Quantum Theory : A Pointer To An Independent Reality

B. d’Espagnat
Laboratoire de Physique Théorique et Hautes Energies
Université de Paris-Sud, Bâtiment 210, 91405 Orsay Cedex, France
Fax : 33 1 69 15 82 87

Abstract

While philosophy of science is the study of problems of knowledge concerning science in general, there also exists - or should exist - a “philosophy in science” directed at finding out in what ways our actual scientific knowledge may validly contribute to the basic philosophical quest. Contrary to philosophy of science, which is a subject for philosophers, philosophy in science calls on the services of physicists. When, in its spirit, quantum theory and Bell’s theorem are used as touchstones, the two main traditional philosophical approaches, realism and idealism, are found wanting. A more suitable conception seems to be an intermediate one, in which the mere postulated existence of a holistic and hardly knowable Mind-Independent Reality is found to have an explaining power. Some corrections to comments by Schins of a previous work on the same subject are incorporated.
1 Introduction

As we all know, quantum mechanics raises interpretation problems. But within the realm of what philosophical standpoint should their solutions be looked for? In articles on the subject this question is, as a rule, implicitly answered without even having being asked. Right at the start an implicit philosophical conception is taken up. The reason is that most of the authors of these papers have, ingrained in their mind, an intuitive but quite definite view of what “knowledge of the world” can and should be. Consequently the questions they investigate are of the type: “How can quantum mechanics possibly fit into my philosophy which, obviously, is the only sensible one?”.

This approach induced significant findings. However, also another type of questioning is conceivable and interesting. It consists of noting that, for centuries on, several different conceptions of knowledge, notably realism and idealism, have been in competition; that, as philosophers well know, neither one of these two was finally “ruled out”; and that the advent of quantum mechanics yields new clues that could conceivably help us choosing between them or finding one that would fit more closely what we now know.

The purpose of this paper is to have a further look at what can be achieved along these lines. “Further” since, as a matter of fact, the present author already considered this subject in his recent book, Veiled Reality [1]. However, the larger part of the book in question - whose subtitle is An Analysis of Present-Day Quantum Mechanical Concepts - deals with the more technical aspects of the interpretation difficulties quantum theorists have to cope with. It is conceivable that for some readers this obscured the treatment of the broader issues. Anyhow, the fact is that, in a paper bearing the same title as this one (and a subtitle referring to my work) J.M.Schins\(^2\), while adequately capturing the general trend of my book, most seriously misinterpreted important elements of the “philosophical reasoning”, so to speak, contained in it. In part, this paper is intended as a rectification of these misunderstandings.

It is constructed as follows. Section 2 is a short reminder of the various forms idealism and realism may take up. Section 3 reports on a set of questions bearing on these conceptions and concerning which I claimed in the book that quantum mechanics yields important clues. In Section 4 Schins’ main misinterpretations concerning these points are explained and rectified. Finally, in Section 5 my own conclusions are stated.

2 Glimpses on Realism and Idealism

A glimpse on idealism

It would be quite preposterous to aim at deriving a brand new, full-fledged philosophical conception just from quantum physics, which is essentially a formalism. What we should do therefore is to consider the main, competing “received philosophical standpoints” and examine to what extent contemporary physics fits with them. To start with,

\(^2\)J.M.Schins, Quantum Theory: A Pointer to an Independent Reality, A Discussion of Bernard d’Espagnat’s “Veiled Reality”. Chapter 11 of [2].
let us have a look at idealism, a name appropriate for covering all the conceptions - often also called phenomenalism, empiricism, positivism, pragmatism, operationalism etc. - stressing that any object we may meaningfully speak of is by that very fact an “object of knowledge” and viewing therefore any such object as depending on our human abilities at observing and thinking. Since the human species is a mere atom in the Universe, such a dependence is, at first sight, very much counterintuitive and so is, therefore, idealism as well. However, as early as in the XVIIIth century even its opponents, Diderot for instance, realized how difficult it is to formally disprove it. Neither the standard objections to it nor the well-known corresponding counter-arguments can, of course, be reviewed here. A rough knowledge of them must be assumed. Let it merely be noted that, when all is said and done, idealism appears as a seriously backed-up conception and that practically all the philosophical views that are being developed to-day partake, in some way or other, of it.

There exist several variants of idealism. For the benefit of the forthcoming discussion it will prove convenient to consider two different partitions of that set.

(i) Distinguishing “radical” and “moderate” idealisms

Let us call “moderate” the versions of idealism in which it is considered that although Mind-Independent Reality is not knowable still this notion is meaningful. Kant’s conception is an example (in it, the said Reality bears the name “Thing-In-Itself”). By contrast, let us call “radical” the versions in which this notion is considered meaningless (neo-kantianism is an example).

