Contrary to classical physics, which was strongly objective i.e. could be interpreted as a description of mind-independent reality, standard quantum mechanics (SQM) is only weakly objective, that is to say, its statements, though intersubjectively valid, still merely refer to operations of the mind. Essentially, in fact, they are predictive of observations. On the view that SQM is universal conventional realism is thereby refuted. It is shown however that this does not rule out a broader form of realism, called here ‘open realism’, restoring the notion of mind-independent reality.

1 KANT’S TWO TENETS

Is reality something meaningful and is science steadily coming closer to a true depiction of it? These two questions are obviously related and belong very much to the domain of those to the analysis of which Evandro Agazzi most efficiently contributed. But I’ll argue that they are distinct ones, and we shall see that at least one essential element in Agazzi’s approach definitely points in this direction.

On this subject the right way to proceed is obviously to begin by considering the second question, in which, of course, by ‘reality’ what is meant is mind-independent reality, that is, the concept of something that would ‘be’ even if conscious beings did not exist. Is science in principle capable of describing it? As is well known, from the works of Kant, the positivists, the Marburg School neo-Kantians, etc. it became increasingly clear that a proof the answer is “yes” just simply cannot be given. On the other hand, the mere fact that a proposition cannot be proven is not a proof that it is wrong. It is therefore conceivable that science is able to reach at mind-independent reality - a position that may be termed conventional realism - and, a priori, the fact that the refinements brought by science to our primitive ideas about things make our knowledge more and more efficient may well induce us to think that way. But a priori it is also possible to consider that human finiteness will for ever prevent us from attaining such an ambitious goal and that what we are able to describe with certainty can only be (mathematically...
synthesized) relations between observed phenomena.

A fact that incited not only philosophers but also theoretically minded scientists to show a preference for the second standpoint was that, by successfully restricting the basic concepts to just a few ones - some of which, such as inertia, quite disconnected from direct experience - and correspondingly emphasizing the role of laws, the Galilean revolution gave credit to the view that far from being a (tentative) description of the intrinsic properties of objects science might just be a construction grounded on prescriptive principles chosen a priori, in the sense of not being dictated by experience, and justified a posteriori through the fact that the observable consequences of the science derived from them agree with what is actually observed. Kant is generally considered to be, not really the originator but at least the main promoter of this idea, which indeed may be said to constitute one of the two fundamental tenets of his philosophy. Which, of course, immediately raises the issue of how the said principles are to be chosen. And to this question Kant also gave quite a definite answer. So definite indeed that we may take it to be the second fundamental tenet of his thinking (in his writings the distinction between the two is hardly drawn but J.Petitot [1] pertinently stressed its rational necessity). It is the view that the principles in question are given a priori - that is, once and for all - by the very structure of our sensibility and understanding.

Both tenets have a mentalist flavor. However, while mentalism is quite explicitly at the core of the second one, in the first one it is somewhat secondary. There, it merely corresponds to the fact that instead of being dictated by the external world the prescriptive principles are chosen by us (with however the redoubtable final check that the overall theory they generate has to agree with observed data). But it implies nothing as to the nature of these principles so that a priori it may well be that those that work - that yield a theory matching with what is observed - happen to be compatible with an interpretation of the said theory as being a faithful description of mind-independent reality.

And indeed it is worth noting that this is more or less the direction in which the situation evolved during, roughly speaking, the classical era. For, in fact, the inferences Kant had drawn from his second tenet - such as the view that since we cannot but perceive objects as being embedded in a three-dimensional Euclidean space the physical space has to be three-dimensional and Euclidean - very soon became untenable. Followers of Kant were therefore obliged to progressively weaken the importance they imparted to this tenet - to reject the psychological foundation of Kantism, as is often said
and finally drop it altogether. Correlatively, as Michael Friedman showed in detail [2], while holding fast to the first tenet they repeatedly had to change its prescriptive principles, going from the three basic Newton’s laws to Einstein’s principle of equivalence, via Helmholtz ‘principle of free mobility’ and the special relativity principles. Such a sequence of changes, which has been termed relativization of the a priori, clearly would not have been possible if Kant’s second tenet had been kept: the basic structures of human sensibility and understanding do not change so fast! Two points, in this, are worth noticing.

One is the fact that the expression “a priori” does not carry the same meaning in the two tenets. In the second one it has the original sense of something that cannot change since, by definition, it is given right at the start, once and for all, independently of our observing and theorizing. In the first tenet its meaning is much weaker and somewhat akin to that of a working hypothesis, even though a fully general, basic one.

The other point is that, as already observed, the first tenet, considered in isolation, is not, by nature, incompatible with the view that science reveals or will in the long run reveal what mind-independent reality truly is; for it may well happen that the successful prescriptive principles, though not consciously chosen with the purpose that they be compatible with the said view, still turn out to be so, perhaps because their progenitor was intuitively inclined to think that the view in question had to be true.

