Quantum Interrogation, the McTaggart A Series, and the Many Bubble Interpretation

Abstract

The 'Many Bubble Interpretation" appears in a model of the McTaggart A series. Without being intially sidetracked into the fascinating coherentist theories of epistemic justification, we simply loosely define A series bubbles for present purposes as being entities inside which a person, persons or whatever are for the moment severally confined, each at some personal present (which we know from as far back as the work of Kleinhuber, Libet, etc., is not readily defined as a single point in time, but more usually is taken by psychologists and others to have at least some ongoing 'duration'}, and with a past, a present and a future, in accord with the spirit of the McTaggart A series. The work of LePoidevin, Quentin Smith, Dean Zimmerman and many others is borne in mind. And as Dyke has said, we may not be forced to countenance plurality of further worlds in such circumstances - although we can. The A series is treated as a large category, intrinsically unmappable one to one onto the B series. There is also a B series and this can often be represented by a quantum mechanical description of the universe.

I start with a brief explanation of the idea of quantum interrogation as clearly the relevance of quantum theory to the mind has great relevance. This fact was noted at a very early date in the so-called 'Schrodinger Cat Paradox'. I attempt to retain the 'Cat paradox' here, in my new Many Bubble Approach, but in a way that is helpful and warning in a kindly way, rather than minatory and implying the possibility of immediate muddle and paradox - a use for which the 'Cat paradox' seems to have been frequently historically put.. It transpires that when used with the MBI, that according to Kwiat's interpretation of his work on quantum optics, for the purposes of computing by a quantum computer, it should be possible to almost noninvasively study the human mind, probably in a way at least as nonivasive as fMRI scans. In explaining this, the illustration given by Dean Carroll about measuring the presence of a sleeping puppy without waking him up is considered, as well as other aspects of the quantum interrogation matter.

Further, there are other useful applications of the MBI, in particular for dream research and perhaps many varied psychological experiments such as near death experiences and synaesthesia. Work is proceeding at the Institute for Fundamental Studies, Vasai, near Mumbai, India. The dream research experiments are not construed as precognition but as an application of an advanced Stickgold effect.

Introduction

There is a brief discussion of quantum interrogation followed by its application to the effect on the McTaggart A series, in a way which also expands the description of the A series given on 4th July 2007 and on 22nd September, 2007, at http://ttjohn.blogspot.com/. The Many Bubble Interpretation (MBI) is introduced. A rough notional illustration shows how in principle we can detect the presence of a sleeping puppy in a box, using quantum theory, without disturbing the puppy by more than an almost infinitesimal amount. The MBI also allows a better understanding of the Schrodinger Cat paradox, and so on. An obvious potential application to neuroscience, using the A series, is referred to in the conclusion of the article.

Brief explanation of Quantum Interrogation

Quantum interrogation appears a stranger phenomenon than most which are found using quantum mechanics. Press reports have frequently suggested that it is even stranger than it is.

Kwiat says roughly the following: Sometimes called interaction-free measurement, quantum interrogation is a technique that makes use of wave-particle duality (in this case, of photons) to search a region of space without actually entering that region of space. Utilizing two coupled optical interferometers, nested within a third, Kwiat’s team succeeded in 'counterfactually' searching a four-element database using Grover’s quantum search algorithm.

Briefly, the Press in effect have sometimes omitted the word "entire" from a paraphrased version of the statement apparently made by Professor Kwiat "It seems absolutely bizarre that counterfactual computation – using information that is counter to what must have actually happened – could find an answer without running the entire quantum computer." The word "entire" is there to stay in my view, but needs explaining - and the explanation involves the almost equally bizarre Quantum Zeno effect.

A lack of understanding of what happens has led to the following explanation by some (not I). Say you've got two programs running, P1 and P2. P1 is performing some enormous calculation, while P2 is doing nothing. If P1's calculation returns any answer other than 5, then P1 closes P2. You come back to your computer and find that P2 is still running. Even though P2 didn't calculate anything, and even though P1 never did anything to P2, you can immediately conclude — from P2 alone — that the answer you wanted was 5.

But that is not how it happens, and it is important to know that.

The simple "sleeping puppy" explanation in Carroll (2006) seems to me to roughly explain the matter.

