Article

Part II: An Intelligent Face to Evolution: The Vertebrates - Exploring Knowledge of Emotive Behavior

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ABSTRACT

The parallels in the natural record continue to confirm the self-similarity implicit in the evolutionary order, from the form level in the plants, up through the routine level in the invertebrates, to the knowledge level in the vertebrates. We may expect the pattern to continue with humanity's cultural evolution at the idea level in the hierarchy, but we will not find four levels completely delegated within this level. We shall see that in our brief journey out of the jungle that we have barely reached the stage of developing global technologies associated with our collective routines. Even at this level we are threatening our own survival. Man's evolution is far from complete, but we are slowly becoming aware of our own evolution and the impact that our endeavors are having on the biosphere. A few hundred thousand years ago, Homo erectus had a brain close to the size of our own. He lived and hunted in groups, erected dwellings, made use of fire, and hunted big game. He must have possessed at least rudimentary language skills to accomplish these things, and he could make limited plans. These ground breaking achievements were the inheritance of Homo sapiens who brought sharper perceptions and talents to bear on the development of early human cultures. With the emergence of a single species, about thirty-five thousand years ago, human evolution graduated from our biological roots to become a distinctively cultural affair within a relatively fixed biological form.

Key Words: Cosmic Order, evolution, intelligence, integration, idea, form, routine.

Knowledge-form:

The hagfish and lampreys are the last survivors of the earliest vertebrates: the jawless fish, called agnathans. Early versions of jawless fish became widespread in the seas of the Cambrian and Ordovician periods some 500 million years ago, but they were quite different from their modern descendants. They had thick bony plates covering their bodies that probably evolved as a defense again giant sea scorpions two meters long with pincers that could crush an unprotected animal. These early fish began to give way to the cartilaginous fish, such as the sharks, and the bony fishes, beginning in the Devonian period, about 400 million years ago.

By the mid Devonian, about three hundred and eighty million years ago, some species of fish had developed both gills and lungs, together with fins that were attached to four lobes that contained bones and muscles inside. These lobe fins could be used for crawling, so these fish could breathe air and drag themselves over land for short distances. It is believed that amphibians developed in a gradual way from these lobe-finned fish by random mutations, although amphibians go through a

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tadpole stage and their skeletal structures are refined into leveraged jointed legs and digits, together with a host of other differences.

In any case, by the late Devonian a few amphibians had established themselves on land with the well defined jointed quadruped limb structure that we know today. They could lift their bodies off the ground and walk, and they had a strong rib cage with adaptations to keep their organs from collapsing under their weight. They also had a shoulder collar separate from a head, so that they could move the latter independently. Amphibians became dominant land animals in the swamp forests of the Carboniferous period, a few reaching lengths of over four meters. They were weak-jawed lizard-like creatures that developed through a tadpole stage.

The vertebrate head brain consists of cerebral hemispheres that have blossomed above primary structures closely associated with the brain stem at the top end of the spinal cord. The autonomic nervous system also developed in concert with the cerebral hemispheres. The cerebral hemispheres became progressively more convoluted as their surface area increased in the higher vertebrates. The external surface layer of the hemispheres is associated with higher levels of consciousness and intelligence. This outer rind of the hemispheres consists of densely packed layers of nerve cells a few millimeters thick, called the cortex, hence the term cerebral cortex. In humans it contains a few hundred billion nerve cells. The two hemispheres function with a degree of independence and yet they are interconnected through nerve bundles called commissures, the largest by far being the corpus callosum.

Previously it was pointed out that the cerebral hemispheres, including the cortex, developed in three stages associated with the reptile, the lower mammal and the higher mammal. These three developments, old, median, and new, correspond to what are called the archicortex, the mesocortex, and the neocortex, all of which were present in undeveloped form in early vertebrate amphibians. Although the three brains were undeveloped, they represented an indication of developments to follow. In other words they indicated a development plan anticipating events far in the future, contrary to the Darwinian view.

The reptiles largely replaced the amphibians after about eighty million years, during the Carboniferous period as forests appeared. They developed a watertight egg that freed them from a tadpole water stage, allowing them to become fully terrestrial. The amniotic egg has an outer shell that protects the developing embryo with the help of three additional membranes within. One membrane encloses the embryo itself. Another membrane acts as a collecting bag for waste, also functioning as a respiratory organ. The third encloses the other two together with the yolk, thus separating them from the albumen, a reservoir of water and protein. The reptiles also developed a modified skull with powerful jaws and teeth. At the same time the continents were converging into the supercontinent Pangea, and this allowed a common vertebrate format to become established throughout the world.

It’s a curious thing that very early in their development the reptiles explored mammalian characteristics. The pelycosaurs included both mammal-like carnivores and herbivores and were replaced in the early Permian, about 260 million years ago, by more advanced mammal-like reptiles, the therapsids. Some species, up to five meters long, lost most of their teeth and developed beaks, becoming the dominant herbivores. Some early carnivores were like sabertoothed cats, some were dog-like, others were smaller shrew-like creatures. More advanced carnivores may have had hair, and some of them may have been warm blooded. They had longer legs which later moved under their bodies, rather than sticking out sideways as in living reptiles.

Although they may have been mammal-like in form, it is very unlikely that these early reptiles were mammal-like in behavior. They lacked the cerebral capacity to select a variety of behavioral patterns and moods and thus were more limited than mammals in their ability to modulate their behavior. They integrated experience more directly at a spinal level, with minimal conscious input. In this way each species was more stereotyped in a reptilian way, being locked into fixed behavioral responses to their environment. The large variety of species nevertheless explored a broad range of behavioral forms

Just before Pangea began to break up, about two hundred million years ago, toward the end of the Triassic period, there was a mass extinction in which many species disappeared, including most mammal-like reptiles that had evolved a variety of mammalian features. During the Jurassic and Cretaceous periods that followed two archosaur lines, the crocodiles and dinosaurs, emerged as dominant. The dinosaurs began as small and medium sized creatures, however their legs moved underneath the body allowing them to later support enormous weights as they explored the upper limits to size. Some dinosaurs reached lengths well over a hundred feet. One flying pterosaur reached a wing spread of forty-nine feet. They all became extinct at the end of the Cretaceous, about sixty-five million years ago. By then the flowers had arrived in abundance to foretell their doom.

