

Chapter 2: A Point of View

Footnote: Genes of Consciousness

Does there exist, encoded within the living cell, a blueprint from which is constructed the conscious entity that becomes aware of its own existence? Or does consciousness, though functionally dependent on the physical brain, reside beyond the bounds of human perception?

The Material Universe

The material universe seems to be founded upon a set of dissimilar non-linear force-fields that interact through symmetries in the geometry of space-time to form complex resonant structures of standing waves. These are what we perceive as primary particles, which combine to form atoms, which combine to form molecules, which combine into stars and planets, which combine into galaxies and clusters. The myriad ways in which these standing wave-structures can form, change state, combine and separate is determined by what appears to be a set of rules that are known to us as the laws of physics.



The laws of physics form very strong attractors. These impose strict upper limits upon the permitted size and complexity of the standing-wave structures that we know of as particles, atoms and molecules.

For instance, the *lead* atom is the largest completely stable atomic structure. Atoms larger than this are unstable to a greater or lesser extent. They crack up under their own "weight". An atom of the largest element known so far that can strictly be called such, ununoctium, can't hold itself together on average for even one millisecond before breaking up. The attractors that govern atomic structure certainly prohibit the formation of atoms the size of golf balls, no matter how many zillions of years you may wait for such an event. Even if such an atom formed, its half-life would probably be less than a Plank interval, which would mean that it would never exist anyway.

Similarly, there is a limit to the size of molecules that can freely form within a chemical "soup" of whatever recipe, no matter what the ambient conditions. This limit is much smaller than many of the molecular components of life.

Consequently, the universe is, for the most part, made up of astronomical quantities of relatively simple structures. It is as if most of the universe comprises swirling masses of dissociated components that have never been assembled into anything of systematic complexity. They are like a hill of pristine bricks that have never been assembled into a majestic mansion. They are like a pile of nuts, bolts, gears and shafts that have never been assembled into a working machine.

Nevertheless, these simple atoms and molecules of the universe do possess the inherent potential *to be assembled* into life-forms. But they cannot do this under the direction of the laws of physics alone. They are bound by mathematical attractors that simply do not permit it.

The Web of Life



Part of the universe's swirling mass of dissociated "bricks" forms the thin atmospheric and oceanic mantle of Planet Earth. This is a churning complex-dynamical system of weather and ocean currents that forms a benign catalytic environment in which all the components necessary for building life can be readily found. But they are not life. The [giant leap from protein to bacterium](#) cannot take place under the laws of physics alone. Such a leap is way beyond the bounds of the mathematical attractors within which the Earth's biosphere is constrained to behave.

Consequently, under nothing more than the resident forces of nature, large so-called "organic" molecules like proteins can form, but not life. The laws of physics have neither the capability nor the motive to construct something as complex as life.

Yet we see the Earth's biosphere teeming with life in its myriad species. Each specie occupies its unique functional niche within the biosphere. All together, they form a highly interdependent web of life. Some people personify the life of the Earth's biosphere. They call it Gaia. I do not think of Gaia as a person. As far as I am aware, the Earth's biosphere is not conscious. It is an interactive complex-dynamical system of beings, each of which is intensely dependent upon all for its existence.

The terrestrial environment thus may be seen as the vessel within which the present Web of Life obviously took form. Its many species must have automatically moulded and shaped their environment into a labyrinth of niches, each ideally suited to support and sustain its respective populations. The life-niches of the Earth's biosphere thus form functional centres of attraction that are tuned precisely to support the various species that respectively fill them.

All species within the Earth's biosphere are intensely interdependent. No single specie can therefore be considered a self-sufficient system. Even the human can be considered only as a mere *sub*-system of Gaia. I readily perceive that as a human being, I depend for my very existence on what Gaia provides. I need to breath her air. I need to drink her water. I need to eat food she grows. She recycles my waste. She teaches and trains my mind. She inspires my spirit and breathes awareness into my consciousness. I, like any other life-form, am a mere component of her vast interactive web of life.

Adaptation of Species

Gaia is essentially a pumped complex-dynamical system. It is a system whose active elements are fluids (essentially water and air) in continuous chaotic motion. Its motion is powered by solar energy. This is delivered in a daily cycle superimposed upon an annual cycle that is rendered slightly more erratic by a monthly lunar cycle. It has innumerable other cyclic influences that work together to ensure that it remains benignly chaotic and never falls into a hard regular rhythm that could shake it to destruction. Consequently, Gaia is constantly in flux. Its configuration is continuously oscillating, swaying, expanding, contracting and pulsing. This causes the boundaries and characteristics of the various life-niches within it to wander chaotically, making random excursions from their nominal states.

The boundaries and characteristics of a specie's niche change over both time and space. The niche of a particular specie in a particular place changes its boundaries and characteristics over time. The niche of a particular specie also has somewhat different boundaries and characteristics in different places at the same time. To survive within its niche at a particular location, a specie must continuously adapt its own form and behaviour over time to follow such excursions. To survive

within its niche during migration to another place, a specie must continuously adapt its own form and behaviour to follow the way its niche varies from place to place.

Adaptation during migration over distance can be illustrated in principle by the way an intelligent machine adapts to a changing geographical environment. It can be programmed to change its profile and behaviour to accommodate changes as it goes. For example, a self-navigating unmanned air vehicle, can automatically traverse vast empty oceans. It can also wind safely through torturous mountains. It can avoid collisions in crowded airspace. It can steer clear of forbidden areas and circumvent raging storms. Each requires it to behave in a different way. All the necessary foreknowledge about these various types of terrestrial environment is built into its navigation software. This matches the right piece of foreknowledge with the kind of environment through which it is currently travelling. It then adapts itself to the most appropriate aerodynamic profile and flight behaviour.

Throughout its lifetime, a specie can adapt to small changes in the boundaries and characteristics of its niche. However, over a much longer term, the boundaries and characteristics of its niche can change way beyond its ability to adapt as an individual. This is because there is a physical limit as to how far an individual instance of a specie can adapt. For example, it cannot change its size or basic energy requirements.

However, unlike a machine, a life-form can reproduce. So to survive long-term more extreme changes in the boundaries and characteristics of its niche, it adapts slowly over successive generations. The essential scenario is as follows. The Gaian niche of a particular specie drifts over a period of generations. The specie detects that its form and behaviour are becoming less and less optimized for its continued well-being. The specie's reproductive mechanism responds by generating offspring that have slightly modified forms and behaviours, which are better optimized for surviving within the changed niche.



This was famously observed in species of birds in the Galapagos Islands. Each specie was specifically adapted to its local biospheric environment. Humans are also observed to adapt in size over generations according to the availability of good nourishment. In the United Kingdom, in the past, the better nourished upper classes were larger and lived longer than working class people. Officers in the armed forces were generally a head taller than the ranks they commanded.