*Thought Experimen*t :

A puppy is allegedly sleeping in a box. We wish to make sure he is in the box without opening it. If we pass dogfood to him through a slot in the box, he will wake up noisily and eat it, and we will know he is still in the box. If we pass in a salad, the puppy will stay asleep.

We do not want to wake the puppy. To avoid this, we use quantum theory. Let us suppose we can describe the puppy's food quantum- mechanically in a simplistic way, as in the equation of Carroll (2006)

food = a* salad + b*dogfood The components of the vector are a and b. ..... (1)

In ***Note 1*** we briefly explain how in these circumstances, we can detect the presence or otherwise of the puppy in the box with an extremely small (almost as small as we want) chance of waking him. It seems to me that, in *Note 1*, the first time the wave function is rotated by a small angle it will collapse if observed by the puppy, under the Copenhagen interpretation. The main problem in Note 1 is that Note 1 requires a good deal of removal and insertion of the food into the box, having the experiment set up in such a way that it involves quantum mechanics, and so on, or in real life terms, for example something like carrying out the Kwiat (2006) experiment which involves fairly normal experimental equipment in quantum optics.

Interpretations of the Kwiat experiment still seem to be at issue, Kwiat (2006a) and Mitchison (2006). Furthermore, it seems to me that to understand the fully the application of the quantum Zeno effect in the Kwiat approach, one has to consider the actual Kwiat experiment as described, and indeed the hypothetical Kwiat experiment and not go to the simple illustrative example above and in Note 1. In Carroll (2006) there is reference to Kwiat's own blogged comments, which should help somewhat. Kwiat (2006b) gives Kwiat's own account of the Quantum Zeno effect.

Relation to the A series

I have written several times about the McTaggart A series so will only briefly recapitulate. There are numerous interpretations of the A series, presentist (rather like actualist in metaphysics), 'Growing Block' (almost explanatory), eternalist (for example perhaps Smith, Craig, and Williamson) and in my view a few other types. Zimmerman (2005) mentions some variants of the A series. Newton-Smith mentions "We [may] lack the grounds to assume time has its topological properties as a matter of necessity ... It is [perhaps] the task of the philosopher to demonstrate the consequences of supposing it to have such and such a topology". Quite so. For immediate purposes we will not even consider where, if at all, Swinburne and others fit in with all this. And the work of Dyke (1998) makes it clear that we may be dealing with models only in such circumstances and may not be forced to countenance further plurality of worlds.

Indeed, there seem to be more 'metaphysical' variations of the A series, in existence or possible, than there are of a 1958 Ford Edsel, but hopefully not of the same fate.

So to keep it simple for the moment, I am provisionally simply copying from Maxwell (2004) the rough definition, which we may change if fitting "McTaggart, famously, distinguished two conceptions of time: the A-series, according to which events are either past, present or future; and the B-series, according to which events are merely earlier or later than other events".

Now Baldwin (2004) says "This point connects with a deep distinction between practical and theoretical points of view. The practical point of view is essentially 'first-person' ('subjective'): it assumes knowledge of who I am (TRB), where I am (York), what time it is (today's date). The theoretical point of view is essentially impersonal ('objective'). It doesn't require this first-person knowledge. So the A-series/B-series distinction is a case of the distinction between these two points of view, the practical and the theoretical."

Or to put it my way, we would probably be talking about a person in the A series, a map in the B series, and whilst we leave aside Baldwin's idea that the A series is practical but the B series theoretical, which is pretty much an exact fit so far, it does follow that my brief definitions in http://ttjohn.blogspot.com/ that the A series is good for people but the B series is best for objects, is actually more mainstream than some of the bizarre metaphysics in the literature, though as with all mildly homespun (some prefer the term foundational) ideas it does need watching closely.