The Indian subcontinent was speeding into Asia at 6 inches a year gobbling up the sea floor and plowing some of it into the richest oil deposits on Earth in the Arabian Gulf, while placing the continental plates in compression, raising mountain ranges in Asia. Mountain building proceeded also in Europe and the Americas. East Africa, the American West and the Tibetan Plateau were raised. These events were associated with the largest volcanic outflow in the planet's history. The Deccan traps originally covered about half of India's 1.2 million square miles. Depleted in area by erosion today they still cover an area of 200,000 square miles over a mile deep.

It is noteworthy that a study by M.J. Benton shows that the Cretaceous extinction didn't have a major impact on other land animals and plants, although it affected marine life. Yet the dinosaurs were exterminated. If the extinction was caused by a huge asteroid impact bringing on a nuclear winter scenario, as some believe, then why wouldn't many species of plants, and most other land animals be eliminated also?[1] There have been other large asteroid impacts in geological history that didn't bring mass extinctions as well as mass extinctions that did not align with asteroid impacts.

Be that as it may, reptilian evolution remained anchored to a common skeletal, visceral, sensory and motor arrangement. None developed six or eight legs or multiple eyes as some invertebrates did. The archicortex of the reptiles blossomed, and there was a lesser expansion of the mesocortex

[1] Benton, M. J., Diversification and Extinction in the History of Life, *Science*, **268**, 52, 1995. The evidence does not confirm a regular period to mass extinctions such as might be associated with periodic cataclysmic physical causes raining from the heavens.

associated with the lower mammals, with little change in the neocortex. Mammalian features survived, consolidated in a few small rodent-like mammals that made their appearance well over two hundred million years ago. Typically, the mammals diverged early in the reptilian period and not as a gradual evolution from the dinosaurs that came later.

The cerebral expansion of the reptilian archicortex and the lower mammalian mesocortex in the reptiles was complemented by comparable refinements to the autonomic nervous system. The latter is geared to the automatic function of the body to fuel its emotive and emotional needs. It provides energy to the body's organs and muscles in patterns suited to certain actions, while at the same time providing patterned emotional feedback to conscious awareness. The cerebral hemispheres work something like a TV screen upon which emotional energies can be reflected for conscious observation.

So the reptiles developed a limited cerebral capacity to consciously reflect on their needs as they relate to the behavioral *form* of the body and its functions. They acquired an awareness of exertion or the lack of it, and of the pattern of energy associated with specific actions. Each species explored their patterns of behavior to their limits. There is awareness of lunging after prey, struggling to escape, fighting, seeking shelter, basking in the sun, suffering hunger, thirst, injury, birth, death, all relating to the many reptilian species of vertebrate form.

A broad spectrum of experience was explored in the conscious awareness of reptiles. These patterned energies that were reflected in awareness integrated a vast spectrum of behaviors that span space and time, since each energy pattern involves action through space and time. Although behavior was stereotyped according to species, many species appeared during the reptilian reign of more than two hundred million years. In the reptiles there was thus an exploration in conscious ***knowledge*** of the basic vertebrate ***form*** in a huge variety of species of all shapes and sizes under many conditions. To a lesser extent this is true of the fish and amphibians also, from which the reptiles emerged. The integration of experience spanning space and time is facilitated through the agency of the timeless and boundless Void.

***Knowledge-routine*:**

A reptile is not a very expressive beast. A crocodile sleeps, swims, or eats without showing a variety of moods or emotional modulation in the character of its behavior. Its emotive energies are reflected in cerebral awareness through an expanded archicortex, but it can't do much to alter their pattern because the mesocortex is less developed, and the neocortex is undeveloped. A reptile's somatic motor functions are largely integrated at a spinal level with minimal conscious involvement. It is not much different to a fish or a primitive amphibian in this respect and it has minimal capacity to transcend the organic dictates of its species. It can't reflect well on the pattern of reflection because the neocortex is undeveloped.

The mesocortex blossomed with the lower mammals, together with limited but significant expansion of the neocortex. With it came a much improved capacity to modulate their emotive energies. Anyone who has ever watched young colts, or calves, or lambs romp and frolic can attest to this. They play at mock aggression and the chase, or simply thrill at their own antics. These animals can also emotionally bond to humans, sense our moods and intentions, and be trained to some extent. They have *knowledg*e of various behavioral *routines*. Crocodiles don't care much about feelings of anything apart from primal appetites.

As the dinosaurs perished, the mammals rapidly diversified in three groups. A few egg laying monotremes, the duck-billed platypus and the spiny anteaters, still survive. In the pouched marsupials, the labor of birth falls to the tiny undeveloped fetus which must crawl unaided into the mother's pouch and attach itself to a nipple for the remainder of its development. In the placental mammals the fetus develops in the womb and the labor of birth falls to the mother. The placenta derives from the second membrane in the amniotic egg, the fetus receiving oxygen and nutrients from it and discharging wastes into it, without the mixing of blood between mother and infant. All mammals nurse their young, including the few surviving species of monotremes. Although monotremes have no nipples, milk is secreted from pores on the mother's belly. There is a period of parental supervision in all mammals that increases with more evolved species of placental mammals.

There are many anatomical and physiological modifications in the mammals. For example, unlike most reptiles (not all), mammals have a four chambered heart, two auricles and two ventricles, with separate circulation to the lungs for the more efficient respiration needed to support a higher metabolic rate. Mammals have internal temperature control, usually assisted by a warm layer of body hair, they have improved kidneys, a better system of bone growth that allows highly leveraged activity in the young, and they generally have more efficient organs. These anatomical refinements made a much greater diversity of behavioral routines possible, from the seasonal migratory patterns of caribou, to the bat's mastery of flight.

The lower mammals, small at first, re-explored the limits to size after the dinosaurs. The early dog-sized rhinoceros of the Eocene period grew into a sixteen ton Baluchiterium that stood eighteen feet high at the shoulder. The somewhat larger Indricotherium or "giraffe-rhinoceros" had a long neck in addition and could graze from the tops of moderately sized trees. They lived during the Oligocene epoch among lesser giants, about thirty million years ago.

In those days there were also some fearsome carnivores, such as the wolf-like Andrewsarchus that was sixteen feet long with a head three feet long. During the Miocene there was Dinohyus, a pig as big as an ox, and Moropus, an oversized horse-like creature with claws. Giant building continued in successive waves into the Pleistocene epoch of the ice ages, with Daedicurus, an armadillo over ten feet long, and the six meter tall Giant Ground Sloth. The marsupials also produced giants during this time, including a wombat as big as a grizzly.

