Category theory applied to a radically new but logically essential description of time and space

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Abstract

McTaggart's ideas on the unreality of time as expressed in "The Nature of Existence" have retained great interest for many years for scholars, academics and other philosophers. In this essay, there is a brief discussion which mentions some of the high points of this philosophical interest, and goes on to apply his ideas to modern physics and neuroscience. It does not discuss McTaggart's C and D series, but does emphasise how the use of derived versions of both his A and B series can be of great virtue in discussing both the abstract physics of time, and the present and future importance of McTaggart's ideas to the subject of time. Indeed an experiment using human volunteers and dynamic systems modelling which was carried out is described, which illustrates this fact. The Many Bubble Interpretation, which also derives from McTaggart's ideas, is discussed and various examples of its use and effectiveness are referred to. The Schrodinger Cat paradox is essentially resolved in principle, the quantum Zeno effect interpretable, Kwiat's recent result referred to, and the newly discovered reverse Stickgold effect described.

Introduction

I began in the late nineteen sixties , with Professor R.O. Gandy in Manchester, England, by trying to describe and attempting to completely incorporate into a mathematical system, the laws of physics. I used basic methods, such as those of Gentzen, Heyting Brouwer etc., etc. But both I and Professor Gandy found a practical solution, even in the very abstract, to be too difficult at the time. I believe we both thought that we needed some new mathematics, which either did not seem to exist or which we simply had not located !

Now the work of Turing, and later Chaitin and Connes, for example, should have helped but somehow it seemed to me necessary to go even deeper down and more basic. In fact the philosophy of approach with which I began was that of the early formal system theory of

Smullyan (1961). Clearly on the face of it, it looked as if strange mathematical constructs like that of Godel universes as well, could be included in such an approach. But at that point, the pieces did not seem to fit. For example, pursuing the Turing path, which has been trod by so many workers by now, like for example Juergen Schmidhuber, was not going to be enough. There was more to it than simple computability problems, we needed to go in a sense to a higher level. Even using the physically peculiar looking results of quantum theory which have by now been incorporated into modern methods of quantum computing, and some of the early results of which, for example, were first published in a journal which I founded and of which I was Editor in Chief for many years (Feynman, 1982) could certainly enlighten us and might well have to be included in some more complete description of the universe which more finally became of use to us, were probably too intellectually ad hoc and thus too flimsy to effectively suppress or even mollify the deep angst of our lack of basic understanding. It was almost like trying to understand modern number theory in a position where transfinite numbers had not been invented. There almost had to be "another dimension or dimensions", or even another "kind of dimension".

Early string theory was around at the time, but at this very basic level, the explanation was unlikely to have that kind of simplicity. It was likely to be much more basic, deep and profound. In sum we were looking for fundamental mathematics, not just the simple technical physics that string theory, even today, would seem to amount to.

I felt in the early nineteen sixties, and still feel now, that the great Emmy Noether, who has since been described flamboyantly but possibly realistically as the greatest mathematician who ever lived, in making a comment on the equality of numbers outlined a more basically sensible approach and that comment should be able to enlighten our understanding. "If one proves the equality of two numbers a and b by showing first that "a is less than or equal to b" and then "a is greater than or equal to b", it is unfair, one should instead show that they are really equal by disclosing the inner ground for their equality". The same idea applies of course if, for example, a does not equal b but the formulation of our problem here is thornier. And although I end up here talking about the A and the B series, it is not with the idea of using a simple logical, physical, or mathematical proof but a striving for something closer to the absolute.

McTaggart and Angst

Referring now back to space and time, Buber (1959) pointed out 'A necessity I could not understand swept over me: I had to try again and again to imagine the edge of space, or its edgelessness, time with a beginning and an end or a time without beginning or end, and both were equally impossible, equally hopeless – yet there seemed to be only the choice between the one or the other absurdity'. The problem here is that when Buber tried to get down to philosophical details he just had not got the right stuff and relativity theory shows us that. There is really no certain reason, using relativity, why time or space would have a beginning or an end - philosophical problem solved.

Now we could say that Buber's confusion was caused by his acceptance of Newton's concept of space rather than Leibniz's. In Newton's world-view physical objects could exist by being in space, but space could exist even if devoid of any physical objects. In Leibniz's view, objects existed anyway and could touch one another, be separated by various distances and so on but space, per se, did not exist. This immediately resolved Buber's problem. One can solve such a problem by showing that it contains an untenable proposition. In this case the problem was not with space itself, but with Newton's conception of space. The answer was to accept Leibniz's more economical view, or simply to look for a consistent definition of space, which without relativity was hard to find.