(ii) Distinguishing “transcendental” and “non-transcendental” idealisms

When, in the middle of the XVIIIth century, it became clear (essentially from Berkeley’s work) that idealism is a self-consistent view, this finding was viewed as dramatically worrying by a majority of philosophers. Kant, in particular, considered it a scandal that if somebody thought good to doubt the existence of things outside us we should be unable to counter his doubts by any satisfactory proof. To put this right he decided to redefine such basic notions as existence and reality, and he proposed to refer them, along with all others, to human knowledge. We do not know - and shall never know - object-in-themselves. But never mind. Just forget about them. Since both science and general knowledge exclusively deal with objects-for-us - stable elements of our perceptions - these are the elements that can properly be said to exist and compose reality. Clearly, with this convention the existence of, say, a table cannot be doubted any more. Of course, space, time, causality etc. are defined in the same way, that is, by referring essentially to us.

The just summarized conception is what is called “transcendental idealism”. Clearly it can quite well be “radical” as well (if Mind-Independent Reality is unknowable, why not drop it altogether ?). But it can also be “moderate”, as the very existence of Kant’s system suffices to show. Similarly, a non-transcendental version of moderate idealism is, of course, also conceivable. It can be defined simply by stating that, in it, the meaning of such words as “existence” and “reality” should not be restricted, as Kant did, to the realm of phenomena. Then, however, care should be taken not to designate two altogether different notions of reality by means of the same word. More precisely, within
such a version it is suitable, when referring to the set of “objects-for-us”, to use, not just the word “reality”, as Kant does, but rather the expression “empirical reality”; and similarly, when referring to Mind-Independent Reality, to use indeed the full expression “Mind-Independent Reality” which has the virtue of preventing any confusion with the preceding notion.

A glimpse on realism

Of course, our everyday language is implicitly realist. We tend to think of the “usual things” as existing and more or less having their observed properties, quite independently of us. Remember that this view rests in fact on a postulate: the postulate that, either because of their thorough simplicity or for some deeper reason such as those Descartes considered, concepts such as forms and relative positions of objects must be “true”, that is, fitted to a description of reality as it is. We may call “near realism” (“near” meaning “near to us”) the conception that indeed such “clear and distinct” concepts (as Descartes himself called them) are necessary and sufficient for the description in question. It goes without saying that notions such as space, time and locality are so “simple” and “obvious” that they rank among those that, in near realism, must be basic. Viewed as a realist theory atomism is a paradigmatic example of near realism. But others, of course, can be thought of. As is well known, near realism is not the only conceivable version of realism. Another one, particularly favored by Einstein in his later years, may be called “mathematical realism” (although it is not to be identified with the Platonism of some pure mathematicians). It consists in considering that the concepts that truly fit Reality are of a mathematical nature. Admittedly the borderline between these two variants of realism is not quite sharp. For example, classical electromagnetic theory may be said to partake of both. In it, the basic entities, the fields, are mathematically defined but still the theory verges on near realism since these fields are defined as one-point functions so that Bell’s locality is preserved and consequently the fields in question may be considered “real stuff”. Note that a corollary to realism is counterfactuality: If such and such a proposition holds true when thought about in association with an experimental device that would make it possible to verify it without altering its content, it should also be true in cases in which that device is simply not there.

Both near realism and mathematical realism assume that, at least in principle, Mind-Independent Reality is knowable, in the sense that it is possible to describe it in precise words and in detail. It is however neither obvious nor proven that this is a necessary condition for a realist philosophy to make sense. The claim (to be considered below) that existence is logically prior to knowledge may be considered in itself, apart from any reference to knowability, as being a form - perhaps the mildest one - of realism.
3 Discussion. Realism and idealism in the face of contemporary physics

Our purpose in this section is to consider some basic questions and pinpoint the difficulties they raise concerning, as the case may be, either idealism or realism, account being taken of quantum physics. Basically, these questions are those Schins mentioned. Only, he thought every one of them constituted in its own right a self-consistent objection to either idealism or realism. This is not what I had written. In fact, as we shall see, some of them raise difficulties of this type only when taken together.

3.1 Visuability

Idealism conveys in a natural way the view that, since the physical laws are regulated by the a priori modes of our sensibility and understanding, the laws in question should be constructed in terms of “visualizable” concepts, that is, concepts corresponding to customary intuition. For this reason it may be considered that, for example, to shift from the familiar Euclidean space to the non-Euclidean space of General Relativity was conceptually more difficult for an idealist than it was for a realist (since realists have no basic difficulty in shifting from near to mathematical realism). However, it is true, of course, that while curved spaces have nothing to do with a priori forms of sensibility the mere fact that they are elements of mathematics may be seen to mean they are a priori forms of understanding, as neo-Kantians hastened to retort. And, clearly, the same can be said concerning the many other concepts that contemporary physics borrows from mathematics. But this hardly alleviates the difficulty for pure mathematics swarms with notions of various kinds, only a small number of which are useful for physics. Why are precisely these ones useful, not the others? If there exists nothing at all corresponding to the notion of a Mind-Independent-Reality, in other words if all the valid scientific concepts come exclusively from the human mind, this question, obviously, has no answer. “It should not be asked”, as idealists promptly assert. Whereas if realism is true it is answered immediately and in a fully satisfactory way, just by stating that discovering the role of curved spaces and so on discloses some real structures of Mind-Independent-Reality. All this shows that idealists - and particularly upholders of radical idealism - who aim at self-consistency unavoidably have a hard time when they try to modify Kant’s original system so as to make it consonant with contemporary scientific findings. In other words, it may be considered a more or less inherent feature of idealism that it requires using a “universal objectivist language”, that is a set of words referring - basically in the way Kant stated - to what he called the a priori forms of sensibility (spatiality, figures in space etc.) and understanding (causality etc.). Contemporary physics however shows that this language is inadequate for describing the totality of our scientific experience.
3.2 Experimental refutation of mathematically consistent theories