In other terms, a physicist of the early twenties, impressed by Einstein’s achievements, could legitimately consider that the latter’s fruitful method of deriving new physical concepts from pure mathematics had put him on the track of the truly good concepts, those by means of which the human mind may expect to, finally, describe mind-independent reality as it really is. And he could consider that on thinking this way he was not parting with what, in Kant’s doctrine, remained unaltered and significant for research (what we called his ‘first tenet’). Anyhow it is a fact that mature Einstein was a realist himself and that the ‘prescriptive principles’ (to use Kantian language) that he put forth are interpretable - and were quite unambiguously interpreted by him - as referring to mind-independent reality.

What all this seems to show is that, while the acceptance of Kant’s above defined ‘second tenet’ implies ipso facto the logical necessity of adhering to a mentalistic interpretation of physics, neither the Galilean revolution nor even (contrary to a widely held view) the acceptance of the main lines of Kant’s teaching entail the said
necessity, provided that the acceptance in question be that, not of Kant’s original doctrine but of a restriction of it to its ‘first tenet’ which just means: to what it was bound anyhow to evolve to, due to the fact that after Kant’s time the ‘prescriptive principles’ of both geometry and physics had to be altered in ways that left practically no place for psychological elements.

This however is not to say that due to this evolution transcendentalism - meaning by this the general, philosophical conception put forward by Kant and developed as well as amended by his successors - merged into conventional realism. But in, say, the early nineteen-twenties the remaining difference between the two was essentially of an a priori and philosophical nature. It rested on the facts that theoretical physics is a mathematical synthesis of phenomena and that in transcendentalism it is generally considered an axiom that to interpret this synthesis as being, or as leading to, a faithful reconstruction of mind-independent reality would amount to attribute to the human mind powers exceeding its finiteness. Conventional realism obviously rejects the said axiom, so that clearly, in spite of the evolution transcendentalism had to undergo as we saw, between it and conventional realism a difference remained whose very nature - that of being a difference between two a priori conceptions of the capacities of the human mind - made it impossible that the question as to which doctrine is right be answered.

On the other hand it sometimes happens that by changing some elements in the debate science truly sheds light on philosophical problems. And we’ll see in the next Section that such is the case with this one.

2 QUANTUM PHYSIC’S ‘WEAK’ OBJECTIVITY

Up to the stage at which our schematic historical review led us, that is to the last and culminating achievements of classical physics, adepts of conventional realism could, as we saw, rationally entertain a strong belief not only in the existence but also in the accessibility of mind-independent reality. True, the legitimacy of this standpoint rested on the postulate - rejected by Kantians as above noted - that human mind is endowed with all the concepts that ‘fit’ reality. But, after all, up to the advent of quantum mechanics this postulate seemed validated: Indeed, for a long time theories could be expressed just in terms of simple, fully intuitive concepts: space, position, motion, force etc. And we observed that later on, when these concepts proved insufficient - theories such as general relativity
could successfully make use of similarly descriptive concepts, such as curved space, borrowed, this time, from mathematics.

On the advent of quantum mechanics it could naturally be hoped that it too would prove consistent with conventional realism. And indeed this hope was entertained, not really by the founding fathers of the theory, Bohr, Heisenberg etc. (even though the latter linked it with realism [3], but in another acceptation of that word) but, as it seems, by many of their successors. But was it fulfilled? As long as we consider but static problems, such as calculating eigenvalues and the like, we may be tempted to answer “yes”, for these problems are indeed qualitatively similar to classical ones. In some cases however what quantum mechanics yields is only the probability that, upon measurement of such and such a quantity, such and such value should be found (the ‘Born rule’). And at this place a discrepancy with conventional realism appears since when we say “should be found” we implicitly refer to somebody who finds, or to some detection device conceived of by human beings for the purpose of detecting. Admittedly, in everyday life the corresponding difficulty is easily removed. Instead of saying “the probability is so and so that if we have a look at this card we’ll see a King” it suffices to say “the probability is so and so that this card is a King”, thus attributing the need for probabilities just to lack of information. But this explanation calls for the existence of hidden variables and cannot therefore be transposed to standard quantum mechanics (SQM) that is, to the quantum formalism supplemented by the no hidden variable hypothesis. The point is that in such cases what SQM yields are just measures attached to the various possibilities. For imparting a meaning to them, hidden parameters being barred out, we have no other alternative than to resort to the facts that a measurement is a question and that a question cannot have several mutually incompatible answers. We decide therefore that the measures in question are probabilities of this or that result: an argument that involves the notion “measurement” in a very specific way, not detachable, as it seems, from voluntary action.

Admittedly, from the time of Louis de Broglie and David Bohm to the present one a number of brilliant physicists put forward theories that by introducing hidden variables could indeed reconcile conventional realism with the whole experimentally verifiable content of nonrelativistic quantum theory. Most interesting new vistas were opened thereby and indeed this line of research is still active and rightly so. It is fair to say however that up to now the efforts in this direction could no solve all difficulties, particularly concerning the matching with relativity theory, and that, consequently, no such
theory could gain general acceptance.