McTaggart (1927) reasonably showed that in his context time showed a contradiction and he was right and logical to suggest that time did not exist, or is unreal. That was a sensible and economic view but slightly harder to develop than in Leibniz's case, where Leibniz had effectively inferred that space, per se, did not exist and was able to get quite a good theory for his era. But McTaggart's concern with time is in many ways very analogous with Buber's concern with space. Buber knew more or less what space was, but when he thought about it, it looked somehow spooky and unreal. Maybe we could say that that is "Angst". It is certainly a clear indicator that something needed to be done.. Anyway, the same thing happened to McTaggart with time, and as we will pointed out here, just as Einstein resolved Buber's philosophical worry about space, so too category theory can up to a point resolve McTaggart's problem with time. But that of course does not give us the right to ignore McTaggart's problem just as relativity has shown we should not certainly not have ignored Buber's problem. Just as in a way we have all been ersatz Leibnizians, prior to Einstein, let us importantly try to avoid continuing the same line of error with McTaggart, whether or not a resolution of his problems is more of a serious mathematical and philosophical challenge than Einstein's resolution of Newton's problem was.

Neurophenomenology and Category Theory

The term 'neurophenomenology ' was used by Varela, who also made a serious effort to understand consciousness (Varela 2000,2000a). It has to be said that it is a good idea to take his work at least almost as seriously as that of McTaggart (1927), and indeed Lawvere (2005).

In his day (till 2001) Varela was probably at the forefront of neurophenomenology. However even as recently as the end of the last century, there was relatively little work on complexity theory and category theory as applied to neurophenomenology. The papers of the Ehresmanns (1999) gives an account of how the Ehresmanns at least, tried to use category theory. And references (Ehresmann, 1999) at least explain how it could be done. Some ongoing work is being done, for example, by Brown (2006). This indicates potential use of category theory which is anything but irrelevant and abstract.

Varela and the Specious Present

I should point out that though Varela wrote frequently about the specious present he does not seem to have ever actually used category theory as a working mathematical tool, nor to have given reasons why not. However both Varela and many others have clearly found coping with the specious present to be difficult, and certainly have not given convincing accounts on McTaggart's paradox. However when we read the account of Brown (2006), for example, we can readily work out that at least a meaningful account of the specious present can be made. At this point we are not unduly concerned with emergence, for which Brown thinks he may be able to obtain answers and, apparently, even mathematical results.

What we can certainly try to do now is to use colimits in a way like Brown et al (2006) tried to use them. There is a problem with Varela's work and it comes out clearly, for example, in section 3(2) ('The neurodynamics of temporal appearance') of reference (Varela, 2000a). I believe that one problem is that earlier workers have had to try to describe the McTaggart A series in terms of Newtonian time. Newtonian time is essentially punctal and in using it, we would have, very often, in effect to try to turn a blob into either one dot or into a series of dots. That is what happens to Varela. I will not give a bibliography here of all the other efforts to turn a blob into a dot, but they are common. For example, some of them are referred to in the references in Savitt (2002). Symbolic logic certainly produces some intricate formulae but those do not describe an 'instant in time' very well either.

Colimits and the Specious Present

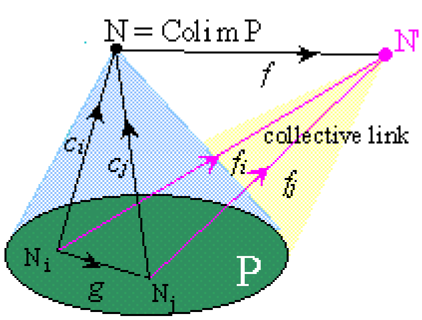
We may not need to go quite so far as Brown et al (2006) does. We only need for the moment to consider an approach somewhat like that of the Ehresmanns. I append two diagrams from the Ehresmanns' study (Ehresmann, 1999).

I will carry out this explanation in a way paralleling reference (Ehresmann, 1999), so that anyone who reads and understands Ehresmann,(1999) may be able to refer back to it directly to help to make it clear what I am saying here. There are many important differences to Ehresmann (1999), however.