The principle of adaptation may therefore be summarized as follows. The niche of a particular specie comprises the planetary biosphere and all other species therein. Adaptation is driven by changes in the respective environmental niche of each specie. Each specie consequently adapts dynamically to match changes in the character of its niche. Adaptation optimizes the efficiency with which a life-form can acquire its needs of life within a changing niche. There appears to be a continuum of adaptation for each specie both alive and fossil.

Nevertheless, observation strongly suggests to me that, ultimately, adaptation has fairly *narrow limits*. The unmanned air vehicle has neither the physical nor the functional capability of navigating the ocean floor or embarking on a voyage to the furthest depths of the universe. The habitats and global distributions of many animal species suggest that they too have only a limited ability to adapt to different environments, even over many generations. We don't see polar bears in central Africa or Brazil. We don't see humming birds flitting across the Siberian or Canadian tundra. And, at a more

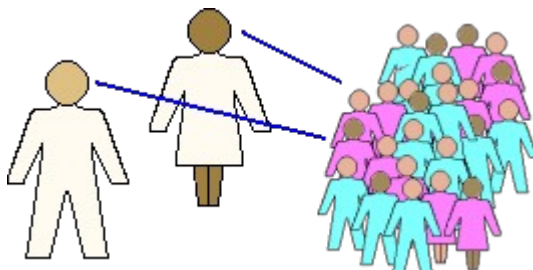
fundamental level, it does not appear likely that the lion could ever adapt sufficiently to survive within the niche of a lamb.

Consequently, it does not seem plausible that one genus could adapt to survive and prosper within the separate niche of a different genus. Even if individuals of different genres from different niches mate, they produce no offspring. For example, I have heard that many humans engage in full sexual intercourse with their pet dogs. But they never have babies, puppies or anything in between. Apart from having no stable niche, such a half and half life-form would probably be biologically dysfunctional anyway. Although there have been many scientific hoaxes, evidence that transgenic life-forms have ever existed is scant, sketchy and inconclusive.

Individuality in Populations

All instances of a particular specie live in what is essentially the same biospheric niche. A niche, however, can comprise many far-flung territories that are isolated from each other by such things as mountain ranges, deserts, sea, impenetrable forests or just plain distance. Individuals in one territory are thus generally unable to mate with individuals of another territory. On the other hand, individuals within the same population (individuals that inhabit the same territory) are able to mate and produce offspring. The probability of one individual mating with another is a function of its effective geographic proximity to the other within its local population.

Each instance of a specie has some degree of individuality. This is most noticeable in humans. For example, each has a face that is recognizably unique. If two individuals mate, the set of individualizing characteristics inherited by their offspring is a complexly-determined hybrid of the individualizing characteristics of the two parents. Variety, and consequently individuality, are thereby preserved. Furthermore, as populations increase, so too must variety, otherwise individuality would become less discernible, which it doesn't.



It is all a consequence of relativity. No two individuals can occupy the same space at the same time. Likewise, no two individuals can occupy exactly the same position within the population of which they are members. Each individual within a population therefore has what we could term a *social event horizon*, which is, necessarily, unique. It is his *unique view* of the population of which he is a member, as seen from his unique position within it.

This forces populations to preserve and generate variety in individuals. In humans we see such individualizing characteristics as blue eyes, brown eyes, dark skin, light skin. One would intuitively think that interracial marriage would create a world of coffee-coloured people. But it doesn't. In Brazil, where so-called racial mixing is common, the distinctive characteristics return. For example, a couple can have twin sons of whom one is white European in appearance while the other is of an African Negro appearance. All the differentiating characteristics seem to be somehow preserved.

This suggests that, within life-forms, there must be a mechanism that combines and selects these individualizing characteristics (through some kind of complex-dynamical deterministic process) and transmits them to their progeny.

Internal Programming

It is self-evident that Gaia comprises a myriad different genuses of life, each with its own role to play in the overall functioning of the biosphere. Some people categorize the various genuses of life according a hierarchy of predators and prey. I think this view is erroneous and antiquated. I view Gaia as more of an interactive network of life-forms that are matched to operate efficiently within their respective niches. The niche of each specie comprises the inanimate environment (earth, air and water), plus its predators and/or prey. Here, I include edible vegetation as prey.

The procedure that a life-form must follow in order to locate, capture and eat its prey is not an inherent property of the prey. A blade of grass does not contain the instructions to the cow on how to eat it. The cow must contain internal programming that tells it how to eat the grass. The cow thus has to be imbued with instinctive knowledge about the nature and purpose of grass.

The cow and the grass are not independent entities. The cow eats the grass. The cow digests the grass. The cow shits on the ground. The ground (bacteria etc.) break down the shit into basic nutrients. The roots of the grass absorb the nutrients. The grass grows. The cow eats the grass. This is essentially a complete process, although it has innumerable connections with other Gaian processes. The mechanism that executes this process is not just the cow. It is the cow, the grass, the ground, the air, the water and, to some extent, the whole of the rest of Gaia.

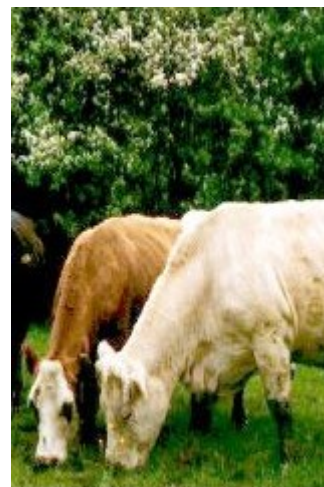
One could argue that the cow needs the grass but the grass doesn't need the cow. However, grass does not fair well if it is not grazed.

The cow's role in this process needs something to control it. This control is provided by the cow's instinct, which is programmed into its brain. This program must contain all the details on how to control the eating, digesting and defecating parts of the process. However, this must be done in such a way that it operates harmoniously and seamlessly with the rest of the process. Consequently, in order to create such a control program, one must have knowledge not only of how the cow works, but also of how the grass, the ground, the air and ultimately the rest of Gaia works.

In other words, the internal programming of the cow needs to include not only the procedures for controlling its own internal mechanisms, but also a *protocol* for handling the physical and chemical behaviour of its niche. This *protocol* is the cow's instinctive procedures for surviving and prospering within its niche. In order to construct such a protocol, it is necessary for whoever or whatever designed or developed this protocol to have had insight into the whole working of Gaia.

The cow's niche can be thought of as the whole of Gaia as seen from the cow's point of view. In other words, it is Gaia as seen from the cow's position in space, time and the biospheric order. To be able to apply its protocol for survival, the cow's brain must contain a pre-installed internal model of its niche. But this model must, within limits, be capable of being adapted by a cow's tangible experience of its niche.

The fine details of the niche of a Frisian grazing an English meadow may be a little different from that of a Nelore grazing the grasslands of western Minas Gerais. These two instances of the cow-niche are, in principle, the same class of object and can therefore be founded upon the same pre-installed model. However, in order to accommodate the differences, the neural model of the niche within a cow's brain must be, to a limited extent, adaptable according to the cow's real experience of life.



