

Conscious Events

By Dr Steve Brewer November 2012

Abstract: This article explores how a scientific understanding of the origins and evolution of our highly developed embodied conscious minds can be informed by the application of some concepts derived from the process philosophy of A. N. Whitehead.

“I will show you fear in a handful of dust” T.S. Eliot The Wasteland

How can a handful of dust and a few buckets of water become conscious? The way dust and water were transformed into life is pretty well sketched out, but it's our conscious mind, this being there in the thick of a flood of emotions; this is the big problem that science has so far failed to explain. However, science believes it has eliminated another problem, the one created by the traditional view that the body and mind are two entirely different substances. The problem, as pointed out by Descartes, was that this would require some means for both body and mind to be brought into contact with each other. His solution was to use God for this role, a sort of detergent to help oil and water to mix! Our scientific solution, saving God from this rather menial task is to argue that mind is not a separate substance at all. It is a product of living bodies and consciousness some further development of mind. The conscious mind is embodied, so there is nothing to be joined and 'problem solved'.

On face value this seems a good solution, but unless stones have minds and boulders are conscious, we must also conclude that bodies can exist without minds and very likely minds can exist without consciousness. The scientific answer is that the embodied conscious mind emerges only from the particularly complex form of matter that makes up living bodies. The problem is we are now left with two mysteries to explain; why, at a certain level of complexity of matter a mind should emerge, and why at a certain complexity of mind, consciousness appears. A waving of hands and the statement that these are 'emergent and unpredictable properties' is not an ideal solution. Instead, it would be much more convincing if we could show that conscious minds are a necessary consequence rather than an accidental property of highly organized living bodies. But to do so is to support the apparently ludicrous

thesis that the very dust from which our body is constructed also contains the elements required to bring our conscious minds into being. This is indeed the thesis I'm going to support, but before you start committal proceedings, the argument I am going to make is based on those of a well regarded philosopher-mathematician A. N. Whitehead, and his metaphysics, *Process and Reality*. I realize that there will be those who maintain that his metaphysics has nothing to say about science and science has no interest in philosophy, especially metaphysics. I dispute this attempt to put up boundaries between the two and I hope to show you how in this case both can inform and enrich each other.

If I am to take you with me on this argument, then you are going to need to know a bit about physics, chemistry, information science as well as evolution. The main text contains everything you need to know in order to follow the argument. The boxes, however, are for those who need some further justification for the rather broad brush strokes I have used in the main text.

Dynamic Dust

So what is this the nature of dust from which our living conscious embodied minds are constructed? The message from physics is that all matter, whether living or not, is made up of particles composed of various dynamic forms of energy. The particular particles used to construct our embodied minds are the elements carbon, oxygen, nitrogen, hydrogen, sulphur and some minerals. Thanks to another particle called the electron, these elements can combine into an almost infinite number of organic (carbon based) molecules. These electrons hold the system together by forming into a unifying cloud of electronic energy (see Box 1). If this cloud intercepts other electrically charged particles, such as another stray electron or a photon of light their energies combine.

What happens next is that sooner or later the combined energy must be released or used in some way. When a red dye is bombarded with white light, only the red light is re-transmitted. The structure of the dye itself remains unaltered since the energy from the other colours is dissipated as heat. In contrast, when the energy of a free electron combines with this dye, the product is a highly reactive 'free radical'. This can cause a whole chain reaction of chemical events leading to its disintegration. This is why colours fade.

Now the point of this chemistry lesson is to get you to see these molecules as tiny processors of energy. These form part of an energy transmission network where the energy released from one processor will be transmitted to another, processed and retransmitted. I'm doing this because I want you to join me in a leap from chemistry to information science. You will notice that if instead of molecules I say 'information processors', and the particles they process 'bits' of information, then the whole system becomes an information processing network. The molecules sit at the nodes, and the information bearing messengers flit between. You might think this to be a ridiculous leap of imagination, but for a number of reasons physicists now consider energy and information to be the same (see box 2). When you adopt this perspective, you begin to see how information processing nodes can evolve into our own highly advanced embodied minds.

