Fractal Adaptation

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   It is believed that life on earth has evolved through the **gradual unfolding** of successive phases of growth or development. Thus "evolution" becomes the general name for the history of the steps by which any living organism has acquired the morphological and physiological characters which distinguish it. Gradual unfolding implies that each step of evolution could and should be reflected in the fossil record. The supporters of this theory believe that these small steps are found in the fossil record and that there is no missing link in the evolution of species. But unfortunately the link between species, indicating a gradual and slow change, is generally missing. Furthermore some species have remained unchanged for millions of years.

   The main problem of this way of rationalizing comes from our preconceived idea of evolution. I am of the opinion that the term "evolution" is misleading and that **adaptation** is a better term for explaining the present situation. Adaptation means that there is not just a specific species to be considered, but instead a species **interacting** with its natural surrounding. Any living species (populations of interbreeding organisms) is bound to exist within a certain range of external temperature limits and certain feeding conditions. When the surrounding natural conditions change considerably the species must either change its surrounding by migrating to more amenable locations or become extinct. A third possibility is the sudden appearance of a new and better adapted generation of offspring.

   There are many species that migrate long distances twice a year. It is very possible that humans had also a similar way of life. During summer they moved, together with their herds and domesticated animals, to high pastures and as winter approached they moved back to lower and warmer plains. This way of life has been going on for several thousands of years among the people of Central Asia. Early humans survived in the cold weather by wrapping their body with animal fur. The control of fire and the protection from cold with animal fur have been the two main quantum jumps that prevented the homo-sapiens from being extinct.

   We are now in the position to consider the process of adaptation from a different perspective. In the previous chapters we saw that a single equation could reflect four different modes or regimes of existence. A small change in the *order parameters* guide the system into a **Stable** regime, a **Periodic** regime, a **Bifurcation** or a **Chaotic** regime. Each regime is linked to one or several

strange attractors (see article **11-Order and Disorder**). For many animal species the surrounding weather conditions act as a strange attractor and the temperature gradient becomes a guideline for their migration.

   Migration does not only depend on the climate, but it also depends on the food supply. Predators follow preys, thus the movement of prey animals becomes a strange attractor for carnivorous animals. Thus, a strange attractor does not have to be static but can also be dynamic. The relationship between a given system and its strange attractor may seem to be continuous, but in fact it is a discontinuous interaction that involves discrete steps. Each step is a ***quantum jump*** that results in a bifurcation. Quantum jumps happen at the microscopic level and are equivalent to ***quantum fluctuations*** that occur in the universe. The microscopic changes coupled to macroscopic adaptation result in creating different and better adapted species.

   According to Darwin's Theory of Evolution, animal populations have divided into different species over time and if we search far enough back in time, we will find that organisms share a common ancestor. For example, humans shared a common ancestor with chimpanzees about 8 million years ago, with whales about 60 million years ago, and with kangaroos over 100 million years ago. Shared ancestry explains the similarities that reflect the inheritance of traits from a common ancestor. Although this way of thinking is not wrong, it undermines the effect of the environment. The microscopic variations arise from mutations in the DNA molecule, activating a change of a certain macroscopic trait. It is the general belief among biologists **that *mutations arise by chance*** and without foresight for the potential advantage or disadvantage of the mutation. Although **mutations are quantum jumps that are initially random, they are organized spontaneously towards a definite goal**.   This goal is what is called "**existence**" for non-living beings and "**survival**" for living beings.

 Existence or equivalently survival is a group phenomenon. It can only happen through the interaction of a group with its surroundings. A single mutation will be wiped out easily and quite naturally. This will happen both at the microscopic as well as the macroscopic level. We know that the DNA has a certain capacity for repairing itself and random mutations are quickly phased out. On the macroscopic level an animal born with some different traits has a much less chance of survival than the one which has all the required traits of the group. This effect is linked to **natural selection** and is defined as the survival of the fittest.

   It is an error to think that natural selection happens as the result of selecting one species among many similar ones. Natural adaptation, rather than selection, is an interaction between a given species and its environment. When a certain critical point is reached, natural adaptation happens spontaneously and a rapid change in the population occurs, resulting in a better adapted group with different macroscopic traits.

   A good example is the sudden change of coloration in the peppered moth (Biston betularia) found in England. Prior to 1900, the typical moth of the species had a light pattern and the dark colored moth was rare. With the industrial revolution light colored moths became rare and dark colored moths became

abundant. This is because industrial wastes darkened tree trunks and killed off lichens. Light colored moths became easy prey for birds who could distinguish them from the dark tree trunk background. Adaptation, for moths, meant melting in the color of the background and becoming invisible. Thus, a sudden bifurcation happened in the genes of large numbers of moths producing a quantum jump in coloration. As the moths were threatened with extinction the color changed in a stepwise manner and dark colored moths appeared spontaneously. It is a well known fact that many animal species acquire the color of their background. Such spontaneous changes which increase the chance of survival, is observed in almost all animal species. This is what the neo-Darwinists call **Punctuated Equilibrium**.

   Punctuated equilibrium claims that there exists periods of little or no discernible change in a lineage of a given species. This period of stability is called a "**stasis**" or equivalently –as mentioned in my previous articles- a *stable state*. The concept of *stasis* is in perfect accordance with modern physical theories. We saw that a system which is attracted towards a *strange attractor*, experiences a sudden quantum jump at the critical point, which may or may not lead to a bifurcation. If the symmetry of the system is spontaneously broken, a new stable branch (stasis) appears at the bifurcation. Each new branch is a new stasis which exists in a punctuated equilibrium. This is what I call **Fractal Adaptation**. I am of the opinion that the term Fractal Adaptation is more informative than the term Punctuated Equilibrium.

   Below we see some mammals that co-exist even today as a result of Fractal Adaptation. They are not the result of slow and gradual evolution, but rather are the result of sudden quantum jumps occurring at certain critical points. They happen when some important changes occur in their natural environment. If the external conditions do not change drastically, the species will continue to exist without any apparent change in their way of life and behaviour.