Now for anyone who has not a copy of McTaggart (1927) on hand, Professor Soshichi Uchii's rough one-page summary (Uchii, 2003), which does not go into all the subtleties of McTaggart's two volume book but will do for an introduction though is probably inadequate for the preparation or consideration of critical comment, is available on the internet. Uchii's summary at least tries to represent the A series as instants in time. (Don't worry about most of his comments or views at this stage).The B series can be a 'block universe' or some other punctal time representation that we care to use.

We don't worry about the McTaggart paradox as such at this point either, we just set up a McTaggart style representation.

We consider an instant P as a pattern of past present and future. This could be at this point the past present and future of the universe or of one object, say an observer, in a universe.



In a category, a pattern P is modelled by the data of a family of objects Ni and of some distinguished links between them. A collective link from the pattern to another object N' is a family of individual links fi from each Ni to N', correlated by the distinguished links of the pattern, in the sense that, if g is a link in P from Ni to Nj, we have gfj = fi .

The collective links model collective actions (constraints, energy, or information transfer) of all the Ni acting in cooperation along their distinguished links, and which could not be realized by the objects of the pattern acting individually. The cooperation can be temporary, as in a group of people who decide to cooperate for a particular work. But the association itself can be represented in the system by a more complex object N, which 'binds' the objects of the pattern and acts by itself as the whole pattern, in the sense that its links to any object N' are in 1-1 correspondence with the collective links from the pattern to N'.

In a category, the object binding the pattern (if it exists) is modelled by the colimit (or inductive limit) of the pattern. An object N is the colimit, or the binding, of the pattern P if it satisfied the two conditions:

1. there exists a collective link (ci) from the pattern to N,

2. each collective link (fi) from the pattern to any object N' binds into a unique link f from N to N', so that fi = cif for each i.

If a pattern has a colimit, it is unique (up to an isomorphism). In this case, we also say that the pattern is a coherent assembly and that its colimit represents a higher order object which subsumes the activity of the assembly.

The colimit actualizes the potentiality of the objects to act together in a coherent manner by integrating the pattern in a higher unit (for example, the protein as such). In a natural system where the links have a given 'strength', the formation of a colimit is characterized in two ways:

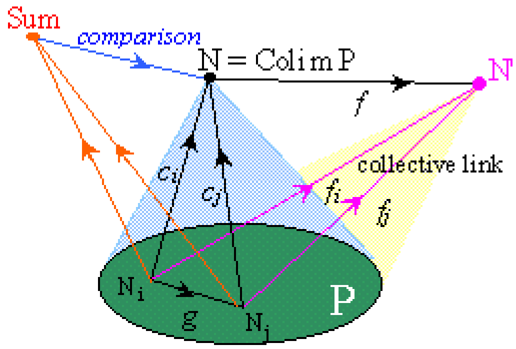
1. 'locally and structurally', a strengthening of the distinguished links of the pattern restricts the degrees of freedom of the objects to ensure a more efficient cooperation among them;

2. 'universally and functionally', the actions of the colimit on the other objects of the system subsume the activity of the whole pattern (they correspond to its collective links).

For example, a molecule is the colimit of the pattern formed by its atoms with the chemical links defining its spatial configuration.

Roughly, the colimit forgets the precise organization of the pattern and records only its collective actions, and these can be the same for more or less differing patterns.

The rôle of the distinguished links of the pattern P is paramount: they determine the 'form' of the colimit and allow for the emergence of collective actions, transcending the individual actions of the objects. The coherence and the constraints introduced by these links can be measured by comparing the colimit to the simple amalgam of the objects Ni of the pattern, obtained if the links are forgotten, which is modeled by their sum.



The sum (or coproduct) S of the family (Ni) is the colimit of the pattern P' formed by these same objects but without any distinguished link. It classifies the individual actions of the objects, while the colimit of the pattern P classifies their collective actions made possible thanks to their distinguished links in P. (Think of the difference between the behaviour of an unorganized mob, and the behaviour its members adopt under the direction of leaders.)

There is a comparison link c from the sum S of the Ni to the colimit N of P, which binds the canonical links from the Ni :to N. It measures the constraints imposed to the objects by their distinguished links, hence by their participation to a collective action. The links from S to an object N' which factor through c correspond to the emergent properties of the complex object N compared to the properties of its components Ni.

Now we could say that a series of 'instants' P, which we could call {P} could occur as part of an ordered set or otherwise but we do not have to do this. And each 'instant' has its own past-present-future. And a series of instants will exist in some category Cp, say.

