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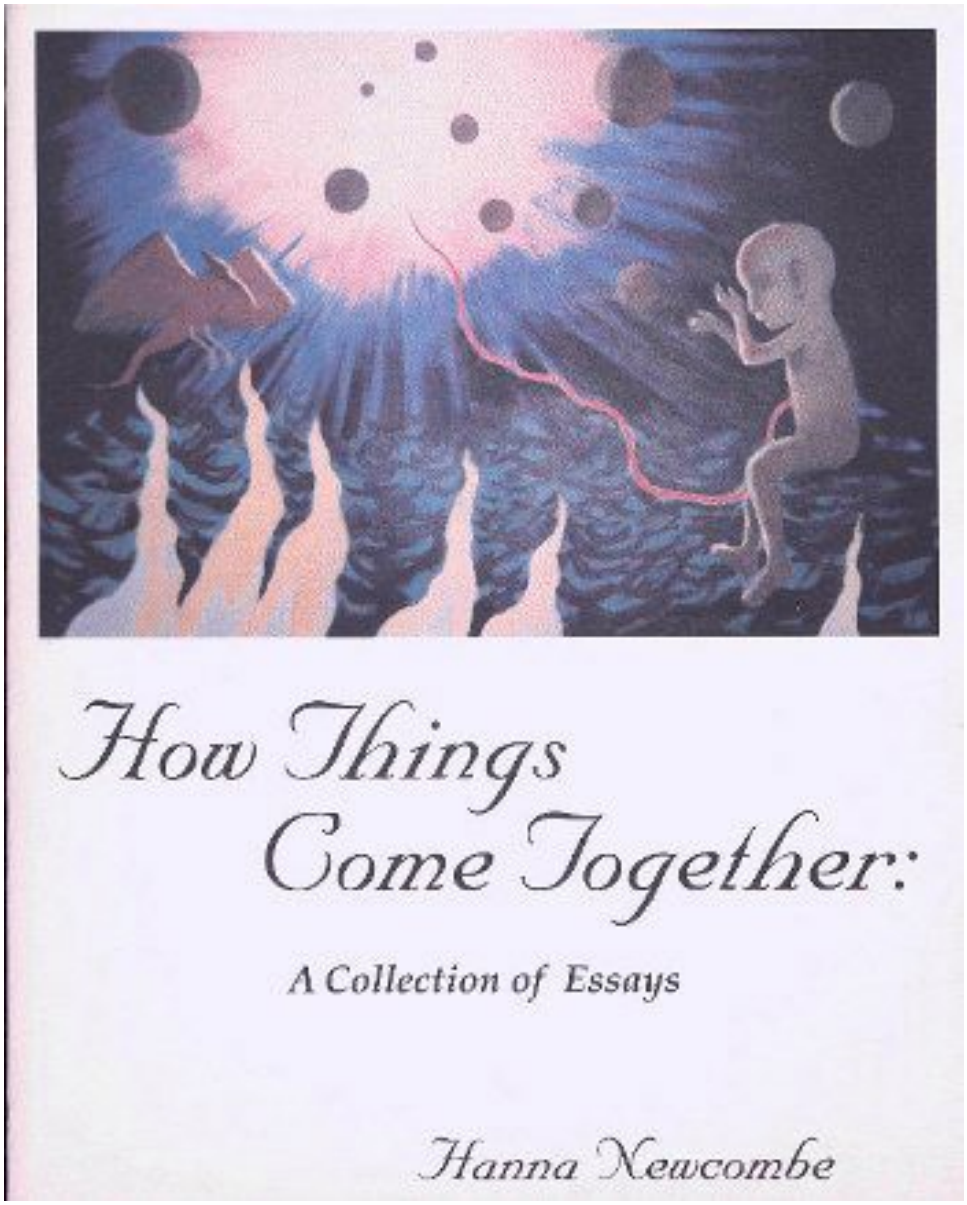
How Things Come Together: Volume 2



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Life

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WHEN REACTION RATES MATTER.

Explosives are usually associated with death, not with life. But more or less the same chemical elements are involved in explosion reactions and in life reactions: carbon, hydrogen, nitrogen, oxygen, and perhaps phosphorus and sulfur (abbreviated to CHNOPS). Gunpowder consists of saltpeter (containing nitrogen and oxygen), charcoal (carbon), and sulfur. The mixture burns as the carbon and sulfur avidly react with oxygen. Nitrogen in the form of nitrate (in saltpeter) provides a source of loosely bound and concentrated oxygen. The mixture burns quietly if unconfined (no pressure), but explosively when confined.

Yet gunpowder is only a mixture, and the three ingredients cannot be mixed intimately enough. In high explosives, all the necessary chemical elements are contained in the same compound, so that they can interact at a molecular level. Nothing can be more intimately mixed. Nitrocellulose (guncotton), nitroglycerine, and TNT (trinitrotoluene) contain the CHNO needs of powerful explosions. (S and P are not really necessary.)

In aerobic life forms energy metabolism consists of combining carbon-hydrogen-containing compounds (sugars and fats) with oxygen, through initial glycolysis followed by the Krebs cycle taking place in mitochondria, all the way through to carbon dioxide and water. (If proteins are metabolized, there is nitrogen and sulfur as well, but the fate of these elements need not concern us here.)

Explosions and metabolism essentially involve similar reactants and identical final products. The main difference is the rate of the oxidation reactions. Both involve “burning” of organic compounds to the most stable free energy compounds, carbon dioxide and water. However, the reactions proceed very rapidly in explosions, since the drop in free energy is very large, and when all obstacles are removed, events proceed very rapidly, as in a waterfall or a lightning bolt. In the metabolism of living cells, on the other hand, the “burning” is slowed down by making it proceed through a number of small steps, each controlled by enzyme catalysts. So instead of a sudden cataract, the burning proceeds as if through multiple locks and canals. Compare the flow of water from Lake Erie to Lake ontario through the Niagara River and the Welland Canal. We go from the superfast and spontaneous to the slow and controlled. There is beauty in the cataract, but the canal is more useful for navigation.

Yet, what is time? It makes the difference between fast and slow reactions, but “fast and slow” are subjectively viewed in our human frame of reference. In a way, we are “exploding” from conception to death like the Big Bang universe. We could go on indefinitely, being an open system unlike the universe, but nature says “no”, for the sake of posterity and further evolution.

In the same context, reaction rates matter when otherwise very slow reactions are accelerated by enzyme catalysts. Without enzymes, the constituent reaction steps of metabolism would proceed so slowly as to be imperceptible at our time scales. So “the little enzymes that run the world” act both as controls on explosion speeds and accelerators of blocked reactions; they are both brakes and gas pedals.

Between explosion-type speeds and glacier-type speeds life winds its way.

WHAT TIME IS IT, ANYWAY?

At a recent conference, James Joseph reported eloquently on a recent meeting of urban gang leaders in Kansas City in which they made peace with each other. It was a moving moment. James Joseph, a religious leader who had convened that Gang Summit, compared it to the Parable of the Prodigal Son. He said “When the sinner returns home to his Father’s house, it’s Party Time!” He received a standing ovation.

In his recent record cassette, “The Future”, Leonard Cohen sings movingly about “Closing Time”, the end of the party which is life.

It’s Party Time! It’s Closing TimeWhat time is it, anyway? It is High Noon, the time of decision.

It’s party time when the prodigal son returns
to his own Father’s house, reformed.
It’s closing time when prodigal daughter spurns
her Mother Earth, and sees her deformed.
It’s High Noon time when the train will bring
the one who deals out life or death,
decision time when minutes cling
to every move and every breath.
It’s crisis time. So who are you?
One to break down, or to break through?
For the n-th time since the Earth was formed,
a creature goes down, or lives, transformed.

GEOGRAPHICAL REFLECTIONS.

As Lister Sinclair pointed out in the CBC program “Ideas” in July 1996, East and West are fundamentally different from North and South on the Earth’s surface, although they look identical on.a small flat map. When you go North on the globe, you eventually start going South when you loop over the Pole; the same happens in reverse when you go South—you start going North eventually. But you can continue going West, round and round, forever; and likewise when going East.

This has to do partly with the properties of a spherical surface, and partly with the way we draw lines on it meridians for the North-South direction, and parallels for the East-West direction. The reason why we draw these lines of longitude (meridians) and latitude (parallels) differently is because the Earth rotates (spins) on a North-South axis, with its imaginary ends emerging at the Poles.

The meridians are all great circles (a term in spherical geometry). Great circles are circles drawn on a spherical surface such that their centres coincide with the centre of the sphere; these are the biggest circles that can be drawn on a spherical surface. On the other hand, among the parallels only the equator is a great circle; the other parallels are all lesser circles, getting smaller and smaller as we approach the Poles, where they shrink to a point (dimension zero). The meridians measure longitude and daily time zones, the parallels measure latitude and main climates, from tropical to moderate to Arctic/Antarctic. Thus longitude is linked to the daily rotation of the Earth about its axis, and latitude is linked to the annual seasons, i.e. the Earth’s revolution around the Sun.

On a sphere, the meridians converge at the Poles, while the parallels never converge. “Of course”, you say, “parallel lines never meet”, whether they are straight lines or circles. But wait: imagine two roads in tropical or moderate latitudes going straight North: are they parallel or not? They surely seem so, in the short range, but truly they are not, because in the long range they converge at the Pole. “Parallel” on a spherical surface has a different meaning than on a plane. Meridian roads would seem parallel for a long long time, and yet they finally converge quickly at the end.

Longitude, latitude, and altitude (the height of mountains above sea level and the depth of ocean trenches below sea level) are the three dimensions that pinpoint any location on the Earth’s surface. They can be compared to the three dimensions of the U.N. voting behaviour o’ nations during the Cold War (1946-1989). East-West differences (politically) are like longitude, and they have almost converged in our unipolar system with one remaining superpower. North-South political/economic differences are like latitude, and they have not converged at all. Supranational tendencies are like altitude (“lofty aspirations” and “deep longings”). Altitude measured in length units is rather insignicant in size when compared to the other Earth dimensions; even Mount Everest is just a pimple on the globe, and even the Marianas trench is only a dimple. Likewise, supranational voting is (was) also relatively insignificant in comparison to the major political divisions.

Last night I watched a beautiful sunset at Sauble Beach on Lake Huron, where the sun sets over the water. For the first time, I had an impression, not of the disk of the Sun dipping below the horizon, but of the Earth spinning to hide the Sun, swinging our location to the night side, in a regularly repeated circadian eclipse. What had been superficial intellectual knowledge became a.brand-new cognitive experience. I have finally internalized what I had thought I knew.

THE LARGE AND THE SMALL.

The very large is enfolded in the very small: stardust elements in cell's nucleus and wall.

The very small is wrapped up in the very large: quantum particles give stars their spin and charge.

The Universe as hologram is ultimately One; tightly interlinked, undecomposable, and run in space and time for aeons and light-years, as galactic cloud first forms, then clears.

The tiny and the huge hum songs together, weave climate happy times and stormy weather. Suspended in between, we live and die and share our joys and bitter tears may cry.

The medium ground is where the large-small meet, where telescope and microscope the eye does greet. Our home in size-spread is what we know best: from small twigs in huge tree we build our nest.

The introduction of iteration as a distinct mathematical operation quantizes time, just as the atomic theory quantized matter and the quantum theory quantized light.

What about quantizing space?

FORCES AND FIELDS.

In a gravitational field, massive objects such as planets and stars move in directions and with speeds pre-scribed by Newton's law. In an electromagnetic field, electric charges move similarly according to Maxwell's laws. In the various gauge laws of quantum theory, particles move in accordance with symmetry laws. However, we don't know in what form these forces exist in the fields in the absence of the masses, charges, or particles to be moved.

For example, to study a magnetic field, we can use iron filings to indicate the strengths and directions (vectors) of the magnetic forces. But without the presence of the filings, we know nothing. And what exactly do we mean by the "density" of the magnetic lines of forces, or "squeezing" or "bending" them, or "excluding" them from some substances? The lines of force are purely imaginary, the image of iron filings abstractly generalized from a physical observation. How many we draw per cubic centimeter is purely arbitrary, and they are not precisely located where we arbitrarily draw them. So how can these immaterial lines be squeezed, bent, or excluded?

Forces and fields were introduced into mechanistic materialist physics in order to explain observed phenomena in mechanics and electromagnetism, and the usage then expanded to other observations (quantum theory). These concepts were needed for theoretical explanations of observed phenomena, but their introduction profoundly undermined the materialistic basis of the sciences in which they were used.

Newton had especial philosophical problems with "action at a distance" in gravitational attraction, and this also affected Maxwell's theory, even though the distances involved there were smaller. Originally, in mechanics, a force was defined as a pull or a push, but that required that the bodies in question had to be in direct contact. How can a push or a pull be transmitted through empty space?

At first it was proposed that space is not empty, but is filled with "ether" which facilitates the transmission of forces. However, the Michelson-Morley experiment (which gave rise to the special theory of relativity) proved that there is no ether. After that, no new proposal for explaining action at a distance was made; people just accepted the notion that it exists, and went on from there.

All that can be said is the following: A field is a configuration of forces, such that the forces would move particles or charges if the latter were present. That is, forces and fields represent the tendency or ability to move matter. This is usually identified with energy, also defined as the ability to move matter. So a field stores energy; but in what form? We can say it is potential (not kinetic) energy, that becomes manifest (translated into kinetic energy) when the object it can act upon is present. That is like the potential energy of a pendulum at the extreme end of its swing, just before it starts back, transforming its potential energy to kinetic energy.

That comparison helps somewhat; it is still a metaphor in terms of something material (the pendulum). However, in the case of a force field, what exactly corresponds to the pendulum at the end of its swing? Nothing material seems to be there; only the tendency to move mass or charge.

