Anticipative Anti-Anti-Anthropomorphism

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Abstract
We argue that the evolutions of Anticipative Capability and evolution itself are broadly equivalent. Key to establishing this equivalence is the adoption of a viewpoint which rejects both 19th century anthropomorphism and late 20th century anti-anthropomorphism in favour of an anti-anti-anthropomorphic stance which presupposes the continuity of evolvability and AC between blind dependence on Newton's Laws and human technological control. We suggest that Darwinian Evolution is a late product of the evolution of evolution, and that the early random nature of evolution has been progressively modified towards a more directed anticipative form by first simulating Anticipative Capability – e.g. in amoebas and the Venus flytrap – then later implementing it – e.g. in insects and animals.
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1 Introduction

Anticipation is a comparative latecomer to considerations of evolution. The traditional Darwinist view is that mutation, reproduction and selection are evolution's primary components, and this characterizes evolution as a blind adaptation to environmental influence. While this view may have been defensible until the middle of the 20th century, technological, and most specifically medical developments have now placed all three of these components within the realm of human control, driven by anticipation as a prime feature of innovation. Which leaves us with the question "Has anticipation *always* been a part of evolution?" We accept that it is simpler to presuppose that earlier examples of evolution were purely random, for example that of molecular mutation in a primitive organism. However, if we go back beyond primitive organisms to interactions between inorganic molecules or atoms, even this supposition demands a strict categorization of nature into 'entities which are capable of some degree of anticipation' and 'entities which are not'. Disturbingly, such a distinction is so supportive of our collective ego that we must in all honesty question its applicability or validity.

History has been both fashioned and bedevilled by our human wish to be more important than our surroundings, to be like gods. The ancient Greeks were associated with various attempts to resolve this dilemma, most particularly those which relied on the mutually exclusive viewpoints of Plato and Aristotle. In the Middle Ages, the Christian church gained extensive control over European countries by supporting the

convenient view that humans were made in the image of God. During the 19th century, great debates ranged over the relationship between 'man' and 'nature', culminating in the idealistic propagation of *evolution* as a means whereby we could 'both have our cake and eat it': 'man' was descended from the 'lesser' animals, but stood far above them (to rather nicely mix metaphors). Attempts have even been made to explain 'injection' of 'the soul' into the evolutionary record – unsurprisingly *just* before humans appeared!

The 20th century witnessed two great globally-scaled wars. The first, the Great War, neatly split history into two parts. It began in an almost gentlemanly atmosphere of chivalry, of some kind of moral code and respect, but by the time it finished war had become an acceptance that 'the end justifies the means', within which *atrocity* is a category applied to an enemy's actions *alone*. The Second World War of the 1930s and 1940s had a more profound effect, however, on our relationship with nature. Necessity being the mother of invention, through this period war progressively changed its character from individual combat to technological conflict, and its progress and conclusion were driven by technical innovation, from the magnetron and radar, to liquid fuelled missiles, to Enigma and Colossus, to Kaiser and the Liberty ships, to heavy water and Los Alamos, ...

The immediate post-war period was one of elation and a belief that science and technology could resolve all problems. Although conflict between religion and science had been endemic for centuries, this was arguably the last nail in the coffin, and 'man' placed himself at the summit of all things, supported by Science, rather than by God. This egocentric position generated an anthropomorphic attitude with regard to nature, within which science confined itself to 'that which could be understood by reference to human analogue and logic', and eliminated the rest. Most noticeably, the prevailing outlook was that a single viewpoint is completely sufficient to understand our surroundings. This attitude eliminated the possibility of conceptual advancement in any domain which lacks organizational centrality, most particularly in that of living systems. Although the major control which had been exercised by religion had now diminished, constraints were reinvigorated by a new belief in the primacy of human scientific logic. Man was still the lord of all!

Towards the end of the 20th century, and especially with the inroads made into Science by chaos theory, 'we' began to relax our requirement for supremacy, and there was a concurrent upsurge in ecological thinking and the beginning of acceptance that humans are *a part* of nature, and not its regulator – much as quantum mechanics should have enlightened us earlier in the century. Adoption of this anti-anthropomorphic position, however, failed to completely remove the basic tenet of anthropomorphism, and '*man* versus *the rest*' was replaced by '*what is alive* versus *the rest*'. Given that we still habitually impose rigid mono-viewpoint logic on our surroundings, this should be no surprise. Even in domains which rely on multiple agents and their cooperative and competitive behaviours, we even now characterize success by extracting at every stage a single viewpoint which will enable us to 'see what is happening', and we presuppose that any system worth investigating can be dealt with as if it were in a state of near-equilibrium.