The specific 'instants' are not like a series of beads to be hung on a string, but form significant but differing parts of a whole. In a sense each instant could be taken as a past-present-future representation of some whole. The whole could form a specific structure, possibly a category we might like to call MacA. We bear this in mind as a structure, which like so many others, needs further definition in due course dependent on circumstance.

But to sum up, I realised before too long that McTaggart's paradox, far from being well understood - and indeed it now almost seems to some to be like an effete toy for philosophers - still had not been resolved. There is in fact both a McTaggart A series and a McTaggart B series, even if philosophers try to pretend it has all been sorted out. We know that Zeno's paradox, for example, still has much to say, and so indeed has McTaggart's paradox. I will press on for the moment rather than to justify in detail. Philosophers still make a lot of money by dicussing the pro's and con's of McTaggart's paradox, so I will not add further to the agony at the moment. (Chalmers, 2006)

So we have an A series and a B series, and we need to know what to do with them. Just an A series, just a B series, or two separate series which do not seem to map properly onto each other.

The A series in more detail

So what is really wanted now is something which gives solid physical prospects, such as more detailed dream experiments (as I tried to point out in Yates (2008)) or OBEs (out of body experiences) or NDEs (near death experiences). The mathematical and physical prospect of many worlds type interpretations is better than those of much of today's physics, in fact a useful quantum computer is likely to be built by 2020 (Ball, 2006), and this may help the process of such lines of understanding or intuitive interpretation. As these things go, the present supposed restrictions of any MWI is certainly likely to evolve in that time, and of course we have as yet no details as to how. But the A series for instance will probably turn out to be be a proper class (Note 1) and to begin with we may have to map a pseudo A series onto a mock B series to get results, and in effect I recently suggested something like that in my blog, Yates (2008). The 'block universes' of the B series type have been relatively easy to handle so far, though philosophically and to the intellect not altogether satisfactory, without an A series.. When we look at the A Series and the work of, for example, Varela and Ehresmann, but consider problems such as (and only "such as", certainly not exclusively) that the A series may be a proper class (that is, roughly, a class which is not a set) we are left with at least two obvious approaches, the first being to examine further immediately the A series properties of time and consciousness in terms of the work of Varela, Brown and Ehresmann for example.

Preliminary plans for a detailed MacA (or Category Theoretic Mactaggart A series)

Chalmers (2006) said : "The Time and Consciousness conference in Sydney yielded a lot of food for thought. The talks focused on a number of different connections between the phenomena .....There's obviously a lot of room for further work here, and I'm looking forward to seeing how things develop in coming years."

Chalmers is right about the conference providing a lot of food for thought and he is even more right in that there is a 'lot of room for further work'. In fact a lot of ideas but nothing solid yet. And I am hoping to provide something a bit more solid, as I have already tried to do in my blog, especially involving 'specious time" and category theory

To be more explicit about the last paragraph: What I am finding from the conference details, and from earlier work, is that in problems being in and relating to the 'specious present', philosophers are frequently putting forward interesting discussions and concepts nowadays but that these on closer examination seem to have a circular or self-serving element. I choose as an example Kelly (2006) I quote "...the specious present, by nearly all accounts, lasts only a relatively limited time. Recent estimates generally agree that it is in the area of three seconds or so. But we often experience things to be moving for periods that are longer than this. If you watch an airplane taking off from the runway you can follow its continuous motion for several minutes before it disappears."

Great concept! Kelly then discusses the Retention Theory and its relation to perception experiments and philosophy. Well, for me the whole manifesto of such lucubrations to date seems encapsulated in Alexander Pope's doggerel. "Remembrance and reflection - How allied ! What thin partitions sense from thought divide." In fact Kelly goes on by discussing Kant and

Husserl and ends with "What we would like is a standard set of examples that give us the feel for what it is to experience something now as just-having-been." A good idea perhaps - but how? So I am left with the view that a more satisfactory category-theoretic interpretation has to be made and this will come closer to giving us a correct mathematics. When you think of it, perhaps he is looking for an extended A series here but may end up by conflating the lot with a B series, or something other writers may see as a B series.

In sum, a simple B-series interpretation of the world involving the physics of Galileo or Newton/ Leibniz or Einstein is very adequate for some predictive descriptions. If we need to we further note that there is as yet no apparent compulsion (as in Le Poidevin (2006)) to consider Relativity (special or general) in any detail to start with, during our own continued lucubrations. Hopefully it will not add to time-ordering problems in our A series or can be dealt with when it does. These problems, which Kelly and others mention, should either fall from our existing simple A series work, but very clearly manifest themselves in the A series discussions.