If force fields are not material in the usual sense, could they be mental? That is pushing it too far; there may be such things as mental or psychic fields, but gravitational and electromagnetic fields are purely physical, though not material. Could they be phenomena where matter and mind meet—a kind of a bridge between two essences? Or in terms of the three spheres of Roger Penrose,* could fields (with their mathematical description) represent the Platonic sphere abutting both the material and the mental sphere? But perhaps

there is a simpler explanation.

Einstein showed, in his theory of general relativity, that gravitational forces are equivalent to distortion (curvature) of space. It certainly could be the case that electromagnetic forces (as well as nuclear weak and strong forces) could also distort space, the latter on a much more local tiny scale. Then we can picture the particles and charges as simply sliding down the geodesic lines. The “particles” can be as large as planets or stars, or as small as electrons. The “charges” can be electric charges or “colour” charges in quantum chromodynamics.

However, probably such a general explanation will have to await the unification of all the four forces, the much desired and hotly pursued “theory of everything”.

- See my essay Abstract Structures

REVOLUTION IN COSMOLOGY.

(From article in Scientific American)

According to previous theories, there were three alternatives: (a) Expansion of the universe is decelerating rapidly; this will make it collapse back onto itself in a “Big Crunch”. (b) Tre expansion of the universe is decelerating slowly, which will cause the universe to expand forever, but asymptotically to a limited size.) The expansion of the universe is decelerating at a rate which is “just right” to make the expansion stop at some point. This means that the universe is “flat”. [Why?]

However, recent observations lead to the conclusion that the expansion of the universe is not decelerating at all, but accelerating. (This conclusion follows from the observation of distant supernovae Ia.) This would mean that the universe is a hyperbolic space-time, which would make it older than we thought. This would remove the contradiction between the ages of the oldest stars and the age of the universe. (Some stars seemed to be older than the universe, which is impossible.)

But why would the expansion of the universe accelerate? Here there are two possibilities:

1. Either intergalactic space is not empty, but is filled with virtual particles popping in and out of existence from the vacuum field. This would be linked to a fifth force (“quintessence”?) linked to anti-gravity, which is repulsive rather than attractive.

2. Or the inflation of the very early universe, a theory which explains many other features very well, did not happen after the Big Bang. However, it may have happened before the Big Bang, which would imply the presence of many “bubble” universes.

The “missing matter” in the universe has been a puzzle for some time. It now seems that there are four types of matter:

(a)	Visible (stars, galaxies) contributes	1% to the total.
(b)	Dark baryonic (brown dwarfs, MACHOs)	5% “ “ “
(c)	Dark non-baryonic (axions, neutrinos) (WIMPS)	30% “ “ “
(d)	Cosmological (virtual particles)	60%
Total		96%

But the cosmological, although it is known as “the cosmological constant”, may not be constant.

Before the Big Bang, our universe was stuck in a false minimum, but tunnelled its way out of it to reach the true minimum. The break-out of the false minimum represents the Big Bang. [Or the inflation?]

We might well live in an infinite universe in finite space.

SOME IDEAS FROM RUPERT SHELDRAKE.

(From Wim Kayzer's "A Glorious Accident".)

1. Physical laws are not eternal, they evolve just like the rest of the universe: human thought and artefacts, biological species, stars and galaxies.

2. You can't shove it (the formation of physical laws) all back to the Big Bang and say it was all set in the first ten-to-the-minus-thirtieth second.

3. Fields are physical, but not material. [Newton had trouble with action at a distance, but Maxwell made fields respectable in electromagnetic theory.]

4. Structure (form) predominates over matter. (Formative causation.) [This may be where mind and matter meet.]

5. Memory extends to pre-human (pre-mammalian, etc.) times. It exists as a structure in a morphological field, not in some storage unit. [The books about Ayla, postulate that the Neanderthals had inherited ancestral memories, e.g. about the curative properties of herbs. But of course, this is fiction.] .

6. Post-death experience is like a dream or a nightmare, a self-made heaven or hell. [This resembles the Tibetan Book of the Dead.]

7. Recall of a past life may be dipping into any other past personal life, recorded in Jung's collective unconscious. Reincarnation presumes the existence of separate souls, but maybe we are instead fungible sparks or drops of divine essence.

AN ALTERNATIVE COSMOLOGY.

In a previous essay (Eons of the universe), I have proposed that our universe may eventually get so cold that all matter is converted into a Bose-Einstein condensate (one huge ball of overlapping bosons), and that there will eventually occur a super-symmetry transformation, that will transform each boson into its super-symmetry partner, a fermion. Because fermions are not capable of occupying the same space at the same time (have all quantum numbers the same) according to the Pauli exclusion principle, there will then result a huge explosion (the Big Bang) to start a new universe.

SUPERSYMMETRY TRANFORMATION: A REPRISE.

In an earlier essay (Eons of the universe), I have postulated a supersymmetry transformation at the end of a forever expanding universe to the beginning of a new universe. Supersymmetry refers to the postulated fact that each subatomic particle has a partner of the opposite kind: i.e. a fermion has a boson partner and vice versa. The transformation would involve the change of all particles into their supersymmetry partners, e.g. all bosons into fermions. At the end of an increasingly cold and dark universe, all still existing matter would condense into a huge ball of Bose-Einstein condensate in which the bosons can coexist in the same place at the same time. But the transformation would flip them all into fermions, which cannot occupy the same place at the same time and so a huge explosion would occur: the new Big Bang. (White hole into Black hole.)

I considered this fanciful, since no one to my knowledge had ever envisioned such a transformation. But now a modified version was mentioned by Morris (“The Universe, the Eleventh Dimension, and Everything”). According to him, at time zero of the Big Bang, we can postulate that. the huge amount of matter, which was positive, was almost exactly cancelled. by the huge amount of negative qravitational energy; so there never was all the matter of the universe squeezed into a singularity point.

It can then be inferred that what happened at time zero was a massive conversion of energy into matter, i.e. of bosons into fermions. This comes very close to my postulated supersymmetry transformation of a Bose-Einstein condensate into a fermion explosion initiated by the Pauli exclusion principle active in Fermi-Dirac statistics. He does not state that this is a recycled universe, like I do. He considers a recycled universe unlikely, because it would be degraded. But I think that in a supersymmetry transformation it would not be degraded. It is a fresh new start, not a replay of the old history.

MAGIC NUMBERS AND TENSEGRITY.

Plato and Pythagoras were right: numbers and geometry rule the world. Two articles tend to show this: Matthias Brack, “Metal Clusters and Magic Numbers”, Scientific American, December 1997, pp. 50-55, and Donald E. Ingber, “The Architecture of Life”, ibid, January 1998, pp. 48-57.

Brack shows that small clusters of metal atoms (e.g. sodium, Na), up to 1000 atoms or so” are stable when they have configurations of regular icosahedra (20 triangular sides), cubes (6 square sides), or octrahedra (8 triangular sides).. This happens when the mini-clusters are cold. WC;n hot, the mini-clusters become spherical; they melt, a phase change from solid to liquid. But of course, spheres are only n-sided polyhedra when n approaches infinity.

Ingber shows that most structures, from the tiny to the huge, self-assemble into structures of “tensegrity”, in which tensions and compressions are balanced. Ingber borrowed ’the concept from architecture. Buckminster Fuller’s geodesic dome is an example. Kenneth Snelson used a similar concept in his statues.

The cytoskeleton of cells is composed of micro-filaments (producing tension), microtubules (bearing compression, like struts), and intermediate filaments (tying them together). This is analogous to the macro-level skeleton of vertebrates, compcsed of muscles, bones, ligaments, tendons, and sinews.

The shape of cells can be changed from flat to globular through intermediate stages, and this affects the cells’ behaviour. Flat cells tend to divide repeatedly (mitosis), round cells tend to undergo apoptosis (a death program), while cells with in-between shapes tend to behave normally, fulfilling the function of the organ in which they are situated. This is in accordance with the Goldilocks effect: the golden mean is better than either extreme. It also illustrates the balance between two opposing tendencies common in living systems, e.g. the balance between the sympathetic and the parasympathetic nervous system. This effect of the shape of cells on their behaviour is relevant to the initiation of cancer: flat cells receive signals to keep on dividing and become immortal, round cells receive signals to stop dividing and commit programmed suicide; in-between cells are instructed to do their normal job.

The tensegrity model applies universally, eg to a buckyball (60 carbon atoms, 90 C-C bonds), an adenovirus, a protein-enzyme complex, a pollen grain, and multicellular Volvox. Most of these structures have radial symmetry, like an atom, like the benzene ring, like the Earth, like the Sun, like any star. These are Mandalas or prayer wheels. (A spiral galaxy does not quite have radial symmetry).

In folded proteins, the alpha-helix domains are the compression-bearing struts, the beta-regions the tension-bearing filaments. There is no radial symmetry. Neither is there in RNA and DNA, which have not even axial symmetry, only spiral symmetry. Yet both folded proteins and nucleic acids are also tenseqrity structures. Nucleic acids have a ribophosphate spine as a strut (like the spine in a vertebrate skeleton), and the purine-pyrimidine bridges (steps in the circular staircase) as the tension-bearing links that stabilize the backbone spiral, even if it gets over-twisted, as it does sometimes. When DNA unwinds to replicate or transcribe to RNA, each single strand looks like a charm bracelet with the coding bases hanging down.

Now let us go back to the structures with radial symmetry. Brack’s Platonic solids (metal mini-clusters) do not have struts and filaments; they are close-packed heaps of atoms, piled up like apples or oranges at the grocery, which naturally form regular polyhedra. Each polyhedron has a “magic number” of atoms, determined by geometry. For example, the series for hot sodium metal mini-clusters is 8, 20, 40, 58, 92, 138, 198, 264, 344, 442, 554.

Magic numbers also occur for completed electron shells of the rare gases in the periodic table of chemical elements (2, 10, 18, 36, 54) and for the numbers of protons and neutrons in atomic nuclei (2, 8, 20, 28, 50, 82, 126). Magic numbers are reminiscent of the frequency intervals in a musical scale, or the combining ratios of atoms to molecules in simple compounds. (However, intermetallics and complex macromolecules have different rules.)

Each Platonic solid can be geometrically imagined as having compression-bearing struts, in the various hypotenuses., to hold up the outside perimeter.

The oligo-atomic clusters of Brack fit into the Ingber size series (see above) at its beginning, at the scale of the buckyball or a clathrate made of water ice and hOlding a rare gas atom in the middle. A buckyball is an oligo-atomic structure too, but made of carbon instead of metal.

The size scale can be extended to structures of a single atom with orbiting electrons held at a distance from the nucleus by “struts” of quantum restrictions, thus being prevented from spiralling into the nucleus as classical physics would predict. The struts have become non-material, mere force-f1elds, but the principle is the same. This structure. is repeated again, at an even smaller scale, in the structure of the atomic nucleus, with its various shells of enhanced stability. At the other end of the size scale is the solar system (Sun and planets), with sub-systems of planets and their moons, held in place by the balance of qrav1tational and centrifugal forces. The Sun and other stars are held in place by-the balance of gravitational collapse and fusion-heat-generated outward pressure:

And perhaps each planet, including the Earth, is held in place by its own spin, static structures being less stable than dynamic ones (like a moving versus a stationary bicycle). Finally, the universe at the macro scale has huge voids and walls, which could somehow uphold the whole structure.

The entire size scale then is: nucleus, atom, nano clusters including bucky-balls and clathrates, nucleic acids and proteins, viruses, the cell with its cytoskeleton, Volvox, pollen grain, vertebrate skeleton, planet, star, solar system, universe. Not all are classical polyhedra, but all are tensegrity structures. Close-packed structures sometimes substitute for geodesic dames, and sometimes force-fields replace material struts. .

This architectural view of structures from the sub-atomic to the cosmological, via the physical and the biological, confirms the idea that structure is more important than matter, not only in organisms but in the whole “cosmic zoom“emphasizing the formal over the material cause of Aristotle. Note that some of the struts are non-material forces or fields, at both ends of the size scale.

An even more complex view is that process supersedes structures, as Fritjof Capra states in “The Web of Life”. Under “process”, Gregory Bateson would include the two “great stochastic processes”, development (embryology) and evolution.

This whole view of Popper’s “World I” (things in themselves), derived from our phenomenological perceptions and our Platonic mathematical insights (Penrose’s physical and Platonic spheres feeding into our mental sphere) gives us a physical yet non-material theory of how things come together. We cannot know World I, but we can infer, from evidence and intuition, its basic structure and process. What we construct (Popper’s World II) shares some basic properties in common with World I. We still see only the shadows on the cave wall (Plato), but we discern at least the two-dimensional outlines of the real world.

This is only a theory, but complex and interesting enough to have the ring of truth. This is how God would create it, if only we could approach the mind of God.

NUMBER-IN-ITSELF.

We write a number 15, or 26, or 42, or 196,884.* But that is only its decimal-system notation. Its symbol would look different in base 3 or base 8. E.g. decimal 15 is 1111 in the binary system. But the essence or reality of the number-in-itself remains the same, regardless of the symbolic system (binary, decimal, base 8, or other) in which it is expressed. It is like the real object (thing-in-itself, Ding-an-sich) and the word denoting it in different languages (German, French, or other). It is a relationship ofa symbol to its referent. The word “table” is not the object “table”. The map is not the territory. They belong to different worlds of meaning.

So what are the properties of the number-in-itself? First, it may be a prime or. a composite—a product of two or more primes, uniquely so defined. No two numbers have the same string of factors, just as no two human individuals have the same string of bases in their DNA. (Even more so for numbers, since the possible sequences of DNA bases, while extremely large, are finite, but the number of combinations of prime factors is infinite.)