Of course we need not bother with all this, and just stick with the B series or something like it that will satisfy our problems in a half-hearted way, but then we seem to be left with a 'theoretical' result that looks sort of funny, with a Schrodinger's cat and kittens and many other things unexplained, with no clear chance of getting at humanity or even a God or Gods if we believe them to be there, no direct link to biophysics or psychology or even the study of dreams and other as yet rather strange but undoubtedly existing phenomena, and perhaps worst of all, what distinctly looks like an unresolved case of McTaggart's paradox, implying perhaps the non-existence or vacuous nature of time itself, unresolved metaphysical puzzles and all the rest of it. Much more can be said but why strain ? My way can lead to a simple and constructive expansion of the philosophy of the mind. And of course time does involve change, we know from personal experience that it does and that people have a past, a present and a future, and allowing change is the essence of the MBI approach.

In my mind, and not entirely accurately, I tend to think of the A series as being like a lot of bubbles floating freely, each of which representing a person or sentient object, and his or her past, present and future at some time, and we could hopefully index the persons in the bubbles as (Pn,Tm), this being person Pn at time Tm. By now the apparition has degenerated to a pseudo A series (almost nearer to being a B series). But in principle we are mapping an A series to some model we can understand. And if we want we can follow memes through the bubbles by now, and index like (Pn,Tm,Mi) where Mi is some meme which may occur as part of one or more bubble. But this is intended as a guide rather than mathematics or metaphysics.

And whilst as presented above, the A series has a "future" along with each "present" and "past", in the individual bubbles. This is only a model and not a metaphysical description of the universe. It is however by the nature of the model, many world in structure. The claim is not made that these many worlds have to exist in actual fact. So the MBI ("Many Bubble Interpretation") seems to be in basic distinction from the MWI of Price or Deutsch or indeed the MCI ("Many Computations Interpretation") of Mallah (2007). The latter two are in origin B series, and to aid consistency should possibly be assumed to exist, in some sense, at least in the sense that the quantum mechanical results in Hilbert spaces exist. In the MBI, the many bubbles of time, each with its own past, present and future, are as real as the person or conglomerate observing them, and only exist in a model of the A series. The A series itself, in some metaphysical sense at least, can be taken to exist. So the Baldwin (2004) bubble referred to above, will contain the person (TRB) at the indexed time in the bubble in York, with a past somewhere else, perhaps partly in Leeds, and presumably a future somewhere else again, perhaps partly in Blackpool. This will

simply be at the 'time' referred to above for TRB, and the bubble is only part of a model which contains many more bubbles. But this is only part of a model of the A series.

And, without even invoking quantum theory, Quentin Smith (2002) explains how some models of the A series can seem to have B series concomitants, even in special relativity. In fact if we wish, we could consider our A series bubbles corresponding to different Tm values to be linked to one another by a spider web of gossamer chains. The spider web could now seem to be very clearly savouring of the B series, although we had started with a model based on the A series. Given suitable provisos, that spider web might well suit STR (Special Theory of Relativity).

Furthermore, the Schrodinger Cat riddle seems to give no essential problems in the MBI, and the MBI has the additional virtue of flagging up the obvious apparent anomalies that the Cat paradox has seemed to show to some, in the B series (***Note 2*** gives more details).

At any rate, the important factors which may distinguish the A series from the B series, both being discussed in some detail in http://ttjohn.blogspot.com/ , are likely to be in the simple supposition of use referred in this note. That the situations involving human interaction are likely to be best described in the A series. Since the human/puppy experiment mentioned above will entail human and puppy observations, and/or possibly contrived mathematical situations simulating or paralleling these, we will see in the A series, the 'counterfactual' (?) results of these experiments - in a reasonably good model of the circumstances at the corresponding A series point. In other words, much what Copenhagen theorists would predict from a quantum-mechanical Kwiat experiment. The math may occur in the B series, but the human (and possibly the puppy) observers would emerge in a good A series model. So the strange thing of Kwiat will be intrinsic to the B series but only be necessary in terms of results in the A series model - which could still probably drill down deeper by a mathematical formalism which would parrot the B series. And of course we must remember that we are really dealing with a pseudo A series in formalisms devised for the B series. The interesting thing is that here the A series will represent the stolid physical truth, in a provisional model, but the B series will look mildly paradoxical in human terms. But the system has now been tamed to the point where the apparent absurdities in quantum mechanics now sound no more unusual than the use of, say, complex numbers in algebra. And importantly there is now a link between quantum mechanics and consciousness.

