

## **The Application of McTaggart's results to Consciousness Studies and Category Theory.**

### ***Abstract***

It is explained how and why category theory may be used, together with relexive monism, to explain the McTaggart paradox. This suggests the likelihood of even more applications in future.

### **Introduction to the Development of our Phenomenology**

Ideas like "time" or "education" or "justice" or "mercy" are easy enough for most people to recognise, understand or use, but when it comes to the nub, quite hard to explicate or theoretically reconstruct. This tends to lead to nuances in interpretation which quite often are unnecessary or inappropriate in a particular context.

This fact comes out very clearly when relatively historically new concepts, like "electricity" are considered. Even today, it is sometimes said:

NA1: "In spite of everything we know about electricity, we do not know what electricity is."

The idea being perpetrated is that whilst we know what charged particles are, and we know Maxwell's laws and other such properties of electricity, but nonetheless however much knowledge of this kind is gained we will never know what electricity is. But this is wrong because by knowing about charged particles, Maxwell's laws etc for the most part, we do know what electricity is. Of course we cannot sum up this extensive knowledge in a brief paragraph.

To clarify even further, in NA1 we could just as easily substitute the words "your nose" for "electricity" and make it NA1n. It is absolutely clear that we do know what "your nose" is and to say we don't is splitting hairs for most real purposes, philosophical details aside. Hard cases are likely to make bad law, here as elsewhere and we must rely on context and in the normal context, NA1n is absurd.

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 erzatz 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.

All the above should be roughly palatable to most people.

### **Quinton's work as interpreted by Norman Swartz and then by me.**

Now Quinton (1962) describes a man living in England who when he falls asleep finds himself at a lakeside in a tropical setting. His experiences at the lakeside, unlike many dream-sequences, are as ordinary, as matter-of-fact, and as uneventful as are his everyday English experiences. Nothing dreamlike, fantastic, or wildly unlikely occurs in the tropical environment. The hero passes the day in the tropics and when he falls asleep there immediately finds himself in England. And these English and tropical experiences regularly alternate. Life in both locations appears equally real and Quinton has no reason to claim that objects in one reality have any spatial relations to those in the other, for no matter how hard he searches each reality he can never discover evidence of the other. That, at any rate, is Quinton's rather impractical concept-structure for the purpose of argument that two regions of space need not be connected and the structure has been considered again and again by philosophers since 1962. Swartz (2001) in his book, "Beyond Experience", reasonably claims that there is also a good case for taking it that all regions of time need not be connected either and we extend that notion here, as follows.

Quinton asks whether we can construct an analogous tale showing the possibility of there being two times. Surprisingly he argues that time, unlike space, is unitary, that there can be only one time. But the same dream argument can be applied to time as to space and, unlike Quinton claims, but as philosophers subsequent to Quinton sometimes correctly claim (Swartz, 2001), there is no reason why the two regions of time need be connected either! This is because when Quinton's hero, according to Quinton, keeps a diary 'At the beginning of day 1 in England I write down in order all the lakeside events I can remember. On day 2 in England I cannot remember whether the events of day 1 follow or preceded the lakeside events in the list. But the list will be there to settle the matter and I can, of course, remember when I compiled it'. How does Quinton's hero know that he is writing down memories (of past events) and not precognitions (of future events)? I'll specifically quote Swartz here 'No mental phenomena carry with them an identifying mark of memoryhood. Some of the things we think we recall never happened at all, yet introspectively these thoughts (images, beliefs) are indistinguishable from genuine memories. Merely being memorable or, more exactly, having the felt quality of a memory is no guarantee of the truth of that which has that quality. Our mental faculties can be faulty or deceived. We can believe that we remember events and it turns out that these events did not occur, and similarly we can fail to remember events that did occur. That a thought or mental image is really of a past occurrence and not perhaps a precognition of a future one is guaranteed by nothing in the thought or the image itself. The manner in which memories and precognitions present themselves to consciousness seems to be all of a piece. To learn that a memory-like thought is really a memory and not a precognition we must depend ultimately on objective criteria and more exactly on physical criteria.'