It is a fact that we sometimes build up quite beautifully rational physical theories that experiments falsify. Experiment cannot falsify the rules of the game of chess - nor those of any other game - because these rules are just created by us. In this case, therefore, there is nothing “external” that could say “no”. But in physics it sometimes (and even quite often!) happens that something does say “no”. How could this “something” still be “us”, as idealists would require? It seems that the degree of intellectual contorsion necessary for answering such a question in any positive way exceeds what is acceptable. Again, and essentially for the same reason as in point 3.1, idealism - and particularly its “radical” version - is here in trouble.

3.3 “Existence” versus “knowledge”

Philosophers anxious to keep aloof from unwarranted metaphysics commonly stress the fact that we only know the phenomena and willingly combine this with the wise observation that we should only speak of what we can possibly know (“Whereof we cannot speak, thereof we must keep silent”, as Wittgenstein wrote in his Tractatus [3]). Radical idealism extrapolates this maxim to the idea that only the phenomena have a meaning. But, reasonable as it may look at first sight, this extrapolation openly makes the notions of knowledge and experience conceptually prior to the notion of existence and this is a standpoint the internal consistency of which seems questionable. Should not, in fact, the tables be turned? It seems quite impossible to impart any meaning to the very word “knowledge” without postulating - implicitly at least - the existence of somebody, or something, or what-not, who knows. Of course, the nature of this entity is thereby left unspecified. Only its bare existence is certain. This fact, however, suffices to set the notion of existence in a “conceptual” position making it prior to knowledge.

In this connection, let it be pointed out how erroneous it would be to believe that in Kant’s system existence is *really* totally subordinate to knowledge. Admittedly Kant claims that the existence of objects, and even that of the self as a sentient and thinking being inserted in time, is phenomenal and not noumenal. In this respect it depends, he states, on the general, a priori conditions of possible knowledge. But this does not imply that existence in the basic sense nowadays usually given to this word totally depends on knowledge. Indeed, Kant is fully aware that, through the very fact that he mentions knowledge as a kind of an ultimate reference, he imparts a meaning to the notion of transcendental self, that is, to the notion of a subject who is not to be confused with the phenomenal self and who (or “that”) is able to have such a knowledge. To be sure, Kant did not assert that this transcendental self “exists” (since he saved up this verb for being used in the limited, phenomenal, descriptive sense we mentioned first) and he explicitly stated that it cannot be an object of knowledge. But he claimed that it is “Being itself” (Critique of pure reason, Transcendental dialectics, Book II, Chapter 1). If Kant is to be followed it must therefore be considered that the notion of a Being conceptually prior
to knowledge is necessary. And since in our present-day language the idea of “being” is expressed by the verb “to exist”, it follows that we must consider a certain notion of “being” and existence as being prior to any knowledge.

To sum up: when all is said and done it must be considered that, for radical idealism, the ambiguity inherent in the relationship between existence and knowledge constitutes a difficulty.

### 3.4 Weak and strong objectivity

Of course, the statements that compose physics are objective. All are not so in the same way, however. Many, especially in classical physics, have such a form that, at least at the times of classical physics, they could be understood by a conventional realist as faithfully describing attributes (or existence) of “objects as they really are”. Let them be called “strongly objective”. Others explicitly or implicitly involve in their very wording some reference to human actions, abilities and, last but not least, perceptions. Let them be called “weakly objective”. Weakly objective statements, especially in the form of predictive observational rules, play quite a specially important role in quantum mechanics. Indeed, as we all know, the whole predictive power of this theory can be derived from a set of a few “axioms” or “principles” somehow playing the role devolved in Newtonian mechanics to the three basic Newton laws but with the difference that, contrary to the latter, some of them (e.g. the Born rule) are weakly objective only (predictive of observations). It is true of course, that, formally, any of these axioms can be couched in terms that, grammatically speaking, are of the strongly objective kind. This is done by expressing them in terms of “pointer positions” rather than in terms of “observations”. But then, if conventional quantum mechanics is attributed universal validity the very concept of pointer position raises Schrödinger-cat-like questions and it is well known that none of the numerous so-called quantum measurement theories succeeded in answering the latter in a strictly satisfactory way. Decoherence theory, in particular, does not remove the so-called “non-unicity paradox”. Besides, it leads to a view flatly contradicting near realism since, in it, while the macroscopic objects appear to have forms, positions etc. they definitely do not have these properties “in themselves”. According to it we can say these objects have them only in the sense that neither we nor other (hypothetical) local sentient beings will ever be able to observe some quantum-mechanically predicted correlations that are incompatible with attributing the said properties to these objects. Consequently it must be granted that, at one place or other (depending on how it is formulated), conventional quantum theory involves statements that, although they are essential for making it meaningful, are not of the strongly objective kind. Such a theory may adequately be said to be “weakly objective” only.