Secondly, a number-in-itself may denote a geometric object or several of them. The dots on a die cube give examples up to 6. But a 3 could also be a triangle, or a 6 a hexagon. There can be space object, like 27 being a 3W3W3 cube. There are multiple geometric shapes for larger numbers; each may display the factors of composites, but the hexagon does not. If there are 4 or more prime factors, the object may have more than 3 dimensions, but it may also be a polygon or something in between. However, primes are not representable by simple regular shapes. Primes are like chemical elements, composites are like chemical compounds (e.g. H20 is an angle, but C02 is a straight line).

Positive integers are an infinite series of mathematical objects, each completely different from all others, like individualized (non-fungible) personalities, even though to human minds that personality is difficult to perceive when the number is large (easy for small numbers). Possibly a mathematical genius could discern the personality of large numbers. Most of us lack this faculty.

- The numbers 26 and 196,884 come from an article in scientific American, November 1998, pp. 40-41, about Richard Borcherds. The number 42 comes from “Hitchhiker’s Guide to the Galaxy”, as the computer’s answer to the meaning of the universe. (42 = 2W3W7, which means something in numerology.)

ANALOG AND DIGITAL: THE ROLE OF DISCONTINUITY.

Mendelian heredity is discontinuous or atomic (in the original sense of not infinitely divisible), like matter and electricity, and unlike time and space. This is parallel to the concepts of digital as opposed to analog operations in computation. The latter can lead to chaos because of the indeterminacy of initial conditions, since on the line of real numbers there is a super-infinity of points. It is known that digital disks and tapes are clearer than analog ones.

So when replicators (RNA and DNA) entered into incipient life forms, they converted the previous protein system from an analog one to a digital one. Replication and reproduction is digital, like iteration in mathematics and in computation. All computers have clocks, as do organisms. Both iteration operations and reproduction consist of discrete steps called generations. Since life is basically a conglomerations of information systems, being digital makes the transmission of messages more clear and distinct. Cycles, like the Krebs cycle of oxidative respiration or the dark reaction of photosynthesis, are also discrete batch processes, although they run continuously like a conveyor belt.

Discrete steps (rises and runs of a staircase) also characterize the “Devil’s staircase”, a fractal “curve” which has no tangent. I prefer to call it the Angel’s Staircase, as in Jacobs dream of a ladder extending to Heaven, with angels ascending and descending. A discontinuous ladder or staircase is better than a continuously sloping ramp. Saltation in the origin of new species is better than continuous gradual evolution from small variations, as in Darwin’s original scheme. .

ACRONYMS.

The acronyms of world organizations and agencies and programs and projects that I keep hearing at this conference are like amino acid sequences in the working parts of enzymes , the “domains”, sometimes highly conserved across species and even phyla in evolution.

We permute the 26 letters of the alphabet like the 26 amino acids, to create units of meaning.

World society is still evolving, very actively and rapidly now, to some kind of new organismic unity—if we make it. Will these acronyms be highly conserved?

“In the beginning was the Word.” And the Word will be at the end—unless there is nothing.

MUSICAL SCALES.

The diatonic scale (octave) is divided into 6 intervals (4 full tones and 2 half-tones) between its 8 tones from beginning to end. How to do it, to have the frequency ratio between beginning and end 1:2?

There are two well-known ways: the major and the minor scale. They differ in the positions of the two half-tones. But why is the major scale perceived as happy fulfillment and the minor scale as sad disppointment? Why should the placement of the half-tones correspond so universally to human moods? This is true transculturally, I believe. Even the do-mi-sol triads have these mood differences.

Do any cultures anywhere use the other possibilities of placing the 2 half-tones? As combinations of 2 out of 6, there should be 13 others, for a total of 15. What would their mood correlations be, if any?

LAMENT FOR INFORMATION LOSS.

Old paper books yellow and crumble,
old diskettes are erased by stray magnetic fields.
Poetic verses jumble into mumble,
a learned treatise no more wisdom yields.
A singing voice gives out with age,
a loss of money impairs the sage.

Our life-form patters are much better preserved
in genetic language with an alphabet so sparse.
No precise copies, yet the variations served
the progress seen in forms new, diverse.
Could words, mind's children, but learn Nature's trick,
survive decay of medium/body, emerge renewed and slick.

Note in the text edition of this volume: This record was promptly lost from the diskette. I have no idea where it went. It's extinct except for this specimen and its Xerox clones.

THE MEDIA OF EXPERIMENTATION.

In bio-medical experiments, we speak of “in vitro” and “in vivo”. By analogy, Stuart Kauffman does computer simulations and calls them experiments “in silico”. Could there be other kinds? Let us list them all.

In vitro—experiments in test tubes, flasks, beakers, or Petri dishes.

In vivo—experiments in living organisms: E. coli, yeast, fruit flies, mice, rabbits, humans. But are these all the same or different? They may be only partial “models” of each other.

In silica—computer simulations: mathematical (numerical) modelling of relationships too difficult to solve analytically.

In mensa—thought (“Gedanken”) experiments sometimes done by physicists; or by historians modelling the “counterfactual”. (“What would have happened if”)

In spirito—experiments in mysticism, usually producing results inexpressible in words.

And experiments in various artistic media:

In lapido: sculpture.

In pigmento: painting.

In musico: music.

Some of these words are linguistic abominations, and better ones must be invented. However, the implication is clear: we experiment (seek answers to the truth) in many media, or play with meaningful patterns in different ways. The play or the search is basically the same, regardless of the medium. We must master the medium, in a technical way, before we can express the meaning, but it is the meaning which is important. The medium is NOT the message.

MORE ON COMPLEXITY.

In my previous essay “Complexification and the Mind of God”, I referred to the book by Paul Davies “The Mind of God”, in which he defined two important terms:

Algorithmic Complexity (AC) is the length of the minimal program that would yield the observed output in a computer simulation. For sufficiently complex systems, the program is (almost) as long as the output. We say that the output is algorithmically incompressible.

Logical depth (LD) is the running time for the minimal program to generate the observed output. Simple systems are logically shallow, complex systems are logically deep; sometimes the running time is infinite, i.e. the program would never halt.

We can combine low and high AC and LD in 4 ways, as follows, along with typical examples as indicated:

Scheme A: Low AC, low LD—small crystal or a tiled bathroom floor. The repeating patterns do not extend indefinitely, hence we specify “small” crystal and “bathroom floor”.

Scheme B: Low AC, high LD—Koch snowflake and other fractal structures, even the entire Mandelbrot set. The program is quite short, but it runs forever.

Scheme C: High AC, low LD—embryo development. The program is very long (the entire genome), but the running time is limited (9 months for humans, much less for many other species).

Scheme D: High AC, high LD—bioloqical evolution. The very long program is still running, and will continue until the end of the Earth as a living planet.

Stuart Kauffman in “At Home in the Universe” considers embryonic development “a subcritical phase” (a sea of order with some islands of chaos, i.e. pretty well set with occasional errors), the biosphere as a whole “a supracritical phase” (a sea of chaos.with some islands of order, i.e. subject to Gould’s condition of “contingency”), as still growing. Ontogeny does recapitulate phylogeny, but only up to the point where that particular organism has evolved. Ecosystems are probably at the point of transition from subcritical to supracritical, “on the edge of chaos”.

Complexity theory, as it fits into my scheme of the expanded “windmill model” of the sciences (see “Unfinished Road of Penetration Into Truth” and its sequel, “Combining the Mandala of the Sciences and the Room with Many Doors), uses schemes B, C and D as defined above. Scheme A is the subject of crystallography and geometry. Scheme B deals with fractals, schemes C and D with life processes.

There are transitions: from A to B we still Use repetition (iteration mathematically speaking), but at progressively diminishing scales, as in the Koch snow~lake and same of Escher’s pictures. From (A or B) to C we st~ll have growth. but in C it is differentiating rather than repetitive growth. From C to D we go from predetermined growth to unpredictable growth.

A is the order of rocks (lithosphere), B is the order of seashores, lakeshores, mountains, and clouds, (hydrosphere and atmosphere), and C + D is’ the order of the biosphere. Going in the other direction, C + D is the biota, B + C + D is the biosphere in the extended sense (i.e. the biota plus where it resides), and A + B + C + D is Gaia—the whole surface of planet Earth. Is Gaia alive? Sphere A (the rocks) not too much, but perhaps it is like bone or shell or the wood in trees; sphere B (water and air) more so, ever changing in climate and

weather; sphere C definitely, but stuck in species specificity and hence somewhat rigid; sphere D supremely so, with unfulfilled potential still beckoning. The unfairly devalued polytheistic nature religions saw spirits not only in animals and plants, but also in lakes, mountains, and rocks; all were holy. This is God (or Goddess) immanent, whatever the transcendent God may be.

What do we value? Diamonds are merely crystals, qold is a mere product of the rocks. King Midas found that the golden touch was a liability, since it transformed living beings into mere statues. An opposite process is indicated in the myths of Galatea and pygmalion, as well as Pinnochio. We value (or should value) entities with great algorithmic complexity and great logical depth.

FROM ORDER TO RANDOMNESS.

Truly random number sequences are difficult to qenerate. Computers produce only approaches to it, with some residual order. Only natural phenomena produce truly random sequences. (Scientific American, October 1998, articles on cryptography.)

Below, I present a possible scale.

Order	bifurcations	chaos (1 equation)	high-degree chaos	true randomness
(2, 4, 8, 16very large)		(several to many equ's)	(infinite no. of equ's)	

Is that how it is?

In this scheme life is between many bifurcations and chaos, while the weather, history, the stock exchange, and computer-generated "random" sequences are between chaos and high-degree chaos. Even high-degree chaos is still deterministic (if we follow the iterations), but true randomness is not.

Thus, while true order (perfection) is nearly unattainable (even crystals have defects), true randomness is likewise, in spite of the entropy law.

In fact, randomness is the most complex system, logically wholly incompressible.

RING THE CHANGES.

Permutate letters to make words,
permutate words to make sentences,
permutate phonemes to make speech,
permutate numerals to make numbers,
permutate tones to make melodies,
permutate colours to make images,
permutate pixels to make graphics.
permutate genes to make genotypes,
permutate bits to make information,
permutate memes to make memories,
permutate sounds to make harmonies,
permutate scents to make perfumes,
permutate emotions to make personalities.

Ring the changes, like bells,
kaleidoscopes, holograms.

Create mandalas, Julia sets, symphonies
algorithms, spreadsheets, equation sets.

All complex wholes are made up of a few fundamental units, (26 letters, 8 scale notes, 4 primary colours, 10 numerals, 20 amino acids, 4 DNA bases), but are far more than the sums of those units, since the patterns are more important than the units. Millions of molecules are made up of only 92 (natural) atoms. And so on.

The units are the “givens”, the raw materials, but the patterns are chosen, for their meaning and beauty. Like ascribed and achieved status.

There are esthetic limits: e.g. melodies should not be too random (“white”) or consist of tones too close to each other (“brown”, as in Brownian motion, i.e. too orderly); but 1/f (fractal definition, or what I would call “beige”).

What is the probability of chance formation of functional sequences in proteins and nucleic acids? Is the origin of life easy or difficult? How does a composer choose notes for melody or harmony? How does a sculptor choose shapes? How does a painter choose colours?

Primary computer output (zeros and ones) looks meaningless, “mere information”. But higher computer languages disclose the meaning hidden there.

Meaning can be deliberately hidden, e.g. by encryption.

Meaning is hidden in sequences of cards, solitaire, hands of bridge, euchre, blackjack, fortune-telling. Meaning is hidden in words on the scrabble board or in crossword puzzles when we try to combine them into sentences. Syntax can be satisfies while semantics and logic are violated.

“Meaning” is devilishly hard to define. What is the meaning of “meaning”?

The mathematics of permutation and combination is the key to some of these questions. The unexpectedly huge numbers sometimes observed are surprising to our intuition.

How does order emerge from this randomness?

Why are our minds not attuned to grasp hidden order instantly, without having to play out the game?

Some mathematical geniuses can do it. Do they have differently-structured minds? Higher or just different?

Some minds might not have to laboriously derive proofs in Euclidian geometry, but grasp their truth immediately and intuitively, since the hidden connections are already all there. No one needs to shout “Eureka”. These other beings would just yawn and say “What’s the big deal?” “So what’s new?”

FROM "THE SYMBOLIC SPECIES: COEVOLUTION OF LANGUAGE AND THE BRAIN" BY TERRENCE DEACON.

(My outline of the steps.)

1. There are 3 kinds of signs for association: icons which depend on contiguity or closeness, indexes which depend on similarity or correlation, and symbols which are defined by arbitrary convention (e.g. the word “table” for a certain piece of furniture). Contiguity and similarity are also the two kinds of magic, as described by Frazer in “The Golden Bough”.
   Indexical relations are involved in conditioned response kind of learning, which can be done with both animals and humans, when reinforcement of the associations to be learned is achieved by rewards (food) and punishments (electric shocks). The animal essentially learns the persistence of a correlation between the token and the object.
   Symbolic learning is different: it is learning by insight, as in Gestalt psychology (seeing the configuration as a whole, the forest not the trees). These two kinds of learning illustrate the difference between knowledge and understanding.
   However, a word standing by convention for a thing (as a noun does) or an activity (as a verb does) or a quality (as an adjective does) is still only an indexical relation, according to Deacon. Symbolic reference comes in only when relations between symbols (horizontally) are recognized and habitually used. This involves abstraction, classification, and generalization. He claims that this is highly counterintuitive.

