A Tribute to Darwin: complexity and it relationship with evolution

(part of an editorial)

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Introduction

This year is the 200th anniversary of Darwin's birth and the 150th anniversary of the publication of Origin of Species. Just about everywhere you go at present there is something about Darwin or about evolution – on the radio, the television, special exhibitions, special editions of journals like this one. Why? Was Darwin so important? The fact that species evolved into each other had already been recognized – by his own grandfather, Erasmus Darwin, amongst other people. So what was so special about Darwin's contribution?

Darwin's great contribution was to develop a theory as to why evolution happened – a theory other than that evolution was God's plan for us to ascend the Great Chain of Being, as Erasmus had believed.

Darwin recognised the vital importance of variety – of messiness, fluctuations, imperfections, chance. This was a first in philosophy as well as science and captured the imagination of many scholars quite apart from the biologists. He saw evolution as proceeding via two steps; the first is that a variation happens – in an animal in a particular pond, or to a plant in a particular field. Second, is the process of natural selection; that is to say, the variation either fits well with the local environment (with the other species and with the weather conditions, food availability and so on) – or it does not. If the fit is poor, the slightly modified specimen will not survive, if it fits well – and better than any competing animals or plants that are there - then it may survive. Evolution is thus fuelled as much by what ceases to fit so well and dies as it is by what emerges.

Darwin's theory shows that change and the emergence of new species actually start locally – with one change to one animal in one pond. If the change is successful and the changed animal survives and breeds, then this change is carried forwards – and if these sons and daughters fit equally well in other ponds around and about, then eventually we may see a changing species.

Evolution, emergence and complexity

For science, Darwin's ideas are revolutionary as they throw in the air any ideas of predictability and certainty. They show that the way things proceed (i) depends in part on chance variation, (ii) depends on the order in which things happen – ie the path of history, (iii) starts locally, bottom-up. This is a very different image of science than embedded in our traditional, mechanical perspective. It intrigued Ilya Prigogine, a physical chemist working in the 1940s. He found an explanation for evolution and it was a very simple one, He recognized the critical importance of the fact that most things of interest are **open** to the environment and

can exchange energy and information and matter; traditional science makes the simplifying assumption that the system being studied does not interact with its surroundings.

Prigogine's work, for which he got the Nobel Prize in 1976, led onto the development of Complexity Theory. One physicist, Lee Smolin, has got so excited by this work that he believes evolution is **the** central principle of the universe and suggests that even the laws of physics have evolved, maybe through several big bangs and are not fixed for all time, as we like to think.

Complexity Theory adds a third step to Darwin evolutionary process and it explains why sometimes a small change can lead to a radical shift. It is called self organisation. Basically a small shift (variation) may cause existing connections to move around and reconnect in new ways; the resulting new form may be radically different from what was there previously. Then it is this new form that is open to natural selection. This process of self organisation provides an explanation for why we never see a 'nearly' eye or an 'almost' heart; it also helps to explain why evolution seems to happen in bursts – the so-called punctuated equilibrium identified by Stephen Jay Gould.

Evolution since Darwin

Evolution has moved on since Darwin's time in many ways; investigating DNA and genetics has allowed more information about the 'tree of life' – what was an ancestor of what. It shows, for example, that the eye was only ever evolved once; all eyes from all animals from the fruit fly to the human share similar genetic code. It shows that all 600 species of fish in Lake Malawi are in fact members of one species – despite their enormous diversity.

The fossil record is now more complete, with intermediate species between dinosaurs and birds found and several 'almost human' skulls. And living animals are testament to evolutionary processes; for example whales have an ankle bone similar to that sported by cows; koalas have a head too large for their brains – their brains reduced in size as thinking costs energy and you don't need much thinking ability to sit in a eucalyptus tree and chew! Equally, the peppered moth which used to be mainly white evolved to be darker so it would be camouflaged against smog-stained trees and then evolved into a paler form again after the clean air act.

Socio-biology, particularly the work of Edward O Wilson, investigates how social behaviour can be understood in evolutionary terms and emphasises that survival is really more about collaboration and interconnection rather than competition. Humankind would never have survived if we had not cooperated – so we could take on the lions and other fast animals and hold our own in hunting game.

So, what does all this mean for us?

Stuart Kaufmann is a Complexity theorist and he has considered in detail what emergence (the process by which new species evolve) means for us in our lives. Kaufmann's conclusion is that the spiritual - or divine - is an immanent quality in all things, rather than a transcendent

one. We – all that is here on earth and in the universe – build on the past yet co-create the future. So how we act, on what we focus, are themselves collective spiritual acts of creation.

The evolutionary principle shows that we must not assume the future is predictable – and yet it is not random either, but builds on the past. (We do not find new species sport three hands or fourteen fingers – patterns, once set, tend to sustain).; we must embrace diversity with all that means – in spiritual traditions, apple varieties, teams and economic strategies; we must recognise that evolution is as much about destruction and extinction as it is about newness – and not be complacent about the future of humankind or even about life on the planet. The evolutionary principle emphasises our part in co-creating the future; the future is not fixed, yet if things 'tip' or self-organise into a new order, there is no easy way back.

Evolutionary thinking has much too offer us as humans as we consider issues of social justice and governance and policy - but I can hardly emphasise too strongly that evolution is not anthropocentric; evolution is a dance – sometimes to the death - between all species and favours none. It encourages collaboration, diversity; it emphasises the importance of local holistic communion and of living harmoniously with the earth.