The position we wholeheartedly reject in this paper is that of categorical differentiation between 'what is alive' and 'what is not'. By adopting such an anti-anti-anthropomorphic position, we also automatically accept that at some point in our argument the distinction we simplistically observe between 'what is alive' and 'what is not' must naturally occur as a result of the properties of the various entities *in the context of their environments*.

But that is not all. A second automatic acceptance is that must expect anticipation to play a role at *every* level of natural organization, and *not* only within our human intellects.

2 The Evolution of Evolution

It is tempting to imagine that Evolution sprang into being in its conventionally 'understood' form from the moment that complex bio-chemicals appeared on the Earth. But this ignores the central characteristic of evolution – that, if nothing else, it epitomizes entity-environment coupling. Entities evolved; the environment evolved: should evolution remain static? Well, not impossibly, but that would rather stretch belief. More reasonably, we would expect evolution *itself* to evolve, especially within our chosen specification of anti-categorization. A standard reply to those who speak of 'evolution of a chemical system', for example, is "That is not Evolution"[1]. Granted, that is not Evolution, but it *could well* have been earlier in the evolutionary record!

Our supposition here will be that the form of evolution recognized by Darwin is a late evolved manifestation of an earlier process. This begs the question "So, by what means did evolution evolve, if Evolution was not available to it?" In our acceptance that anticipation plays a role at *every* level of natural organization this paper constitutes an attempt to answer precisely that question.

We maintain that the seeds of primitive evolution are still with us, and that they were recognized by Newton, although he described them in a way which was more consistent with an anthropomorphic differentiation between 'what is alive' and 'what is not. When two classical particles collide and rebound, each of them carries away with it some degree of information about their states before collision. But why do they bounce off each other? What else could they do? Merge? Pass through each other? But could they then maintain their identities? A vital part of Newton's propositions is just that: particles maintain their identities. Why and how do particles do that, unless by intention? Yes, ok, ok, this would be a ridiculous suggestion if we suppose a clear differentiation between 'what is alive' and 'what is not', *but not if we remove the categorization*! If we accept that there is no categorical difference between 'what is alive' and 'what is not', then our recognition of 'what is alive' becomes simply the observation of specific characteristics which are manifested above the threshold of our observational capacity. It is then not only evolution which is permitted to evolve, but *all* of the properties of natural systems, including anticipation.

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[1] In the text we indicate Darwinian Evolution with a capital letter, and more general evolutionary processes without.

So, are we suggesting that classical particles are alive? No, we submit that 'what is alive' versus 'what is not' is a convenient differentiation between observed systems, which supports the success of our own anticipative efforts to survive by limiting the number and kind of hazards we must take into account. We do not expect a stone to reach out and attack us. Our eyes have evolved to take account of just this kind of distinction, by concentrating on the detection of movement. Anticipation of inorganic dangers requires far less information processing power than anticipation of organic ones! But the argument goes far beyond that. Why does nature appear in such a manner that many difficulties can be easily resolved without overburdening our neural information processing engines? The key lies in understanding that relativity creates two opposing characteristics. First, it permits the localization of entities. Second, it removes the possibility of immediate inter-locational communication. This second result is a problem, in that it risks tearing apart the fabric of nature through conflict between the communicated results of processes which have occurred in different spatial locations. However, out of the many possible 'versions of reality' which comprise a 'universal phase space', nature has presumably evolved one within which inter-locational conflict is minimized, and where 'the local' and 'the global' correspond most closely. This is the phase which Newton recognized, where local and global correspond and the effects of relativity are reduced to 'small errors'. The reader should note that we are now even attributing evolution to the domain *within which* evolution and Evolution operate!

To sum up, we are proposing that 'evolution' is a part of all that we observe, that in all its occurrences it itself evolves, and that at all the stages of its various evolutions it is guided by its propensities, either by accident or design – by the apparent simulation or implementation of anticipation.