Evolving clever embodied minds

All the information processing described above is a totally wasted. Nothing constructive gets done with the signal and any output is simply lost in a random noise of responses. What we need is to bring order to this disordered mix of simple processors. This is where Darwinian evolution comes into play although with a new twist; we are now evolving tiny information processors to form ever more intelligent embodied minds. The cleverness is still about out-competing your rivals for food and reproducing yourself, so we aren't altering the process of evolution, but we are giving it something it's always lacked; a direction towards intelligence. It's now survival of the cleverest and reproduction of the most resourceful. The result is that after 2 billion years of this Darwinian process, we are now surrounded by a plethora of embodied minds at various levels of mental complexity (see box 3).

Human embodied minds seem to be pretty much at the apex of this evolutionary process. What is important, however, is that the seeds of our embodied minds were there in the structured forms of energy from which the universe itself is constructed. Just as there can be no form without energy and no energy without form, there can be no mind without body and no body without a mind. Thus the enormously complex bodies we find with living systems must also contain extraordinarily complex minds to keep it all functioning. So we can see how our embodied minds can emerge from the most basic energy-information processing structures found in the universe. No mysterious new entity or force needs to be added

to those already present when the universe came into existence some 14 billion years ago.

Conscious events

You might think you can see where this is going; the mind is some form of highly advanced information processor formed by the necessity of survival and reproduction. But you philosophers will point out that if this is so, all we have described is an advanced calculator. We still haven't identified the origins of consciousness itself, our feeling of 'being in the world' and all the emotions this entails. To do this, we need to emphasize another essential component of the information-energy processing molecules described earlier. To bring these processing nodes into operation, an external event is needed. Without such an event, it does nothing other than maintain an internal state of balance. The event disturbs this balance; it 'goads' it into some form of reaction. My contention is that the basis of consciousness is to be found in such event based disturbances.

When seen in this light, our advanced embodied minds forged by natural selection are able to intercept a vast array of vital information in the form of sight, sound, touch and smell. To cope with this vast data input, our embodied mind is organized into a hierarchical system. Skin, eyes and noses are all part of this system. Each part plays its role, responding to events in terms of suppressing, comparing or amplifying a response. From the humblest chemical receptor where signals are accepted to the neural networks found in the brain, events must be evaluated and because of the accumulated energy associated with this information, some form of output must be made. We feel these effects as an emotionally charged presentation of the world enhanced to emphasize features key to our survival and reproduction.

These enhancements to the incoming data often appear as properties of objects we find in the world. This happens because as the internally processed events get passed on, they still carry information concerning their origin. As a result our internal valuations can be projected back onto their sources. In this way the world is 'coloured' and made ours. It was the realization that these properties of things were generated by mind that caused sceptical philosophers to doubt that we could ever know the real world. Admittedly before processing, light possess no colour and chemicals aren't sweet. These enhancements are determined by the actions of our embodied mind with the aim of providing information so that we can take appropriate

responses. What is important to realize is that since the mind is embodied in the world, everything it perceives is derived from real events caused by that world. That of course isn't to say that such a complex system is not prone to error. But these will be down to the incorrect projection of a chain of energy-information processing to the wrong sources, with of course potentially deadly consequences.

The overall effect of the massive input of energy transmitting events is that our bodies are continually forced out of equilibrium. Our embodied minds are held in a state of excitement as trillions of events are received and processed. Physically it means that we exist on the edge of destruction and the system needs continual maintenance. We are forced to seek food not only to reproduce but also to maintain the system. These excited states are experienced as powerful emotions that swell and subside according to the strength and valuation of the inputs. We might be able to suppress some higher level responses but lower level sub systems are continually monitoring environmental events. If necessary their increasing energy will force them to the forefront of consciousness so that instead of the energy being dissipated as heat, it is released into physical action.

Just as our embodied minds have their origins in dynamic forms of energy our consciousness has its origins in the necessity of these systems to respond to the disturbances caused by exterior events. Our highly advanced consciousness is not a mysterious new entity within the universe, but it's how it feels when the information-energy disturbances generated by integrating trillions of tiny events must be released as some form of action. In this way, consciousness is not experienced as a state of being, but as a perpetual becoming.