Nowadays, as we all know, quantum mechanics is the great “framework-theory” and indeed the only one the universality of which can reasonably be conjectured. Consequently, its weak objectivity is a powerful indication that what science describes cannot be conceived of as being “Mind-Independent” Reality.
3.5 Ontologically interpretable models

In the last sentence above the words “powerful indication”, not the word “proof”, are used. This is to take into account the quite significant (even though often overlooked) fact that there exist so-called “non-standard” models. They are theories that aim at - and, to an appreciable extent, succeed in - reproducing the observational predictions of conventional quantum theory but are fully expressed in strongly objective terms. There is no place to mention them all here. Some are undeterministic, others, like the Broglie-Bohm model [4,5,6], are deterministic. The important point is that, due to Bell’s theorem [7], all of them must be nonlocal. This has momentous, and, in fact, disturbing, effects, not all of which can be reviewed here (they are in [1]). The most unpalatable of these failings has to do with the relationship between quantum mechanics and relativity theory. In a nonlocal theory influences are propagated superluminally. Special relativity, on the other hand, specifies that no signal can be propagated faster than light. Can these two facts be reconciled? In the realm of an idealist (or “weakly objective”) approach - where physics is a description, not of Independent Reality but of our knowledge concerning what we can perceive (the “phenomena”) - a conciliation is indeed at hand, for it was pointed out that the just mentioned superluminal influences cannot carry information, that is “signals”. But within a realist conception such as the later Einstein’s one, where “signals” are identified with “influences”, it seems we are in a deadlock. This, in my view, explains the fact that, whereas a relativistic version of conventional quantum mechanics (a weakly objective theory as we just saw) could emerge but a few years after the advent of quantum mechanics itself (in the form of the Quantum Theory of Fields), all the attempts made at reconciling the ontologically interpretable quantum models with special relativity have, up to now, failed.

For this and related reasons the present author has evolved a rather special opinion concerning such models. It consists in considering that their usefulness merely lies in their existence. This has to do with the aforementioned non-unicity paradox (the apparent non-unicity of individual measurement outcomes, also called Bell’s “and-or” paradox, see e.g. [1]) that affects all formulations of conventional quantum mechanics. The point is that this paradox is simply not present in these models. Hence the mere fact that such models are possible shows that, far from being final, the paradox, in fact, just stems from an unwarranted demand from our part for an ontological interpretation of conventional, hidden-variable free, quantum mechanics. But on the other hand this indication does of course not alleviate the difficulties these models meet with. Along with the embarrassing proliferation of the latter, the difficulties in question constitute serious objections to the idea that, through them, conventional (or even some brand of moderately unconventional) realism has been salvaged.

---

\(^3\)B.d’Espagnat [8], footnote 30; Eberhard [9]; Ghirardi et al. [10].
3.6 Intersubjective agreement

If Alice and Bob agree that they see a teapot on the table, the “simplest” explanation seems to be obtained by following the realists. It consists in considering that at that time a teapot is indeed on the table, that its being there owes nothing to the representations and so on that are then taking place in Alice’s mind and that the same holds good concerning Bob. If on the contrary, as the idealist claims, the statement that the teapot “really exists, at such and such a place” has no meaning beyond that, for Alice, of describing the way she mentally organizes her sensations (and same, of course for Bob), then the fact that Alice and Bob agree that they have the same sensations in this respect becomes puzzling: a kind of constantly renewed miracle, in fact. The realist is therefore entitled to press the idealist on this point, and ask what explanation he has to offer that would be as simple as the one just stated.

Surprisingly enough, few idealist philosophers seem to have worried about this problem. In the relevant literature, practically only intersubjective agreement concerning general ideas or mathematical concepts, in short, non-contingent facts, is discussed. Such philosophers explain, for example, that we all have the notion “triangle” because we are all similarly constituted. To them, this point can readily be granted; and we are even quite prepared to extend the argument from triangles to teapots, at least as long as only the general concept “teapot” is considered. But it is difficult to grasp why the fact that Alice and Bob are similarly constituted could explain why they both perceive, or do not perceive, a teapot at the same place, while it practically never happens that, at the place in question, Alice sees one and Bob sees none or vice-versa. Among the philosophers in question, Husserl may have been the only one who took an interest in this question. Unfortunately his analysis of it - in the fifth of his Méditations cartésiennes [11] - is so complex and, as it seems, confused that it is difficult to find it conclusive.