Now that is, very briefly, Swartz's approximate argument and whilst there may be philosophical problems as to what we can reasonably consider as a physical criterion and what as a mental criterion, that is Swartz's argument as it stands and it could be amended further if we were desirous to do so. As Paul Churchland (1985) points out, for instance, precognition is occasionally cited in favor of dualism. Be that as it may, the argument does show that we cannot therefore logically infer that there is one unitary time but not one unitary space and Quinton's argument as amended shows that neither one unitary time nor one unitary space is required. We could say that modern string theory would presumably not object to that idea anyway but it would be naively accepting to accept use string theory simply on that basis, particularly after the work of Woit (2006), Smolin (2006) and others and we most certainly cannot accept all the wild and woolly dictates of string theory without useful qualifications. Indeed we may not well wish to support string theory at all.

### **How to relate these views to Cognitive Science**

At the moment, perhaps the most popular philosophical explanations for cognitive science and mental phenomenology are dualist and of a physicalist or functionalist nature,. However the currently most plausible explanation may be Velmans's reflexive monism (2000 et al).

Jeffrey Gray (2004) pointed out that functionalism will not work, as conscious states cannot be identical to functional states (Note 1). He cited synaesthesia as synaesthetes can apparently instantiate the same conscious state type without instantiating the same functional state type. As he pointed out to me during a meeting in December 2003, he only needed to find one such type of case, or indeed technically only one case, to disprove functionalism per se. Functionalists can claim, of course, that synaesthetes do not experience the same qualia in the two functional states or they could adopt a supervenient functionalism or something else. There is an element of question-begging to such contrary arguments and whilst there are several such possibilities, then reasonably assuming Gray is correct (Note 1), the fabric of functionalism is wearing thin to the extent that simply because of Gray's work it is becoming more practical to consider, for example, Velmans's reflexive monism instead.

Velmans (2000 et al) has given many cogent reasons in favour of reflexive monism anyway and reflexive monism is not thrown over by synaesthesia considerations.

Kihlstrom (2002), (who by and large supports Velmans's views), makes a number of points about the placebo effect. Kihlstrom mentions, with examples, the fact that placebo results must be taken very seriously. Indeed it has been said recently (Hislop, 2006) that the placebo effect helps the UK National Health Service to keep alive, partly due to the ability of the NHS to refer its clients to 'alternative' (and often absurd) practitioners. Kihlstrom himself suggests that the placebo effect may work by allowing conscious beliefs to alter bodily states and implies that work like Velmans's may provide part of the clues to this. My own experience in altering my own pulse rates and so on by using biofeedback suggests that whilst such factors undoubtedly exist and may indeed be highly beneficial (Note 2), that there is much more hard science required if we want to gain a thorough understanding of such effects though Velmans's work may lead to steps in the right direction. So there are results that scientific experience and not just probable illness remission rates but immediate experiments with a pulse rate monitor make clear. Clearly physicalism sounds as if it ought to be a worthwhile and sensible explanation of mental processes but reflexive monism seems to leave more opportunities for investigative progress.

### **How to relieve an Angst-ridden world of the problems of McTaggart**

Following the theme of the introductory section, we do want to relieve everyone of the Angst that

McTaggart's ideas seem ineluctably to lead to, just as Einstein relieved the world of Buber's Angst, and as we mentioned in the section on Quinton's work, a sort of 'precognition' might be definable in terms of our new and less Angst-ridden description of physics. Now 'precognition' or if we want to call it that 'presentiment' is a very popular (or populist) notion but one that is, for very good reasons a notion which is almost anathema to current highly respectable physics literature (Note 3), though not to the philosophy literature to the same extent. Precognition served as a useful tool for Swartz in his comments on Kant. So does precognition fit neatly into our program, or perhaps more to the point, can the concept of precognition enlighten us as to the possible direction of any programme? Can precognition at least serve as a torchbearer during a relay on the long road to enlightenment?

As I mentioned in the last section, Paul Churchland (1985) pointed out that, for instance, precognition is occasionally cited in favour of dualism. Now today when we think of dualism we may want to cast the net somewhat wider than that if we can, and indeed the obvious approach to consider may well be the reflexive model of Velmans (2000,2006), and that or something like that seems worth considering. In the sections below we attempt to follow Velmans's approach.