2. Deacon claims that the symbolic transition is very difficult to achieve for animals thinking in iconic and indexical terms, because it involves some unlearning of old habits as well as the learning of new ones, thinking in a new mode. It seems that only humans have achieved this transition, although some apes can catch on after strenuous training, if they are still young and plastic.
   The transition to symbolic reference in humans is associated with the beginnings of language, some 1.5 million years ago, in Homo habilis and then Homo erectus. But it is not clear if symbolic reference led to language or vice versa.

3. The transition is not directly related to brain size, either absolute or relative to body size. Rather, it is related to a reorganization of brain circuits. Language (or any other brain function) is not localized in any particular brain area, but is distributed to many areas through neuron connections 2nd circuits. The axons can be very long and reach across areas, as is already evident in embryonic development when these connections are made. An excess of neurons are formed, and those that do not reach their proper targets are eliminated by apoptosis (programmed cell death).

4. The prefrontal cortex gained predominance over circuits previously used for other functions. Circuits normally compete for access, in a quasi-Darwinian fashion, and dominance (a “larger vote”) is gained by greater use. (Cf. Dennett’s “demons” in “Consciousness Explained”). Then the prefrontal cortex also grew in relative size. While ape brains increased in comparison to average mammalian brains, relatively, because bodies got smaller, human brains increased relatively in comparison with ape brains because brains got bigger for the same body size.
   Reorganization of the brain involves both neuron proliferation in some parts (e.g. the prefrontal cortex and some other areas) and different parcellation, i.e. how many neuronal connections are received in and sent by particular brain structures. I.e. a re-wiring is involved.

5. Use of language created a bigger and more differentiated brain, not vice versa. But they mutually supported each other (coevolution). The mechanism was Baldwinian evolution: behavioural changes affect the customs of society (social or cultural

evolution by “memes”); then society exerts selection pressure on individuals (e.g. less fluent language speakers are less desirable as mates and thus leave fewer descendants); therefore the genetic propensity for fluent language skills increases. Behaviour affecting genes is almost Lamarckian, but not really; the mechanism is strictly Darwinian.

6. Language use was advantageous in society because it was needed for social contracts: (a) for peace, to counteract Prisoner’s Dilemma situations and promote reciprocitytype cooperation, as in Axelrod’s “Evolution of Cooperation”, and (b) for marriage, to reconcile permanet pairbonding needed for child-care, with larger group cooperation among men for hunti~g large animals.

7. Hunting and use of stone tools for butchering became necessary when meat eating had to supplement the original vegetarian diet due to shortages in the ice age. Men had to be away for prolonged times, since women with small children could not hunt. Marital fidelity had to be assured by means of a binding contract: the pair bond, involving promises of both fidelity and provisioning, had to be established by a publicly witnessed contract, with penalties for betrayal. Rituals were invented for this purpose. Both the contract and the ritual required language.

8. Pair-bonding replaced polygyny when fathers were needed to bring food to dependent mothers and children. Child care came to require more work and time as infants were born earlier and more helpless. This in turn was because the heads got too big to go through the birth canal, because of the growth in brain size. So what caused what? It seems to be a cycle.

9. Physical changes other than brain reorganization were also needed for efficient speech production, especially descent of the larynx in the throat. There was a cost for this: a greater probability of choking while eating, especially when talking at the same time.

10. The habit of symbolic reference and the use of language led to a different type of consciousness. Animals using icons and indexes have a consciousness, but it is different in kind. We still have this kind of animal consciousness in the background. It is non-verbal, consisting of sensations, emotions, and impulses. It is studied in a philosophical tradition called phenomenology. In any case, Whorf was wrong when he said that we cannot think at all without words.

Humans can form the idea of the self (as children do at some stage), and also recognize a similar self in other humans. (Some apes can recognize their own self, but not that of others.)

This makes humans into responsible moral agents. They can deal with others on a nI-Thoun basis. Unfortunately, this has not yet completely taken hold in human behaviour. By mentally dehumanizing others, we can justify mistreating them. We still do this on a widespread world-wide scale, but increasingly we hold war criminals in the Light—at least in the light of public (and perhaps soon legal) disapproval. (I am referring to the imminent creation of a World Criminal Court.)

In any case, world society is still evolving. Perhaps this further transition to becoming fully responsible moral agents is still in progress.

ACQUISITION OF LANGUAGE.

The March 14, 1997 issue of *Science* has a series of articles on recent advances in psychology, including an article on the acquisition of language by children, and the comprehension and production of language by adults and children. The article is by Alan Prince and Paul Smolensky and is entitled “Optimality: From Neural Networks to Universal Grammar”.

Neural networks are computer designs which can learn. Between the input units and the output units are placed intermediate units with variable states. The computer network is first “trained” with some problems whose answers are known, thus producir.g an initial adjustment of the variable units. This serves as an approximation when the unknown problems are later introduced. The network is given feedback as to the correctness of its output, enabling it to make further adjustments, until it can produce mainly correct answers.

Neural networks were deliberately designed to simulate what were thought to be the cognitive mechanisms in the human brain. The usual Von Neumann linear computer design was thought not to resemble brain mechanisms too closely, since brain mechanisms are “massively parallel” rather than linear. It is inter~sting that now Prince and Smolensky try to apply the neural network computer mechanisms to help us understand what happens in the brain when we learn, comprehend, and produce language.

A basic model in linguistic theory has been that of Noam Chomsky, who postulated a “universal grammar” (sequence of words etc.) valid for all the hundreds of human languages. This universal grammar must therefore be innate in humans, he thought, i.e. genetically based. This has been questioned by subsequent writers. Most concede that there is a genetic component to the acquisition of human language, but perhaps it is not exactly the component postulated by Chomsky.

The basic idea of Prince and Smolensky is that children approach their knowledge of how to use language incrementally, just as neural computer networks do, learning by trial and error; the errors are pointed out by adults, and correct usage is reinforced by adult approval. This is called “optimization” in neural networks; it is a gradual approach, through successive approximations, to the best compromise between various contradictions. These contradictions arise when certain rules clash’ with one another, and some “metarules” are then needed to resolve the conflicts. This optimization procedure then results in the “universal grammar”. The rules are the same in all languages, but the meta-rules may differ from one language to another.

The meta-rules (my term, not used in the article) take the form of “strict dominance” (the authors’ term). This means the following: when two principles (or rules) clash, one of them becomes,dominant. The meta-rule of strict dominance then prescribes that no amount of success of the weaker rule wins over the failure of the dominant rule.

The usual clash occurs between “structure” (certain constraints of word-sequences in a well-formed sentence, e.g. subject-predicate-object) and “faithfulness” (favouring exact replication of input even at the cost of structural complexity). Different languages differ about which principle should be dominant, structure or faithfulness. (Concrete examples are needed here.)

The best balance between the demands of various constraints is attained in neural networks by adjusting the “weights” in the intermediate (variable) layer of units to a so-called “harmony pattern”, which in language formation is equivalent to a “well-formed sentence” in a particular language.

Optimality theory is a higher-level theory, like thermodynamics. Neural computation is like the underlying lower-level theory of statistical dynamics. The lower-level theory provides the mechanism which makes the higher-level theory valid.

Comprehension (interpretation) of language differs from language production. The former is much easier, and provides the initial “training” from which the child (like the computer network) derives the original “weights” in the intermediate layers. A child learns to speak by being spoken to; a fact generally known for a long time. For a time, children comprehend much more language than they can produce. The necessary feedback as to the language production then comes from classical conditioning: the approval or disapproval of adult listeners.

So what is innate and what is learned in language acquisition? Possibly the child’s brain contains some structure analogous to a neural (massively parallel) computer. This certainly is not too far-fetched, since neural computers were deliberately designed to simulate the brain. But the training and final harmonization and optimization of language production is learned from the interaction with adults.

In early child language production, “structure” constraints tend to predominate over “faithfulness” constraints: e.g. words are pronounced differently, but rules of sentence structure are observed. This is what had impressed Chomsky so much. But “improving” grammar means only re-ranking the constraints.

More advanced properties of linguistic structures, such as the nesting of syntactic phrases (subordinate clauses etc.) are learned much later, again by successive approximations and adult corrections. Syntax learning is later supplemented (and sometimes first introduced) in formal school classes.

I would like to add that, to me, grammatical-syntactic structures are structures of logic comparable in their beauty to structures in mathematics. It offends my sense of harmony to read a sentence without a verb, or a complex sentence ending with a subordinate clause without closure of the main clause. It has the feel of a melody without the closure of a final chord, or a mathematical proof without the final “ergo” statement. Omitting the teaching of grammar in primary schools is a profound mistake.

LANGUAGE AND THE MIND.

According to ancient lore, the mind contains the three faculties of Reason, Feelings, and will. The structure of language mirrors these basic divisions.

Nouns reflect reason (as perception of objects or persons and conception of ideas), adjectives reflect feelings or emotions, verbs reflect will or action. Also, adverbs provide the emotional coloring of the will, pronouns are proxies for nouns, conjunctions are links between all of the above, and prepositions provide space-time orientations, sometimes tinged with emotion.

Action is impossible without emotion, as Damasio showed. If the brain region responsible for emotion is destroyed, reason may correctly analyze situations and prescribe appropriate actions, but the actions are not carried out, because the motivation is lacking.

This is like social situations, e.g. in the field of environmental protection, where science (reason) provides the correct analysis and recommends appropriate actions, but they are not carried out because “the political will” is absent. The public has not been emotionally aroused to a sufficient extent.

Our rational analysis of the crisis must become much richer in adjectives, arousing both despair and hope. Perhaps pictorial representations would “speak” to this more eloquently than language.

COMBINING THE MANDALA OF THE SCIENCES AND THE ROOM WITH MANY DOORS.

This is an attempt to combine two previous essays: “The Unfinished Road to Knowledge”, which presents the windmill model of cognitive development from childhood to mature science, also called the mandala of the sciences, and “The Realm of the Mind”, which describes the mental world as a darkened room with a central light of consciousness, and doors to the deep unconscious, to the body, to the collective unconscious, and to the spiritual.

In the first essay, cognitive development is traced through the Piaget stages to commonsense physics to Newtonian physics, representing the shaft of the windmill, and then branching out in four directions: (1) special relativity theory for the very fast and general relativity theory for the very large; (2) quantum theory for the very small; (3) thermodynamics and statistical mechanics for the very numerous; and (4) complexity theory (including networks, chaos, fractals etc.) for the very interactive.

The head of the windmill can be seen as relativity theory going to the left, quantum theory to the right, thermodynamics downward, and complexity theory upward. Then the horizontal (left-right) direction represents physical theories that are time-reversible, and the vertical (up and down) direction represents physical theories that have an arrow of time.

It is now proposed to add a fifth direction (perhaps going forward), which would be an exploration of the inner mental world. Since the mental world is itself not simple, as shown in the second essay treated here, we would need to explore not only the central room with its shaft of light, but also the separate side doors. The picture then might be: add another forward-going shaft to the original windmill, which then branches out to the head of a second windmill.

OPEN AND HIERARCHICAL?

In a discussion with a young woman, I questioned her condemnation of hierarchical structures. “The brain”, I said, “exploits the rest of the body by taking the lion’s share of blood supply and oxygen.” “Nonsense”, she said, “We are open systems.” The bell rang for resumption of sessions, and the noise level of people moving on from coffee break increased, so that she could hardly hear me saying that open systems can also be hierarchical.

Today I would put it even more strongly: it is closed systems (cycles) which are non-hierarchical, because they are intransitive: there is no point of dominance in a circle. (This is why King Arthur’s knights used a Round Table.) And of course a circle (cycle) is a closed figure.

On the other hand, cascades, flow-through systems, and Prigoginian structures are open systems in a thermodynamic sense, they are transitive, and they are hierarchical. A cascade of hormones, each releasing the next, goes from the pituitary gland to the sex glands, releasing several stages; and also to the thyroid gland, to the adrenal gland, and so on. Another cascade sends a message from a hormone through a receptor to an internal cell messenger to the nucleus, instructing the DNA to initiate protein production.

We are open system because we are flow-through systems, open to matter and energy flows through our bodies and out again (in changed, degraded forms) from the environment and back out again. We take in oxygen and exhale carbon dioxide and water. We take in food and discard what is not needed.

My young friend, a spiritual descendent of the flower children, understood these words in a different meaning. “Open” was good as opposed to “closed” (as in open mind versus a closed mind), and “hierarchical” was bad, as practised in authoritarian structures of the state and in armies and schools. And the good things should go together and the bad things should go together.

This is an illustration of how intellectual differences can result from different interpretations of words and concepts. We could have argued all night if that bell had not rung, unless we clarified what each of us meant by the words we were using.

DIFFERENT MEANINGS OF INTEGRATION.

Many words, of course, have multiple meanings, either because they are used in different contexts or because different users employ different definitions. This is only one example of such a weasel word: INTEGRATION.

Kenneth Boulding classifies systems of power as threat, exchange, or integration. In this sense, “integration” means the power of cooperation motivated by love, not merely by reciprocity as in exchange, and far removed from the power of threats and punishment. A well-functioning family is an example of integration, where cooperation goes beyond both reciprocity and contract to genuine concern for each other’s welfare.

“Integration” can also mean the opposite of mere “aggregation”. An aggregative society operates by a compromise among competing special interests, with final decision by a majority vote, without necessarily reconciliation. (Contest to be fought next time, perhaps.) This is the adversarial model of society as envisioned by liberal-democratic thinkers. An integrative society operates on the assumption that all citizens should seek the greatest welfare for all citizens and the society as a whole, and vote in accordance with “the general will” (Rousseau) as they perceive it. An integrative society sounds far more idealistic and utopian, but tends to degenerate into repressive dictatorship, when those incorrectly perceiving the general will (or actually pursuing selfish interests) are severely punished. Sometimes the lesser good in theory proves to be the greater good in practice.