Now, is this a decisive blow to idealism, establishing that it fails on a point where realism is successful and that we should therefore revert to realism? No or, at least, not yet. To realize that the question deserves further thinking let us reformulate it in terms of predictive powers. The above argument then is that if Alice were a fully consistent upholder of radical idealism she would have no convincing reason to believe that Bob also sees the teapot. Hence she could not predict that when the two will meet, say, the day after, their memories of the event (the notes in their notebooks) will coincide. Whereas, if she adheres to near realism she certainly will predict such a coincidence, which indeed is in fact observed. To repeat, at first sight this seems quite a strong argument in favor of realism. Note however that the argument works specifically in favor of near realism since it is based on the notion that a teapot always is actually at some definite place, independently of our states of mind. Now, this remark may well arouse our suspicions since we know from physics - and quantum physics in particular - that near realism cannot be universally valid since it fails in the atomic realm. Could it be that intersubjective agreement also fails there?

As we know, the answer is “no”. Imagine for example that Alice and Bob both perform, one immediately after the other, a measurement of one and the same spin component of a particle, each one using his own instrument. And assume further that before
the first measurement the spin state of the particle was not an eigenstate of the measured quantity. Even then, the rules of quantum mechanics unambiguously predict intersubjective agreement. The calculation may be done in several ways (either by assuming a collapse at the time of the first measurement or by attaching a state vector to each one of the “instrument pointers” and analysing their subsequent correlations or etc.), corresponding to quite different pictorial representations of what takes place. But the final outcome is always the same and therefore quite unambiguous: when Alice and Bob later compare their notebooks they will discover that they both got the same result. Before the first measurement, however, as the conventional quantum mechanical formalism tells us, the measured spin component had no definite value whatsoever, hence not that one in particular. The, allegedly obvious, realistic, “teapot-like” explanation of intersubjective agreement is, in this case, just simply false, and yet this agreement is predicted by the theory!

A variant of this example consists in assuming, not that Alice and Bob make two consecutive measurements on the same particle but that each one of them measures the same spin component on two distinct particles whose spins are strictly correlated. For example, we may have to do with a pair of spin 1/2 particles created in a spin-zero state. Here, again, conventional quantum mechanics states that before the measurements the spin components have no definite value and yet it unambiguously predicts a strict (negative) correlation of the measurement outcomes, and hence intersubjective agreement (Alice can predict what Bob will see and conversely). The interest of this second example lies in that it removes an objection to the above that the aforementioned Broglie-Bohm model could suggest. In a sense, this model may be viewed as the best possible quantum-mechanical approximation to near realism since it imparts definite positions and velocities to all particles at any time. Could the “teapot-like” explanation of intersubjective agreement be salvaged at the price of believing this model is true? No for, in the model, the particles are driven by the wave function which, in the second example, is a highly nonlocal entity. Consequently, as detailed calculations show as soon as Alice, say, has performed her measurement on “her” particle the outcome of the, as yet to come, Bob’s measurement is determined, not in the least by the hidden variables specifying the position of “Bob’s particle” but, strange as it may seem, by the outcome of Alice’s measurement.

To sum up: Concerning intersubjective agreement about contingent data traditional, philosophical idealism remains vague and unconclusive, mathematical realism does not deal with such matters and near realism definitely fails yielding a universally valid explanation. By contrast, conventional quantum theory correctly (and universally) predicts the agreement in question (we could say: it succeeds where philosophy failed!). But it does so by means of strictly observational predictive rules that, as we saw, have no unambiguous pictorial interpretation (remember the two distinct modes of calculation that both lead unambiguously to the Alice-Bob agreement although the tentative realistic interpretation we might imagine concerning them are extremely different). This is an important fact. Does it turn the tables in favor of idealism, after all? The question is tightly related to another one, namely: “do such observational predictive rules constitute by themselves genuine explanations?” Answering yes on this last point might be

---

4J.S.Bell [12]; Veiled Reality [1], Section 13-3.
acceptable, under conditions to be specified below. My own, preferred answer, however, is “no”. If, every time I heard my telephone ring it happened to ring three seconds later in my neighbour’s home I would derive from this a predictive rule, but I would certainly not consider this rule as constituting, by itself, an explanation. And I would hold on to this view even if I remained durably unable to discover the explanation in question. This is the standpoint I am inclined to adopt concerning the problem at hand. At our disposal we have the basic rules of quantum mechanics, which are excellent observational predictive rules, that do predict correlations. But their very existence requires an explanation of some sort, the minimal element of which seems to be the existence of something external to us acting as a support of them. It is this something that should, by definition, be called Mind-Independent Reality. It is not described by these rules since the latter are predictive, not descriptive of anything. Still, we must consider it exists.