And, we can use different A models for different circumstances Swinburne's evangelising can, at a pinch, fall under our aegis. And models being what they are, there is nothing unusual in using new models for new positions within the A series, if we need to change our description of the A series somewhat as time goes on.

Conclusion

The fairly simple discussion above shows that with the A/B series differentiation I have discussed elsewhere we can avoid worrying too much about strange quantum results, and concentrate on obtaining new biophysics results as I have done in the http://ttjohn.blogspot.com/.entries on 4th July 2007 22nd September, 2007 entries. In the long term we will thus probably be able interpret latest quantum results in a totally non-paradoxical way, which is even true, or may be true if Kwiat is correct, for counterfactual quantum interrogation. MBI is clearly not simply Copenhagen, MCI or MWI, but a description which can create models and building blocks capable of being better than all of these and can incorporate all or any of them, and humans as well.

Further applications of Quantum Interrogation: In the simple example above, we could replace the sleeping puppy by a human brain, in principle, and thus be led to a wonderland of strange quantum mental applications, with which, as with fMRI scans, we might hope not to damage or alter the brain. Now generally speaking, whether we all end up agreeing with Kwiat or not, the puppy seems to have been interrogated while still asleep, and this makes a point anyway. If sticklers query that as well, I need only refer to Smith's (2002) comments on well-established special relativity theory and point out that our MBI interpretation will smooth over that problem in the A series enough to show MBI's potential utilisation. So whilst it will be much happier if Kwiat is right, in no way is that matter intrinsic to the

continued merit of the MBI.

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Note 1

This is largely due to Carroll (2006). Start with some food in the (salad) state. Stick it into the box; whether there is a puppy inside or not, no barking ensues, as puppies wouldn’t be interested in salad anyway. Now rotate the state by ninety degrees, converting it into the (dogfood) state. We stick it into the box again; the puppy observes the dogfood (by smelling it, most likely) and starts barking.

But now imagine starting with the food in the (salad) state, and rotating it by 45 degrees instead of ninety degrees. We are then in an equal superposition, (food) = a(salad) + a(dogfood), with a given by one over the square root of two (about 0.71). If we were to observe it (which we won't), there would be a 50% chance (i.e., [one over the square root of two]2) that we would see salad, and a 50% chance that we would see dogfood. Now stick it into the box — what happens? If there is no puppy in there, nothing happens. If there is a puppy, we have a 50% chance that the puppy thinks it's salad and stays asleep, and a 50% chance that the puppy thinks it's dogfood and starts barking. Either way, the puppy has observed the food, and collapsed the wavefunction into either purely (salad) or purely (dogfood). So, if we don't hear any barking, either there's no puppy and the state is still in a 45-degree superposition, or there is a puppy in there and the food is in the pure (salad) state.

Let's assume that we didn't hear any barking. Next, carefully, without observing the food ourselves, take it out of the box and rotate the state by another 45 degrees. If there were no puppy in the box, all that we've done is two consecutive rotations by 45 degrees, which is simply a single rotation by 90 degrees; we've turned a pure (salad) state into a pure (dogfood) state. But if there is a puppy in there, and we didn't hear it bark, the state that emerged from the box was not a superposition, but a pure (salad) state. Our rotation therefore turns it back into the state (food) = 0.71(salad) + 0.71(dogfood). And now we observe it ourselves. If there were no puppy in the box, after all that manipulation we have a pure (dogfood) state, and we observe the food to be dogfood with probability one. But if there is a puppy inside, even in the case that we didn't hear it bark, our final observation has a (0.71)2 = 0.5 chance of finding that the food is salad! So, if we happen to go through all that work and measure the food to be salad at the end of our procedure, we can be sure there is a puppy inside the box, even though we didn't disturb it! The existence of the puppy affected the state, even though we didn't (in this branch of the wavefunction, where the puppy didn't start barking) actually interact with the puppy at all. That's "non-destructive quantum measurement," and it's the truly amazing part of this whole story.