3 The Simulation of Anticipative Capability

Does a digital computer anticipate events for which it is programmed to react? Not at all. But it *is* capable of *simulating* anticipation. It seems likely that simulation of this kind appeared at an early stage of evolution. The 'simplicity' for a digital computer is to be aware of exactly what it is doing internally, at the level of its designed logic, at least. The difficulty for a complex organism, even a very primitive one, is to be sure that our understanding of its internal processes corresponds to those processes themselves. Is 'real' anticipation only possible in neural information processing networks, or can it feature in organisms lacking neurons? We do not know. But we should at least be *aware* that we do not know, and not presume that our models of internal processes are conclusive[2].

There are non-neural organisms which at least *appear* to exhibit anticipation. For the moment we will reserve judgment, and categorize this as *simulation*.

Albrecht-Buehler (1991) has demonstrated that individual mammal cells can detect a source of infrared light and extend new pseudopodia towards it. We would normally

[2] Even those of our own!

expect detection and consequent action to depend on neural processing. A great deal of recent research has indicated the importance of extensive sub-neural information processing. Reasonably, in a multi-cellular organism exhibiting cellular differentiation, it would be no surprise to find that some cells specialize in that information processing which is already inherent, and become neurons. This is yet another area in which we must beware of egotistically relying on previously accepted conclusions about the capabilities of complex systems.

Fast-moving single celled amoebas (e.g. *neutrophil*) are observed to hunt for food. Without neurons! Recent research has even indicated how they direct their movements (Gross, 2006). At the very least, this indicates the *simulation* of anticipation, if not anticipation *itself.*

One of the best examples of low-level anticipation is provided by cellular quorum sensing. This is the phenomenon where an accumulation of signalling molecules enables a single cell to sense the number of bacteria in its environment. It is particularly important for pathogenic bacteria during infection of a host to escape its immune response (see, for example, *quorum*, 2006).

The Venus flytrap *Dionaea muscipula* catches insects by rapidly closing its trap-like leaf structures, thus enabling it to then digest its meal at leisure. Is this directly anticipative, or the simulatory result of randomly adaptive Evolution?

We are here in the region *between* Darwinian and Lamarckian evolution. Can an organism by its actions or requirements direct its own evolution towards greater survivalist fitness? Darwinian evolution maintains that directive development is a fiction, the result of modelling which does not take account of the results of combining random mutation with environmental selection. But Darwinian evolution *does* simulate anticipation. Is that its *real* nature? Is it just the manipulation of anticipation into a workable strategy by entities which are not yet endowed with the conceptual power of consciousness? Later evolution, first of mammals and then of humans, finally brings the strategy to fruition in their capabilities to engineer environments and avoid future problems. Without anticipation, our species would most probably be brought to its knees by AIDS; and even though this possibility still remains, there is hope that the anticipative strategies of science may enable us to avoid that fate.

4 The Implementation of Anticipative Capability

The concept of anticipation is most usually attached to a presumption of conscious, intended, controlled action. Somehow, this capability has emerged 'from the slime' by evolution. A major difficulty in modelling evolution over its relevant timescale is the minimal probability of 'successful adaptation' at every step. Even if primitive cellular infrared vision provided some safety while more elaborate optical sensors developed, how did the elaboration of mammalian eyes come about? A presumption of Anticipative Capability in some form over the whole evolutionary pathway to some extent alleviates this objection.

Few would object to the installation of humans as the prime possessors of Anticipative Capability, but if Evolution has any sense this capacity must appear at least

to some degree in earlier mammals, and most probably in their precursors as well. Given that overt anticipation is a result of neural processing, it seems reasonable to attribute Anticipative Capability at least to any organism possessing a neural network – to insects, for example. Here again, it is difficult to differentiate between simulation and implementation, but that is the nature of our entire argument: evolution evolves *by* changing, and *to* change its characteristics and those of its products in the face of environmental influence.

5 Conclusion

We conclude that Evolution and the development of Anticipative Capability have evolved hand in hand, and that this symbiosis has facilitated the comparatively rapid development of the human species. An important part of this conclusion depends on rejection of both 19th century anthropomorphism and late 20th century anti-anthropomorphism in favour of an anti-anti-anthropomorphic stance.

Conventional wisdom points out the error of describing humans as being 'at the pinnacle of evolution', because evolution 'has no target', and that it would be justifiable on the grounds of DNA considerations to suggest that bacteria should hold this position, if it exists. The authors have no objection to either point of view, but wish to note that if Evolution and Anticipative Capability have developed symbiotically then *they are their own targets*.

6 References

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