This “something” however needs not be anything like a “substance”. Could it just be a law? Could it - after all - be a mere “observational predictive law”? In other words, can the conditions we impose on whatever we accept as “explanation” be relaxed to the extent that, as cursorily noted above, the laws, including even those that are merely predictive of observations, could be seen as constituting an “explanation”? Maybe. But then the “explanatory power” of these laws entirely lies in their generality, so that the latter cannot be thought of as limited by contingencies or circumstances. The explanatory power in question is preserved only if we reject such statements as, for instance, “unknown laws do not exist” (Meyerson [13]) or if we refuse to identify the “laws” such statements mention with the “great laws” we consider as candidates for constituting an explanatory basis. Hence, this corroborates the above. It seems to imply that even along such a “minimal” view as the one under discussion in this paragraph there must be “something” - namely these laws - that does not depend on us. A “something” then, that constitutes, by definition so to speak, an “ultimate” reality.

To put all this in a nutshell: In favor of near realism intersubjective agreement is, as we saw, but a deceptive argument and this observation might be thought at first sight to plead in favor of the conception “opposite” to realism, namely idealism. This however would be a somewhat simplistic standpoint. It is true that mere observational predictive rules - those of quantum mechanics - do predict intersubjective argument. However, to rank as an explanation of the latter these rules must be considered either as constituting or (preferably) as reflecting great structures of some Reality that does not just simply boil down to “us”.

3.7 Quantum measurement theories

This item cannot be covered here (see e.g. [1]). Let it just be recalled that, as mentioned above, within the realm of standard quantum theory no strongly objective description of the measurement process is available, although many theories of the said process were formulated with that goal.
4 Remarks concerning Schins’ account

Concerning the above points 3.1, 3.2, 3.5 and 3.7 as well as in his summary of my broad conclusions Schins has, on the whole, not unfaithfully reported the views stated in [1]. Unfortunately on the other listed items, same as in a few of his comments, the ideas and especially the arguments he attributed to me do not, to repeat, actually correspond to those I really wanted to express.

On point 3.3 he described my argument as being the view that it is not possible to conceive knowledge without accepting that the known object must exist. This has nothing to do with what I had written (see above).

With regard to item 3.4 (weak objectivity) he did not grasp the main point in my conception, which is that, notwithstanding its deceitful vocabulary, standard quantum mechanics is but a synthetic account of what we (collectively) perceive and shall perceive, not a description of what is. Consequently he tried to illustrate my views by stating, in terms of naive realism, an interpretation of a measurement process that is quite alien to what is written in my book.

With respect to point 3.6 he rightly noted that what I wrote in [1] concerning intersubjective agreement involves objections to both radical idealism and realism, but from that point on we differ.

Within the first item (objections to idealism) he reproduced without comments the part of my argument concerning Alice, Bob and the teapot and he then stated (without explaining) that neither this one nor my other arguments against idealism are conclusive. The content of point 3.6 above should make it clear that on the whole this report of my views is misleading.

On the second item (objections to realism) my difference with Schins is more considerable. His view is that I did not analyse the right problem. When discussing the case of Alice and Bob both measuring a given quantum observable (in [1] I had taken up the example, not of a spin but of an electron position) he stated: “In the context of intersubjectivity one needs to explain that there is a ground that two scientists should agree on a single fact (the electron position as measured by the first apparatus), not that two different facts (the electron position measured with different devices) should be related in some special manner”.

Well, I beg to differ. I think that the example I considered is the continuation in the microscopic domain of exactly the problem Schins called attention to. My argument runs in two steps. The first one consists in noting that there is no conceptual difference between two scientists looking at an instrument pointer and Alice and Bob looking at a teapot. Note that while, in such situations, we say the object is “directly seen” by the observers this is, in both cases, a simplified description. In either case the observers in fact use photons and their eyes (and glasses if shortsighted) as instruments. My second step then simply consists in noting that conceptually the problem remains the same whatever the size of the pointer is. Only, if it is too small to be perceived by naked eyes the instruments must be chosen appropriately. If the “pointer” reduces to just one electron our two scientists will have to make use of instruments appropriate for measuring electron positions with suitable approximation. Call these scientists Alice and Bob and you get my problem
in its quantum version. It is true that, in the teapot and pointer cases, the two onlookers are supposed to observe simultaneously, but such macroscopic observations necessarily last some finite time, so that they may also be considered as composed of sequences of shorter observations made in turn by each onlooker. Note also, in this connection, that even though some descriptions of the Copenhagen interpretation popularized the thesis that no “measurement without disturbance” is possible, this thesis (that Schins seems to refer to) cannot quite be taken at face value. Ideal measurement of an observable, when performed on a system already lying in an eigenstate of that observable, entails, in principle, no disturbance of the system. As Araki and Yanase showed, this ideality is in some cases impossible, even on theoretical grounds, but considerations of such a kind are clearly disconnected from the present problem.