Many parallels were explored between the marsupial and the placental mammals even though they diverged shortly after the demise of the dinosaurs. The marsupials evolved forms very similar to many species of placentals in complete isolation from them, especially in Australia, which has been isolated from the rest of the world for about sixty million years, since the end of the Cretaceous. There have been marsupial counterparts to the wolf, cat, mouse, rat, mole, bat, anteater, bear, squirrel (including a gliding version), monkey, and others.

This is another strong indication of cross species communication in a global evolutionary context. That the same forms should have evolved, together with very similar equipment, from nostrils to eye lashes, to complex neurological organization and function is uncanny evidence of biospheric resonance at work. In light of this obvious parallel evolution in a common form and pattern of integration, even the most biased observer should find it very hard to believe that this could be the result of countless sequences of random chance, especially when other major fundamental differences have persisted between the two groups.

A remarkable difference in the marsupial brain (as well as in fish, amphibians and birds) is the lack of a corpus callosum. This huge nerve bundle interconnects most areas of the right and left hemispheres in the placental mammals, although interconnections tend to be sparse or lacking in the freer more distal limb segments such as the hands and fingers that function more independently in humans. In marsupials transfer between both hemispheres is accommodated by their smaller but more developed anterior commissure, but in a more generalized manner. In the Diprodontia marsupials such as the kangaroos and wombats there is an additional commissure called the fasciculus aberrans.[2] It interconnects more dorsal areas of the neocortex that are generally associated with sensory integration.

These differences between marsupial and placental mammals allow differences in bilateral behavior patterns to be explored since the two hemispheres in marsupials are required to function more independently, while still being anchored to a common emotional apparatus and receiving similar sensory input. A major degree of bilateral polarization of brain function, such as that so markedly associated with language in humans (and probably to a degree in some higher placental mammals) was forestalled in the marsupials.

This means that the intuitive planning of marsupial behavior, distinct from the explicit formulation of behavior, tends to be worked out more independently in each hemisphere of the marsupial brain. Obviously the right and left hemisphere versions have to complement one another in the bilateral integration of movement. One side of the body must be coordinated with the other side. This is basic to *routine* behavior. In both marsupial and placental mammals routine behaviors become automated at the spinal level and conscious integration is also facilitated by the cerebellum. The independent intuitive planning of behavior in each hemisphere requires secondary sensory and motor areas in each hemisphere to sustain polar relationships between the intuitive integration of meaning and the explicit technique of behavior. (See Appendix 1 and 3)

The situation in marsupial and placental mammals is similar, so far as working out separate yet complementary behavioral patterns for the two sides of the body is concerned, except that in the placental mammals one side is a more completely hard wired referent to the other side via the corpus callosum.

The sensory areas, operating in polar relation to motor areas, assimilate the intuitive patterns for each sequence of movement for each half of the body. This is then translated into specific action by the primary motor area on one side of the new brain which transmits the pattern to the muscles on the opposite side of the body. The change in position of one arm or one leg is monitored by proprioceptive feedback to the sensory areas which assimilate the next sequence of movement, and

[2] Heath CJ., Jones EG. Interhemispheric pathways in the absence of a corpus callosum. J. Anat. (1971), 109, 2, pp. 253-270

so on.[3] The proprioceptive nervous system rapidly feeds back information about the relative position of the body in space to both the cerebellum and the cerebral cortex.

The hippocampal commissure provides a route to the hypothalamus and the reticular system that regulate the independent activity of the autonomic nervous system and allows emotional feedback from the primitive limbic system to neocortical awareness. The independent capacity of the new brain to reflect upon and modify the emotional patterns of the reptilian brain provides both marsupial and placental mammals an enhanced degree of freedom to tailor their actions to better suit the needs of circumstance, albeit more limited in the case of marsupials.

The spinal cord is also organized in sensory and motor areas with proprioceptive input that allows for local spinal integration of simple sensory-motor behavior. Minimal conscious participation on the part of the host is needed, as in the more stereotyped behavior of the reptiles. It also requires minimal conscious participation in mammals and humans when repetitive motions such as walking have been automated and delegated to the spinal level.

The absence of a corpus callosum places marsupials under somewhat of a handicap when it comes to consciously integrating complementary behavior on the two sides of their bodies. The topological representations, called homunculi, are paired in motor and sensory sets. Since one set is essential to developing the intuitive idea and another set is essential for its explicit motor enactment, two sets are thus essential in each hemisphere if it is to function independently of the other hemisphere.[4,5] This neural organization is especially essential in the lower mammals for the bilateral organization of more flexible and refined body movements in both the marsupials and the placentals. In more developed form it is essential for the bilateral polarization of brain function associated with language and human creativity.

In the marsupials, however, the complementary patterns for each hemisphere must be intuited more independently, without the same benefit of a more complete hard wired referent to the other hemisphere. It seems likely that the exploration of a variety of marsupial forms with close placental counterparts facilitated the bilateral organization of brain function in both classes of mammals. Patterned energies have been mutually accessible to similar species of different classes, facilitating both their biological and their behavioral evolution.

Otherwise there would be no mutual referents to independent yet complementary motor patterns by which to refine behavior consciously, either in the marsupials or in the placentals. The

[3] The description given here is very general. For a complete description of how the human nervous system works synapse by synapse see Campbell RC. (2006). The Nervous System- Part 1- Spinal Integration: http://www.cosmic-mindreach.com/System4_Sequence_Steps.html and Part 2- The Cerebellum: http://www.cosmic-mindreach.com/System4_Sequence_Part_2.html.

[4] Woolsey CN, Organization of Somatic Sensory and Motor Areas of the Cerebral Cortex in Biological and Biochemical Bases of Behavior, Harlow HF, Woolsey CN eds, University of Wisconsin Press, Madison, 1958.

[5] The intuitive idea is developed as a sensory pattern relating to a motor context, and the explicit technique is developed as a motor pattern relating to a sensory context. Idea development takes place to the rear of the central sulcus, motor development takes place in front of it. This complements the organization of the spinal cord, where the sensory areas are in the dorsal horns and the motor areas are in the ventral horns.

marsupials needed the placentals to refine complementary topological patterns, while the placentals needed the marsupials to refine independent topological patterns. Without this interplay, accessible through biospheric resonance[6], the mammals would be left completely to the vagaries of trial and error. It appears that placental evolution has been globally enhanced as a consequence. The higher placental mammals have clearly outpaced the marsupials.