True, the (standard) quantum mechanical probabilistic statements can still be considered objective since they are valid for anybody. But clearly, contrary to those of classical physics (with due reservation concerning classical statistical physics) they are not expressed in terms a conventional realist would be happy with, since they involve us whereas in order to agree with conventional realism a statement should bear on what exists, not on what we see or intend to do. Statements of such a type I proposed to call “weakly objective” [4] in contrast with those, called “strongly objective”, that a conventional realist can take to be bearing on mind-independent reality. While in theoretical works this particular difference between classical and standard quantum physics is quite often left implicit, personally I consider it an essential one since in my view it is the decisive fact that renders standard quantum mechanics incompatible with conventional realism. Note that according to Kantism all scientific statements are weakly objective only. But within that doctrine they are so just because, in it, the finiteness of the human mind capacities has been posited a priori as an axiom. In standard quantum mechanics that same feature is an inherent element of the very structure of the theory so successfully used to account for observed data, an argument that, in my opinion and also, I think, in that of most scientists, has a greater weight. As just noted, since the set of the quantum mechanical axioms includes the Born rule standard quantum mechanics is but weakly objective and this in turn implies that according to this theory conventional realism cannot hold true at atomic magnitude scale. Admittedly it could a priori be hoped that, at least, it would somehow hold true at the macroscopic level; and indeed when decoherence theory appeared, at first some of its promoters seemed to believe it could be interpreted that way. But it soon became clear that this is not really the case.

1 Admittedly the fact that SQM is both weakly objective (i.e. intersubjective) and generally considered universal raises two conceptual problems. The first one is that, whereas classical physics could be developed without even mentioning mind, the fact in question, in view of the reference to “us” it implies, forces this vague, ill-defined notion into the picture. The second one is that minds are plural, which makes intersubjectivity something to be accounted for. As a matter of fact, thinkers did not wait until the advent of quantum physics to start pondering over these problems. It is worth noting, however, that the first one did not worry them appreciably, the reason being that whoever does not entertain the predetermined idea that mind must be a product of matter has no reason to consider it to be one. As for the second one, note that intersubjectivity follows from the Born rule, so that in the eyes of whoever considers the Born rule an inherent part of SQM (or claim it can be derived from SQM’s other axioms) intersubjectivity is accounted for by quantum theory. People reluctant to admit that much may still rest content on that matter by adopting Bitbol’s view that: “the point of support of science is not an explicit assertion concerning what other human beings see and think; it is simply a practice of communication which anticipates or presupposes the perfect interchangeability of positions amongst the members of the linguistic community.” [5]

2 In Zurek’s 1982 seminal paper [7] on decoherence a remark seemed to mean that, just in
tatis mutandis, similar remarks could be made concerning Everett’s relative state theory and many other valiant attempts at somehow reintroducing strong objectivity in the picture while keeping to the view that standard quantum theory is universal. Obviously this is not a proper place to review all the numerous valuable efforts that were made along this line throughout the whole century last: a vast subject indeed, not susceptible of being summarized in a few pages. After having devoted much time and attention to its study (see Refs. [6] for a critical survey) what I may here confirm concerning it (and which all quantum theorists are aware of and is after all hardly surprising in view of the foregoing) is that, ingenious as all these interpretations are, all of them not only totally diverge from the commonsense picture of the world that we have in mind in our daily life but, what is more, are such that in them the link between what is claimed to ‘really be’ and what is observed is so strange, weak and indirect that its very existence gets extremely controversial.

Aware of the acuteness of the problem a number of conventional realists, remembering that no great theory is eternal, then considered the possibility that standard quantum theory should be replaced with a fully different one. Of course all its experimentally verified predictions had to be kept. But, as we know, along with them it also suggests something bizarre that normally is not observed, namely what we now call ‘entanglement-at-a-distance’ [14], which, within a realist viewpoint, would imply that when two particles have once interacted they somehow remain linked together at a distance by some mysterious eternal bound. Einstein, already, found this so-called nonseparability unacceptable. A priori the idea of a theory that would be free from such odd features seemed an attractive and realizable prospect. And it could be hoped that conventional realism would be recovered thereby.

As we know these hopes were not substantiated. In 1964 John Bell [16] proved - independently of any specific theory - that to assume both conventional realism and ‘locality’ (i.e. to bar out virtue of decoherence, the instrument pointer already has, in every case and before we look, a definite position, period. This raised questions from such people as Elby [8], Healey [9], Bub [10] and myself [6], and later on Zurek explained that his statement had to be understood just in the sense that decoherence (‘einselection’) “allows observers to anticipate what states in the Hilbert space have a ‘relatively objective existence’” [11], relatively objective existence being defined operationally, by means of a criterion involving imagined measurement sequences.