This all begs the question of how the cow acquires the structural and behavioural information about its niche and the procedural protocol for surviving within that niche. One could say that perhaps the cow acquired all this from its environment through its senses. But senses can only supply raw parametric data. They cannot provide structural and procedural information. In other words, the cow's niche does not inherently contain information about how the cow should respond to it.

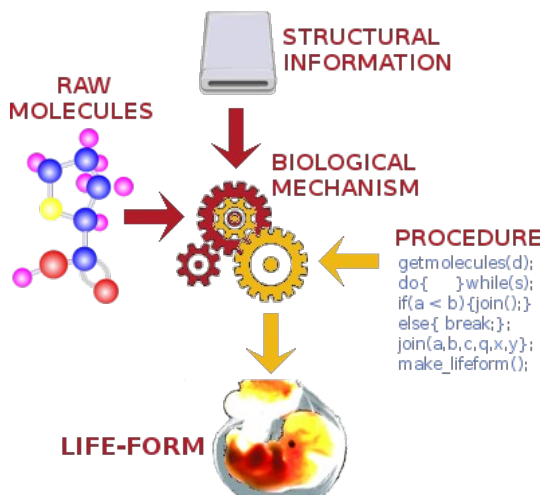
Consequently, the cow still needs to be pre-equipped with very complex programming on *how* to go about acquiring, through its senses, the structural and behavioural information about its niche and the procedural protocol for surviving within it. Furthermore, this programming cannot be created, or otherwise brought into existence, without pre-existing knowledge about the niche. One way or another, information about the nature of Gaia needs to be put into the cow's brain from a source other than the cow's physical senses.

The cow's body can sense changes taking place within its niche. Its niche may be drifting to a warmer and drier climate or a cooler and wetter one. Systems within the cow's body consequently adjust the cow's reproductive mechanism so that its future offspring will be better adapted to the changed conditions of its niche. This process may alter the offspring's size, structure and behaviour.

When the cow is mated with a bull, the structural and behavioural specification of each is somehow combined to form what are hopefully the better characteristics of each. This will contain all the information necessary for constructing and operating a new calf in the changed niche.

To Build a Life-Form

To construct and operate a new calf - or any other life-form - the new construction and operating procedures alone are not enough. This is because they are just unanimated information, like words written on a piece of paper. The calf must be actively built by some kind of external mechanism that can assemble the raw molecules of life together in the right way according to the prescribed procedures to form the prescribed structures.



To construct a life-form, a pre-existing biological mechanism must execute a prescribed procedure upon structural information that specifies how the raw molecules should be put together. They can't connect together in the right way by themselves under no more than the blind determinism of physical law.

The diagram on the left uses chemical, mechanical and computing symbology to illustrate the following unavoidable observation. A vast amount of complex information is needed to create life. The generation of such information is far beyond the capability of the universal laws of physics alone.

The basic building brick of a life-form is the living cell. My simplistic understanding of the process by which a

life-form self-constructs from a single cell is as follows. An initial generic (all-purpose) cell absorbs appropriate material from its surroundings. It uses this to grow and make itself bigger. It then splits into two such cells. Each of these cells then repeats the same process. The number of generic cells thereby increases geometrically. Soon there are millions of them.

At some stage in this process, cells start to change themselves from generic cells to specialized cells. In one part of the mass, cells start to change into brain cells. In another part, they start to change into

skin cells. And so on for about 210 different types of specialized cell in the case of the human being. What type of specialized cell a generic cell "decides" to change into depends on [whereabouts it is located](#) within the mass of cells. Thus the various distinct parts of the body start to materialize.

My intuition suggests to me that this process must be orchestrated by some kind of program that I shall call a *construction procedure*. This program must receive sensory input from the cell's immediate environment to tell it whereabouts it is in the mass of generic cells. The *construction procedure* must then execute appropriate adaptations with reference to appropriate *structural data* to change the generic cell into the appropriate kind of specialized cell, such as a brain cell.

Once construction is complete, the *construction procedure* must initiate another program that I shall call the *operating procedure*. This orchestrates the on-going operation of the cell. In the case of a brain cell, for example, it must manage the process by which it connects to other brain cells to form part of the neural network.

The *structural data* is used by the *construction procedure* as its plan or template for constructing an instance of a particular type of cell. I think this *structural data* must comprise two distinct classes of information. The first class is what I would call *generic information*. This is information from which the *construction procedure* morphs its host cell into, for example, the type that constitutes the iris of the eye. The second class is what I would call *individualizing characteristics*. This would specify, for example, the colour of the iris.

The *construction procedure*, its *structural data*, the *operating procedure* and its *operating data* constitutes a vast amount of information. This must all be carried within the cell on some kind of *recording medium*.

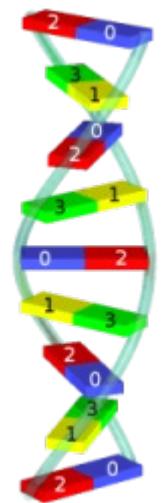
The DNA Molecule

Most scientists now believe that this vast amount of information is stored on a very large helix-shaped molecule called DNA. As an aid to visualization, I think of DNA as nature's equivalent of a data recording medium like a computer's permanent memory. A computer stores information in the binary form of 0s and 1s. DNA stores information in a code comprising four elements, which could be designated 0, 1, 2, 3 as illustrated on the right.

The 3,000 million base-pairs that make up a molecule of human DNA are believed to contain all the information necessary to construct and operate a human being. This information is stored in the form of the 4-element code described above. The fact that it is coded means that the information stored within the DNA molecule is a *symbolic representation* of how to construct and operate the life-form. It is therefore not a physical analogue of a human being.

In other words, it is not in the form of a pattern or a jig that directly reflects the structure of the life-form. A human DNA molecule in no way resembles a human being. Nor does it resemble any kind of framework within which a human being could take shape. It is merely a set of "written" instructions (and their associated data) for constructing and operating a human life-form.

Instructions and data have to be "written" in a language. The elements of a language are not elements of the object that the language is describing. Instead, they are symbols that *represent* elements of the object that the language is describing. For example, neither the written word "human", nor the sound of the word when spoken, resembles in any way the physical form or behaviour of what it represents.



The reader must use his intelligence to *interpret* the symbol "human" to invoke the thought or mental image of the physical being it represents.

Similarly, the instructions and data carried by a human DNA molecule are a symbolically-encoded program for constructing and operating a human being. Consequently, it is necessary to interpret their meaning before they can be used to construct and operate a new instance of human life. There must exist also a *biological mechanism* we can call a DNA Interpreter. Once interpreted, the instructions must be carried out or executed in order to construct all the different components and integrate them to form a functioning human being.