In Haas’ (and others) theory of “integration”, Western Europe is seen as an example. “Integration” here means the voluntary combining of sovereign states into a larger unit. The ultimate expression of this form of integration would be the formation of a world federal government.

In the calculus branch of mathematics, “integration” is the opposite of differentiation, just as in arithmetic and algebra, addition is the opposite of subtraction and multiplication is the opposite of division. While differentiation divides the object into infinitesimally small units in order to determine their instantaneous rates of growth, integration sums up an infinite number of infinitesimally small sections (e.g. of an area) to a finite measurement. Integration and differentiation are seen here as opposites.

However, in the embryology branch of biology, integration and differentiation are seen as complementary. In a developing embryo, cells differentiate to become parts of different tissues and organs (skin, muscle, liver, brain), while the organism as a whole remains integrated as a functional unit in which the organs cooperate.

Another meaning of “integration” is seen in race relations as the opposite of “segregation”. Schools are integrated when black and white children attend the same classes. Same applies to restaurants, swimming pools, and other facilities, including housing.

Summarizing: “integration” can be seen as the opposite of (threat and exchange), aggregation, state sovereignty, differentiation (in calculus), and segregation; and the complement of differentation in development.

HOT PERCEPTIONS: ADJECTIVAL OPPOSITES.

In Ch. Osgood's scheme of the Semantic Differential, the adjectival opposites Good-Bad, Strong-Weak, and Active-Passive play a key role. They seem to be transculturally valid to various extents, with the Good-Bad pair most, the Strong-Weak the next, and the last least so, sometimes being replaced by Fast-Slow (which is almost a synonym) or Hot-Cold.

The following is an extensive list of opposites from R. Gregg ("Self-Transcendence", London, Gollancz, 1956, pp. 61-62), (as cited by Stephen Sayers in "The Eternal Embrace", *Friends Quarterly*, July 1999, pp. 293-299). Some of them are nouns rather than adjectives.

From the senses: hot-cold, hard-soft, sweet-sour, light-dark, sound-silence, fragrance-fetor, vertical-horizontal, rest-motion, winter-summer, night-day.

From the mind: truth-error, wisdom-folly, belief-doubt, symmetry-distortion, growth-decay, many-few, cause-effect, change-permanence, creation-destruction, subject-object, attack-defence, willing-reluctant, freedom-necessity

From feelings: like-dislike, pleasure-pain, love-hate, hope-despair.

From moral nature: good-evil, pride-humility, innocence-guilt, courage-cowardice, respect-contempt.

From science: acid-base, positive-negative electric charges, north-south magnetic poles, crest-trough of a wave, oxidation-reduction, clockwise-anticlockwise spin, life-non-life, analysis-synthesis.

Sayers claims that perception of the world in terms of opposites arises from our experience as time-dependent beings. This creates ambivalence and perpetual existential anxiety. We know that all clouds have a silver lining (a source of hope, but also that all silver linings imply clouds (a source of despair). Thus a life lived primarily in the plane of time will know of anxiety, but never be entirely without hope.

However, eternity is the absence of the perception of time as an inexorably forward-flowing river. Eternity is not an infinitely extended time, but the ever-present moment to include both the past and the future. Time is, after all, only a (somewhat imaginary, but only in the mathematical sense) dimension of the space-time continuum, according to the theory of relativity.

The sense of eternity, which is the essence of immortality, can be achieved in this life by deep meditation, the communion with God. In this expanded awareness of the present, we are nearer to the past and the future than it is ever possible to be. The eternal binds past, present and future together. "I am Alpha and Omega, the beginning and the end", saith the Lord.

Gregg compares this with a "gathered" Quaker meeting for worship, in which all temporal distinctions, between God and humanity, the dead and the living, you and me, past and future are weakened by the radiance of eternity. We can feel all with us, fused with our own being, in an eternal embrace.

CAN OUR REACH EXCEED OUR GRASP?

"Our reach should exceed our grasp,or what's a Heaven for?"—Tennyson

Gvdel showed that not every truth is provable in formal mathematics, and not every falsehood can be disproved. This is well illustrated in the diagram in Hofstadter's "Gvdel, Escher, Bach", p. 71.

Some statements are undecidable as to their truth, e.g. "All Cretans are liars" said by a Cretan, or "This sentence is false" (self-reference). Fuzzy logic would call them half-true and half-false, i.e. truth value = 0.5 if true = 1 and false = 0. Other fractions are possible, like the dimensionality of a fractal.

"Undecidable" also refers to problems like the Travelling Salesman (finding the shortest route among a number of cities); it would take even the fastest computer so long to solve as to exceed the age of the universe. (Actually Turing pondered whether there are algoriths that never stop at all.) Yet in practice we use reasonable approximations, just as Arrow's theorem of the impossibility of combining individual utilities into collective utility in a democratic way does not prevent us from practicing a reasonable approximation to (imperfect) democracy. We use something like fuzzy logic to operate in the real world.

As in the diagram mentioned above, we penetrate into truth only partially like a fractal tree, proceeding from axioms to theorems and lemmas. This fractal tree never covers the whole area of truth, just as a Koch snowflake never attains the dimensionality of 2, i.e. never covers the whole area of its enclosing square.

However, we can often guess at or approach or intuit unprovable truths in practice, albeit not with deductive certainty. Computers can only do algoriths, but human minds can reach beyond (Roger Penrose). Some non-computable truths are grasped by intuition, which is a higher human mental faculty, beyond both deduction and induction

So could there be "intuitional axioms"? (Axioms do not need to be proved.) I would suggest one: the moral principle of "shared essence", which induces us to believe in the moral obligation not to harm other human beings, and by extension a reverence for all life (though compromises must be made in practice).

Probably knowledge in the sense of certainty has definite limits for human beings. Approximation and fuzzy logic can take us a step further, and perhaps intuition (but what is that exactly?) another step. Yet there is still a sense of Gvdelian incompleteness. Karl Popper's "World One" (Kant's "things in themselves") will always remain inaccessible. "World Two" (subjective sense experience or phenomenology), is knowable, as is (with some limitations like Heisenberg's uncertainty principle) "World Three", the objective scientific interpretation of the world we perceive with our senses and then reason about, with some inter-subjective agreement among ourselves).

To say that "God is Truth" (or "Truth is God" as Gandhi would say), implies that God is transcendent (unprovable, in fact inconceivable) as well as immanent (provable, visible in His creation). He (and Truth) is simply greater by far than we can conceive by reason. If intuition might be a candidate we cannot yet say.

NON-AXIOMATIC TRUTHS.

Are all non-axiomatic truths (truths that cannot be proved as theorems) trivial, like the Cretan liar paradox or other self-referential statements? Only such statements are involved in Gvdel's proof of incompleteness. The same kind of statements would be excluded from formal logic by Bertrand Russell. But I suspect that Gvdel left the door open to the existence of other, more significant, unprovable truths.

Unlike computers, which follow only algorithms, i.e. deductive logic, humans can "leap to conclusions", which may be true or false. Their truth status cannot be determined deductively, but can sometimes be tested empirically, and at least partially confirmed by inductions, i.e. repetitions of the experiments (replication); and by approaching the question from different sides. If the results converge, the hypothesis is confirmed, at least until some other experiment falsifies it; then the theory can be either amended or abandoned for a better one. This is the essence of the scientific method.

Humans are very good at hypothesis-formation, sometimes too good. The left-brain interpreter (Michael Gazzanica, "The Mind's Past", University of California Press, Berkeley, 1998, 201 pp.) fills in gaps in sensory input to weave a complete scene or story; this sometimes leads to visual or auditory illusions, mental confabulations, or false memories, but sometimes gives rise to Eureka-type insights. It can be a step from data gathering and manipulation to understanding, which is quite a different mental state. Humans are inferior to computers in rapid accurate calculations; we cannot usually (except for idiot-savants) multiply two large numbers in our heads. But we are good at leaps of understanding.

The ability to seek patterns in data and to form hypotheses about why these patterns arose or why they exist is part of symbolic thinking, which distinguishes humans from animals. According to Terrence Deacon ("The Symbolic Species", W.W. Norton, New York, 1997, 527 pp.), animals are capable only of iconic and indexic thought; the latter means associating inputs with results, antecedents with consequences, correlationally. Hence they are capable of learning by conditioned response, which can be reinforced or extinguished. Humans can do that too, but in addition they are also capable of symbolic thought, which asks WHY a certain patterns of antecedents and consequences exists—and then supplies an answer, from intuition or imagination. Possibly, the rewiring of the brain during evolution which made us human involved, among other features, the creation of the left-brain interpreter. This is a kind of confluence or "consilience" (E.O. Wilson's word) of Gazzaniga and Deacon.

Thus humans can reach non-axiomatic (non-algorithmic) truths by intuition (pattern-seeking imagination) and induction (experimentation and confirmation); i.e. we can do science as well as mathematics and logic. But we are not perfect at it: hypotheses can be wrong, theories may be disconfirmed or included as special cases of broader theories. And intuition alone can lead us astray into elaborate magical or theological structures which do not even seek confirmation, except in direct revelation by a deity.

To indulge in one of these (and I leave its truth-status suspended): God knows all truths, axiomatic or not. He is quite beyond Gvdel incompleteness, and beyond intractability as well (referring to problems which a computer could solve only in a time greater than the age of the universe), because he has eternity available for computing. (Actually, eternity is not just an infinite extension of time, but a different dimension, timelessness, the "eternal now". So an intractable computation would in eternity be solved instantly.) This is what it means to say that He is all-knowing (omniscient). But He leaves a gap of uncertainty for human free will, voluntarily and graciously abandoning omniscience to leave room for the mind and life of His creatures. Hence the Bible Code contains predictions of disasters, but qualified by the (almost desperate) question "Can you change it?"

Human intuition is still hazy and imperfect; it can be wrong, false like false memories, like seeing through a haze or semi-darkness. We may grasp some unproveable truths, and accept them by faith, but doubt is ever on our heels. In science we try to remove doubt (or at least lessen it), but in metaphysics we lack the tools to do so. Humans are only imperfect images of God, who can reach ultimate truths unfailingly. Should we then accept His word in revelation? But then, how to guard against false prophets? And what if different prophets have different revelations? If they are combinable, well and good, we can take them as partial revelations. But if they are mutually inconsistent, we are in trouble.

Truth is like the Holy Grail, forever beyond our grasp.

CYCLES AND PARADOXES.

The electric buzzer and the governor of a steam engine (both examples taken from Gregory Bateson's book "Mind and Nature") are cycles, but cycles operating in time. In static (timeless) logic, they produce either nonsense or paradox. They are related to the Cretan liar paradox in its several versions, always put in the language of logic. In mathematics (a logical deductive system), this paradox is an important part of Gvdel's proof of incompleteness. It seems that the human mind can discover non-theorem type of truths, unlike formal algebra and unlike computer algorithms.

Is this because time plays no part in mathematics, which is seen as an "eternal" deductive system? But one might think that time does play a part in computer operations; there are temporal sequences in algorithms, and even a clock in the computer hardware. But that is an error: computer algorithms, like the steps in an algebraic proof, should not be seen as temporal sequences. They are only the steps in syllogisms. And computer hardware is composed only of "logic gates". (The "clock" is only a mechanical convenience.)

A computer asked to "solve" the Cretan liar paradox will give alternating "true" and "false" answers, ad infinitum. This is a bifurcation of truth; yet only the first bifurcation (an oscillation), not chaos, which involves an infinite number of bifurcations (but following each other at rapidly converging intervals, so that chaos can be reached in finite time). It is a case of limited symmetry-breaking. Fuzzy logic solves the paradox by calling it half-true and half-false. As usual, we generalize by permitting fractions, i.e. creating new "numbers" as we need them.

The buzzer, the steam-engine governor, and the Cretan liar paradox are examples of real-world cycles between two possibilities. Penrose's three worlds (Platonic, physical, mental) is an example of a three-pronged intransitive cycle, which is also a paradox. But intransitive paradoxes abound, like the game of "paper-stone-scissors" or the "voter's paradox". They only seem to go against logic, because logic is too narrow. They are perfectly explainable, in a different way in each case. The "Great Wrap-Around" of God and the Universe is the supreme example. The Snake is able to eat its tail.

THE ANSWERING MACHINE.

“Do it as I said before—back to the original plan. In view of new information, it’s back to the original plan.”

This message concerned only plans about a meeting place to carpool to Toronto. But by mistake it went to the wrong answering machine. (The wrong number was dialled.) The caller did not leave a name or phone number. What would the wrong addressee think the message might mean?

1. He had overheard the plotting of conspirators. He should trace the number and report it to the police.

2. This was a pair of lovers planning to elope. Do nothing; it is none of my business.

3. It is the voice of an extraterrestrial with an enigmatic message.

4. An angel is calling us back to Paradise.

5. Thieves are planning to rob a bank. Call the police.

6. An old girl friend is calling the addressee back to the old relationship. Look for her phone number and call her back immediately.

7. A husband calling to a widow from beyond the grave.

8. A misdirected message by Ma Bell.

THE UNKNOWABLE.

In a book by this name, Gregory J. Chaitin (Springer, Singapore, 1999) probes the limits of mathematics. When George Cantor formulated his theory of transfinite sets (whole different orders of infinities, each including the previous and continuing on to infinity), this when analyzed by Bertrand Russell led the latter to certain paradoxes.