3The search for such interpretations still actively goes on. In fact there are by now quite a number of them and, concerning my above mentioned survey, I have to grant that, extensive as it was meant to be, still some most interesting recent or fairly recent such proposals, such as those of Richard Healey [12], Michael Esfeld [13] and Carlo Rovelli [14] are not covered by it. Note however that all of them fall within the just described category in that none of them bears any resemblance with any of the various kinds of realism that laymen and philosophers normally have in mind when making use of that word.
any such things as the “mysterious bound at a distance”) entails that some inequalities between measurable numbers must be satisfied whereas - he pointed out - they are violated by the quantum mechanical predictions. And indeed experiment confirmed this violation. By now, barring most incredible ‘conspiracies’ Bell’s inequalities have been experimentally shown to be violated in a wide range of correlation phenomena involving not only photons [17] [18] [19] but also massive particles such as protons [20] and even systems such as heavy ions [21] and atomic ensembles [22]. It is true that practically all these experiments bore on systems conventionally labeled ‘microscopic’. However it is notoriously impossible to draw a sharp distinction between macroscopic systems and microscopic systems endowed with mass so that, combining the just noted fact that nonseparability was observed on such systems with our knowledge that it is predicted by quantum mechanics - more and more considered to be a predictively universal theory\(^4\) - we are led to the, if not strictly inescapable at least extremely well grounded conclusion that any scientifically sound realism we may conceive of should be one in which the locality condition is violated. Which means that this realism must radically differ from the commonsense sense one we have intuitively in mind\(^5\).

It should of course be remembered that since the Bell theorem does not include the no hidden variable assumption within its premises, considered in isolation the experimentally observed violation of the Bell inequalities does not yield an answer to the question, central to the present quest, whether or not mind-independent reality is knowable in principle (the non-relativistic hidden variable Broglie-Bohm theory is an example of a theory compatible with the answer “yes it is”). But the said violation yields nevertheless a most important clue in this respect since it shows that even if, in

\(^4\)The nineteenth century progressive merging of magnetism with electrical science and optics with electromagnetism, followed in the twentieth century by the unification of electromagnetism and the weak nuclear force together with the unified quantum treatment of this whole field and the strong nuclear forces is what convinced most physicists of the universality of the quantum laws (even though gravitation still remains outside the picture).

\(^5\)The question might be asked whether Agazzi’s pertinent remark [23] that: “reality is investigated by every science from its own point of view, consisting in the fact that only certain aspects of reality are considered” makes it possible to refute the conclusion just arrived at. What, at first sight, speak for this possibility is the fact that sciences such as biology or neurology have laws of their own. However, it seems there can exist but one mind-independent reality and it is now well established that no science violates the laws of physics, so that what physics shows is impossible cannot be possible just because, within another science, other aspects of reality are considered. In other words, if such a science displays an ‘aspect of reality’ that is at variance with the conclusion we arrived at, a conventional realist will be forced to take that aspect - in a somewhat Kantian spirit - to be a mere phenomenon, that is, to merely be one of the ways mind-independent reality appears to all of us, due to our common sensorial and intellectual equipment.

\(^6\)Nor does it exclude it [24].
the hope of recovering conventional realism, we dropped the no hidden variable assumption this would hardly help us since whatever description we could construct of mind-independent reality would anyhow basically differ from any image we try to build up of it.

Such a state of affairs may remind us of structural realism that is, the idea, already present in Poincaré’s works [25], that we know, not the objects themselves but only the relationships between them (the equations), one implication of which is that the monadic propositions contemporary physics makes use of when dealing with electrons, quarks and so on merely describe phenomena in the Kantian sense of the word. True, structural realism also implies that nevertheless we can know something of mind-independent reality, namely its structures, and this is an interesting idea. But independently of it the foregoing holds true. Consequently structural realism agrees with standard quantum theory in stating that electrons, quarks, atoms etc. and their attributes are not elements of mind-independent reality. To repeat, they are just phenomena, and constitute what may be called empirical reality.

To all this it should be added that under extremely general assumptions decoherence theory nicely accounts for the appearance (to us) of a classical world (with distinct macroscopic objects endowed with definite, robust attributes and so on), thus extending to macroscopic objects the above stated conclusion and sparing us the inconvenience of having to resort to the esoteric (though thinkable) idea that this classical world exists in an absolute sense even though the parts it is composed of do not enjoy such a status.

To this impressive list of scientific arguments speaking against conventional realism it is perhaps appropriate to add the well known “no God’s eye view” one, a philosophical argument but still one often put forward by scientists. It consists in the observation that being ourselves parts of the world it is quite natural indeed that far from being a strongly objective picture the view we get of it should be highly dependent of our position within it, same as the view we have of a gulf when sitting on one of its beaches is altogether different from the (correct) one we should get of it were we on a plane or an orbiting satellite.