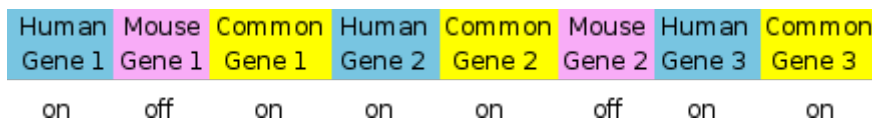
Clearly, the DNA Interpreter requires prior knowledge of the language in which the DNA program is symbolically encoded within the molecule. Consequently, in order to produce a life-form, it is necessary that the *DNA program* (structural information + construction and operating procedures), its *symbolic Interpreter* and its *physical Expediter* all exist concurrently. The last two of these are represented by the BIOLOGICAL MECHANISM (gears) in the above diagram

Switched Functionality

I was interested to learn that the DNA of a mouse is practically the same size and contains about the same amount of information as human DNA. Yet I think it is fair to say that a mouse is a simpler life form than a human. I wondered why this should be. Then I remembered something from decades ago when I used to develop computer software. I had developed what, in those days, was a very large software package. It covered all the functionality necessary for a particular industry. Its completeness meant that it was complicated. Not everybody wanted all its functionality and preferred a package that was less complicated.

One solution would have been to split up the software into separate pieces and sell the pieces as separate products. But this would have made the tasks of distribution, maintenance, upgrading and interoperability too complicated. So instead, I arranged to supply the complete software package intact, but with a 32-bit switch word in the initialization sequence. This enabled me to activate installation and execution of only the services that each customer actually wanted to buy and use at the time. From a commercial point of view, I was thus able to offer a whole series of product choices while, from a technical point of view, I was developing and maintaining only one.

Perhaps this is, in principle, what DNA does. To construct a mouse, perhaps only the *mouse-specific functions* are switched on while the functions specific to all other species are switched off. To construct a human, perhaps only the *human-specific functions* are switched on while the functions specific to all other species are switched off. In each case, there must be many more universal functions (equivalent to software common subroutines) that are permanently switched on for every species.



Somewhere within the DNA, or its associated biological devices, there must be an equivalent of my 32-bit switch word that selects whether this instance of the system is to construct and operate a mouse or a human - or whatever other specie.

I do not think it arrogant to suggest that a human is more complex than a mouse. So why has nature found it necessary to include and preserve, within the DNA of a mouse, practically enough information to construct and operate a human? Why didn't the mouse delete all that unneeded baggage and make its program of construction and operation simpler to interpret and execute? The

answer could be that perhaps the concept of a genome pertains more to Gaia as a whole rather than to individual species.

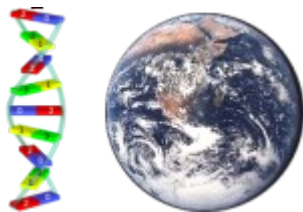
Genome of Gaia

Each specie has a functional niche within the Gaian superstructure. The shape and form of this niche changes over time. The specie must adapt, within limits, in order to maintain optimum alignment with its niche. How else would its genetics "know" how to adapt in this way if the information within its DNA were not seamlessly interoperable throughout Gaia as a whole?

The complex dynamical ebbs and flows within the Earth's biosphere cause the niche occupied by a particular specie to alter over time. To survive, the specie must adapt to continual changes in the form and behaviour of its environmental niche. If its niche changes too far or too rapidly, the specie will not be able to follow and consequently will not survive. To survive, a specie must always adapt constructively. To be able to do this, it must possess internal foreknowledge of the limits within which its environmental niche is likely to change, and the strategies and tactics for survival that are appropriate within the various parts of the range of variation of its niche.

Strategies and tactics for survival pertain neither to the specie nor to its niche, but to the *relationship* between them. A relationship is more than its participants in the way that a system is more than its parts. The information that specifies the nature and protocol of a relationship is above and beyond the form and structure of each participant. To participate in a relationship, therefore, the *active* participant must have internal foreknowledge about the nature of the relationship and the protocol that governs it.

In the relationship between a specie and its niche, the specie is an active participant. The necessary environmental foreknowledge - the strategies and tactics for survival and their ranges of adaptability - must therefore be pre-programmed into the specie's genome. In that its niche may contain predators and prey in addition to a passive terrestrial environment, the niche too may be considered to be an active participant. Corresponding foreknowledge must therefore be pre-programmed also into the genomes of the respective predators and prey. Furthermore, the pre-programming within the genome of the specie must be compatible and interoperable with the pre-programming within the genomes of its predators and prey. They must all together form a unified intelligent system.



Consequently, I favour the idea that there must be a *master program*, inhabiting the collective DNA of all the species of the Earth, whose functionality is seamlessly interoperable across all life-forms. Perhaps, once upon a time, *Gaia's Genome* existed in its entirety as a myriad instances of a single class of DNA molecule within each cell of each ancient specie. But from where could the information content of Gaia's Genome have originated?

Scientists have access to a vast accumulation of knowledge. They have the power of conscious abstract thought with which to analyse what they observe. Yet they can understand only imperfectly and in small part how Gaia works. They do not know enough to construct a complete computer simulation of Gaia. They certainly do not know enough to establish a new Gaian system on a suitable but lifeless planet.

On the other hand, the biological mechanisms, constructed and operated according to the information encoded within the DNA of each specie, interoperate harmoniously and seamlessly within the Gaian system of Planet Earth. Yet nature does not have man's conscious intelligence and

powers of observation. So from where did nature get this symbolically-encoded information that achieves what is light-years beyond the capabilities of human science and engineering?

It must have come from a source that is, as yet, beyond the range of scientific and philosophical perception. Yet it is real and is indelibly engraved, in what is ostensibly a decipherable code, within a physical molecule.

Information Loss

For basic versions of the software product that I sold back in the 1980s, most of the programming was switched out. For more complete versions, most of it was switched in. Nevertheless, every version contained the whole program. Correspondingly, if the genres of Gaia collectively operate according to a seamlessly interoperable program, then I would expect the DNA in every genus to be the same size. But it isn't.

On the other hand, some evolutionists postulate that the DNA programming within each genus was extended as needed, by internal biological mechanisms, as the genus itself evolved from simple to complex. In other words, each genus established and progressively extended its DNA independently, from the bottom up. However, if this were true, I would not expect the DNA of the mouse to be anything approaching the complexity of human DNA. And I certainly would not expect the DNA of the Bufo toad to be nearly 2.4 times the size of human DNA. But it is.

The only plausible explanation I can think of goes as follows. Once upon a time, the DNA of each separate genus contained the whole of the Gaian genome. As time passed, each genus lost different small parts of this universal genome. Nevertheless, most of the universal genome survived in most forms of life. Certainly, vastly more of the universal genome survived within the DNA of each genus than was necessary for constructing and operating a life-form of that kind.

How could different fragments of a universal genome become lost from the DNA of different species?

Loss By Damage

DNA fragments can be lost due, for instance, to chemical attack or bombardment by cosmic rays and other forms of high-energy particles or radiation. Fragments could also become lost by faulty copying. However, for such a loss to propagate, each pair of a mated couple would have to lose exactly the same fragment from its DNA. Since damage of this kind is spatially random on a molecular scale, the probability of such a loss being propagated must be disappearingly small.