Still concerning the same item Schins fell the prey of a second misinterpretation. It consisted in stating that I saw the example where Alice and Bob measure some quantum observable as being an argument against realism. This is not what I meant. What I consider the example actually shows is that - contrary to what some realist may think when the teapot argument first springs up to his mind - the fact that intersubjective agreement is experimentally firmly established does not prove that near realism is true. It does not, since the mere predictive rules of quantum theory do yield the agreement in question without any recourse to near realism and even in cases where such a realism is, to say the least, questionable (this is just another example of a well known fact: if a hypothesis, or theory, works, this is no proof that it is right). On the other hand, to claim that the “quantum” example suffices for disproving realism is going too far. It amounts to claim that conventional quantum theory is the only possible description of our atomic experience. As we know (see 3.5 above) and as emphasized in [1], this is not the case. Hence, the analysis must be pursued further, as I tried to do in 3.6.

Unfortunately, an even grosser error was committed by Schins. He claimed that in all the places in my book where I explained what he calls my “arguments against realism” and used the word “ontological” this word could harmlessly be replaced by “determinism”. And more generally he stated he had the impression that for me, “realism is inevitably burdened with determinism”. He gave no reason whatsoever for explaining these judgements and I must say I am quite at a loss imagining any. All I can say is that in [1] I discussed at length both determinist and indeterminist ontologically interpretable models, stating which ones are determinist and which ones assume that intrinsically random effects occur, and that I defined there ontology as “questions on what really exists”, which obviously implies no commitment to determinism. In fact, I always considered that these two notions are totally different ones. For this as well as on other grounds, although I do entertain the main general views Schins attributed to me in his text (for example on the necessity of an “extended causality”), it is impossible for me to endorse the account he gave of most of the reasons I developed in their favor.
5 Conclusions

When an author X has developed some ideas and attempted to justify them, if others give an erroneous description of his arguments to this effect he has good reasons to worry. This is particularly the case when the ideas in question substantially part with the views that are presently the “received” ones. For indeed competent upholders of the said views have then some apparent ground to exclaim: “see how unsubstantiated X’s ideas are: they rest on premisses whose falsity is obvious”. This is the reason why, while I appreciate that Schins popularized my conceptions, I felt it necessary to write down Section 4 above.

Now, setting this matter aside, what are the conclusions that may be said to reasonably follow from the material presented in Sections 2 and 3? The first one is that neither realism nor idealism are truly satisfactory. Near realism is trivially contradicted by relativity theory and quantum physics, and, in spite of appearances, not salvaged by the Broglie-Bohm model (remember nonlocality and the variant of the Alice-Bob quantum example in 3.6). Mathematical realism is in trouble because contemporary physics centers on quantum theory, that is, on a theory that is weakly objective only (3.4). The attempts at changing it into some strongly objective theory - the various so-called “ontologically interpretable models” - meet with difficulties concerning relativity theory that, again, have essentially to do with nonlocality, as explained in 3.5. As for idealism, transcendental idealism (in both its “radical” and “moderate” versions) suffers in particular from the visuability difficulty explained in 3.1. The way this difficulty affects transcendental idealism is that it removes what historically was one of its basic motivations. In Kant’s view, as we know, giving up the idea that the true objects of knowledge are the things-in-themselves; granting that they are mere “phenomena” shaped and made visualizable by the a priori forms of human sensibility and understanding, was the “price to be paid” for, at least, guaranteeing the certainty of descriptive knowledge, that is, the relevance of a descriptive science. Apparently he considered that science had to be both descriptive and certain, that such a guarantee was therefore essential, and he thought this was the only way to get it, which means of course that he thought it was a possible way. The present loss of visuability obviously removes the guarantee in question (in quantum physics we still have sure statements but some of the main ones are just predictive of observational results; they are not consistently descriptive, not even of “objects for us”). This means that a powerful traditional argument in favor of transcendental idealism has vanished. In addition, radical idealism suffers from the difficulties explained in 3.2 and 3.3.

Finally, as we saw, quantum physics accounts in quite a precise and general way for a phenomenon for which near realism merely offered a partial, hence deceitful, explanation and that idealism was unable to handle, namely intersubjective agreement bearing on contingent data. The question then is: should the said quantum mechanical account be viewed as being “in the spirit of realism” or should it count as “a success of the idealist approach”? Since it refers to anthropocentric predictive rules it might at first sight be considered as being in the line of idealism. But remember the argument with the telephone ringing in two appartments at the same time. The steady repetition of an event such as this one cries out for an explanation, which means that it cannot be considered as being
its own explanation. Something more is needed, that common practice calls a law. The
most we could concede to the idealist is that there may be no “substance” underlying
such laws; that what exists is but the laws themselves. But, to repeat, these laws must
then, as we noted (3.6), be something more basic than just the predictive rules we happen
to know at a given time. So that, even then, some sort of a Mind-Independent Reality,
composed of known and unknown laws, must be thought of.