Philosophy of Organism

This explanation of the origins of our embodied consciousness is inspired by the philosophy of A. N. Whitehead. By bringing together the concept that energy and information are equivalent with the evidence that substances are discrete forms of energy, we see physical substances are also information processors. The fact that energy gets transferred between these discrete energy systems, and energy equals information, means we can also describe the universe as a network of information processing nodes linked by the transfer of data. I believe this corresponds to Whitehead's description of the primordial state of reality but made more intelligible to the scientific community by presenting it in the language used by modern information

technology. But for our enlightenment trained minds, the concept that such a system also contains the elements of a primordial consciousness, often termed ‘panpsychism’ is likely to cause instant rejection. My solution to this is to interpret a conscious event in terms of computer programming terminology where any input, such as pressing a key, is an ‘event’ that gets handled by autonomous programs called ‘objects’. In both cases, this is the transfer of energy and information into a processor that demands a specific action to be taken. By seeing this primordial consciousness on the same level as a random series of ‘key press events’, I hope to help the scientific community over this ‘panpsychism hurdle’. Once we can do that, it’s easy to see how the organization of vast numbers of such molecular scale processors by Darwinian evolution can lead to a level of consciousness we experience.

Finally, by demonstrating that science can still be informed by metaphysics, I hope we can re-establish the enormously productive interplay between these two great disciplines.

Box 1

Particles of energy

Particle physicists have produced substantial evidence that all matter is composed of various combinations of elementary particles. Some of these provide mass and others transmit forces gluing them together into larger super-particles. The proton is one such super-system (composed of 3 quarks and a gluon) that is both positively charged and remarkably stable. Together with the much less stable neutron these two sub-atomic particles make up the compact atomic nucleus of the chemical elements. The chemical properties of the elements depend on how many protons their nucleus contains. For example, one proton makes the gas hydrogen, and with six protons you have carbon. The reason why protons are important for chemistry is because they attract negatively charged electrons, one for each proton. The electrons occupy a series of energy shells around the nucleus, the shape and capacity for electrons being defined by quantum mechanics. This means that depending on the number of protons in an element, some of these shells have spaces for electrons and others an excess. The energetics of the system means that each shell needs to be filled with electrons. One way of satisfying this requirement is to share electrons between different elements. Given the number of elements, there are a vast number of ways

this state can be achieved. It is for this reason that our world is composed of such a diversity of chemicals in such a range of states.

Box 2

Energy equals information

The concept that energy and information are the same is a rather more subtle change in the way physics views the structure of the universe. For our purposes, we can use the fact that energy is transmitted as packets (or quantum) of energy, not as a continuous stream. Now view the smallest energy packet needed to excite the electrons in the molecule as equivalent to the smallest amount of information called a 'bit'. This bit will have sufficient energy to switch the molecule from the 'off' (ground state) to the 'on' (excited state). The molecule will need to do something with this energy so that it can return to the ground or 'off' state. This is the processing step and the nature of this depends on its electronic structure. After this happens, the energy will be outputted in some way. This could involve re-transmitting it unchanged, or suppressing it by releasing the energy as low grade heat, or even amplifying it. Relatively simple chemicals with all these energy-information processing properties have been found in nature. Therefore, what we have at the basic level of the material universe can also be described as information processing nodes in an extensive communication network.

Box 3

Evolution

Before life itself started to evolve, there must have been an extensive stage of chemical evolution. This stage is thought to be based on an unusual class of chemicals called auto-catalysts. These chemicals are important clues to the origin of life because they also can transform chemicals in their environment into copies of themselves. The more they make, the faster they replicate, and the faster they replicate the more they deplete their environment. This is a chemical equivalent of the 'struggle for survival' required for Darwinian evolution. What is very rare is to find an auto-catalyst that occasionally forms non-identical products. This is essential for evolution because a faster auto-catalyst will out-compete the rest. In the laboratory chains of nucleic acids (molecules similar to DNA) have been synthesised that can do just this. When the reaction is started, the system will select for the most

efficient auto-catalyst and these will eventually come to dominate the population. The argument is that given the immense time-spans and the innumerable crevices and niches our world contains, the necessary conditions have existed to set this process of chemical evolution into motion. There are of course many gaps, but it is argued that further self organizing developments in special natural micro-environments will eventually lead to primitive cell based living systems. Such cells contain their own micro-environments and this allows them to spread out and occupy a wider range of environmental niches.

With living systems, information from the environment is no longer dissipated but integrated and processed with a purpose, that of survival and reproduction. Because there are so many ways to achieve this, all sorts of strategies are developed and the most efficient solutions to the problem found. The more complex the embodied mind becomes the more complex the environmental issues it can solve. Therefore Darwinian evolution is also driving embodied minds towards greater problem solving abilities and hence complexity and integration.