But there will only be relatively generalised answers at least to begin with, and this is not necessarily bad either. Consider the Baez example of a beautiful and possibly prehistoric use of category theory (Note 2). So we are trying to be like the shepherds of old, but not just inventing the B series as we could assume they did, but the A series!

Smith (2006) is probably also worth chewing on as the dynamic nature of time does seem to come out rather roughly in a scheme which proposes individuals existing at independent 'specious presents" ie a row of ...p0, p1, p2,..... etc. The idea of dynamic following is the hard one to include in the category and there is no reason why we are obliged to spell it out in terms of B series physics. However it exists as individuals exist in the frames ... p0, p1...etc. for each individual and the fact that we have mapped them on to a kind of ersatz (using Chalmer's (2006a) B-series word) A series or 'fallen' A-series does no harm.

The point is here that the MacA has to include dynamism whether or not some decategorified or set theory version does. At the same time, present day mathematics has no simple format for providing dynamism within category theory statements or proofs. Certainly, the proof could be presented for example in the form of a video or even a notional mental headup display but this would not seem to present more actual mathematical content than the more normal pen and paper. Bearing in mind that at this point we are trying to present an A series in B series terms, this is not surprising.

And it is as well to remember that, say, the B series equation representing a ball rolling down an inclined plane does not need to be rolling down some inclined plane itself to be of immediate use. But this obvious fact is not the same as our current problem.

Indeed the obvious way is to try to write down a decategorified version of MacA in terms of some decategorified element pa where pa is a member of ...p0, p1,...is possibly to let pa be a presentism's p at time ta. This may help to eventually write the matter down in more detail in category theory terms. It sounds like a cumbersome multistep way to do things but may be appropriate. It should perhaps be pointed out that this process is not simply intended to result in an unnecessarily tautologous form of presentism but ultimately for enough positive description to allow an A series.

What to do then? From Chalmers (2006a) we could try to sort out the two-stage model (Note 4) and maybe relate it to Velmans'(2002) work - bearing in mind Chalmers claims to allow different models (presumably including Velmans' model with required justifications i.e. provisionally as I might do). The result may eventually be a new or a mutual model which could be multi-stage. However Note 4 is only an indication of possible proceedings; certainly the result should be expressible in terms of category theory.

On the face of it there clearly can be some form of mapping from 'real time' (or 'eden time' or whatever it might be) to a B series time as such mappings have given many of our results in physics to date. To say that is almost tautology. Whether such a mapping presents a suitable or adequate representation or not is another matter. And certainly we may be now encumbered with an 'eden time' A series and an 'apparently observed' A series. Whether this will be a simpler or better way to handle things, as yet we cannot be sure but one way would be to bear in mind a 2-stage representation as a possibility until the matter is more specifically concretised. I think we will need the A series even with the two stage model in any event. It could be that a 'de-Edenised' A series will not look very different to a 'de-Edenised' B series. The process which I would have in mind would be similar to or perhaps equivalent to obtaining categorification by first decategorifying and the categorification again, really not too different to what could normally be used in category theory anyway to obtain suitable categories from naive mathematical results in a fairly transparent way. (Note 5)

So I get to a point that a reasonable physical assumption seems to be that the A series is a Proper Class. Bays (2001), in "Reflections on Skolem's Paradox " says "if we start with a proper class which "satisfies" some finite collection of sentences, then the Skolem hull construction lets us find a countable set which satisfies the same collection of sentences"**.**

Briefly what I am saying, and obviously there are many provisos, hedges and restatements, is that I consider a form of A series and a form of B series - but the A series is probably a proper class (like the somewhat similar class of all automata for example is a proper class (Adamek et al, 2004)) and probably cannot be effectively mapped, certainly not one to one, onto the B series. We only need to look at say Goldblatt (1984). In other words time is a rather complicated entity and when we get down to the mathematics or even the logic of time, we are using at least two different and not one to one mappable onto each other (mathematical) categories, A and B say (Note 4). And McTaggart had thus considered that he had found unreality in time when he was actually trying to compare two different things - though it is possibly not necessary to follow through his precise reasoning here, particularly on the C and D series. Clearly when considering a complex entity like 'time', there may ultimately be many more matters to consider but that does not remove the fact that McTaggart had found at least two such entities, the A and the B series.