The main one was “Is the set of all sets that are not members of themselves a member of the set?” The answer is both yes and no, or rather, if yes then no, and if no then yes. This is quite like the second paradox, that of the Cretan liar: the Cretan said “All Cretans are liars”. If it is true, then it is false; if it is true, then it is false. More tersely, this can be put in a shorter statement, “This sentence is false.” (The one about the barber shaving himself, however, is resolved if the barber is a woman.)

These paradoxes are due to a property called self-reference; this was illustrated copiously and ingeniously in Hofstadter’s “Gvdel, Escher, Bach”). Russell proceeded to eliminate the paradox from formal logic, declaring it inadmissible. However, this seems rather arbitrary, like ruling out the existence of a creature that does not conform to your ideas of biology; yet it exists. (Like proving by engineering principles that a bumblebee could not fly.) We have since learned how to deal with it by inventing “fuzzy logic”, defining the Cretan liar statement “half-true and half/false.

Incidentally, physical phenomena of this nature also exist, e.g. the electric buzzer: is the electric circuit open or closed? Well, half and half, vibrating between the two states. And where are the double bonds in a benzene ring? Vibrating very rapidly between two configurations, actually stabilizing the structure. Of course, quantum theory abounds with fuzzy overlapping states.

Self-reference is actually an instance of intransitivity in a binary system, when you think about it. Usually intransitivity requires at least three members: A is greater than B. B is greater than C, but C is greater than A. Self-reference seems to be an instance of A is more true than B, but B is more true than A. Nature in physical systems deals with this paradox by vibrating the alternative states. But in strict formal logic and mathematics this is impossible, because these are static structures—trying to be eternal, in a way.

Yet Russell should not have ruled out the self-reference paradoxes. It is better to retain them, not deny them, and admit that any formal mathematical system is either in-complete or contradictory (i.e. inconsistent) . This is what Kurt Gvdel did in his famous proof; he used a self-referential statement in the proof. We could “vibrate” “incomplete” and “contradictory” if we wished, but “incomplete” seems more acceptable to most mathematicians and ordinary people. This is because, if contradictory statements are admitted into symbolic logic (i.e. if A and not-A are both true), the consequence is that ANYTHING could be proved.

Gvdel’s proof of incompleteness defeated Hilbert’s project of establishing a complete formalization of all of mathematics as a way of removing all uncertainties. It meant that there are true statements that are not theorems, i.e. cannot be deduced from a small basic set of axioms, as well as false statements that cannot be proved to be false. (The picture is one of mutually interpenetrating fractal trees of black and white.) Yet the question still remains, how many of these unprovable statements are there? How serious is the contamination? If the exceptions are only self-referential statements, perhaps this is not too serious. We might be able to ignore them, or rule them out, as Russell did.

Alas, it is not so. The malignancy has translocated to other sites, like the metastasis of cancer cells.

ABSTRACT STRUCTURES.

We accept logic, geometry, number theory, and other structures as something given, part of the external (though non-material) world that is a basic framework of thought. Why then do the followers of Noam Chomsky think that language structures (grammar, syntax, semantics) have to be innate in human brains in the form of a genetically determined “universal grammar” module? Why should we think of verbal language structures as internal, while mathematical and logical structures are seen as external, only to be discovered by us, and then seen as self-evident?

True, some of the universally present rules of grammar, common to all languages, are not immediately obvious; they could have been otherwise. But geometry, too, could be Riemannian and not Euclidean; logic can be “fuzzy” as well as classical; and numbers can be imaginary or complex as well as real. Yet we do not think of any of these primary structures (Euclidian geometry, classical logic, real numbers) as innate in the brain. Why should generally observed grammatical rules be so considered? It is good to remember that mathematics, too, is a form of language.

Abstract structures, linguistic or mathematical, are in a class by themselves: not material objects in the external world, and not neurological brain states or phenomena (whether innate or not). Abstract structures stem from classification and generalization; for example, Russell and Whitehead’s definition of number as a class of classes of n objects. A noun, a verb, an adjective, an adverb (or subject-predicate-object) are similarly a class of classes of particular names of things, of activities, and of qualities. Abstract thinking is a part of symbolic thinking, which is indeed (probably—but how do we know?) peculiar to humans. Abstract structures are close to Platonic ideas, out there beyond the shadows of the cave, in a cognitive mental heaven (universal mind). We PERCEIVE them through brain mechanisms, but they are not brain mechanisms themselves. They just ARE.

THE END OF CERTAINTY.

(Comments on book of the same name by Ilya Prigogine.)

When physical systems are simple (e.g. composed of only a few particles, preferably only 2) and lack instabilities, they can be described (as Newton did) in terms of particle trajectories obeying the laws of motion. Such systems are deterministic (if we know the initial conditions and the laws of motion, the future can be predicted with certainty); they are also "integrable" (his word—I think it may mean "decomposable"); and in addition they are time-reversible (they can be run forward or backward; there is no difference between the past and the future). Quantum systems are also time-reversible; the Schrodinger equation has no arrow of time. Yet in ordinary experience, time flows inexorably in one direction like a river.

However, as the number of particles increases (even a 3-body problem, such as the Sun, the Earth, and the Moon, is already difficult), instability appears because of Poincare resonances. Interactions among many particles are persistent and no longer transitory. When the number of particles becomes of the order of 10^{23} (Avogadro's number, the number of molecules in one litre of gas at standard temperature and pressure), we hit the "thermodynamic limit". We then have to abandon explanation in terms of individual particle trajectories and deal with ensembles, as in statistical mechanics. We go from micro-scale explanation to macro-scale explanation. Such complex large systems are no longer time-reversible, because the random ensembles are much more numerous than the ordered ensembles, and if we only count the variously disordered and ordered states, the system tends toward greater disorder, i.e. entropy increases. Thus time acquires an arrow, and the past differs from the future, because the future has more entropy than the past. In principle the process could be reversed to produce order in the future, but this is extremely improbable.

Even this "time-reversibility in principle" is abolished, according to Prigogine, if the system is far from equilibrium and open to the flow of matter and energy. Such systems (dissipative structures) undergo fluctuations and bifurcate repeatedly to higher forms of order (or break down instead). They become holistic, nonintegrable, nondecomposable—i.e. the whole is more than the sum of the parts, because of the persistent and frequent interactions. Time symmetry then breaks completely, because these systems evolve in unpredictable ways. (I.e. if the tape was wound back and re-run, it would produce a different result, as Gould said about evolution.) Certainty is replaced by possibility or probability, or what Gould called "contingency". These systems evolve; they have a history, consisting of events that could have been otherwise. Determinism is gone; novelty can be produced; emergence of new phenomena becomes possible and is manifested. All this is the result of instability which may lead to chaos, out of which new order may emerge.

Nature often exhibits such instabilities, leading to phenomena such as turbulence in weather systems, in evolution, and in history. This is because initial conditions can never be established with complete accuracy, since an infinite number of irrational numbers exist between any "adjacent" fractions, and natural systems tend to diverge even if the initial conditions differ only very slightly.

Prigogine goes on to show that this (the creation of the arrow of time) applies not only to Newtonian physics, but also to quantum mechanics and to relativity theory. In the latter, time may be "spatialized" by multiplying it by the imaginary unit i, making it into "real time" (??), but this does not really happen. The space-time framework is rotated in the Lorentz transformation, but time remains different from the 3 space dimensions. But instead of discussing these aspects, I now turn to some of my own analogies.

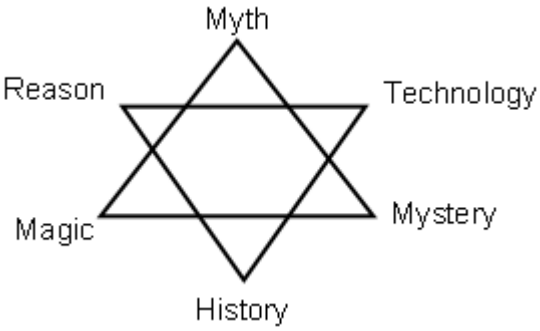
Complex systems become holistic and non-decomposable because of frequent and

persistent interactions among particles. This means that the interactions become more important than the particles; that structure predominates over matter. (Aristotle's formal cause applies rather than his material cause.) This is very evident in living bodies, where materials and energy come and go, but the form or structure is conserved. In a way, there is conservation of information and non-conservation of matter and energy—a complete reversal of what happens in closed systems.

It is also noteworthy that, in Robert Axelrod's "Evolution of Cooperation" experiments with Prisoner's Dilemma games, tit-for-tat cooperators win over other strategies (especially the nasty "meanies") when the programs meet each other again and again, thus giving rewards to each other. Interactions among people, which Axelrod's tournaments were meant to simulate, also become cooperative because of reciprocity, but only if the partners expect to interact repeatedly. As in a net, the links become more important than the nodes.

The structure of frequent interactions is the essential web that knits together both the natural and the social world.

ROSZAK TRIANGLES.



The diagram illustrates the interpenetration of the sacred and the profane, according to Roszak. I would also add that it shows the succession of the ideational and sensate ages according to Sorokin. Scientists like E.O. Wilson, who in “consilience” wants to derive everything ultimately from physics via biology, would prefer one triangle, while spiritually inclined people would prefer the other. Roszak himself is evenly balanced, arguing only that we have over-emphasized reason and technology and need to also incorporate elements from the spiritual triangle to restore mental and cultural balance.

Perhaps there are two entities intertwining in the world, mind and matter, like the two chains of Fibonacci numbers in Alcock’s book “The Trumpets of Angels”, or like the two complementary strands of DNA. The metaphor of two sides of a coin is too static; it suggests the rule of chance in flipping the coin. The image of the two sides being really one side in a Moebius strip is better.

The superposed triangles form a Star of David pattern, and the beginning of the fractal Koch snowflake. The opposite vertices illustrate the polar pairs Reason—Mystery, Myth—History, and Magic—Technology. The first pair deals with understanding the physical world, the second with understanding the human world, and the third with acting on the world. Another polar pair elsewhere in Roszak’s book is Ethics—Ecstasy, referring to two aspects of religion.

The idea of consciousness dimming from human to animal to plant to mineral may also be false, if God is immanent in all of nature. The divine ousis may crystallize anywhere as the spirit of a lake or of a mountain, especially in sacred places along the global ley lines of Alcock or the core cities of the Global Peace pioneers (1) in the book I lost.

And beneath matter in the quantum realm may be mindlike stuff, as in David Boehm’s intelligent electron, or his enfoldment idea.

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REALITY. (1970s.)

What is reality? You don't need
philosophers to tell you;
you know.
When you think you see a person
and it's only a dress-store mannequin,
you know the difference,
your whole tone of attention changes.

A photograph in a newspaper,
when looked at with a magnifying glass
is "in reality" only an array
of dots of varying density.
But a real human face, when magnified,
is organized and patterned
down to levels beyond the cell,
to the macromolecular basis of life,
and so is "real" through and through.

"Real dialogue" is not just words,
sounds, air waves, grammar or syntax,
or even just thoughts, concepts, and messages.
The only reality is revelation of personality,
direct experience of the life-stuff in action.

THE SNOW QUEEN (1970s)

Wandering, meandering, Gerda looked for Kay.
So many adventures, dangers, crises, escapes~
A life-time of trials and tribulations,
a quest for the Holy Grail.
While Kay sat, numbed and drugged,
and near-blinded by a mirror fragment
to the goodness in everyone and everything,
embittered old-young man,
senility before maturity.
And the ice-block scrabble
would not spell ETERNITY.
She came, as pure as she went into the fire,
as loving as when the briar-roses
entwined over their windows
in pre-mirror days.
Innocence preserved through the valleys of despond,
and the bleeding feet, and the bleeding heart.
She came and she wept sweet tears of sorrow
as she beheld her Holy Grail filled with hemlock.
She wept as if her cup overflowed.
Seeing her weeping, he wept. And the mirror
fragment left his field of vision,
and the world was sweet and innocent again.
Even as she who had just kissed the sleeping prince.
And they were children again, and the rose briars
formed a bower over their heads,
and the ice was melting all around.
They danced with joy, and the stones danced,
And the ice-blocks danced, and in a huge
negentropic leap, they spelled ETERNITY.
Eternity was theirs, all sins forgiven,
washed away with the tears of an
innocent and brave maiden,
in tears of love and hope.
Knowledge of eternity came spontaneously,
like the wind and the waves,
not laboriously or with effort,
Spirit-knowledge, love-knowledge
of Truth on high. The Light was brighter
than everything, but not at all blinding.
It was soothing and cheering, nourishing,
a flood of knowledge, a flood of truth,
a flood of love.
Hand in hand they danced and skipped home,
two happy children. And home was
just around the corner. No long journey now,
no encounters with dangerous creatures.
or any further trials.
Just run home as Mother calls for supper.
Everything is so easy, run downhill
to pure springs of Being.

COMPARISON OF DAMASIO AND CAIRN-SMITH.

(Antonio Damasio, “The Feeling of What Happens”, Harcourt Brace, New York, 1999, and A.G. Cairns-smith, “Secrets of the Mind”, Springer Verlag, New York, 1999.) The two authors use different terms for what seem to be the same entities. This is set out in the diagram below.

Damasio	**Cairns-Smith**
Proto-self (body-based)	Greater Self (unconscious)
Core (Self) Consciousness	Evanescent Self
Extended (Self) Consciousness	

The difference between the two schemes (besides the greater elaboration of the Damasio scheme) is a difference in emphasis and evaluation. For Damasio, the body-based proto-self is more primitive than what follows consciously; for Cairn-Smith, the unconscious Greater Self does most of the work of perception and volition, and is more skilled, faster, and more intelligent~than the conscious mind. (This latter view is also similar to Steven Pinker’s view in “How the Mind Works.”