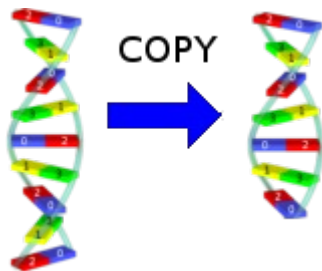
By using techniques such as data redundancy and checksums, human engineers have now made data preservation and integrity almost impeccable. So, to preserve the genetic code, I would expect nature also to have all the algorithmic paraphernalia necessary to guarantee the detection of missing or faulty DNA fragments. From what I understand, mechanisms do exist that effect repairs to damaged sections of DNA.

Consequently, once offspring with the depleted DNA mate with a partner without exactly the same missing fragment, the missing part of the DNA is naturally replaced from the mate's DNA. The loss is thereby made good in the offspring.

Notwithstanding, there is a situation in which statistically small amounts of this kind of loss would not necessarily be made good in this way. Suppose the lost information is not at all detrimental to the genus. For example, the lost fragment of the universal genome is not necessary for constructing and operating a perfect instance of that particular genus. The genus could carry on as if nothing had happened, except that its genome would be now lacking a fragment that was irrelevant to it.

On the other hand, if the damaged fragment were essential, or even preferable, for constructing and operating a perfect instance of that particular genus, then the resulting dysfunctional offspring would become eradicated by either natural or sexual selection.

Loss By Omission



Another way that information could possibly become lost from the Gaian genome as recorded on the DNA molecule of a particular genus is as follows. The inter-generation copying process may be selective. It may omit fragments of the genetic code that have not been used for some time. The time concerned may span only one generation or several.

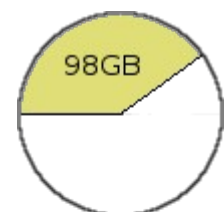
This would result in a genome that contained only the necessary and sufficient information to build and operate instances of the genus concerned. The time-span would allow the DNA to retain the ability of the genus to adapt to changes in the boundaries and characteristics of its niche over that same time-span.

However, this would result in a genus-specific DNA of a size that matched only the complexity of that genus, which is not what is observed. The DNA of (as far as I know) all genres seems to contain vastly more information than is currently known to be used for building and operating instances of each respective genus.

Over-Abundant Storage

On the other hand, perhaps information doesn't get lost. The greater part of the DNA molecule of any specie is unknown. Much of it appears to be unnecessary. So perhaps this unknown content isn't coded information at all. Perhaps its base-sequences are just spare base-sequences that carry no external significance. They are simply the equivalent of blank storage media.

The permanent storage medium of my computer is 250GB. But only 98GB of the medium contains my data. The rest is spare for when I need it. I have another model of computer (another genus) that has only a 120GB storage unit. The same 98GB of programs and data are stored on that machine too. I can imagine my 98GB of programs and data as Gaia's genome and the 250GB and 120GB storage units as the DNA molecules of different genres of life within the Gaian system. The two DNA molecules are different sizes. But they contain exactly the same information.



250GB DISK



120GB DISK

Commonality & Compression

Nevertheless, at least parts of the information recorded within the DNA molecules of different genres appear different. If DNA carries only genus-specific information then this is perfectly understandable. However, if all contain the whole of the Gaian genome, why the differences?

The DNA of any genus may contain all of the Gaian program but not always necessarily in the same form. Perhaps genes can be context-dependent. Perhaps certain genes are analogous to common subroutines or common classes in computer programming. If so, each would only need to appear once in order for it to be referred to and used by many other areas of a genus's DNA program. The same DNA functionality in a more complex genus may thus be encoded in a much more compact form than it would be in a less complex life-form.



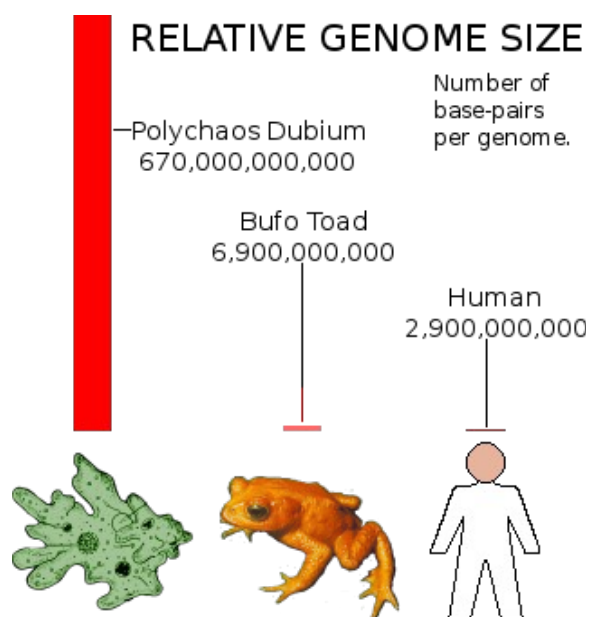
Alternatively or additionally, genes that appear to be missing in the DNA of some genres may be zipped according to some genetic algorithm of lossless compression. If so, they would not appear as themselves but as a smaller stretch of code. Suppose that the niche of a particular genus remains very stable over many generations. The functionality within its DNA that would enable it to adapt to extreme niche conditions is not needed. However, generations in the distant future may need to revive this functionality in order to survive newly-emerging extreme conditions.

Over a few generations of stable conditions, the reproductive mechanisms of the genus may compress the data pertaining to the currently unneeded functionality. This is analogous to zipping or archiving a file on a computer, that you know you will not be using for some time, in order to save disk space. This part of the functionality of the Gaian DNA therefore appears to be different and smaller than the very same information in the DNA of genres in which this functionality is currently active.

Size and Complexity

However, there is a further anomaly. It appears that the size of a genus's genome has no relationship to the complexity of the specie itself. Or at least, if there is a relationship, it is not a very obvious one.

For example, there is a single-celled life-form called Polychaos Dubium (formally known as Amoeba Dubia). It's DNA is [over 230 times the size](#) of human DNA. Yet this creature is nowhere near such an advanced and complex life-form as a human. Information loss by damage or omission, spare unused data storage space, multiple usage of common fragments and data compression are all feasible reasons for this. But it does beg the question as to why this far more ancient life-form should have managed to retain far more information in its DNA than the human. After all, it's DNA has been exposed to all the above mentioned hazards for a lot longer than has human DNA. Damage notwithstanding, why would nature fit this lowly life-form with such an obviously oversized "hard drive"?



On the other hand, perhaps the reason for the Polychaos Dubium's vast genome is as follows. Being the first form of life, perhaps this ancient amoeba is the original custodian of Gaia's complete genome. The genomes of all other genres subdivided from it as they evolved and diversified. Recorded within its DNA is all the structural and procedural information necessary for building and operating it and any other genus of life that can co-exist with it to form an optimal genus-set for the ecosystem of this planet.

Whether or not Gaia's Genome exists as such, I am left with the current belief held by scientists that a genome, as reproduced and interpreted by associated biological mechanisms within the cell, contains and expedites the design for life. But does it?

