective validation of the respective constraints on experience defines the ontological status of the description, that is to say, the existence or non-existence of the object in question. The process of maximizing intersubjectively valid constraints on experience is finite; in other words, it terminates in a fundamental description. The latter's definition implies limits to intersubjective validation in the form of trade-offs between experimental setups, and this means that the consensus on matters of fact between different observers will forever be limited. Let us now consider what would happen if an observer attempted to decrease the quantum uncertainty of a system by carefully observing its interaction with the measurement apparatus and the environment. The nature of objective uncertainty is such that it cannot be removed by tracing the observer-object interaction. Tracing the process of observation, the observer would, therefore, face the same constraints on precision that arise from objective uncertainty. This is because objective uncertainty is a universal feature of the object, the measurement apparatus, and the environment (see the discussion of the common reality above).

It is only natural to conjecture that the same would happen if one tried to observe the duplication of physical information in the act of observation, that is to say, to implement physically the above thought experiment. Unless one improved upon quantum uncertainty by adding a macrolevel regularity to the fundamental description, one would encounter an obstacle: the objectively given trade-off in the precision of measurements. This trade-off would appear to the observer as a "disturbance" caused by the act of observation, which would make it impossible to identify the supervenience bases of conscious states. As a result, the thought experiment and the duplication of information become physically impossible.

In this construction, objective uncertainty makes the caesura of consciousness possible. Maximizing the objectivity of descriptions, one discovers the precision trade-off. In turn, this trade-off makes it impossible for the observer to close the circle by securing an objective description of the process of observation itself. The path of discovering objective uncertainty is subject to the same objective uncertainty, and this lack of certainty in the world is thus the same as (not "caused by") the epistemic caesura produced by the subjective.

Conclusion: a limit on empirical knowledge as an ontological proposition

Consciousness is knowledge of one's own existence as well as the existence of other things. If we were able to develop a recipe for the reproduction of consciousness, which allowed us to reproduce it, there would exist an object, one of properties of which would be its existence. This conclusion, however, defies the metaphysical intuition that existence is not a property and, more importantly, leads to the duplication paradox.

The paradox is avoided, however, because it requires an objective description of a conscious state, and the above argument demonstrates that such a description is not possible. Indeed, the intersubjective validation of experience-constraining descriptions requires the existence of a common reality. The reduction of objects to this common reality must be finite, and therefore, the individuation of objects is always limited. Any object has a finite fundamental description. This limit on individuation appears to the observer as non-eliminable objective uncertainty, that is to say, quantum uncertainty. We also note an equivalence of two limits to the intersubjective validity of empirical descriptions, namely the conscious qualities of experience and the quantum qualities of physical reality. In the most pragmatic terms, this limit can be seen as follows. We can achieve various degrees of intersubjective consensus on atoms, chairs, roses, and even qualia and emotions. This consensus depends on the objectivity of the respective descriptions. A more objective description generates a greater consensus; in other words, it is more intersubjectively valid, and there is no way around it. People agree on tables more often than they do on qualia. The fact that Mary knows basic physics is strictly less intersubjectively valid than basic physics itself. This is because we encounter limits on intersubjectively valid empirical knowledge: Knowledge is paid for with uncertainty. To communicate the physical meaning of the color red to Mary, Peter must destroy the rose—unless, of course, enough roses and other objects have been destroyed already for him to study the physics, chemistry, and biology of colors, petals, and eyes from books. This invasive character of knowledge acquisition reflects objective uncertainty in the form of a trade-off between different components of knowledge. Quantum limits to intersubjective validation make the duplication of physical information impossible and thus can be seen as the validation of the metaphysical postulate that existence is not a property. This is the solution to the ontological puzzle of consciousness as something whose description carries information about its existence. There is simply no such an intersubjectively valid description. That existence is not a property is thus an obstacle to empirical knowledge and not a result of conceptual gerrymandering. This obstacle transpires in the existence of subjective consciousness, which is capable of knowing objects as objectively existing.

This construction is unusual and even counterintuitive in the sense that it contradicts the received wisdom on the empirical irrelevance of metaphysics. The idea that existence is not a property is not new. What are novel, however, are its empirical implications. The objective description of an object is the one that consists in an explanation of how the object can be transformed into other objects. Such a description cannot be refined to include something that distinguishes the object from its copies. It does not refer to the as-yet undiscovered "essence" of a given ("posited") object, which could have pinned down this object's existence. A full description of the physical world is not possible. The epistemic caesura of subjectivity is, indeed, ontological.

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Competing interests

The author declares no competing interests.

Additional information

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