The above discussion illustrates problems associated with hard wiring *routines* of behavior genetically that are subject to volitional control, since it can't be done solely either with or without the conscious participation of the animal. Behavioral patterns are subject to change at the individual creature's discretion, utilizing the same anatomical and physiological organization.[7] This becomes increasingly significant with the lower mammals. Even at this level mammals are not complete slaves of their genetic programming. They are sentient creatures capable of sensing a variety of patterns and modulating their behavior in the task of integrating space and time. Complementary *routines* of behavior are thus worked out in *knowledge* at this *knowledge-routine* level of the lower mammals.

***Knowledge-knowledge*:**

In the higher mammals there is an explosive development of the neocortex, or new brain, such that it outreaches the mesocortex and archicortex of the lower mammals and reptiles and enfolds them inward around the top of the brain stem. The archicortex and mesocortex form the edge, or limbus, of the hemispheres and together with certain structures in the brain stem become a functionally integrated apparatus, known as the limbic system. In the development of the brain in higher mammals the old brains don't get thrown away. Rather they get rearranged to incorporate control over emotive energies, that is over "feelings" that have ancient origins and the corresponding patterned energies that mobilize the body. The limbic system is a common feature throughout the mammalian lineage but it becomes more pronounced with the explosion of the neocortex in the higher mammals and especially in humans. It works in close association with the autonomic nervous system.[8] (See Appendix I.) Together this division of emotional and conscious *knowing* bestows a *knowledge of knowing* on the higher mammals, especially humans.

[6] Experience is quantized into discrete episodes that become structurally integrated as elements of memory in the quantum sensorium, the Void. Quantized elements are recalled to form in the oscillating dance between particulate form and quantized emptiness that makes up the cosmic movie. The biosphere is a living whole that seeks balance and equilibrium between the myriad living organisms on every level that make up the sphere of life that surrounds the planet. It seeks resonance and harmony with itself in its oscillating dance, as surely as beating a drum head or strumming a string on a banjo. Experience explored in one part of the biosphere does not exist in isolation, even though it may be geographically isolated. It is integrated with and accessible to experience in other parts of the biosphere through biospheric resonance. There are countless instances of evolutionary copying between unrelated species, wherever they can exploit a complementary niche in the biosphere. Simply calling this convergent evolution on the assumption that it happens by a series of fortuitous accidents explains nothing.

[7] Established behavioral patterns become quantized elements of technique and are preserved as elements of memory in the sensorium or Void. They are accessible through the structured relationship of the individual to the species, genus, order, class, etc., to the extent that taxonomy reflects the evolutionary order. They are also accessible between different lineages where resonance renders this feasible.

[8] In 1878 Broca demonstrated that a large cerebral convolution which he called the great limbic lobe is found as a common denominator in the brains of all mammals, forming a border around the brain stem. Broca, P., Anatomie

We retain emotional access to the patterned energies explored by our reptilian and lower mammalian roots. They become especially apparent during moments of raw unbridled reactions, as in moments of rage, fear, fervor, lust, greed, hunger, satiation. We remain indebted to ancestors that have long since perished from the planet, and in a sense we are obliged to repay the debt. We continue to refine and tailor their primitive energies in more appropriate ways in everything that we think and do. We still have their primitive brains incorporated into our limbic system that fuels the emotional energy for our every action. This reflux and refinement of behavioral energy seeking balance up and down the levels of the evolutionary hierarchy has been going on for hundreds of millions of years, and its character has evolved at each level as the process proceeds. As the most recent player on the highest level of the hierarchy we span the greatest expanse of history, and we face the greatest challenge in its integration. The human heart is an ancient thing indeed, and we are biologically obliged to consciously cope with primitive energies and emotions.[9]

Even within this primitive limbic system there is some degree of emotional regulation at a lower mammalian level of awareness. The mesocortex that bloomed with the lower mammals is more developed than the reptilian archicortex and it has some degree of independence from it. So there can be a degree of emotional reflection on primary reptilian emotions, albeit within the context of the emotional apparatus of all mammals. Keep in mind that the cerebral cortex is like a screen on which emotional experience is projected in conscious awareness. Since the lower mammalian screen has a degree of independence from the reptilian screen, there can be a degree of emotional awareness of emotion. This is characteristic of the way the creative process elaborates within itself. It is especially true in the higher mammals and humans. We have an emotional brain that is distinct from and yet related to, the new brains of our two hemispheres.

At this point it should be emphasized that the limbic cortex is structurally primitive compared to the neocortex, and it shows a similar degree of organization in all mammals. Unlike the neocortex, the limbic cortex has strong reciprocating connections with the hypothalamus which integrates autonomic functions. (See Appendix II.) This means that there is a strong projection of visceral emotions onto the limbic screen that colors sensory perceptions. By contrast the neocortex or new screen has expanded immensely with the development of the higher mammals, with consequent enhancement of our intellectual potential. The neocortex integrates sensory impressions of the external world with minimal emotional content. The limbic cortex and the neocortex thus function in independent yet mutually related realms.

P. D. MacLean, who did much of the early research on the limbic system, called this split between the intellect and emotion a built-in schizophysiology in humans.[10] As Arthur Koestler put it, the

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comparée des circonvolutions cérébrales. Le grand lobe limbique et la scissure limbique dans la série des mammifères. *Rev. Anthrop.*, **1**: 385, 1878.

[9] Papez first advanced the idea that the limbic cortex and related structures provide the anatomical substratum of emotional behavior. Papez, J.W., A Proposed Mechanism of Emotion, *Arch. Neurol. &Psychiat.*, **38**, 725, 1937.

[10] In 1949 Paul Maclean first introduced the idea that there is a built in schizophysiology between the neocortex and the limbic system, since the former has no built-in biological controls over the latter. Many articles including: MacLean, P.D., Contrasting Functions of Limbic and Neocortical Systems of the Brain and Their Relevance to Psychophysiological Aspects of Medicine, *The Journal of American Medicine*, 1958, **25**, 611.

immense intellectual capacity of our neocortex, capable of building atomic bombs and sending rockets to the moon, is biologically harnessed to the emotional capacity of a crocodile and a horse.[11] Judging by our tragic history of destructive violence it seems an accurate assessment of our human situation.

One might like to hope that the main potential for emotional tailoring and regulation in the higher mammals derives from the much larger neocortex. It doesn't happen through hard-wired control of the neocortex over the limbic system, however, because the neural connections are just not there to allow it.