In other words, I can use conventional complexity theory mathematics to study the A series as long as I remember that I am no longer in "block time" or B Series time. Now authors like John M. Gottman (2002) have used simple enough mathematics for years to solve psychological problems and seemingly eventually tried to shoehorn their ideas rather without thinking into a "block time" scenario where they will not properly work. And the heartbreaking discussions amongst proponents of tensed and non-tensed time may never again have to carry so much weight, (at the Sydney conference, (2006) they mainly did carry weight) in a situation where a tensed time (A series) is used where convenient for people, and a non-tensed time (B series) where convenient for objects. And the maths can be great in both cases. Though of course that does not say it will be straightforward or easy.

Also the fact that we are using not a real A series but a pseudo A series mapped into the B series, undoubtedly changes the mode of operation and the character of any work we may do. And in sum, the above tends to dispose of the somewhat short sighted idea, which I feel may have been despised by such as Emmy Noether, that we only need deal with the B series anyway. Then we would not have a past, present and future, but only idealised 'block time', which is in no way a complete description of the universe though it has served physics in a limited fashion for generations.

The Many Bubble Interpretation

The ‘Many Bubble Interpretation”or MBI, (Yates, 2008a) appears by means of 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.

So we have both an A series and a B series, and McTaggart’s work and Zeno’s work, (and/or their modern counterparts), can pose no problems. Now in practice, since the A series will almost certainly be a proper class, we still have not pinned it down in great detail and indeed may because of its nature, never to be able to do, so we are using a pseudo A series written in the B series. Obviously there will be lacunae and these lacunae may exhibit themselves partly in the form of the quite hard to describe Berkeley Madonna equations we will be immediately confronted with.

Outline of the MBI

A relatively simple basic mathematical model for a “bubble” in the MBI (’Many Bubble Interpretation’) discussed earlier, can be constructed. For a 'look and feel' description, see Note 5. Many bubbles – and there would be many – could be much the same, in principle, and given by Berkeley Madonna, for example. And in the simpler cases of the model there need not exist episodic memories to retain many of the apparently intrinsic features of human thought (Egan, 2007). Even total loss of personal memory made no difference in subjects tested. Indeed

Rosenbaum (2007) goes so far as to say: “We found that if you’re trying to put yourself mentally in someone else’s shoes, you don’t need to put yourself in your own shoes first.” We do not even need, of necessity, to consider mirror neurons to ‘have a life’. We can even, in terms of level of simulation simplification, try to emulate Winfree. And no complex ‘Theory of Mind’ is required (Ramsay, 2007).

There is no need to deal at this juncture with the problems posed by Honderich or by, for example Trevena and others, to the work of Libet (2003), and its defence by Haggard, Klein and others. Libet’s results, or others, will just be part of the Madonna formalism within the bubble, which can be “pseudo A series” in its formulation, I think.

Obviously, more complex contents can be given to the MBI and this is being done.

Applications of the MBI (example only)

A concrete case of the application of the application of the Many Bubble Interpretation appears in Complex System Theory. I used the standard Dynamical Systems methods as described in Hannon and Ruth (1997). Whilst that book recommends the use of the program STELLA, I in fact used BERKELEY MADONNA (8.3.11) but the results come out in a somewhat similar format. In fact I used a Romeo and Juliet type model (Sprott, 2004) (Yates, 2008b).

There are many potential uses of such a model, and various examples have been considered. A very striking example, though one out of many, is the example of what may happen when we dream. This seems much more flexible than many other cases - synaesthesia, for example, is a difficult though potentially rewarding one, and this as well as other cases is being documented in the literature. (Yates, 2008, 2008c)

Clearly one direct entry to a study of the unconscious could be by studying dreams, without any necessary preconception as to what these dreams are, or what they mean - if anything. A brute fact about dreams is that they exist, and can thus be studied. Studying dreams is what the shaman did (Charlton, 2002) , and we can do the same. As Charlton (2003) pointed out "The altered states of dreaming consciousness enables hunter-gatherers to cross further boundaries of time and space in pursuit of high-level insights that synthesise and integrate complex knowledge of many kinds ", but he then goes on to say that using systems theory would make this difficult. In fact, to date most studies of dreams look relatively speaking rather basic, to those who want an early quick explanation of such matters. There are interesting exceptions and I mention the experiments of Stickgold, and the Stickgold effect (also perhaps better known in the vernacular as "Tetris Dreams", because of the frequency it was noticed anecdotally, and "Tetris Dreams" even gave over 1500 Google results including a T shirt, but of course the effect can be located in many other cases than simply playing Tetris, and it has interesting neurological implications also).The Stickgold effect (1999, 2000) is a pretty simple idea, in essence - one performs a simple task like playing a computer game, and then dreams about it. So apparently the Stickgold effect induces dreams. We found that there also seems to be a reverse Stickgold effect, where the dreams are dreamt and subsequently the acts dreamt are performed, within the confines of a controlled experiment using double blinds, for example the subjects are kept in the dark about the experimental details during the experiment.