Insufficient Data

Each base-pair within the human genome can represent any one of 4 states (0, 1, 2, 3). A *bit* in the binary system, as used in computers, can have either of 2 states (0, 1). Therefore a base-pair contains 2 bits-worth of information. The human genome comprises around 3,000 million base-pairs. That is equivalent to 6,000 million bits. Since there are 8 bits in a byte, this is equivalent to 750 million bytes. The human genome would therefore almost fit on a 700MB music CD. It would occupy only 0.75GB on a hard drive or just over 715MiB of RAM. It is the size of an mpeg file containing a good TV-definition feature film. It would fit into less than a fifth of a modern personal computer's 4GB of memory or less than a three-hundredth of a 250GB hard drive.

My computer's bespoke-compiled instance of the Linux operating system occupies 4.65GB. That is 6.2 times the size of the human genome. The inherently less compact executable-delivered Microsoft Windows Vista operating system, so I am given to believe, occupies as much as 15GB. That is 20 times the size of the human genome. Is it reasonable for me to ask myself to believe that a program that is only a twentieth the size of Windows Vista is able to orchestrate the construction and operation of something as complex and sophisticated as a conscious human being? I have great difficulty with this.



The world's largest super-computers have only just about achieved a fiftieth of the estimated "teraflop rate" of the human brain. The human brain contains between 100 and 200 billion neurones, the myriad connections between which are each computing devices of immense capability. The motor control of the human body is way beyond anything that can be artificially created. But am I being fair here? Am I comparing like with like?

Science does not know the absolute or most fundamental constituent of matter. The deeper they look, the deeper the mystery. The Greeks thought the atom was the smallest possible unit of existence. Modern science has found that atoms are made of electrons, protons and neutrons. Even protons and neutrons are now seen to be composed of even smaller entities called quarks. Theory leads physicists now to conjecture that even the most fundamental particles are now made of "strings" vibrating in multiple dimensions. Perhaps strings themselves are composed of some ultimate unit of energy called a Planck quantum, which is something that, even in theory, can never be directly sensed or perceived.

On the other hand, the ultimate "particle" of information is directly perceivable by the human mind. It is the logical bistable called the *bit*. It can exist, at any given time, in only one of two possible states, namely, "yes" or "no", "true" or "false", "1" or "0". And it is in terms of the *bit* that I have compared a computer operating system with the human genome. So, at the syntactic level at least, I am comparing like with like. On the other hand, bits are not ends in themselves. They are only of use if different sequences of them are made to *represent* other objects and actions. The base-pairs in the human genome probably do this much more efficiently than do the bits that represent a computer operating system. How much more is another question.

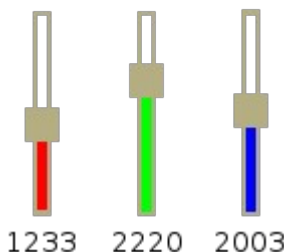
Genetic Installation Script

Notwithstanding, I cannot see the human genome as having anywhere approaching sufficient capacity to contain a representation of the data and procedures necessary for constructing and operating a human being, not even if it were to use procedural nesting and data compression to their theoretical limits. I conclude, therefore, that there must be a vastly greater repository of procedural information embedded within many other functional subsystems of the living cell.

It is for this reason that I think the DNA-borne genome is more analogous to an *installation script* than to a complete construction and operating procedure. In other words, it merely carries the individualizing information for a particular instance of the human life-form. For example, each of us has a uniquely recognizable face. The precise way in which the generic human face is tweaked to make a face that is unique to a particular person is carried in that person's DNA. How to construct and operate a generic human face is embedded elsewhere within various other parts of the cell.



Of course, some individualizing characteristics may not be carried within one's DNA. They may simply be the result of fractal processes proceeding from small random initial conditions. For example, the pattern of the iris or the pattern of the fingerprint may be unique to every individual. However, each may be different solely because of slightly different ambient conditions at the time the iris or finger covering started to form. Whether or not a child inherits aspects of his iris pattern or fingerprint from his parents, I don't know. At the moment, however, I think not. The fact that a child's features bears some resemblance to those of his parents' is, I think, indisputable. I conclude, therefore, that such information must be carried within the child's DNA.



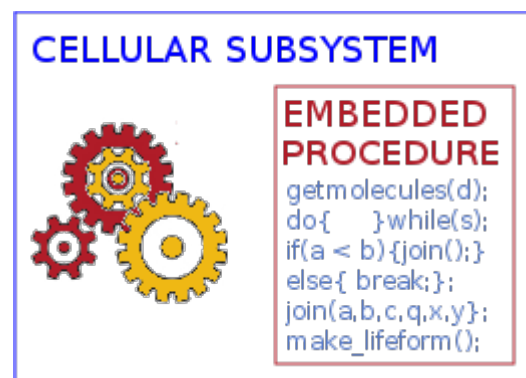
I therefore think that each individual's DNA contains two kinds of information. Firstly, it contains the specifications of all the possible characteristics by which any instance of that particular genus can be individualized. Secondly, it contains the equivalent of a set of switches that are set to a unique pattern for each individual. However, instead of being simple *on/off* switches, I think they must be more like a bank of sliders, each of which can be varied continuously between zero and maximum. In the case of eye-colour, for example, I imagine there to be the equivalent of 3 sliders, one for RED, one for GREEN and one for BLUE. Of course, I do not think the mechanism could be quite so blunt as I have described. I intend my analogy here to be only a very loose one.

[Note: the numbers under the sliders in the above illustration are in quaternary arithmetic. This is arithmetic in which each digit can be 0, 1, 2 or 3 only, corresponding to the 4 possible states that a base-pair can have within the DNA molecule. The 3 RGB (red, green, blue) slider values are shown as fractions of the quaternary number 3333 and represent the average green of the eye shown in the illustration.]

This implies that the size of a genome be in effect related to the degree and diversity to which a genus can be individualized. In this case, the human genome would be by far the largest. But it isn't. The genome of the single-celled amoeba, *Polychaos Dubium*, is 230 times the size of the human genome. I cannot imagine that each instance of *Polychaos Dubium* could be more distinctly unique than each instance of the human being.

I can only offer what I think is a rather lame explanation for this. The DNA of the *Polychaos Dubium* has an equivalent capacity of 167·5GB. That is 36 times the size of my Linux installation and well over 8 times the size of Windows Vista. I can accept this as reasonable for the size of the necessary and sufficient structural data plus the construction and operating procedures for an amoeba within the Gaian system. But even so, I do not think it could be remotely sufficient for a human. Certainly the 750MB human genome could not hold the necessary and sufficient structural data plus the construction and operating procedures for a human being.

Perhaps simple ancient life-forms like this single-celled amoeba indeed do have all their genetic information within their DNA. On the other hand, perhaps the generic cell of the vastly more advanced human life-form has a *distributed software* policy. In other words, to improve efficiency and robustness, each functional sub-unit of the human cell has its own construction and operating procedures embedded within it. The combined functionality of all of the cell's sub-units can then be coordinated from a relatively simple central script held within its 750MB DNA molecule. This way, I think that the human cell could very well accommodate all the data and procedures necessary to construct a human life-form of diverse individuality and equip it to respond sustainably to the Gaian environment of which it is a wholly dependent part.



