"…science…develops its universality only by endlessly refining and generalizing its own principles, with the consequence that by now these principles are quite different from any intuitive idea. Such difficulties are presumably the origin of the fact that a strict partitioning…governs our thought activities. This book is the result of a long-term endeavour to overcome…such obstacles in the path of thinking by making use of some factual knowledge."

It sounds like he is speaking here, at least partially, of Quine's notion of simplicity being the determining criterion governing our choice of theory/thought activities. Perhaps I am reading a bit too much into it; we shall find out as we read on, at any rate.

The author describes the general shift of the basic elements in physics towards things more and more abstract and mathematical in nature. This again, however, seems to me to be a consequence of our tendency to refine theories to maximal simplicity rather than a reflection of something deeper.

The "philosophy of experience" admitting the existence of an independent reality and then giving it only a minor importance seems to me to be a defeatist attitude; we might as well give everything except food clothes shelter a minor importance, then. Unless one claims that the independent reality is in principle unknowable (which is exactly what, we find, many do claim), the concerns of the philosopher cannot end with what can be known empirically.

The Copenhagen interpretation of quantum mechanics stands in favour of the philosophy of experience, for its notion of reality ultimately refers back to human beings. It is still an imperfect theory, however; most glaring being the problem of the regularities in the collapse of the wavefunction-something which does, in its own way, suggest a realist Universe. (Although is this perhaps explained away as a consequence of the brain's tendency to find patterns?) (Another significant argument against the philosophy of experience is that, when applied in its fullest extreme form, it would imply that the past is merely a convenient procedure for summarizing indications helpful to anybody in the future. Basically that the past is purely operational; and I suppose I would certainly be unable to live as if I truly believed the past is exclusively operational. My inability to do so need not rule out the potential truth of that statement, however, and as such, I do not find the past being merely operational to be something objectionable.) (A third objection-the only one which makes me turn away from the philosophy of experience-is that, since we cannot directly know another's sense-data, "all references to communicability…are references to something mysterious positivism does not explain". Basically that this drives us straight up to hardcore solipsism.)

At the culmination of his explanation of quantum entanglement, he suggests that, rather than nonseparable and realist, the system is, perhaps, *indivisible*-something markedly different from nonseparable and even less intuitive, because it includes the instruments and not just the microscopic system, and it links together the objects even before they interact. In this indivisible system, then, perhaps distance does not intrinsically exist between the elements in independent reality and is only put by us in empirical reality.

Is the author going for both a *realist* and local explanation of quantum entanglement? Stay tuned to find out! Perhaps the shift from nonseparable to indivisible is the author's way of going from positivism to realism when viewing quantum entanglement. (Note his argument against scientism rests on the fact that the world cannot be both *deterministic* and local…)

Everyone agrees that science is objective; nobody agrees on what they mean by objective. Later, the author hints that 'objective' here is interchangeable with 'intersubjective' ('weak objectivity')-which I find agreeable.

Neither realism nor the philosophy of experience, concludes the author, is wholly satisfactory…what now?

We go over some collapse theories which the author dismisses with some perfectly valid objections, after which he introduces his vision of a veiled reality.

I consider electromagnetism to be a quintessential example of a theory of veiled reality; a paradigm. An everyday phenomenon which, when reduced as far as possible, boils down to an abstract field defined by a 4-vector which has no evident physical significance and seems more or less purely mathematical.

It seems that empirical reality is, in the author's view, the aforementioned 'veil'.

The wavefunction can also be a constituent of objective reality in this view. But here there is an evident objection: How can one ever know whether the theory you have constructed is the objectively correct one? Quine's indeterminacy thesis tells us there is no end to the number of unique possible theories one can construct to represent reality.

Note also that this conception of reality requires not strong objectivity but merely weak objectivity, otherwise known as intersubjectivity.

And even if we were able to somehow banish Quine's restriction, how can we ever know for sure if a given theory is adequate? Inherent uncertainties in the empirical route we are all forced to take compel us to only tend to certainty but never reach it, do they not?