In all mammals emotional energies become reflected in cerebral awareness and they must be regulated through a degree of intuitive insight into the dynamics of experience that can find appropriate expression in explicit behavior. This process must be integrated through the motor-sensory topology of the neocortex according to the perceived needs of circumstance. Neither the neocortex nor the limbic cortex has dominion over the other. This simply means that emotion and intellect are constrained to live independently in the same house together and must seek a satisfactory balance in the integration of experience.

Thus we find that in dogs, cats, porpoises, whales, elephants, seals, monkeys, apes, and so on, there is a considerable degree of intelligent reflection and behavioral refinement of emotive experience. The higher mammals can modulate their emotive experience more flexibly over a wider range than the lower mammals can and they display more distinctive personalities. They can show anger, fear, joy, anguish, affection, contempt, interest, indifference, trust, a whole range of emotions of a similar nature to humans.

Values begin to blossom with the higher mammals. A conscious evaluation and intentional selection of various emotional patterns becomes possible. This means that explicit *knowledge* of various emotional patterns is reflected for assimilation with other factors. At this conscious level of *knowledge* appropriate discretionary choices can be made between them. There is a *knowledge of knowing* alternatives that form the basis of value judgments. This entails a conscious anticipation of the future that spans space and time introduced into the process of integrating history.

It's worth pointing out that the body is also topologically represented by three homunculi in the cerebellum, the large folded structure to the rear of the brain stem at the base of the cerebrum. One homunculus is centrally inverted on the older part of the spino-cerebellar cortex. The other two are bilateral representations of each half of the body.

The cerebellum controls equilibrium and muscle tone and it is also involved in coordinating skilled voluntary movements. To do this it must reconcile spinal inputs, including proprioceptive sensory feedback from simulations in muscle spindles, with conscious simulations of anticipated patterns of behavior. In short it must reconcile spinal cord and cerebral functions. It tends to be especially

[11] Koestler, A., *The Ghost in the Machine*, Pan Books, London, 1970.

well developed in birds and bats in order to meet the challenges of flight. (Approximately one quarter of mammalian species are bats.)

Motor-sensory topology is closely related to the proprioceptive nervous system that monitors the relative position of the body's joints, tendons and muscles through feedback from complex sensory organs. It gives us our perception of the body's orientation in space. Included are muscle-spindle organs distributed throughout the muscles of the body that consist of special bundles of muscle fibers enclosed within a sheath. These relatively small spindle fibers receive an independent "gamma" motor supply (small motor neurons) from the ventral horns of the spinal cord, regulated by descending tracts from the brain. These small gamma motor neurons constitute about 30% of the motor neurons in the ventral horns of the spinal cord.

This independent motor supply to the muscle spindles allows them to be flexed independently of the muscles they monitor. The spindles in turn transmit two kinds of sensory signals, measuring the degree and the rate of flexion, back to the dorsal horns of the cord at various levels. The same sensory feedback also has collateral branches extending into the motor centers of the ventral horns, as well as transmitting to brain centers, including the homunculi of the cerebrum and cerebellum.

This muscle spindle arrangement allows for an electronic "gamma" motor simulation in the ventral horns of the cord, initiating a simulation in the muscle spindles distributed throughout the muscles of the body, without affecting the skeletal muscles themselves. The simulation generates patterned feedback from the spindles, via the large rapidly transmitting proprioceptive sensory fibers, thus allowing for anticipated future patterns of action involved in the selection of actual motor patterns.[12]

We are often aware of sensing the simulation of the next action sequence prior to enacting it, even in the process of ongoing activity. We can also consciously simulate actions, as in learning dance steps, or any planned sequence of actions. We can also just feel the rhythm of music through the body, as if dancing or marching. The intuitive perception and planning of the body's movements thus needs one set of sensory-motor topology to integrate proprioceptive feedback distinct from a second set of motor-sensory topology for integrating the actual execution of movement in each cerebral hemisphere.

The passive cerebral reflection of emotive patterns of behavior in conscious awareness thus has another dimension added to it in the higher mammals with a more developed neocortex. The higher mammals can intentionally simulate and integrate a variety of behavioral patterns in anticipation of a future outcome, all within the biological format of a single individual.

The capacity to reflect on emotional experience is not confined to an individual's history, nor to that of the species. The higher mammals are quite responsive to the emotions that humans project. They pick up our feelings, emotions and intentions, and this certainly isn't hard wired across species. Some dogs assume characteristic traits of their masters. They can learn to understand

[12] Campbell R. *The Nervous System- Part 1- Spinal Integration*, 2006: http://www.cosmic-mindreach.com/System4_Sequence_Steps.html

verbal commands, and most higher mammals, as well as some birds, can be highly trained. We can also consciously pick up their feelings if we make a modest effort to be sensitive toward them.

And there needn't be a human involved, since social animals bond in groups. Some animals and birds chose one mate for life, and the period of adult supervision and training of the young in some higher mammals spans a number of years. Animals sometimes bond across species, even natural enemies like dogs and cats. Even in aggressive confrontation animals pick up the feelings of others. This capacity to tune into the emotive feelings of others is facilitated via the quantum sensorium, spanning space and time and integrating history.

It is obvious from these observations that the integration of experience is not just an individual or a species affair. As higher mammals we are attuned not only to private aspirations which influence human affairs, but also to the energies of other species with whom we share the biosphere, while sharing also a common basis to emotive experience through our limbic ancestry.

Among the higher mammals the significance of a common limb structure, together with a very similar visceral and neurological organization, becomes especially apparent. The motor-sensory topology of the neocortex, which must always seek a balance with the primitive limbic system, is instrumental in integrating the experience and history of the biosphere in the higher mammals and especially in man. This implicitly requires a common mammalian format with the evolved cerebral capacity to consciously span space and time in *knowledge* extended far beyond the constraints of individual concerns. The *knowledge* implicit in the mammalian format accesses *knowledge* across epochs, eras, species, classes and continents as it seeks balance in biospheric resonance.

The relationship of the neocortex to the limbic system bestows a *knowledge* of *knowing* on the individual in the higher mammals, especially in humans. Through our often destructive endeavors the human being has assumed a position at the top of the biological hierarchy and we are just beginning to learn the responsibility attached. We are more than our social identities going back a few decades to when our mothers gave birth. The human heart is ancient, embracing the entire vertebrate lineage for four hundred million years of evolutionary history.