Considering that quantum theory is by now generally considered to be universally valid what all this shows is that concerning the question whether or not mind-independent reality is, in principle,

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7Note that this is quite compatible with Agazzi’s insistence on the fact that concerning the notion of reality no presupposition should be made bearing on its nature, “the only requirement we need for reality being therefore that of existing, and not that of existing as a reality of such-and-such a kind” [23].
scientifically knowable the advent of standard quantum mechanics radically turned the tables. For, as we saw, while at the end of the classical era the view that physical knowledge is, in essence, a description of mind-independent reality (even though its acquisition rests on freely imagining laws) seemed quite a legitimate and natural one, standard quantum mechanics is quite definitely uninterpretable that way since in it objectivity is but weak. In other terms, while both commonsense and classical physics strongly indicated that only the part of Kant’s doctrine compatible with a naturalistic conception of knowledge – the part defined above as being its first tenet – had to be kept, nowadays if we want to make our general philosophical conceptions consistent with our confidence in contemporary physics – predominantly anchored on the basic axioms of standard quantum mechanics – we must give up this naturalistic interpretation altogether. This means that when Kant put forward an essentially mentalist conception of scientific knowledge he was basically on the right track.

Now does this imply he was right in putting forward his ‘Copernican revolution’? The answer, of course, is yes if we identify the latter, as G. Boniolo did, with the axiom that “we are able to know, also perceptively, only what we have a theorization about” [26], for such a view is nothing else than the above first tenet. But the answer is “no” if if we take this revolution to have the more precise meaning: “while it remains true that the basic elements of physical knowledge are to be described, such descriptions must be given in terms of the a priori concepts dictated by the very structure of our sensibility and understanding”, for then we cannot escape the pitfall that the said a priori concepts include Euclidean space and similar notions. In other words, while, as we saw, contemporary scientific knowledge can only be of a mentalist form (at least in physics), the way of being so Kant ascribed to it must be rejected. Fortunately standard quantum mechanics yields here a working answer for besides being weakly objective the probabilistic statements linked with the Born rule have another significant feature not obviously generalizable to all weakly objective statements: They are explicitly predictive of observational results. And it is a striking fact indeed that while, viewed as just rules for predicting future measurement outcomes the quantum mechanical axioms (with their apex, the Born Rule, included) were immensely fruitful in explaining and predicting effects and never led to erroneous predictions, all attempts at interpreting them as descriptive laws led, up to now, to hosts of consistency difficulties. This shows, I think, that quantum mechanics is in fact an essentially operationalist theory and that,
as such, it does not describe anything - not even mere phenomena in the Kantian sense - except in a sort of figurative and somewhat allegoric way, grounded on abstractions being made from contexts that, if questions other than the one at hand were considered, could not be legitimately abstracted from.

But do these inferences, that I deem conclusive concerning physics and even science in general, imply that the notion of a mind-independent reality is altogether meaningless? In the next sections I shall try to explain why I consider they do not.

3 ARGUMENTS INDICATING THAT THE MIND-INDEPENDENT REALITY NOTION HAS TO BE KEPT

When Kant put forward his conception he declared the thing-in-itself (another name for mind-independent reality) to be unknowable; but he carefully kept the notion. Later the neo-Kantians discarded it, but there are reasons for not following them on this issue. True, none of these reasons emerges from science. They all are but of a philosophical nature. However, I take the three following ones to be well worth considering.

Reason 1
This is just the fact that we are not permitted to believe in any theory we like. It recurrently happens that extremely ingenious theories, quite elegant mathematically, are disproved by experiments. Clearly something resists us and, though not impossible logically, the idea that also this something should be us seems in fact hardly conceivable. In other words there must exist something that is not mind-dependent. Scientists being deeply aware that their theories have to pass the test of experiment, this reason is presumably the one that will sound the most convincing to them.

Reason 2
As many thinkers pointed out, Descartes’ Cogito does not prove the existence of a personal ‘I’. Nor does it prove that thought does not derive from matter. And it is not a syllogism. But still, it expresses our inner experience of the existence of something - consciousness, thought - existing not just as a representation (for consciousness would then be a representation to itself, which makes no sense) but as something - the seat of representations - definitely more fundamental than any representation: in other words existing on a deeper mode. As we see, this inner experience we have suffices to show that
such a notion of existing in a deeper mode than phenomena do, a
mode we may agree to call ‘in se’, has a meaning. And, since to
think one must first exist - and precisely in that sense - it is clear
that such a basic notion of existence is prior to that of thought.
Now, when things are considered under this light the idea that ex-
istence in se is not restricted to consciousness appears to be, if not
compelling, at least extremely natural. Be it only because it would
seem quite presumptuous indeed to believe that the whole of what
exists in such a strong sense is, in essence, us.