In any case, since we do not have access to our own unconscious, introspection will not work as a method for exploring the mind. It will be difficult to build the fifth branch of knowledge as I outlined in my windmill model of the sciences. And yet, while we do not have access to direct observation of the interior of the Earth, we can infer a lot from observations on top of the crust where we sit.

Direct experience in deep meditation? That gives us insight into another “plug” in the “mind as a three-way plug” (an earlier essay), but not into the body-based unconscious.

THEORIES OF MIND.

There are three possibilities:

1. Mind Emergent. This theory postulates that mind emerged as a new entity from the complexity of the brain, after some limit of complexity was reached. Mind is seen as a product of Matter.

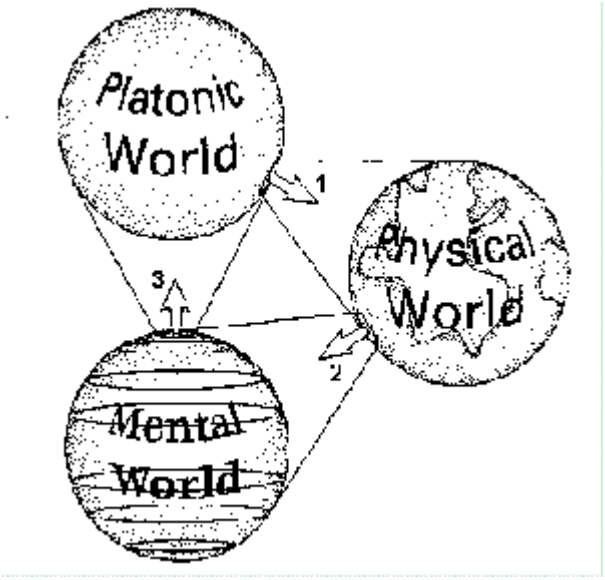
1. Mind Immanent. This theory suggests that Mind is always present in all living beings, though in different degrees of “lucidity”. (Gregory Bateson.) Perhaps Mind or living spirits are also in rocks, mountains, and lakes. (Animist religions.) Mind is seen as coeval with Matter, a second essence.

1. Mind Transcendent. This idea postulates that, while Mind resides in all of nature, as suggested above, it also transcends nature, as a free-standing entity. Mind exists in the eternal order as well as in the temporal order. Mind is seen as the Spirit of God hovering over nature.

These may not be alternative theories between which we must choose. If Mind Immanent is accepted as a vague internal awareness of all parts of nature, becoming stronger and clearer in living beings as they ascend the evolutionary scale, then Mind Emergent is seen as the clear expression of general Mind, becoming more explicit and self-aware in humans. Then Mind Emergent would be a special case of Mind Immanent. If we use a narrow definition of Mind, we will accept theory li if we choose a broader definition, we will prefer theory 2.

The link to Mind Transcendent requires the further concept of the non-transitive “great wrap-around”, symbolized by the image of the Uroborus, the snake eating its own tail. This is a super-cycle: -in short, we create God as the Omega-point of Teilhard de Chardin, while God creates us in the traditional sense. Such super-cycles are possible in the eternal order, where time is only a dimension like space (as in the theory of special relativity). Thus Mind, which is a God-essence or “ousis”, emerges from physical structures like the brain of living beings originating in God-essence in the first place. Cycles in nature in the temporal order would require energy to drive them (solar energy on earth), because perpetual-motion machines are impossible here. But in the eternal order, this restriction is removed, because time, the determining factor in thermodynamics, does not exist as such in the eternal order.

Another useful image is the three-spheres model of Roger Penrose: the Platonic sphere of pure ideas (including mathematics) injects part of its contents into the physical sphere, which is why the laws of physics can be expressed in elegant, beautiful mathematical forms; the physical sphere then injects part of its contents into the mental sphere, via the initiation and evolution of life and then the brain; and finally the mental sphere devotes parts of its contents to developing abstract ideas (including mathematics), and injects these to the Platonic sphere.



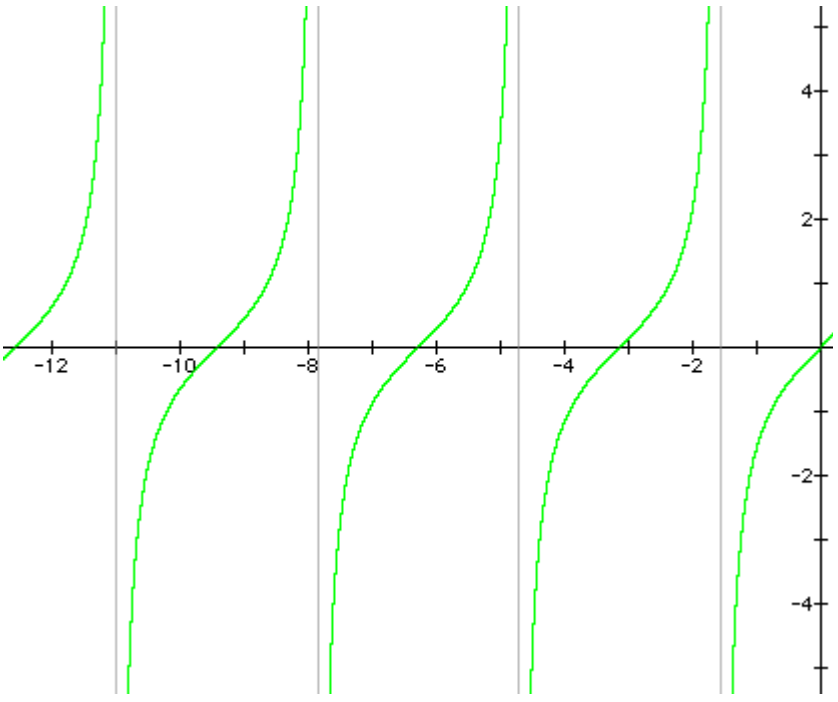
The Penrose model is intransitive: A is greater than B, B is greater than C, but c is greater than A. How is this possible? Somewhat as in the children's game "scissors paper-stone": scissors cut paper, `paper wraps stone, stone breaks scissors. Each is more powerful than the next, in a cycle, but the verb changes. This is the essenpe of the "great wrap-around", so difficult to explain.

Platonic into physical = mind immanent

Physical into mental = mind emergent

Mental into Platonic = mind transcendent

In trigonometry, if we plot tan x against x, we see a jump in the function from plus infinity to minus infinity. Presumably they meet somewhere beyond our conventional space dimensions. In a similar sense, the infinitely hot can be seen as the infinitely cold (absolute zero) in the theory of magnetic alignments. Things which our commonsense sees as sharply discontinuous, even opposite, can merge in a reality beyond our comprehension.



Why should we think that we can understand everything through reason? A physicist once said “The world is not only stranger than we think, it is stranger than we CAN `think.” Our brain evolved to help our survival, not to understand ultimate reality—though we have that capacity to a limited extent as a by-product.

A strip of paper has two sides—right? Wrong! If it is cut, given a single twist and glued back together, it forms a Moebius strip with only one surface. Two opposite sides can be “reconciled” by this simple method; so can seemingly opposite theories. The two sides of a coin are different, but they are part of the same coin. And so Mind Transcendent can form a higher unity with Mind Immanent and Mind Emergent. We do not have to choose.

CORE AND EXTENDED (SELF)-CONSCIOUSNESS.

This article is based on a review of Antonio Damasio's book, "The Feeling of What Happens", Harcourt Brace, New York, 1999, by Thomas Metzinger in Scientific American, November 1999, pp. 125-6.

Core consciousness is the experience of the here and now; it is independent of language, reasoning, and memory. It is stable through a life time.

Extended consciousness adds to it past experiences (memory) and anticipation (imagination). It is thus an evolving personal history (biography), slowly changing.

Related to these are the following: Core self-consciousness is the core self which observes and tries to influence the experience of the here and now. It is the observer and manipulator of "the movie in the brain".

Extended self-consciousness is the (deliberate or unconscious) writing of one's autobiography, with possible embellishments (confabulations), even false memories.

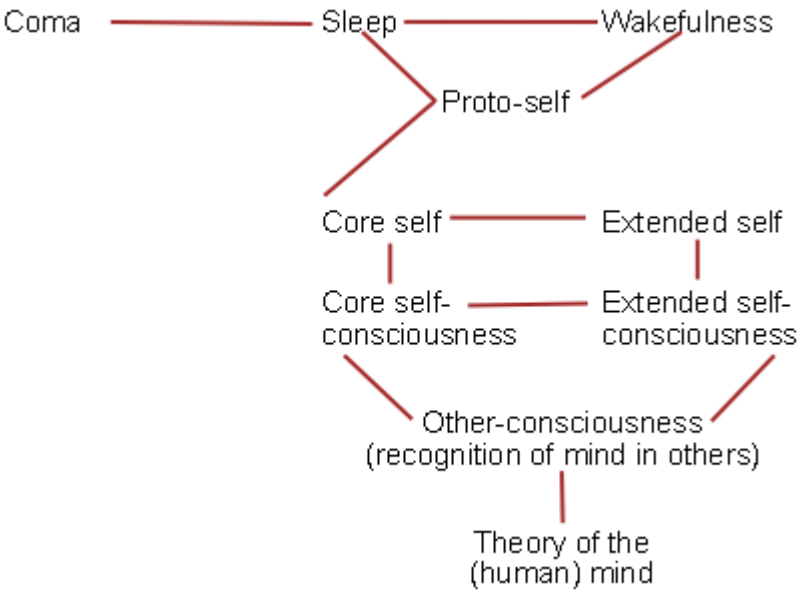
"The movie in the brain" is studied in phenomenology. At some time in a baby's life, the movie is clarified as the movements, colours, and shapes of objects. A little later, the owner and observer of the movie emerges as "the self", which then persists through a life-time, and adds memory and anticipation as features of the autobiography. But both the objects and the self are to some extent illusions. Basic biology constructs the biography.

The presence of the self transforms mere wakefulness (vague awareness of sense perceptions and muscle movements) into true consciousness (presence of observer and mover). Then the self itself can be observed by the self (introspection) .

Emotions always accompany sense perceptions and muscle movements. Emotions (feelings) are bio-regulatory devices for survival. There is an unconscious proto-self defending its existence. It is body-based.

We know some of the corresponding brain structures. The cingulate cortex is the seat of attention, emotion, and generation of voluntary movement. Damage to this site disrupts core and extended consciousness while preserving wakefulness and reasoning power. Such a patient can figure out why it would be advantageous to perform a certain action, but fails to act because no emotion is driving him. The upper brain stem is the site of the unconscious proto-self (sometimes called the reptilian brain), and the hypothalamus is the site of ,the core self (the seat of emotion, the midbrain or mammalian brain). If these structures are damaged, there is a loss of wakefulness—presumably some type of coma. Presumably the brain remains active as a controller of hormones, and so the patient is still alive.

The organism is fundamentally situated in the movie in its own brain, seamlessly immersed in a biologically grounded virtual reality, and simultaneously having an "out of the brain" experience.



Animal minds may be at various other levels, but may also have abilities about which we know nothing.

Comparison of Damasio and Cairns-Smith

(Antonio Damasio, “The Feeling of What Happens”, Harcourt Brace, New York, 1999, and A.G. Cairns-smith, “Secrets of the Mind”, Springer Verlag, New York, 1999.) The two authors use different terms for what seem to be the same entities. This is set out in the diagram below.

Damasio	Cairns-Smith
Proto-self (body-based)	Greater Self (unconscious)
Core (Self) Consciousness	Evanescent Self
Extended (Self) Consciousness	

The difference between the two schemes (besides the greater elaboration of the Damasio scheme) is a difference in emphasis and evaluation. For Damasio, the body-based proto-self is more primitive than what follows consciously; for Cairn-Smith, the unconscious Greater Self does most of the work of perception and volition, and is more skilled, faster, and more intelligent~than the conscious mind. (This latter view is also similar to Steven Pinker’s view in “How the Mind Works.”

In any case, since we do not have access to our own unconscious, introspection will not work as a method for exploring the mind. It will be difficult to build the fifth branch of knowledge as I outlined in my windmill model of the sciences. And yet, while we do not have access to direct observation of the interior of the Earth, we can infer a lot from observations on top of the crust where we sit.

Direct experience in deep meditation? That gives us insight into another “plug” in the “mind as a three-way plug” (an earlier essay), but not into the body-based unconscious.

VISUAL REPRESENTATION OF OBJECTS IN THE BRAIN.

We have discovered how columns of brain cells in the visual system identify objects, in spite of differences or fluctuations in degree of illumination, visual angle, or distance. (Motion too?) Objects have characteristics such as size, shape, colour, texture (though this is partly tactile) .They also have “meanings” in relation to our survival, pleasure/pain, comfort, and everyday experience and activity—i.e. Functions of tables, flowers, cats

But I have an epistemological problem. The explanations above assume an independently existing external world of objects. The experiments on which the explanations are based depend on the manipulation of both the assumed external objects and the brain cell assemblies (seen as external objects by the experimenter). But the observations and interpretations are processed by the experimenter’s brain cells, “seeing” the objects manipulated in the experiment in the very same way which is being studied. The experimenter is not outside the system, he or she is part of the loop. The whole knowledge acquisition process seems circular in its logic. We are using in our observation the very process whose nature we are trying to elucidate.

Presumably, (another questionable inference), brain mechanisms evolved by selection for survival, not for understanding the external world. The brain recognizes and distinguishes objects not for the sake of understanding them in any abstract sense, but in order to be able to react or respond appropriately, especially if the objects represent dangers to be avoided or resources to be utilized. For this purpose, it would be sufficient merely to have some parallelism between the external world and its brain representations, some kind of a symbolic correspondence, a one-to-one mapping.