Knowledge-idea:

The conscious development of creative *ideas* which can give implicit direction to *knowledge*, *routine* and *form*, is a capacity that has developed from early primate origins, through anthropoid and hominid ancestors, to eventually find consolidation in one species, Homo sapiens. Not only are we humans able to create highly independent ideas, it seems that this has been the integrating *idea* involved in the whole evolutionary process over the last several billion years. We potentially have the capacity to become aware of our own evolution, to consciously participate in the process by learning to respond responsibly to one another and our role in the biosphere.

It is believed that primates diverged from primitive tree shrews that lived in the Cretaceous period during the hey day of the dinosaurs. Present day shrews are very small, from less than two inches to at most a few inches long. They are extremely active, aggressive, nervous, solitary and territorial. They are easily frightened to death. They have the highest metabolic rate of any animal on Earth, with a heart rate as high as 800 beats a minute. They must constantly search for food and will eat anything, sometimes preying on animals larger than themselves. If deprived of food most of them face starvation in a half a day. They in any case only live for about fifteen months, so if biologists are correct, we had rather shaky beginnings.

Small prosimians, or pre-monkeys, were common in North America and Europe during the Paleocene to the mid Eocene, from about sixty to forty-five million years ago. The first New World monkeys appeared in Argentina by the late Oligocene or early Miocene, about twenty-five million years ago. The Old World monkeys and apes, from which humans descended, seem to have evolved from different prosimian stock, the earliest cat-sized fossils from Egypt being dated at about thirty million years ago. During the Miocene, from twenty-three to fifteen million years ago, several fossil species are known which were probably relatives of both human and African ape ancestors. The first evidence of a distinctively hominid line is found in the so-called ground apes, the first named Ramapithecus that appeared from fifteen million to about eight million years ago in East Africa, Eastern Europe, Turkey, Pakistan, India, and China.

Primates have several features which have contributed toward developing their intelligence. Their faces are flattened so that their eyes focus together to provide stereoscopic vision, with enhanced depth perception. Their hands and feet have fingers and toes capable of grasping, with flattened nails rather than claws. In many the thumb or toe works in opposition to the other four digits, facilitating the holding and manipulation of objects. They sit in an upright position and some are partially bipedal, freeing the arms and hands for separate tasks. Most live in trees where they use their hands and arms in swinging with a high level of agility. The primates tend to be anatomically unspecialized, so that the group as a whole is better characterized by increasing levels of dexterity and intelligence. All of the higher primates have some degree of social organization, they care for their young over extended periods, and possess a rudimentary level of communication.

Hominid species began to walk upright and clearly differentiate over four million years ago in Africa. Paleoanthropologists have dated fossils of Ardipithicus ramidus found in Ethiopia in 1992 and 1993 at 4.4 million years old, pushing the date back nearer to the time when hominids diverged from the chimpanzee line. Considered to be ancestral to the genus Australopithicus, it had many features in common with the chimpanzee and other features common to later hominids that indicated an upright stance. It lived at least part of the time in wooded areas, challenging beliefs that upright walking began in the open savanna.

Fossils of a number of species of Australopithecus dating from 4 million years to 1.25 million years ago have been found. At some point, just over 2 million years ago, a new genus, Homo (to which our species Homo sapiens belongs), evolved from one of the species of Australopithecus, and it appears from the evidence so far that two or three early species of Homo coexisted for a time.

Homo habilis used stone tools and had a significantly larger cranial capacity than Australopithecus, about 750 cc as compared to 600 cc at most for the latter. Although the evolutionary tree has a tendency to grow branches as more fossil finds are made, Homo erectus came on the scene about 1.8 million years ago. He was larger, more adventuresome and brighter than habilis, with a cranial capacity ranging from 900 cc to 1050 cc and more near the end of his time. Homo erectus survived until at least two hundred thousand years ago, and perhaps later in places. He migrated out of Africa to Asia, Indonesia, and Europe, displaying considerable adaptability and ingenuity in employing tools and techniques to meet different circumstances. He hunted big game, made use of fire, and must have had some command of language to organize collective efforts, as in hunting.

He was followed, or perhaps paralleled, by archaic forms of Homo sapiens, assigned by some to the species Homo heidelbergensis[13]. In any case the sparse fossil record indicates that we first emerged very close to our present form, with an average cranial capacity of 1350 cc, about 100,000 years ago or more in S. Africa, radiating north through Palestine and Lebanon, and appearing about 40,000 years ago in Europe.

However Neanderthal man, a sub-species of Homo sapiens, emerged mysteriously on the scene in Europe about 130,000 years ago. He was more robust than our sub species, which is sometimes called Homo sapiens sapiens. Neanderthals had large brow ridges, a receding chin, and a somewhat larger brain, up to about 1600 cc. They were contemporary with modern man and they had some language skills. They buried their dead with some evidence of ritual, indicating spiritual beliefs, but they generally left little evidence of an interest in aesthetic values. Neanderthals disappeared about 35,000 years ago, leaving us as the sole beneficiary of the human form. Our brain and body size also seems to have peaked about thirty thousand years ago and declined about ten percent since. There is some evidence that Neanderthals and Home sapiens may have interbred.

The upper paleolithic cultures of Homo sapiens were much improved, with finely crafted stone and bone tools, and shell and ivory jewelry. Human knowledge and values had advanced to appreciate beauty and craftsmanship in created ideas. This is clear evidence of efficient language skills coupled to discriminating intuitive perceptions.

The bilateral polarization of human brain function was well under way, with the energies of limbic reptilian and mammalian ancestors being refined anew. Cave paintings[14,15,16] dating back 35,000 years in Europe, at least 30,000 years in Australia,[17,18,19] and perhaps as much as 100,000 years in South Africa[20,21] captured the animating spiritual essence of animals and events. Aboriginal

[13] Lozano M, Mosquera M, de Castro J, Arsuaga J, Carbonell E. Right handedness of *Homo heidelbergensis* from Sima de los Huesos (Atapuerca, Spain) 500,000 years ago. Evol Human Behav 2009; 30:369-76.
[14] Curtis G. The Cave Painters. New York: Anchor Books, 2006.
[15] Clottes J. In: Bahn PG, trans. Chauvet Cave: The Art of Earliest Times. Salt Lake: U of Utah Press, 2003.
[16] Whitley DS. Cave Paintings and the Human Spirit: The Origin of Creativity and Belief. Amherst NY: Prometheus Books, 2009.
[17] Bednarik RG, The Earliest Evidence of Palaeoart. In: Rock Art Research 2003; 20:89-135.
[18] McDonald J, Haskovec IP, eds. State of the art: regional rock art studies in Australia and Melanesia, Proc of the First AURA Congress. Melbourne: Aust Rock Art Research Assoc. Publication No 6, 1988.
[19] Kleinert S, Neale M, eds. The Oxford Companion to Aboriginal Art and Culture. Melbourne: Oxford University Press, 2000.
[20] Villa P, Soressi M, Henshilwood CS, Mourre V. The Still Bay points of Blombos Cave (South Africa). J Arch Sci 2009; 36:441-60.