Now there are real problems in assuring reproducibility of results and I for one will not be happy until at least we reach the high levels of experimental reproducibility obtained in the early Milgram (1974) experiments in general psychology. Preliminary experiments are proceeding at our Vasai, India address at the moment but we are also considering setting up a Science 2.0 style site which will allow the comparison of varied psychological experiments, some of which may contain physical data like DT-MRI data as well as the normal psychological profiling data. Such sites are now relatively common in genome experiments and there seems no reason why the idea cannot be usefully extended to many psychological experiments such as those on the Stickgold effect and the possibly newly discovered reverse Stickgold effect. Perhaps modified versions of the Science 2.0 idea can be described as Psychology 2.0 or in the case where applications could be said to 'transcend' or supplement science, and experimental philosophy results are in the offing. then it can be described as Philosophy 2.0., where we might wish to consider such workers as Chalmers and Knobe (2008). In the present context of the Many Bubble Interpretation there are already possible equations of constraint obtained using the modelling tool Berkeley Madonna and the simplified form of the equations in the present mode, described in more detail on the website of Yates (2008b), is

dR/dt =a*R +b*J*(1-|J|)+e*Z
dJ/dt =c*R*(1-|R|)+d*J +f*Z
dZ/dt =h*S +g*R (S is Heaviside step functions :in N003a,g=f=0)

The next step may we involve the refinement or replacement of the present equations in Berkeley Madonna using methods of Self Organised Criticality,and in particular the use or incorporation of a mode like the sandpile mode may help. If these equations can be improved and/or accurate limits set on their parameters,they could be used for yet more tests and even more accurate results,in for example the mode,duration and timing of stimuli. We bear in mind Winfree's work as a parallel example of such methods. In the above equations, very roughly, R ('Romeo') and J ('Juliet') represent the 'unconscious' and 'conscious' mind or equivalent representations in other philosophical approaches,and Z the applied impulse. The notation is like that of Sprott (2004). The improvement in the equations will likely be carried out along with attempts at semi-empirical assessment of the physical factors under consideration.

In Quantum Theory:

After a consideration of the MBI, the Schrodinger Cat Paradox ceases to seem like a paradox and in a poster (Yates, 2008d) I illustrate this and further examples of the simplification of an understanding of quantum theory and related topics like quantum computing, even including Kwiat's work. The Schrodinger Cat description is in Note 6, equations are as in Yates (2008b) plus conventional quantum theory..

A Specific Application:

A problem involving some applied mathematics and philosophy.

The Many Bubble Effect described herein, together with other factors like McTaggart's paradox and Zeno's paradox, allowed a formulation in terms of differential equations of Stickgold's dream experiments and my interpretation and furthering of them. This led to a number of equations and graphical results. In particular to equations like that described as N003b on my website at http://ttjohn.blogspot.com/ (RSS feed available) and on the CD.

Very briefly, as the 'pseudo A series' might describe it, there could be tiny pushes and impulses to the mind at a given time, from both past and future stimulations, but at a particular time it could be said that the mind is in some kind of dynamic balance which Stickgold altered in the 'Tetris dream' by a push from the past, relatively easy in retrospect. In my case I alter the position of the push from the future to the present, and this worked too. Experiments and trials are still under way, and could show conclusively the merits of the MBI, though their success is not essential to it. And a sandpile Madonna model is considered in Note 7.

Notes

Note 1. Goldblatt's 'Topoi' refers to a 'proper class' as 'a class which is not a set'.

Note 2. arXiv: math. QA/ 9802029 v1 5 Feb 1998 Categorification John C. Baez. This says: "Long ago, when shepherds wanted to see if two herds of sheep were isomorphic, they would look for an explicit isomorphism. In other words, they would line up both herds and try to match each sheep in one herd with a sheep in the other. But one day, along came a shepherd who invented decategorication. She realized one could take each herd and `count' it, setting up an isomorphism between it and some set of `numbers', which were nonsense words like `one, two, three, . . . ' specially designed for this purpose. By comparing the resulting numbers, she could show that two herds were isomorphic without explicitly establishing an isomorphism! In short, by decategorifying the category of finite sets, the set of natural numbers was invented."