The second objection is more easily waived. If indeed there is to be only one unique theory representing the reality, we can say that that theory which has the power to explain all observed phenomena must be the one, for by assumption, there does not exist any other theory with the capability to do so.

The first objection seems more difficult to circumvent…and indeed, he never circumvents it, as we find out later on.

He "circumvents" Quine's restriction in a rather anticlimactic way. He merely admits that there are uncertainties in science, but that we can eventually reduce their magnitude and make them negligible and attain a "quasicertainty" about reality.

But there is now a beast ready to rear its head and tear down the argument at this point, a beast which I sensed had been lurking throughout under the surface.

There had been many mentions of the criterion of simplicity we use when choosing one theory out of many. But is not simplicity a purely *phenomenological* criterion? And if we are basing our theory of an absolute reality on a purely phenomenological criterion…. does not his veiled reality, does not everything come crashing back down to become a subset of positivism?

Near the end of the book, almost as an afterthought, the author suggests mathematical beauty as an element in the set of objects of far realism which can be a criterion for theory-formation. Furthermore, he argues that this mathematical beauty has not just a phenomenological but an ontological importance. The author justifies his stance by citing the theory of the microcosm. And if this stance is sound, we may yet salvage the author's vision of a veiled reality. Let us examine it.

Essentially, the suggestion is that the brain/mind has imprinted upon it "some structures that map those of independent reality", and thus we find some theories (the ones which map reality more faithfully) more appealing than the other. The author flatly admits that this suggestion is currently

unprovable, partly because evolutionary biology is as of now unable to and has still a long way to go as far as explicating conscious emotions is concerned (which makes his suggestion undismissable as well!). We, the readers, may take it as the author's bold prediction of what future biological/scientific discoveries hold for us.

The author recognizes decoherence theory as a strong attempt to reconcile physical realism with quantum mechanics.

The author's first argument against decoherence is that we cannot turn a blind eye to the microscopic, for the macroscopic appears to us to be comprised of components. Furthermore, the line between microscopic and macroscopic must be quite arbitrary; most say that it must be infinite, and that such an analysis is an idealization. Of course, we must discard theories based on idealizations, for we are concerned not with practical predictions but with the nature of reality itself.

Satisfactory rebuttals-for now…who knows how far decoherence theory may one day end up?

(Another assumption had been made to avoid ad hoc theories: Observables on a macroscopic system should only be dependent on a finite number of elementary components. Now, the author's argument could have been circumvented if observables had meant observable in principle, but there is no way to distinguish between observable in principle and not observable in principle, says the author. I take his word for it.)

A way to circumvent nonseparability: Bell's inequalities are based on counterfactual logic, which fails when given null inputs. For example, 'If iron filings in the vicinity are attracted towards it, it is a magnet' gives no sensible output if there are no iron filings in the vicinity.

And so the way to circumvent is this, in line with Bohr's view: The properties we measure simply do not exist when we are not measuring them. However, this view not only spells doom for realism, but counterfactuals also turn out to be essential in distinguishing scientific laws from accidental generalizations, and thus cannot be done away with-and so this view is unattractive to the author. (Although the second argument seems to me to be accidental hypocrisy on the author's part. This use in distinguishing has nothing to do with reality itself but is only useful for the practical, experiential-based scientist within us and thus should not be relevant to a discussion of this type.)

Endnote : The author's view on art invokes some intrigue. On the one hand, he says, "The great forests, which astonish us with their beauty are…built of myriads of molecules reproducing themselves mechanically like so many tiny machines. I…think that it would be dishonest to act…as if they did not exist-a weakness succumbed to so easily by mystics." On the other hand, he says that notions of a great mystical Being are often necessary for progress.

It seems, then, that he gives art only a phenomenological importance and not an ontological one; I find this a remarkably subtle and deft view to have. ('Art' here in the everyday sense, not in the esoteric sense in which the author views reality and the Being.)