cultures all over the world consider the earth to be sacred and regard themselves as an integral part of this holistic and living landscape. They belong to the land and are at one in it with animals, plants, and ancestors whose spirits inhabit it along with transcendent archetypal spirits. These spiritual beliefs still in evidence today pervade the aboriginal Australian, African,[22] Native American[23, 24] and East Asian[25] cultures, the Native Americans having arrived from East Asia during the last ice age with no prior evidence of human habitation. The Aboriginals of Australia arrived about 60,000 years ago. In a recent find a vast rock wall of about 1500 paintings chronicles the history of Australian Aboriginal contact with outsiders, including European sailing ships, 19th-century steamships and a World War II battleship, alongside exquisite rock art more than 15,000 years old.[26] With over 200 languages, 600 dialects and no formal script, they continue to communicate with message sticks consisting of picture sequences that communicate a message.[27]

Various authorities ascribe the origin and significant of cave paintings to shamans who translated experiences in trance states.[28,29] According to Leon Jaroff [30] "*Wildlife and humans tend to get equal billing in African rock art (in the caves of western Europe, by contrast, pictures of animals cover the walls and human figures are rare). In southern Africa, home to the San, or Bushmen, many of the rock scenes depicting people interpret the rituals and hallucinations of the shamans who still dominate the San culture today. Among the most evocative images are those believed to represent shamans deep in trance: a reclining, antelope-headed man surrounded by imaginary beasts, for example, or an insect-like humanoid covered with wild decorations*." Spirit possession is widely practiced in Africa[31] and Asia[32,33] today. It requires an intuitive connection that implicitly invites a spirit to enter their organic body in place of their own. Ancient rock art in Australia is attributed by the indigenous people to dreaming beings. It is regarded as sacred because it shows a continuing ancestral presence that spans space and time.[34]

The paintings indicate that human perceptions and creative abilities had matured to a level comparable to humans today. They could deal with experience in abstraction with a good degree of sophistication. This clearly indicates well developed left brain language skills differentiated from a right brain capacity for intuitive insight.

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[21] Mourre V, Villa P, Henshilwood CS. Early use of pressure flaking on lithic artifacts at Blombos Cave, South Africa. Science 2010; 330:659-62.
[22] Mbiti JS. Introduction to African Religion. Nairobi: East African Educational Publishers, 1991.
[23] Blondin G. Trail of the Spirit: The Mysteries of Medicine Power Revealed. Edmonton: NeWest Press, 2006.
[24] Blondin G. Yamoria the Lawmaker: Stories of the Dene. Edmonton: NeWest Press, 1997.
[25] Dr. Cheu Hock Tong. The Nine Emperor Gods: A Study of Chinese Spirit Medium Cults. Singapore: Times Books Intl, 1988.
[26] http://www.smh.com.au/news/national/rock-art-redraws-our-history/2008/09/19/1221331206960.html .
[27] http://australia.gov.au/about-australia/australian-story/austn-indigenous-tools-and-technology .
[28] Hedges K. Traversing the great gray middle ground. An examination of shamanistic rock art interpretation. Rock Art Res 2001; 27:123-36.
[29] Eliade M. Shamanism: archaic techniques of ecstasy. Princeton: Princeton U Press, 1964.
[30] Jaroff L. Etched in Stone. New York: Time mag article June 2, 1997.
[31] Behrend H, Luig U, ed. Spirit Possession, Modernity, and Power in Africa. Madison: U of Wisc Press, 1999.
[32] Smith FM. Deity and Spirit Possession in South Asia. Delhi: Motilal Banarsidass, 2009.
[33] Pak OK. Spirit Possession Phenomena in East Asia. London: Sage Publications, 1996.
[34] http://australia.gov.au/about-australia/australian-story/austn-indigenous-art .

The neocortical expansion and development which has taken place with the lower and higher mammals was largely symmetrical in both hemispheres. It relates primarily to integrating the bilateral symmetry of the body and its consciously controlled movements. It is quite apparent in the higher mammals, and especially in the primates, that neocortical development has resulted in more fluidly perfected and automated behavioral patterns. Language superimposes upon this bilateral symmetry of the new brain the polarization of right brain intuition and left brain technique. The human capacity for generating creative ideas and translating them into explicit forms is not symmetrically organized in the neocortex of the brain.

This extraordinary fact of the bilateral polarization of the new brain in humans was most dramatically demonstrated by the experiments of Roger Sperry in the 1960's. He performed extensive tests on a number of patients who had undergone surgical deconnection of their cerebral hemispheres in an effort to control repeated severe epileptic seizures.[35] These patients had their corpus callosum cut in two so that the epileptic focus that caused the seizures in one hemisphere could not transmit to the other hemisphere through this massive nerve bundle.

Following this drastic surgery, each hemisphere of these people's brains had to function independently. Under normal conditions, however, both hemispheres are presented with the same sensory input, even though they are separated, and both remain harnessed to a common emotional limbic apparatus. Each hemisphere also possesses the essential major and minor sensory and motor homunculi that allow the independent yet related development of the essential polar relationships. There was therefore little noticeable change in their behavior, except that their epileptic condition was improved.

Sperry, however, devised a means of testing the visual perceptions of these people. If they focused at the center point of a screen, and a picture was flashed very quickly on one half of the screen, the image would only register on the opposite hemisphere of the brain. If a picture was flashed on the left side, say of a pencil, it would only register on the right brain. If the person was then asked what they saw, they could not reply correctly. The right hemisphere cannot speak in right handed people. If then asked to pick the pencil out from a number of concealed articles by touch, their left hand could readily do it, since it is controlled by the right hemisphere. When the picture was flashed on the right screen, registering on the left hemisphere, the left hand could not pick the article out, yet the person could readily say what it was when asked. The left hemisphere has motor control of speech, but not of the left hand.