Much of the comment in this section is mine, and - at Velmans's request - should not be attributed specifically to Velmans except for comments which actually occur specifically in his own work as it is important that he should spend his time answering objections to what he has actually said himself wherever possible.

As Velmans (2006) points out cogently, ideas like his about the spatially extended nature of the experienced phenomenal world 'fit in with common sense and common experience and they will come as no surprise to those versed in European phenomenology have many theoretical antecedents ... for example in the work of Berkeley, Kant, and Whitehead, the neutral monism of James, Mach, and Russell, and the scientific writings of Köhler and Pribram'.

Now to test this to see how it works out: I won't repeat the exposition of Velmans (2006), (which is also referred to in Velmans (2000)), but Figure 1 of Velmans (2006) describes dualism, Figure 2 describes reductionism and Figure 3 describes the reflexive model. In the reflexive model, and there is a dynamic interaction between the observer and the observed.

In dualism (Figure 1) a percept simply occurs in the mind. Precognition can be incorporated by leaving it open as to what goes on in the mind of the individual, for example they could be mentally incompetent during an imagined or real precognition experience.

In reductionism (Figure 2) it is (normally) argued that the percept in the brain is simply a function of the brain and whilst it is separate from the brain, it can still be described in a way (straightforward in principle scientifically) in terms of what goes on in the brain. So the same position arises for precognition. Neuroscience can show that it may occur in the brain, for example due to mental incompetence or possibly simple lack of understanding or naive behaviour.

Velmans justifies his reflexive monism (Figure 3) and points out that it has falsifiability as well as reasonably claiming that physicalism lacks it. Also, he takes pains to point out that he is not an epiphenomalist. These matters are covered in some detail in Velmans (2000, 2002,2002a).

Before we go any further I want to make two points.

1. Velmans M., (2001a) states 'Definitions need not be final for research to get under way. It is enough that, for given investigative purposes, definitions are sufficiently similar for different investigators to be able to agree that they are investigating the same thing. As science begins to unravel the causes of consciousness ... and so on'.

2. Velmans (2001) says, whilst describing a discussion with Dennett 'it does not follow that conscious qualia have no useful place in "first-person" accounts, nor that they do not exist.' This would seem to be a position retained to the present time in using the reflexive model and so we may still use qualia to consider such reflexive models at least for explanatory purposes.

On page 240 Velmans (2000) suggests that attentional processing is closely related to consciousness so that the contents of consciousness become a kind of "psychological present" which is immediately accessible for processing, including the relevant sections for current action, suggesting that input analysis becomes conscious when its products are being disseminated. In my view, consciousness of the past may be through some kind of long term autobiographical memory and consciousness of the future by some form of speculated brain-computer interaction or through a brain mechanism related to planning and evolving which could contain a series of explicit or implicit rules and interactions, such as the saw "red sky in the morning, shepherd's warning, red sky at night, shepherd's delight". I am currently exploring and trying to more clearly delineate other possibilities of 'consciousness of the future' in my blog at <http://ttjohn.blogspot.com/> and of course the largely populist idea of 'precognition', which has some theoretical philosophical force (e.g. Churchland, 1985) still occurs. Much of what is perceived by the brain is known not to be overtly conscious. In some cases attentional processes are partly dissociated from consciousness, and in such cases perception and how it could be occurring can often be measured or noted, as in blindsight and dreams. So we may be already getting somewhere near where we may be able to consider empirical problems and not conceptual problems, indeed 'easy' problems rather than 'hard' problems. And indeed Velmans says essentially that on p241.

If we wished to describe the consciousness of one individual at one time, for example, we could have a narrow attentional section at about that time, an at least partly autobiographical past section and a 'possibly speculative' future section, not just a single dot. The unconscious section would be far more complex and certainly we do not know it all at this time. We are not talking here about the physical state correlates.

By the time he gets to p243 Velmans in fact points out (indeed re-iterates as he first said it in Chapter 1) that each individual has his own consciousness. Thus each individual has his own past-present-future and to conflate each and every individual's past-present-future is not a recipe for accurate physics! In short, the space time cones which relativity uses are actually not good enough to use for a number of people interacting or just existing. Certainly we can treat the people as if they are inanimate objects (who can for instance signal mechanically one to the other) but we must not confuse this with an accurate physical (or NCC) picture involving their own thinking. In a subsequent section I will try to indicate how this may be done, however.