Reason 3
It is just the remark that at least in its most commonly received
version [27] structural realism includes the assumption both that
mind-independent reality exists and that most important elements
of it - the objects - will for ever remain unknowable. Similarly one of
the above mentioned objections to conventional realism, namely the
‘no God’s eye view’ one, while showing that mind-independent reality
is not knowable or at least, not as it really is, still obviously
assumes that this reality exists. Consequently whoever grounds
his/her rejection of conventional realism on either structural real-
ism or the ‘no God’s eye view’ argument cannot consistently deny
the existence of the unknowable. He/she has to take the notion of an
unknowable reality to be a meaningful one (and the same, of course,
is true concerning the cosmologists who take the ‘multiverses’ notion
into consideration).

A ‘Reason 4’ - considered very strong by the persons in the opin-
ion of whom it is scientifically established that consciousness emerges
from matter - is just that, obviously, neither transcendentalism nor
the conceptions that, similarly, define whatever is meaningful by
referring to sensations, perceptions etc., that is, ultimately, to con-
sciousness, are logically compatible with the opinion in question.
Personally I do not share the said opinion so that I do not take this
fourth reason to be a valid one. Still, I believe it is one that has had
a prominent role in inciting physicists to look for ways of recovering
realism.

I think this state of affairs justifies a renewed attempt at philo-
sophically reflecting about realism even though it is clear from the
content of Section 2 that anyhow, whatever realism we may concoct

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8 The hypothesis has also been considered [28] that only structures are real, but there are
objections to this [29], one of them (elementary but still not easily disposed of) being that
relations without relata are unthinkable.
will have to differ very much from everything we think we learned from both experience and experiment (as H.zwirn put it: “it seems that, for the first time in the history of philosophy, choosing to believe in the existence of a world external to all observers and roughly consonant with what we perceive is not possible any more” [30]). In the following Section such an endeavor is described.

4 TWO NOTIONS OF REALITY, OPEN REALISM

In philosophy realism is usually defined to be the idea that the notion of a mind-independent reality is not void (there truly is such a reality) and that the said reality is knowable by us, at least in principle. In essence this is the conception Evandro Agazzi referred to when he described: “the basic ‘realist’ attitude of any knowing subject” to be that “this subject [] believes [his] knowledge actually to be of something other [than himself]”, and stressed a few lines further that “this ontologically distinct world must nevertheless be accessible to the subject” [32].

Obviously, according to this definition - and these Agazzi quotations as well - conventional realism is a combination of two distinct views: the idea that the notion of a mind-independent reality is meaningful and the one that this reality is in principle knowable by human beings. Now, it is a fact that from a purely logical point of view nothing forces us to combine the two together. In other terms, the notion of a reality being what it is quite independently of whether or not it is partly or totally knowable is by no means logically inconsistent. True, such a statement may at first sight sound surprising considering the classic objection that the idea of an absolutely (alias in principle) unknowable reality seems meaningless. A moment attention shows however that the inference: “if an idea refers to something unknowable it has no meaning” is consistent only if the meaning of the phrase “to have a meaning” - or “to have no meaning” - is itself defined by (partly or totally) referring to us (to our abilities at perceiving or conceptualizing or acting or etc.). But this ultimate reference to us - a characteristic feature of idealism - is precisely what realism is meant to avoid. In other words, as

The idea that consciousness and empirical reality (the phenomena composing the world) generate one another is to be found in the works of several authors including myself [31] and is sometimes considered a substitute to the mind-independent reality notion. This view is questionable however for to claim the phenomena are generated by consciousness means they are appearances to it and it seems unthinkable that a mere appearance should produce - or generate - anything, consciousness in particular. And resorting to the well-known alternative definition of causality, namely the ‘regularity’ one, according to which a causal link is just an instantiation of some general law, does not help since no known law exists that could here be referred to.
soon as we have endorsed the notion of a mind-independent reality we have to consider it to be a primary one that is, one that does not have to be defined or, in other terms, has a meaning by itself, quite independently of our abilities. And this invalidates the objection.

Consequently, it is appropriate to take into consideration two very different versions of realism, both meaningful. From now on we shall, by convention, call ‘open realism’ just the idea that the notion of mind-independent reality has a meaning and is valid and we shall keep the expression ‘conventional realism’ for designating, as above, open realism supplemented with the assumption that the entities accepted scientific theories deal with, far from being mere appearances, are elements of mind-independent reality. The open realism notion may, at first sight, look disconcerting but, as already noted, in fact it is, in a way, implicitly postulated by the structural realists as well as by the many philosophers and scientists who quite pertinently point out that since we ourselves are parts of reality it would be most preposterous on our part to maintain we can get a God’s eye view of it.

Of course, for open realism not to be a purely gratuitous conjecture devoid of any bearing on what we think or feel it must be assumed that between the reality it refers to and ourselves some causal links somehow exist. In other words it must be assumed that the said reality generates in our mind some pieces of knowledge. Considered alone, this hypothesis in no way implies that we are thereby informed about what reality ‘truly is’, for the said pieces of knowledge may well be mere recipes for predicting some of our future impressions (or they may even be some pieces of information about it, but uncertain, and so scarce as not to allow for a description). Hence the hypothesis in question, contrary to the one of conventional realism, lays itself open to no sharp refutation either from a scientific or a philosophical provenance.