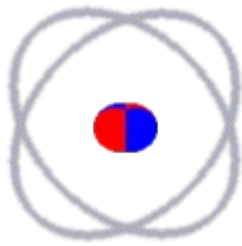
Nonetheless, the question still remains. Why does such a simple life-form as the *Polychaos Dubium* amoeba have 230 times the DNA information capacity of the human? Perhaps it is because this ancient amoeba's DNA is the original repository of the complete Gaian genome from which the genomes and associated embedded procedures of all other species were derived by some kind of [evolutionary process](#).

Consciousness & Self-Preservation

But does human DNA, or any other element of the human cell, include the blueprint for consciousness? A conscious being, especially one that is aware of its own existence, cares whether or not it survives. Its prime concern is to sustain and preserve its own existence. This is in total contrast to non-conscious entities, no matter how complex and sophisticated they may be.

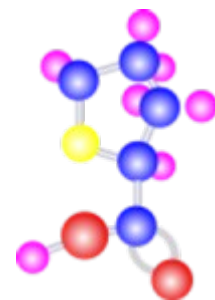
Does a rock care whether or not it gets smashed into smithereens or formed into a beautiful sculpture? Does it even give a damn whether or not it exists? Does a computer care whether it is running or switched off? Does it ponder as to whether the logical states of the processes and data

within it survive when its power plug is pulled out? I don't think it cares at all. Neither a rock nor a computer appear to have any motive of self-preservation.



Atoms are very small. There is a strict upper limit as to how big they can be. They move around within their mean-free-paths bouncing off each other. They combine into molecules and separate again. But they do not do these things of their own volition. Their behaviour is determined by universal laws. But does an atom *care* whether or not it is in combination with others to form a molecule or is free to cavort around space-time on its own? Does it even care whether or not it exists? I don't think it has the capacity to care one way or the other.

An inorganic molecule can comprise anything from a pair of atoms upwards that constitute a stable structure. Whether atoms combine to form a molecule or a molecule breaks up into separate atoms again depends on the conditions (such as temperature and pressure) in the immediate vicinity at the time. Nevertheless, there is a limit to the complexity that inorganic molecules can achieve. Large inorganic structures, such as crystals, comprise relatively simple arrangements of atoms that repeat indefinitely. This upper limit, to the possible complexity a molecule may attain, is imposed by the resident laws that govern the universe.

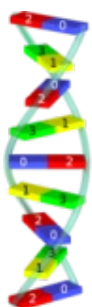


But does an inorganic molecule fear the "death" of being reduced back to its constituent atoms? I have never managed to talk to a molecule to ask it about its inner feelings. I therefore have no way of knowing. Notwithstanding, common sense suggests to me that it neither values its "life" nor fears its "death". Like the atom, the molecule too has no imperative of self-preservation or self-betterment. I think that I may reasonably conclude, therefore, that atoms and molecules are not conscious.

At the other extreme, I have a definite and strong desire to survive. It is as if nature burdens me with a firm underlying obligation to preserve and better my life. I fear death. I have an irresistible compulsion to avoid it. I also have an inexplicable supreme wish for my personal conscious existence to continue after my physical death. I perceive this to be almost universally the case for other humans. Lower animals, insects and even (so I am led to believe) bacteria and viruses have an inbuilt imperative to preserve their lives and species. But not atoms and molecules. And not inanimate objects like rocks. Why does life have this imperative for self-preservation and perpetuation? Why should life even exist? It doesn't seem to be consistent with the rest of nature.

Is The Genome Conscious?

But what about the blueprint for life itself? Is the DNA molecule conscious? Does it care whether it lives or dies? Can a gene be selfish?



The Ten Commandments

1. Thou shalt have no other gods before me.
 2. Thou shalt not make any graven images or any likeness of any thing that is in heaven above, or that is on the earth beneath, or that is in the waters under the earth.
 3. Thou shalt not bow down thyself to them, nor serve them: for I the Lord thy God am a jealous God, visiting the iniquity of the fathers upon the children unto the third and fourth generation of them that hate me.
 4. Thou shalt keep thyself from idols: they that do so will have no part in me.
 5. Thou shalt not take the name of the Lord thy God in vain: for he that so doeth will not be unpunished.
 6. Remember the sabbath day, to keep it holy.
 7. Honour thy father and thy mother: which is the first commandment, that thou shalt love the Lord thy God with all thy heart, with all thy soul, with all thy strength, and with all thy mind: and thy neighbour as thyself: this is the second commandment, that thou shalt love thy neighbour as thyself: on these two commandments hang all the law and the prophets.
 8. Thou shalt not kill.
 9. Thou shalt not commit adultery.
 10. Thou shalt not steal.
 11. Thou shalt not bear false witness against thy neighbour.
 12. Thou shalt not covet thy neighbour's house, his wife, his ox, nor any of his things: thou shalt only love him, thyself, and thy neighbour: for this is the love that is the fulfilling of the law.

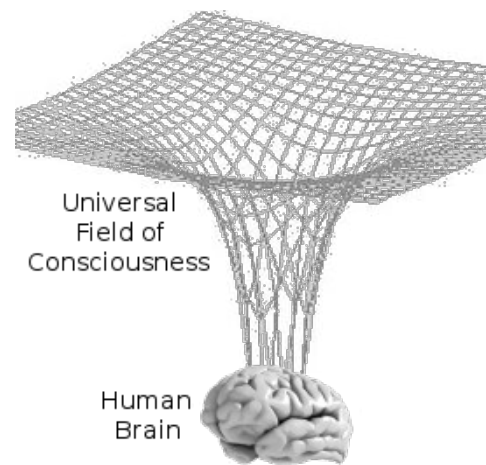
As large as it is, the DNA molecule is still a molecule. It is not a life-form. It is merely the vehicle for the symbolic instructions about how to individualize a life-form. It has no sensing devices - eyes, ears, nose, tongue, sensitive skin. It has no brain to model and interpret any such sensual inputs. This suggests to me that a DNA molecule, with all the genes it contains, is no more conscious than is a piece of paper with instructions written upon it. It is therefore incapable of caring whether it survives or perishes. A gene therefore cannot exhibit the conscious characteristic of selfishness.

The single cell of an amoeba contains the structural and procedural information for operating and duplicating the amoeba. Part of the amoeba's operating procedure causes the amoeba to behave in a way that promotes its own preservation. But does the amoeba consciously care whether it lives or dies? An amoeba has no brain. Consequently, I do not see how it could be conscious. I think it is merely a biological machine automatically and blindly following an embedded procedure. I think it is therefore safe to conclude that consciousness does not stem from DNA, genes or any other data or procedures that may be encoded within the living cell.

Each cell of a human being includes information for constructing and operating the human brain. It specifies how cells in the appropriate region of an embryo are to form themselves into neurones and connect to form the brain. The human brain harbours one's individual consciousness. If neither the DNA molecule nor any other element within its host cell be conscious, how can it impart consciousness to the human brain? I don't see how it could.