It certainly is possible to lay down the mathematics but it does probably require each individual to have at least their own past-present-future (PPF). Clearly there could be similar looking regions in various people's PPF and these could be possibly approximated to carefully using category theory. An analogy might be the common symmetry structures of models of benzene with and/or without sidechains, for the purpose of bulk determinations like UV spectroscopy. But Velmans carefully distinguishes the cat (of his example) as seen in the brain (which for the subject is the 'real' cat) from the NCC which occurs in the brain. It seems to me that the 'real' cat contains the qualia whereas the NCC are an objective map. We can deal with either, and the NCC will, we presume, be relatively observer-independent but the 'real' cat as observed will vary a lot from subject to subject. So we now have the added complication of TWO plans or maps.- the very likely relatively invariant NCC map and the subject-'real' map which will alter from subject to subject., This subject-'real' map could possibly be approximated to however, in the way just described and then may seem more like a NCC map.

I am not sure that Velmans's wave/particle duality comparison (on p250) can be pursued as other than an analogy and I think the whole reflective monism description is best described in category theory terms rather than initially as quantum mechanical terms, as the effect may well not even need a quantum mechanical explanation. Effects such as the Kanisza triangle and other optical effects such as the well known line drawings of cubes with a corner which seem to stand inwards or outwards from the page almost at random, may be helpful in describing what is happening. These effects are so far more commonly personally observed rather than automatically through NCCs (though the effects could be simulated by a computer, they would generally have to be very contrived for simulation). It seems to me, also, that the 'unconscious' effects (page 253) which Velmans considers are allied to the conscious subject-'real' world may have to be allied to the subject-'real' map though would clearly not appear in the subject consciousness, as they are unconscious. So now we have at least the following items to consider.

1. The cat as consciously perceived by S (in Velmans (2000), fig 6.3 or Velmans (2006), fig 3)
  2. The NCC of S (in Velmans fig 6.3)
  3. A mapping of the cat in #1 (One such mapping would literally be the picture of the cat in figure 6.3)
  4. A mapping of the NCC in #2
  - 5 A mapping of the conscious and unconscious perceptions of the subject S whilst the subject observes the cat.
- It all sounds worse than the Danzig corridor and the 'corridor within a corridor' but it probably cannot be helped and the functors need to be considered in detail also.
- We also have
6. The cat as it is generally understood objectively
  7. A mapping of the cat in #6.

and mappings being what they are, there are probably others as well. We may wish to assume that #4 does not need a further mapping of "the NCC as objectively understood" and so on.

On page 253 Velmans gives a plausible enough 3 step solution of his own 'causal paradox'. Importantly he points out (page 277) that in his scheme 'consciousness is the creator of subjective entities'. We are quite happy that Velmans insists on the inclusion of a large number of subjects as individual parts of his overall pattern though he himself feels that some philosophers may find difficulties with it. Mathematically it looks no worse in principle than accounting for individual particles of differing structure in a Boltzmann gas. Though we may for example have to have two categories (say, MacA and MacB) to account for and this fact in itself concretises the system as a possibly conscious one, as it can become conscious once it transcends punctal time ! Without such transcendence, #1 and #3 above will not contain adequate factors to describe human consciousness. We know that humans certainly do not observe time as punctal and any physical representation of consciousness, such as the spacetime continuum of Einstein, is thus suspect in terms of 'brute fact' or simply carried out observations! Psychologists today seem to want to exhibit a form of scotomisation and refer to 'human time' as 'specious time' but it is still a clear attribute of consciousness. It may be that other factors may later have to be added, but these have not yet apparent and the scheme can be altered to fit them. We really want to keep it as simple as we can.

As Velmans points out on page 278, 'if all humans were removed from the earth, only a mechanical earth without consciousness would remain'. It is essential that an earth with humans should have a different description to an earth with humans, or the physics would be wrong. We could of course generalise the above statement, if we needed to refer to 'an earth without life in any form'.