Note 3. Chalmers (2006a) states: "It is a further question how this model should be extended to the representation of time and motion. I am inclined to say that the two-stage model can be extended to time as well as to space, though this turns on subtle issues about the metaphysics of time. A natural suggestion is that the Edenic content of temporal experience requires A-theoretic time, with some sort of true flow or passage. Our own universe may not instantiate these perfect temporal properties, but it may nevertheless instantiate matching B-theoretic properties (involving relative location in a four-dimensional "block universe") that are sufficient to make our temporal experiences imperfectly veridical, if not perfectly veridical. The representation of motion could be treated in a similar way." and

"One might go so far as to suggest that Eden is a world with classical Euclidean space, and an independent dimension of time, in which there is true passage and true change. Our own world is non-Euclidean, with time and space interdependent, and with pale shadows of perfect passage and change. On this view, Einstein's theory of spacetime was one more bite from the Tree of Science, and one more step in our fall from Eden."

Note 4. Chalmers (2006a) on two-stage: "the two-stage view yields natural answers to the objections to the Fregean view that were grounded in phenomenological adequacy. On the relationality objection: the two-stage view accommodates relationality by noting that there are certain specific and determinate properties—the perfect color properties—that are presented in virtue of the phenomenology of color experience.

When Jack and Jill both have phenomenally green experiences in different environments, the two experiences have a common Edenic content, and so both are presented with perfect greenness. This captures the intuitive sense in which objects look to be the same to both Jack and Jill; at the same time, the level of ordinary Fregean and Russellian content captures the intuitive sense in which objects look to be different to both Jack and Jill. By acknowledging Edenic phenomenal content in addition to Fregean phenomenal content, we capture the sense in which perceptual phenomenology seems to be Russellian and relational."

Note 5. In my mind, 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 (Note 5b) style 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 6 gives more details).

Note 5a. Professor T. Baldwin said "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."

Note 6. In the case of the Schrodinger Cat Paradox, as shown on the poster (Yates, 2008), instead of having the epomymous Cat in a room with a bomb and a puzzled query in the mind of persons outside the box, this neatly splits into roughly into three cases, in the present treatment.

(1) A series: Cat and observer, each in their own bubble, no way that we know of so far that the 'observer' bubble can get at the 'cat' bubble. So no paradox.

(2) Pseudo A series: We might try to simulate the cat ideally in the observer bubble, for example. Category theory suggests how. We try procedures as in "Applications of the MBI in the main text above.. N.B. May use 'B' series maths.

(3) B series: cat and observer have the same math structure so far. Not a complete descriptiom but mathematically OK.

Note 7. We can now consider further simple ideas like using the sandpile analogy as it has been tried, for example, with software development, without the physics actually disappearing from the system as the actual software used for development does in the paper (Wu, 2002). That contained an excellent analogy:

Driving force / sand drop /change request
Response / sand slide / change propagation
System state / gradient profile / release, iteration plan
Relaxing force / gravity / stakeholder satisfaction

but plainly "the mathematics was not the territory" just as "the map is not the territory" to a geologist. Even if a geologist goes along with the mathematical fractals approach, it does not get the dirt under his fingertips. But with the MBI approach in physics, we seem to be as close to a physical simulation of the real world as we can be at the moment. Importantly, for example, we have not simply beaten off McTaggart's paradox but on the contrary, we we have used it as strongly as we can.

This may well give us the ability to prepare a more precise or even a new and better Madonna model than the model N003b suggested in an earlier entry, using for instance some of the methods of Dhar (2006) particularly as described in Dhar's section 3 onwards and other such SOC methods, as well as what we are using to date.

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Yates J., (2008a), work to be archived or published elsewhere and in part in ttjohn.blogspot.com ; in fact the Many Bubble Interpretation, proofs for the importance of its use, and current applications, are to be discussed in more detail in separate papers.

Yates J., (2008b) , ttjohn.blogspot.com , especially including "Work in Progress on application of dynamic systems theory to the A series (1) and (2)" at http://ttjohn.blogspot.com/search?q=dR%2Fdt&x=45&y=8 etc

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