Perhaps part of the fundamental fabric of existence is a mysterious universal field of consciousness. When concentrated locally, in the same way that mass concentrates space-time, it forms a localized cusp. The programming within the human cell simply equips the human brain with the catalytic ability to form such a localized cusp.

Alternatively, the field could be merely the medium that propagates an omnipresent *travelling wave* of universal consciousness, with which the human brain is able to resonate. The brain thereby facilitates the formation of a localized *standing wave*, which is the substance of each individual human consciousness.



This *substance of individual human consciousness* must, of necessity, be co-located with the brain that facilitates its formation. Consequently, it must be centred at a unique position in time and space. It is thus, by definition, an event. This event is the individual's [path of conscious experience](#) that spans all the places wherein he may wander throughout the entirety of his life.

All this, however, begs the question: how does the programming within the cell "know" about this universal field and how to cusp it into an individual consciousness? And, conscious or not, why should any life-form care whether or not it survives? What motive does it have and why?

All life-forms, from bacteria to primates, have the imperative of self-preservation. They seek to achieve and maintain a satisfactory level of well-being. But they never change. They never pass anything new to the next generation. They don't develop. Each repeats the same old cycle, adapting to and fro to match the chaotic meanderings of its Gaian niche. Its instinct for self-preservation, its characteristic behaviour and its adaptive excursions seem to be indelibly pre-programmed into it.

Somewhere in between the bacterium and the primate, life acquires the attribute of consciousness. It becomes aware. It becomes able to experience. If sub-human life-forms, such as dogs, do not have consciousness, why are they given anaesthetics during surgery? It is because they experience pain. And to experience, they have to be conscious.

A modern car has an intelligent monitoring system that gives the driver an indication when something is wrong. If the oil pressure drops to a dangerously low level, an indicator light illuminates on the driver's instrument panel. But the car does not experience pain when it is seriously ill with low oil pressure. The mechanic does not give it an anaesthetic to prevent it from suffering while he changes a leaking gasket. Unlike an animal, a car has no consciousness.

Social Evolution

Humans have the consciousness that animals appear to have. But they have something else as well. Humans have a higher form of consciousness that is able to view itself and manipulate abstract models of what it observes.

This gives humans uniquely the power to evolve. They consciously observe events that are taking place around them. They ponder upon these events until they come to understand them. They record the events and their understanding of them. From their records of events, they abstract the principles that govern their physical and social universes. From these principles, they create and realize new ideas. They pass on their new ideas to their next generation. Their next generation then repeats the process but from a more advanced starting point. Human evolution is thus a super-regenerative process that gains momentum from generation to generation.

So humans not only have the imperative for self-preservation and the pursuit of well-being but also the imperative to evolve. But human evolution is not carried in the DNA. Neither the human, nor any other kind of life-form, contains within it the functionality to create, extend or improve its genetic code. It has no way of increasing the [semantic information-content](#) of its genome. It has only the capability of selecting. It is simply a process of switching in or out aspects of its form and behaviour in response to changes in its Gaian niche in order to maintain optimum survivability and prosperity. The programming within its DNA for selecting what is currently the most appropriate of all available forms and behaviours is already there.

A human being, through conscious thought, cannot alter or augment his genetic heritage. Neither can he alter or augment the universe and the rules by which it operates. Nevertheless, humanity can and does alter and augment the repository of knowledge that it possesses about the universe. Humanity uses this repository to create technologies that make it easier and quicker to acquire the needs of life. But this is just *knowledge about* something real. Can humanity alter or augment something real? Can it create something new and concrete? Yes.



The human, uniquely among all life-forms, can alter and improve the way it *relates* to others. Humanity can thereby evolve constructively from its past confusion of bickering egotists, through the covert elite-dominated bondage of the present age, into a future brotherhood of egalitarian peers. But this can never be achieved under any kind of centralized control. Each must change himself. He must create and develop within himself a more advanced form of perception. This must empower him not only to see but also to feel from and sympathize with the points of view of others. He must then alter and improve the protocol through which he builds and operates his relationships with others. He must love his neighbour as himself.

But this won't work unilaterally. It is no use just one person or one million people changing themselves individually in this way. It is necessary that everybody does it together. Only this way can humanity become crystallized into an egalitarian social order. But this necessary change cannot take place quickly. It needs to evolve in small steps from generation to generation. This means that the improvement gained during one generation must be passed on to the next.

The DNA of Consciousness

The tiny physical human cell contains the structural and procedural data that enables it to morph into a neurone that connects with others to form a brain that is the vessel within which a human

consciousness comes to reside. Yet the human cell itself contains nothing that can be called consciousness.

A human being, by taking thought, cannot extend, augment and improve his inherent complexity. But he can extend, augment and improve his conscious self. He can extend his knowledge of the universe. He can improve the way he relates to nature. Most importantly though, he can improve the way he relates to others. Hereby, each contributes to the intellectual and moral development of humanity as a whole. But how can a former generation pass these intellectual and moral improvements to the next, so that the next can continue from where the former left off? There must be some intellectual and moral equivalent of DNA that a human being, by taking thought, *can* extend, augment and improve. Biological DNA is distributed throughout humanity by sexual intercourse facilitated by the physical human body. Its semantic content is the individualizing information by which each instance of human life is made unique.



The intellectual equivalent of DNA is the voices, paper, tape, film and data media that preserves human knowledge. It is distributed by *intellectual intercourse* facilitated by word of mouth, books, schools, colleges, theatre, radio, television and the Internet. Its semantic content is the collective essence of human culture, legend, literature, music, science and, above all, *morality*. It is through this that the formative minds of the next generation are primed. It is the catalytic vessel within which they develop. This ever-changing *spirit of the time* - this *Zeitgeist* - is the real and only transmitter of human evolution.

Notwithstanding, one must beware of the *Zeitgeist*. It is not, for the most part, the harbinger of truth. Human perception is fraught with error. *Collective* human perception even the more so. Majority belief is rarely accurate. It is invariably bent and twisted by conflicting interests. Public opinion is always a fool, easily susceptible to malicious manipulation. Even in such a formal area as science, academic politics and peer ridicule can stifle the revelations of direct observation and experiment.

Consequently, although there is an enormous amount to truth within the *Zeitgeist*, it is diluted by a far greater amount of error. For this reason, the word of the *Zeitgeist* must always be tested for its consistency with nature. The Laws of Nature are our only reliable reference of truth. Fortunately, wherever we may be, all of nature's laws are there to be observed in every small place. We are thus equipped to be able, should we so desire, to prize the nuggets of truth from this great body of human knowledge. But it is not easy.

Nevertheless, the *Zeitgeist* itself is not conscious. It's merely a collective reflection of all the individual consciousnesses that make up human society at a particular time. Consciousness is thus an individual phenomenon. It has the form and nature of an event. It is localized in time and space. And as far as is humanly observable, only *human* consciousness is able to abstract itself and ponder its own existence.

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