So we certainly include factors here which should make the physics better than simple Einsteinian physics, include human beings and sort out MacTaggart's paradox. That is not to say that we have

gone far enough yet but it looks like a fairer starting model than we presently have with the efforts of Einstein and more contemporary thinkers. Velmans ends his book by fairly quoting an apothegm of Jung 'man is indispensable for the completion of creation - in fact he is the second creator of the world, who has given the world its objective existence' and we know that Velmans's basic ideas tend to agree with those of Sri Aurobindo (Velmans (2000), p167).

Crucially, unlike the variants of physicalism and functionalism defended by Torrance, Van Gulick, and Chrisley & Sloman, the reflexive monism of Velmans also conforms closely to the evidence of first-person experience and it thus suits the present category-theoretic formalism.

### **Neurophenomenology and Category Theory**

The term 'neurophenomenology' was coined 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**

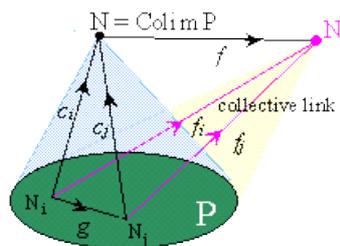
Brown has the enthusiasm to realise that category theory is good stuff. Now, for us to do what we want, we may not need to go quite so far as he does. We only need for the moment to consider an approach somewhat like that of the Ehresmanns. I append two diagrams from the Ehresmanns' study (Ehresmann, 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  $N_i$  and of some distinguished links between them. A collective link from the pattern to another object  $N'$  is a family of individual links  $f_i$  from each  $N_i$  to  $N'$ , correlated by the distinguished links of the pattern, in the sense that, if  $g$  is a link in P from  $N_i$  to  $N_j$ , we have  $gf_j = f_i$ .

The collective links model collective actions (constraints, energy, or information transfer) of all the  $N_i$  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 ( $c_i$ ) from the pattern to N,
2. each collective link ( $f_i$ ) from the pattern to any object  $N'$  binds into a unique link  $f$  from N to  $N'$ , so that  $f_i = c_i f$  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.

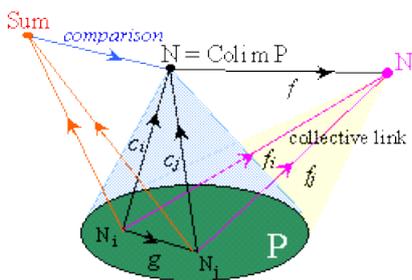
The colimit actualizes the potentiality of the objects to act together in a coherent manner by integrating the pattern in a higher unit (for example, the protein as such). In a natural system where the links have a given 'strength', the formation of a colimit is characterized in two ways:

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  $N_i$  of the pattern, obtained if the links are forgotten, which is modeled by their sum.



The sum (or coproduct)  $S$  of the family  $(N_i)$  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  $N_i$  to the colimit  $N$  of  $P$ , which binds the canonical links from the  $N_i$  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  $N_i$ .

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  $C_p$ , 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.

### **Brief Non-mathematical Explanation of use of Categories here**

It is important to note that there is no simple mapping between such a structure as MacA (which has a clearly defined mathematical meaning and could perhaps be regarded as our "A series") and linear time, as normally described in relativity theory or in ordinary Newtonian physics, which could be described as a "B series" or MacB, a different category. Here we can try to incorporate all the important properties of a McTaggart A-series in our model and all the important properties of the McTaggart B-series in a relativistic or Newtonian model and we find that while some sort of mapping between the two is of course perhaps possible (just as pretty much any two finite things can be mapped to one another) it would be an odd and confusing many to many mapping and its possible creation should not offend the McTaggart 'paradox' nor imply that time is unreal per se.

Interestingly enough, our A series model also corresponds to the sort of thing we would expect of living systems. This does not of course presuppose that it is suitable for cell structure for example. But it looks like there could be at least two suitable models, one good for cell structures and one for specifically mental (consciousness) models and whilst these could overlap or even be identical or hierarchical, they do not have to be and we can still flesh out the mathematical bones of MacA as adequately as we wish or desire. In no way do we require, or imply, a TOE !

I hope I have made the above clear so far.