Things being so, I proposed [31,6,4] a balanced view consisting in considering that the mind-independent reality notion is meaningful, that this entity - which most presumably is not imbedded in space-time - truly ‘is’ (exists, and not merely in our thought), but is essentially unknowable (in the sense of not being describable with concepts), so that what both commonsense and science refer to and are able to really describe is merely what it generates in our mind and we called empirical reality. Obviously this distinction between

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10In other terms, pertinent as the celebrated Wittgenstein axiom “whereof we cannot speak, thereof we must keep silent” may be, it remains true that even though such an unknowable reality is not something we should try to describe, still we may entertain the idea of its existence.
two notions of reality is consonant with quite a fundamental one: the need for which Evandro Agazzi powerfully stressed, to wit the distinction between the sense and the reference of a concept (see e.g. [23]). As I see things, its necessity rests on two pillars.

The first one is the circumstance that science, and in particular physics - just due to the continuous enlargement of its field of research (toward the very small, the very large etc.) - increasingly meets with problems traditionally considered to lie in the realm of metaphysics, so that it has to be more and more careful to avoid admixture of some imprecise notions to be found in the latter, which implies that to deserve the qualification scientific an inference must be grounded on references fulfilling stricter and stricter requirements. Since, considering the arguments of Section 2, it seems fairly clear that contemporary physics essentially is a purely operationalist theory the said references must ultimately be to intersubjectively valid elementary perceptions ('perception' meaning here the mental act of perceiving).

And the second pillar is just the set of reasons enumerated in Section 3 (see especially Reason 2), which, I think, convincingly indicate that the said human elementary perceptions simply cannot constitute the whole of what exists. Which means that the intersubjective mental events - which are, in the last resort, all that physics may refer to and report on - do not include everything that is existentially meaningful. As above noted, these reasons are not scientific ones; but the fact that conventional realism failed is scientific (i.e. is grounded on arguments of a scientific nature), so that, even for a scientist, the choice between possible rational standpoints is restricted. Roughly speaking it is between the one described here and pure transcendentalism and the arguments of Section 3 speak in favor of the former.

They do so all the more as they seem to indicate that, as noted above, in some way mind-independent reality produces in our minds elements of knowledge, although ones of such a nature as not to allow for actual descriptions of it. Of course the most powerful evidence that this is indeed the case is just precisely that physics makes predictions that turn out right: for, to repeat, such predictions follow from rules (ultimately, the basic quantum mechanical axioms) that unquestionably are elements of knowledge, are most unlikely to be mere inventions of ours (see Section 3, Reason 1) and must therefore proceed from something that is not us. Now, once this has been duly acknowledged it becomes possible and even rather natural
to hold that this something also imparts to us other elements of knowledge, some of which, conceivably, may even indicate elements of itself although we cannot know whether or not this is the case (the fundamental constants, for example, fall into that category). Finally, since we cannot know anything for sure concerning this mind-independent reality - this ‘ground of things’ - it is also conceivable - even though merely conceivable! - that some elements of our experience are dim signs of its true nature. So that, contrary to what was the case in the classical physics glorious days, admirers, say, of classical music, or nature lovers, may quite consistently and rationally choose to entertain the belief that the emotions they feel when listening to a concert or just looking at appealing landscapes do open to them some kind of a window looking out on the ‘ground of things’.

Admittedly this conception raises new questions concerning both matter and consciousness. Regarding matter a received view during the said classical days was that it is, by definition, what the physical science deals with, which implies it was considered knowable, at least in principle. And when, even today, we make use of the word matter we have in mind the idea of something the most important features of which scientific research is somehow able to master. Clearly therefore, short of imparting to it a meaning opposite to the one it has in common language we cannot use it for designating the essentially unknowable mind-independent reality we formed here the notion of. In common language matter means something like the set of the atoms or elementary particles or etc. (together with the corresponding fields) and this, in the conception in hand, implies viewing matter just as a set of phenomena, that is, a set of mere appearances to consciousness.

Concerning consciousness this, in turn, has the immediate but apparently baffling consequence that it renders meaningless the hypothesis considered by most scientists to be the most reasonable one, namely that consciousness emerges from matter: for indeed in the present context this hypothesis would amount to asserting that consciousness emerges from appearances to consciousness, which makes no sense. Bearing this in mind, an idea that seems rather natural is to substitute to the said hypothesis the one that consciousness emerges from mind-independent reality: a view that while sounding

11‘Us’ who may be, or not be, just pieces of it. Such purely metaphysical questions are fascinating but, unfortunately, seem to lie somewhat beyond the borderline of the domain human thinking may safely venture into.