By extensive testing Sperry was able to show that there are different mental functions being performed completely independently in each hemisphere, each with a completely separate memory track. There are two minds in one body, so to speak, both of them harnessed to a third emotional or limbic mind that tends to respond through grunts and grimaces. The left brain in right handed people concerns explicit functions that involve language. This includes nearly all of human

[35] Many articles including: Sperry, R.W., Gazzaniga, M.S., and Bogen, J.E., Interhemispheric Relationships: The Neocortical Commissures; Syndromes of Hemispheric Deconnection, *Handbook of Clinical Neurology*, **4**, 1969. Sperry, R.W., Hemisphere Deconnection and Unity in Conscious Awareness, *Amer. Psychol.*, 1969.

behavior, encompassing all socially learned techniques of performance, including science. The intuitive right brain excels at spatio-temporal organization, intuitive appreciation of art, music, aesthetics, the spiritual sense and the like.

So this pattern of three polar focal points to human mental activity is a very real and distinct thing. It is not genetically programmed because the meaning inherent in language must be learned through intuitive access to a reservoir of cultural experience associated with the social tradition in which the individual grows up. A Chinese infant adopted by American parents will become thoroughly American, and vice-versa. Even if there is a limited genetic component to the overall triadic pattern of thought and behavior, the genes are themselves determined by the self-similar universal pattern, not vice-versa.

Three focal points are inherently necessary for creative ideation. There must be an intuitive insight into the spatio-temoral dynamics of any process in order to develop an idea in abstraction. That idea must then find translation into an appropriate technique to make it an explicit reality. It's of little use to try to fly like a bird without an insight into the dynamics of flight, and without some means of developing the technique to actually do it. All the bird-like feelings of flying in the world won't accomplish the task, and yet the energy that fuels the necessary thought processes must derive from our limbic emotional apparatus, since we are spiritually animated creatures.

This fundamental pattern of three focal points involved in the creative process transcends space and time, since it integrates space and time. The pattern is a self-similar reflection of the cosmic order through which the whole of experience is integrated in a perpetual state of evolution and renewal. The creative process is in communication with itself and is therefore implicitly intelligent. We would be a long time waiting for monkeys to bang an airplane together by accident. (See Appendix III.)

We find then that by late paleolithic times human beings had arrived on the scene well equipped for abstracting experience through intuitive insight and giving direction to *knowledge* through creative *ideas.* As individuals humans could independently perceive and communicate ideas from what they learned in experience. They became able to distinguish individual differences and similarities more acutely, but they were also aware that they needed to reconcile the gulf between self and other in order to meet the challenge of group survival. They could consciously develop independent *ideas* to integrate their collective *knowledge* and direct their *routines* in social *forms* of behavior. This capacity became the dominant factor in human social evolution. The universal and particular aspects of experience are always there, defining one another and seeking mutual reconciliation. Phenomenal experience has a universal archetypal component as well as a particular individual component.

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Commentary:

The parallels in the natural record continue to confirm the self-similarity implicit in the evolutionary order, from the *form* level in the plants, up through the *routine* level in the invertebrates, to the *knowledge* level in the vertebrates. We may expect the pattern to continue with humanity's cultural evolution at the *idea* level in the hierarchy, but we will not find four levels completely delegated within this level. We shall see that in our brief journey out of the jungle that we have barely reached the stage of developing global technologies associated with our collective *routines*. Even at this level we are threatening our own survival. Man's evolution is far from complete, but we are slowly becoming aware of our own evolution and the impact that our endeavors are having on the biosphere.

A few hundred thousand years ago, Homo erectus had a brain close to the size of our own. He lived and hunted in groups, erected dwellings, made use of fire, and hunted big game. He must have possessed at least rudimentary language skills to accomplish these things, and he could make limited plans. These ground breaking achievements were the inheritance of Homo sapiens who brought sharper perceptions and talents to bear on the development of early human cultures. With the emergence of a single species, about thirty-five thousand years ago, human evolution graduated from our biological roots to become a distinctively cultural affair within a relatively fixed biological form.

Direct evidence of prehistoric cultures is limited to surviving artifacts that were often made with a utilitarian purpose in mind so that we are lacking direct evidence of belief systems and tribal organization that directed human culture in earlier times. Thirty thousand years ago there were less than ten million people spread throughout Africa, Europe, Asia and Australia. Widely separated cultures evolved independently in a diverse variety of ways that were still exploring the planet and coming to terms with great differences in geography and climate. They nevertheless hummed a common theme, as surely as if they had tuned to the BBC. Biospheric resonance was orchestrating the music.

The bilateral polarization of conscious thought associated with language was a common factor that joined them. Left brain practical concerns with techniques of survival had a polar relationship with right brain spiritual concerns. The latter spiritual concerns transcended physical events in space and time. These early spirit cultures were highly intuitive. They were attuned to energies around them, being influenced by the natural and spiritual environment with which they lived in intimate contact. This much we can gather from descendant spirit cultures surviving into the present in various parts of the world.

With the migrations of Homo sapiens out of Africa to Asia and Europe over 35,000 years ago, three distinct races emerged, each with distinctive qualities in their languages that reflected the three focal points of human thought. The Sino-Tibetan languages of East Asia are intuitive and tonal in nature. Meaning is assimilated holistically as a gestalt, being more closely attuned to the intuitive and spiritual concerns of our right brain. Asian cultures remain closely attuned to spiritual matters to this day.

In contrast the Indo-European languages are more suited to left brain logic, with articles, conjunctions, and tenses to verbs linking external physical events up in a linear flow through space and time. Even though these early cultures were spirit cultures, their languages are more suited to the material concerns of technique and technology. We shall soon see how these characteristics evolved historically.

Meanwhile the sub-Saharan African languages generally have some of the characteristics of both Asian and European languages. They are all tonal and they also have tenses to verbs. They are more closely attuned to the music of our ancient emotional hearts. Polyrhythmic music is a distinctively African creation. They are the oldest cultures on Earth to which we are all indebted.

All three races, with mixes between them, employ all three focal points of the human mind, of course, but the characteristics implicit in their languages meant that each focal point received special emphasis in different parts of the planet. Biospheric resonance was busy developing the fundamental requirements of the human mind consistent with the cosmic order

Once again we may define subsumed levels within the *routine* level associated with the invertebrates, so that we may speak of a *routine-form* level, a *routine-routine* level, a *routine-knowledge level*, and a *routine-idea* level.

References

1. Robert Campbell, Downsizing Darwin: An Intelligent Face for Evolution. MindReach Library (1996).

2. http://cosmic-mindreach.com