At the bare bones level, as an illustration of the above, we could consider a house and a car to be mappable onto one another but that in no way renders the two as equivalent concepts. Assumed equivalence between a house and a car, per se, would not normally need to be anything other than a philosophical and logical muddle in commonsense cases of paradoxes in the real world. We would not, for example, normally live in a car or drive a house (though both have been seen). In the same way we would not normally try to map the A series (with a more or less precise mathematical description now, somewhat like a car has a more or less precise description in terms of say size, colour, speed and the like) onto a house, which also has such a description with significantly different details. Sometimes of course we might map a house onto a car, for example if we thought of purchasing one or the other. In that case we would presumably map the prices and mortgage payments of each vis-a-vis the other, and possibly vis-a-vis our net salary as well. But in other than very carefully chosen and designed special cases like that, we could not normally expect anything other than confusion if we try to map at a useful level of detail, the A-series onto the B-series as both manifestly have more complex and varied and fundamentally different features than a house and a car.

Anyone still not convinced by the argument could consider the inverse situation where we consider the A and B series to be essentially (roughly) the same, to the extent where one can be mapped roughly isomorphically to the other in the way that McTaggart seems to want to contrive.. But this would mean on a routine basis we could take a house and a car to be the same. Perhaps the fact that we perceive differences between the A and B series has something in common with the fact that we perceive differences between objects in general. The common denominator could in this case be downward from time to object perception, and not up from object perception to time. Perhaps McTaggart's greatest achievement was to show the two differing facets of time when there was (in his day, or indeed properly at all until category theory was developed) no simple mathematical description of the differences between and innate complexities of the two aspects of time which he

had claimed existed. McTaggart himself of course, did not fully appreciate what he had done and had taken instead the idea that it proved the unreality or nonexistence of time, a very natural conclusion perhaps, in those days of lower mathematical sophistication. The development of these mathematical features, using category theory, is given here. For example: At a stroke, we may have removed many of the very real problems with relativity theory that many people, Prior in particular, had noted. This is because we normally admit in such cases, separate and distinct categories for A and B series.

The important point now is that by using category theory, we have put some mathematical flesh on the bones of McTaggart's A-series. It is also implied that the A-series could be of particular significance in determining the details of the mind and consciousness. This would even be the case if we happen to espouse physicalism, but it would still be of significance for reflexive monism. There certainly is no reason why other categorical interpretations can not be set up but here we have kept to past-present-future and earlier-later cases. To avoid the paradox, these have to be separate.

We now could compare with Isham's or Gout's different work, or for that matter Ronald Brown's work but we certainly do not require exact correspondences with any of these.

We want to stick, where possible, to the conventions of Lawvere (2005) and in due course may be making use of the computer program (Graves, 2002) for some of the mathematics. This of course does not foreshadow any extreme philosophical representations, such as the 20th Century notion that the human brain can be (or can't be) replicated in a computer.

Some ongoing experiments and further work are given in my blog, <http://ttjohn.blogspot.com/>, which also gives details of my website, email address and egroup.

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### *Notes*

1. My results and/or comments on synaesthesia suggest, on the basis of a considerable number of interviews with, readings of records of opinions of and conversations with, and actual tests carried out by me on some of the synaesthetes considered by Gray, and others, that even after MRI investigations, the precise scientific standing of the phenomenon is still unclear. Only two reasonably well authenticated cases of 'pop out' for normal subjects are known, for example. Generally speaking, most people who have studied the phenomenon agree that there is some sort of real effect but the exact nature of the effect needs more work.

2. There are references as to the positive effect of the mind on bodily effects in Kihlstrom's paper and indeed throughout the literature, for example Sudsuuang (1991) and many other papers. But *nota bene* that at the time of writing this paper, no details in [www.clinicalevidence.com](http://www.clinicalevidence.com) (Tovey, 2006) seemed to show that biofeedback actually cured illness or ameliorated pain on a relatively certain basis, by statistically adequate trials. But the physical effect mentioned in the main text here certainly exists and can be measured.

3. This short paper will not intend to outline the reasons for this - as an analogy, think of previous "discoveries" of "low temperature nuclear fusion" to obtain the kind of problems which could be needlessly caused to the establishment.

4. At times the conventions of "Basic Category Theory for Computer Scientists", Pierce B.C., (1991) may also be needed. But I am trying to keep it all as simple as I can and obviously other textbooks by authors such as Barr and Wells, Awodey, McLarty and MacLane may be needed at times.