12M.Bitbol noted [33] the similarity between this hypothesis of mine and the one Russell put forward in The Analysis of Matter, according to which without having any knowledge of the thing-in-itself, still, we enjoy an indescribable acquaintance with it.
rather similar to the hypothesis in question in fact altogether differs from it since it means consciousness emerges from something that lies beyond our intellectual grasp.

REFERENCES
1 - J. Petitot, Objectivité faible et Philosophie transcendantale, in Physique et Réalité, M. Bitbol and S. Laugier eds, Editions Frontière, Paris (1997).
2 - M. Friedman, ‘Einstein, Kant and the Relativized A Priori’, in Constituting Objectivity, M. Bitbol, P. Kerszberg and J. Petitot eds, The Western Ontario Series in the Philosophy of Science 74, Springer (2009).
3 - W. Heisenberg, Physics and Philosophy, Harper & Brothers, New York (1958).
4 - B. d’Espagnat, Conceptual Foundations of Quantum Mechanics, W. A. Benjamin, Reading, MA (1991), 2d ed reset (1976), 4th ed. Perseus Books, Reading MA (1999).
5 - M. Bitbol, “The problems of other minds: a debate between Schrödinger and Carnap”, Phenomenology and the Cognitive Science, 3 (1), 115-123, 2004.
6 - B. d’Espagnat, Veiled Reality, Addison-Wesley 1995, 2d ed. Westview Press, Perseus Books 2003; On Physics and Philosophy, Princeton University Press, (2002).
7 - W. H. Zurek, Phys. Rev. D 26, 1862-1880 (1982).
8 - A. Elby, ‘Decoherence and Zurek’s existential interpretation of quantum mechanics’, in Symp. on foundations of modern physics, P. Busch, P. Lahti & P. Mittelstaedt eds (1993).
9 - R. Healey in Quantum measurement, Decoherence and local interpretations, G. Hellman & R. Healey eds., Minessota Studies in the Philosophy of Science, (1998).
10 - J. Bub, Interpreting the quantum world, Cambridge University Press (1997).
11 - W. H. Zurek, ‘Decoherence, einselection and the existential interpretation (the rough guide)’, in Phil. Trans. R. Soc. Lond. A 356, 1793-1821 (1998).
12 - R. Healey, The Journal of Philosophy, 88, 393-421 (1881).
13 - M. Esfeld - Holism in Philosophy of Mind and Philosophy of Physics, Kluwer (2001).
14 - C. Rovelli, International Journal of Theoretical Physics, 35, 1637-1657, World Scientific (1996).
15 - E. Schrödinger, ‘Discussion of probability relations between separated systems’, Proc. Camb. Phil Soc. 31, 555-563 (1935).
16 - J. Bell, *Physics*, 1, 195-200 (1964).
17 - S. J. Freedman and J. F. Clauser, *Phys. Rev. Lett.* 28, 938 (1972).
18 - A. Aspect, J. Dalibard, and G. Roger, *Phys. Rev. Lett.* 49, 1804 (1982).
19 - G. Weihs et al., *Phys. Rev. Lett.* 81, 5039 (1998).
20 - M. Lamehi-Rachti and W. Mittig, *Phys. Rev.* D 14, 2543(1976).
21 - M. A. Rowe et al., *Nature* 409, 791 (2001).
22 - D. N. Matsukevich et al., *Phys. Rev. Lett.* 96, 030405 (2006); C.-W. Chou, et al., *Science* 316, 1316 (2007).
23 - E. Agazzi, *Realism and Quantum physics*, (Introduction and article), E. Agazzi ed., Poznan Studies in the Philosophy of the Sciences and the Humanities, Rodopi, Amsterdam (1997).
24 - J. S. Bell, ‘La nouvelle cuisine’, in *Between science and technology*, A. Sarlemijn & P. Kroes eds., Elsevier/North Holland, 97-115 (1990).
25 - H. Poincaré, *La science et l'hypothèse*, Flammarion, Paris (1902).
26 - G. Boniolo, ‘What does it mean to observe physical reality ?’, in *The reality of the unobservable*, E. Agazzi & M. Pauri eds., Kluver, Dordrecht (2000).
27 - J. Worrall, ‘Structural Realism, the Best of Both Worlds?’, *Dialectica* 43, 99-124 (1989).
28 - J. Ladyman, ‘What is structural realism ?’, in *Studies in the History and Philosophy of Science*, 29,409-424 (1998).
29 - M. Bitbol, *De l’intérieur du monde*, Flammarion, Paris (2010).
30 - H. Zwirn, *Les limites de la connaissance*, Odile Jacob, Paris (2000).
31 - B. d’Espagnat - *In Search of Reality*, Springer New York, (1983).
32 - E. Agazzi, ‘Observability and referentiability’, in *The reality of the Unobservable*, E. Agazzi & M. Pauri eds., Kluver, Dordrecht (2000).
33 - M. Bitbol, ‘Troisième dialogue avec Bernard d’Espagnat’, in *Philosophie de la physique*, L. Soler ed., L’Harmattan, Paris (2006).