Note that, if there were a puppy in the box in the above story, there was a 50% chance that it would start barking, despite our wishes not to disturb it. Is there any way to detect the puppy, without worrying that we might wake it up? You know there is. Start with the food again in the (salad) state. Now rotate it by just one degree, rather than by 45 degrees. That leaves the food in a state (food) = 0.999(salad) + 0.017(dogfood). [Because cos(1 degree) = 0.999 and sin(1 degree) = 0.017, if you must know.] Stick the food into the box. The chance that the puppy smells dogfood and starts barking is 0.0172 = 0.0003, a tiny number indeed. Now pull the food out, and rotate the state by another 1 degree without observing it. Stick back into the box, and repeat 90 times. If there is no puppy in there, we've just done a rotation by 90 degrees, and the food ends up in the purely (dogfood) state. If there is a puppy in there, we must accept that there is some chance of waking it up — but it's only 90*0.0003, which is less than three percent! Meanwhile, if there is a puppy in there and it doesn't bark, when we observe the final state there is a better than 97% chance that we will measure it to be (salad) — a sure sign there is a puppy inside! Thus, we have about a 95% chance of knowing for sure that there is a puppy in there, without waking it up. It's obvious enough that this procedure can, in principle, be improved as much as we like, by rotating the state by arbitrarily tiny intervals and sticking the food into the box a correspondingly large number of times. This is the "quantum Zeno effect."

So, through the miracle of quantum mechanics, we can detect whether there is a puppy in the box, even though we never disturb its state. Of course there is always some probability that we do wake it up, but by being careful we can make that probability as small as we like.

Note 2

The Schrodinger Cat riddle has been discussed by many authors, Penrose, in Penrose (2000, 2005) and in many other accounts, gives particularly detailed modern descriptions for example, and Bouwmeester (2000) gives reference to it in his book on quantum computing. Penrose (2005) gives 5 accounts (a) to (f). The Copenhagen account, (a) on Penrose (2005) page 805 clearly sounds simply a very early compromise which has worked remarkably well in some cases, the others he mentions are many-worlds, decoherence, consistent histories, split wave, some new theory (e.g. Wigner's). Equations 2.9(b) and 2.9(c) in Penrose

(2000) give two accounts, for example. He defines these equations in the same semi-formal way as equation (1) above. As Penrose (2000) points out, both of these can bring problems.

In the MBI interpretation however, these problems do not arise, as we are not considering various interpretations or restatements of a known, and hopefully valid mathematically, quantum mechanical description, but a B series in which we can write the maths just as we need within the guidelines of the B series, and an A series which probably brings humans, their problems, and their past present and future, directly into play.

We know, or hope we know, that the A series exists as otherwise, along the lines of McTaggart, time is unreal. We have a century of varied philosophical and other discussions on that already.

And in the MBI A series, the human consciousness exists too. As far as we so far know, in human consciousness, outside of shamanically or drug induced cases or the like, the 'cat' will only occur in two forms, 'dead' or 'alive', and we can write this into our description of the A series as we know it. In other word the only valid human A series maps, assuming for the moment that we are considering human A series (though there is certainly no objection to considering the A series of dogs, cats, and other creatures, or indeed clever mechanical, optical or electronic devices of a deliberately or accidentally pseudo-intelligent nature) which may indeed be important in some pseudo-A or pseudo-B series, should contain no intermediate 'cat' states directly. We would just be wrong in using the wrong A series model, no paradox or riddle at all. But obviously sections of any A series bubble or indeed the entire content of it can contain by fiat no human style devices in an A series model, and then presumably Schrodinger cat states may be directly involved.. But they presumably would be involved directly in the quantum mechanics of the B series anyway, or in derived manifestations in our A series model. Of course even the point that humans cannot experience mixed 'cat' states may be disputed, looking for example of the bizarre but real mental manifestations encountered by such workers as V.S. Ramachandran or at such strange effects as we obtain in synaesthesia or in the Bonnet or Cotard syndromes, and we are considering all three but particularly synaesthesia. But if strange but surmised or actual mental effects are applicable, these can routinely be incorporated in the A series, and where necessary further work done in the B series as well.

There is clearly a lot more experimental work which can be done on the A series, to obtain models and the status of the A series more precisely. But one thing that seems clear at this stage is that the A series does exist, and can be used in a neatly understandable way to include descriptions of elaborate models involving B series results like the Schrodinger cat experiment as well