Moreover, we may even ask ourselves what would be the rationale of going that
far in the direction of radical idealism, considering the above listed difficulties this theory
encounters. In fact, there is quite a significant argument indicating that keeping the
notion of some “underlying stuff” is better. It is that while the “predictive rules” approach
is, admittedly, successful in explaining - in particular through decoherence theory - the
appearance of a classical world (in other words: why we have the impression the world
is classical), it does not remove the “and-or” paradox (see above, end of 3.5). In this
respect it rates much lower than the plain, realist approach since, as previously noted,
onthologically interpretable models do (at least in the non-relativistic realm) remove the
said paradox. But, be careful! This is not to say that we should believe in precisely this or that ontologically interpretable model. There are a few of them and they all
yield this removal. Presumably many more could be produced, that we did not discover
yet. As already pointed out, what counts in this is just their existence. More precisely,
what is significant is their common assumption of the existence of this Mind-Independent
Reality, for the odds are that, whatever ontologically interpretable model is built, whatever
description of this Reality is given, the “and-or” paradox will not even appear in it.

So, this is the final result of this whole query. Conventional realists are in error: as Plato guessed, the contingent details we see are definitely not elements of Mind-
Independent Reality. But neither is man the center and apex of everything. In other
words, idealism is wrong also, at least in its radical version, and so are all the theories,
phenomenalism, positivism, empiricism, anti-realism, constructivism etc. that, implicitly,
are variants of it. Finally, the idea - intermediate between realism and idealism - that
a kind of Plotinian, holistic Mind-Independent Reality truly exists appears as the “best
guess”, that is, the one that, on the whole, accounts best for what we know. Such a con-
ception is not very far from non-transcendental, moderate idealism. Same as the latter,
it considers Reality as not lying in space and time, indeed as being prior to both, and
it involves the view that our only sure knowledge of Reality is one of the negative kind
(nonseparability). However it parts from even moderate idealism on one point: It does
not a priori dismiss the view that the great mathematical laws of physics may let us catch
some glimpses on the true structures of Mind-Independent Reality. For example, it is not
averse to hypotheses such as Primas’ [14] according to which the structures in question
are those of generalized quantum physics (excluding the Born rule) while the observed,
empirical reality of either molecules or thermodynamics are held to result from our free
choice of which “Einstein, Podolsky, Rosen correlations” we decide to disregard.

The question whether the notion of such a Veiled Reality is “negative” or “positive”
distinctly falls outside the realm of the subject matter of this article. Some thinkers view

---

5Obviously, this negative appreciation only bears on those theories that do actually partake of radical
idealism. On the other hand the aversion to ontology that their supporters entertain makes the difference
between these theories and radical idealism virtually unperceivable.
the said notion as tantamount to a betrayal of the most basic purpose of science, which, they say, is just precisely to “lift the veil” and fully describe what really exists. Others, on the contrary, consider this notion as justifying the optimistic view that some of our great emotional intuitions run no risk of being proved unsubstantial by an all-covering scientific knowledge. The point that this paper is meant to make is of a more matter-of-fact nature. It is just that the notion itself seems now well grounded on factual knowledge and rationality.
References

[1] B. d’Espagnat, *Veiled Reality, An Analysis of Present-Day Quantum Mechanical Concepts*, Addison-Wesley, Reading, Mass. 1995.

[2] *Mathematical Undecidability, Quantum nonlocality and the Question of the Existence of God*, A. Driessen and A. Suarez, eds. Kluwer Academic Publishers, Dordrecht, The Netherlands, 1997.

[3] L. Wittgenstein, *Tractatus Logico-Philosophicus*, Routledge & Kegan Paul, London, 1961.

[4] L. de Broglie, *J. Phys.* 5, 225 (1927).

[5] D. Bohm, *Phys. Rev.* 85, 165-180 (1952).

[6] J. S. Bell, *Speakable and unspeakable in Quantum Mechanics*, Cambridge U. Press 1987.

[7] J. S. Bell, *Physics* 1, 195 (1964).

[8] B. d’Espagnat, *Phys. Rev.* D 11, 1424 (1975).

[9] P. H. Eberhard, *Nuovo Cim.* 46 B, 392 (1978).

[10] G. C. Ghirardi, A. Rimini and T. Weber, *Lett. Nuovo Cim.* 27, 293 (1980).

[11] E. Husserl, *Méditations cartésiennes, Introduction à la phénoménologie*, Paris, Vrin, 1969.

[12] J. S. Bell, *Rev. Mod. Phys.* 38, 447 (1966).

[13] E. Meyerson, *Identité et réalité*, Paris 1907.

[14] Hans Primas, *Chemistry, Quantum Mechanics and Reductionism*, Springer, Heidelberg 1981 ; *Symposia on the Foundations of Modern Physics* (Finland), World Scientific, Singapore 1992 ; Editions Frontière, Gif-sur-Yvette, France, 1994.