Philosophers from way before Kant knew that we do not perceive “things in themselves”. That includes the brain cells that we observe in these experiments. We do not “see” them as they “really” are, only some symbols of them. But we perceive them by our own brain cells whose nature is the same as those we observeThe object and the subject partake of the same nature, and its nature is radically unknowable.

Yet, if external objects as perceived (the brain representations of them) did not have a close correspondence to independently existing external objects, why would there be any survival value in reacting and adjusting to them? If they don’t push us around or we cannot push them around, except in our imagination, why would they have the potential to harm us or nourish us? Why fear an imaginary falling rock or charging tiger? Why be attracted to imaginary succulent

MULTIPLE SELVES.

Caetani's (Sveva Caetani, "Recapitulation": A Journey, Coldstream Books, Vernon, BC, Canada, 1995, 128 pp.) different-coloured women ("Presences in the Maelstrom: Angels of Poetry", pp. 80-81) are the possible multiple counterfactual selves of her mother, an aspiring but unfulfilled artist. We all have multiple possible selves, potential personalities which go unfulfilled. This may become a multiple-personality disorder under pressure of some trauma or abuse, but the milder presence of the alternative personalities is enriching, like overtones to the main song of the dominant personality.

The alternative ego crystallizations result from the pattern-seeking activities of brain circuits aiming at integration, filling in the the blanks in data through pure imagination. (A left-brain integrator is described by Michael Gazzaniga "The Mind's Past", University of California Press, Berkeley, 1998, 201 pp.) But this integration can happen in various ways, like visual figure-ground inversions, or the different valleys of stability in Kauffman's diagrams of autocatalytic nets—islands of order in a sea of chaos. (See Stuart Kauffman, "At Home In the Universe", Oxford University Press, New York, 1995, 321 pp..)

Each of these personalities, the women pictured by Sveva Caetani, is in a different colour; but the yellow is tinged with red, the blue with yellow, the beige with black, the brown with white, as they interpenetrate.

LEFT OR RIGHT AT OAK STREET?

The title comes from an old popular song, about a man ored with commuting to work along the same old route every day and tempted to escape into unknown adventures by exploring the other side of life.

However, I use it to denote the left brain and the right brain's role in our daily routines, in the light of theories expounded by Michael Gazzaniga, in "The Mind's Past"(University of California Press, Berkeley, 1998, 201 pp.). According to the author, the left brain interpreter is what makes us distinctively human. It enables us to use syllogisms and sYmbols (cf. Terrence W.Deacon, "The Symbolic Species: the Co-evolution of Language and the Brain", W.W. Norton, New Yotk, 1997, 527 pp.). It also enables us to form hypotheses ("inductive" thinking) and grasp non-Goedelian truths (cf. Roger Penrose, "The Shadows of the Mind"). That is why the left hemisphere of the brain also controls language.

However, some of the brain interpreter's interpretations may be wrong, mere confabulations. The brain interpreter works by filling in gaps in sense data, or in any data, to make a consistent picture or theory; and then we don't know which came from the data and which from the filling in. The result may be false memories or false ideologies. There is too much imagination and too little grounding in reality.

This facility may give rise to our religious experiences (Theodore Roszak, "The Unfinished Animal") and the theologies we weave around them. These could be non-Goedelian truths (which cannot be proved), or they may be the left brain interpreter's made-up stories to quickly satisfy our curiosity, our hunger for quick and easy knowledge. Our minds differ from both computers and animals by being able to jump to conclusions in this way, grasping for truth but risking to be wrong.

The right brain hemisphere, on the other hand, has no interpreter. It can only do indexical thinking (cf. Deacon), i.e. Correlational learning through conditioned reflexes, like animals. (In fact, in certain tasks rats have obtained better scores than humans.) Its world is one of pure phenomenology, without language. But an important virtue of the right hemisphere is that it is more truthful, never fabricates false memories that can confuse court trials.

This is not the usual conception of the tasks of the left and right hemispheres. New Age thinkers usually call the left brain logical, linear, and narrowly rational, wh~le the right is the seat of compassion, lateral thinking, and imagination. Some of these traits may check out, but not imagination; the wildest imagination must be ascribed to the left brain interpreter.

So which is left or right at Oak Street? Routine or adventure? Take your choice—each and every morning.

MY BRAIN AND I.

According to Michael Gazzaniga (“The Mind’s Past”), our brain devices will a motion before our consciousness knows it. (These are experiments by Benjamin Libet.) Somehow this is even more disturbing than the extensive perceptual processing of vision—that we “see” not what is out there, but largely what the brain processes present to us, based only slightly on data coming from the outside.

Both facts are disturbing, though. We like the naive realism of seeing the world as it is, not some elaboration that tries to make sense of it. But the efferent motor signal process is more disturbing than the sensory elaboration. It reduces freewill to complete nonsense, a mere illusion. Our own brain is deceiving us, like a traitor within.

Yet there is a strange twist. We study brain neurophysiology as if it is an outside object and we are the observers. The study reveals to us that the “we”, the subject that studies the object (the brain) is an illusion created by that very brain, supposedly the object of study. Subject studies object, but object creates subject. The subject is merely an illusion that the object creates, so how can the illusion study its creator and come to conclusions about it? It is a twist like intransitivity, like a strange loop, even like the Cretan liar paradox.

Does this lead to nonsense, a contradiction ruled out by rigid logic? But contradictions are now allowed in the Cretan liar paradox: if it’s true, it’s false; but if it’s false, it’s true. This is fuzzy loqic, that calls it half true and half false.

Yet we can start at the other end. Consciousness is the only thing we know or experience directly. When Descartes wanted to doubt everything except the immediately obvious, he asserted his own existence because of his thought. Consciousness is primary, the external world of objects is only derived. And this external world includes the brain as studied by science.

We could come to the diametrically opposed view to the one stated in the beginning: that the brain is a mere mechanism being used by the spirit to interact with matter. It provides a peephole (perception) and a slot for manipulation (as with a joystick) in motor-action.

Weird things happen along the four blades of the windmill of knowledge. Relativity and quantum mechanics all have their paradoxes. So why not psycho-physics? In some interpretations of quantum theory (e.g. The EPR experiment), time can move backwards.

I am not ready to assert anything. Maybe my brain dictates what I write, and is really making fun of me.

MIND AND BRAIN.

Regarding Libet's experiment: Did he take into account the time it takes for the subject to push the button after he forms the intent to move his arm? A nerve signal has to travel from the brain to the muscle and the muscle must contract. This is not instantaneous.

It would take as long to push the button as to move the arm—it is a similar path. Of course the brain change would precede this, because the message has yet to travel to the two muscles involved.

There is no way to time directly the formation of intention. I would assume that it would be simultaneous for moving the arm and pushing the button, preceding both. Do I misunderstand the experiment?

Perhaps the mind-brain relation is like a well-run office, with the boss often absent, but the staff have instructions to get in touch with him by cell-phone (how appropriate!) when a novel situation arises. Most of the time, the highly competent staff run the office without requiring the boss' attention. But they always tell him what they have done and are doing when he asks.

(An alternative metaphor is a system consisting of the car and its driver. But this will not be developed here.)

The boss can forbid certain actions which the staff might spontaneously want to take, such as taking an afternoon off for a picnic (equivalent to the unconscious deciding to take our clothes off in public when it's too hot, or even more daring antisocial acts due to instinctive desires). The staff becomes conditioned, by education, to ask permission for such actions, or even not to suggest them at all.

The boss will not permit these actions, because he is aware of what his colleagues in other businesses would think, and does not authorize actions that would elicit their strong disapproval, because he has to interact with them for business deals. This is the essence of social pressure; and it is where env.ironmental influences can change the somewhat plastic nature of innate mechanisms in the brain.

The boss also has capacities not available to the staff, such as going to certain exclusive clubs,concerned with intellectual, scientific, artistic, and spiritual matters.

Both Dennet and Gazzaniga warn ,against seeking a seat of unified consciousness in the brain, the "cartesian theatre" or "the pearl of the mind", or the "homunculus". ("The boss" in the office analogy.) However, Dennet in the end describes the linear von Neuman computer to which the "demons" (separate brain devices) competitively seek access; and Gazzaniga deduces the presence of the "integrator" in the left brain that gives us the "illusion" of the unity of the self.

But why must it be an illusion? It could equally well be the emergence of a new entity—the very mind which the reductionists try to deny. It was the first fact which Descartes, in his radical doubt and deliberate agnosticism, first acknowledged as the primary fact. After all, it is the mind of the scientists that studies the neuro-physiologq of the brain. As in quantum theory I the observer is a part of the system, and cannot eliminate itself by what it deduces from its own observations.

THE MAP IS NOT THE TERRITORY.

We do not perceive reality as it really is; we only have a map of it. Our percepts/concepts are very elaborate, but they are not “things-in-themselves” out there in the world. Evolution gave us only maps, since these are all we need for survival. Metaphysics is beyond our reach.

That is why quantum theory and special and general relativity seem so strange, and “beyond the Big Bang” cosmology and string theory even stranger. They are not the stuff of our daily experience, not needed for survival. Yet they are somehow features of the real outside world, even when they contradict each other. (There may be a Goedel-type incompleteness in physics, transferred from mathematics.) However, we have “no need to know”, as they say in circles devoted to the secrecy of documents.

Our minds touch the world only in the middle range of sizes, speeds, time intervals, and temperatures. Our “basiclevel” concepts (Lakoff and Johnson, “Philosophy in the Flesh”) are, for example in animal classification, the genus (e.g. “horse”), not either species on the finer side, or order at.the higher level. This is our macula, the spot of sharpest vision. Science can and does reach into the murkier regions, but our common sense notions resist this wider vision.

Common sense is like the view in a distorted mirror, like the mapping of body parts on the brain (hands disproportionally large). Or like the famous Plato’s cave, seeing only shadows on the wall. Metaphorical thinking—we do it all the time, as I just did consciously; but most of the time it is cognitively unconscious.

So the map is not the territory. We will never see the Promised Land, like Moses, or any real landscape at all.

THE WORLD IS MAYA.

We perceive sights and sounds through eyes and ears, scents and taste through nose and tongue, texture and heat through fingertips. All that comes to us is filtered through the flesh. This is our phenomenal world.

Is it real? No—it's sieved through neural mechanisms, as through the fabric of a veil.

Is it any more real to conceive sights and sounds as waves in fields and air, scents and taste as emitted molecules, touch as van der Waals forces, as science would do? No, these theories are creatures of the brain, aided by the left-brain integrator. Even our flesh and brain are imaginary pre- or con- cepts, not ultimately real.

We are forever cut off from reality—Popper's World I—by an impenetrable wall. We no more know what the world is than we know who God is.

There are shadows on the cave wall that help us navigate in the real world, enough to ensure survival. Shadows are two-dimensional, while the world (we can suppose) is three-dimensional, or four if we take time into account. But not really. String theory postulates 10 dimensions, possibly 26, most of them "curled up", whatever that means.

Why 10 or 26 rather than other numbers? (Phase space can have any number of dimensions, including infinity.) They follow from mathematical theories; again, how real? Angels are said to exist in more than four dimensions (space and time), how many we cannot know. To ask how many angels can dance on the head of a pin is not a nonsensical question. However, it is an unanwerable one.

Ich weiss dass wir nichts wissen konnen.
Das magt mir wohl das Herz verbrennen.
(Doktor Faustus. W. Goethe.)

Yet I am comfortable among the shadows, except when I think, often, with astonishment, "What IS this all ABOUT?"

GREGORY BATESON "MIND AND NATURE".

This book is so rich that it can only be summarized in point form, with brief comments. Square brackets [ ] indicate my addition, opinion, or comparison.

The chapter “As Every Schoolboy Knows” [or rather SHOULD know) contains some general principles of the epistemology of science.

1. Science never PROVES anything. It PROBES. i.e. Induction can fail, as shown in the example of a number series.

2. The map is not the territory, and the name is not the thing named. (Alfred Korzybski, General Semantics.) The “Ding an sich” (Popper’s World I) is inaccessible. But we must map, name, and classify [i.e. Symbolize, as Terrence Deacon says in “The Symbolic Species”. Human minds operate almost entirely in the sYmbolic system, related to language.

3. All experience is subjective, i.e. Within an individual mind. Experience is based on neuron firings in brain nets. [But neuron nets are something we derive from experience in scientific observations. Isn’t that a circular argument?]

4. Perception processes (e.g. Visual) are unconscious, though very complex. Examples: (a) Visual perspective—clues come from size and brightness; which is dominant if in conflict? (b) Parallax experiments of Adalbert Ames.) The trapezoidal room. (d) The anti-aircraft gunner.

5. How to divide a whole into parts is arbitrary. Example: the hexagon-triangle.

6. Divergent sequences are unpredictable. Examples: (a) Throwing a stone to break a pane of glass. (b) Where is the chain’s weakest link where it breaks?) Superheating water; a “seed” is needed to initiate change of phase. Same in undercooling, precipitation/crystalization, etc. (d) The great man theory of history and the theory of “social forces” (cf. Tolstoy’s “War and Peace” about Napoleon). The social forces “superheat” the system, but it does not undergo phase change until a great man precipitates it. [Did Gorbachev end the Cold War?] [This should be compared to the butterfly effect in chaos theory and to Gould’s statement that the tape of evolution, if rewound, would not repeat exactly.]

7. Convergent sequences are predictable. [To put it in the language of prigogine in “The End of certainty”, ensembles can be predictable even if their constituent particles move randomly.] Similarly, societies can be predictable even though individuals are not. The bridge between the unpredictable parts and the predictable wholes are the laws of probability and stochastic processes. But sometimes wholes can be divergent (unpredictable, chaotic) too.

8. Nothing will come of nothing. (A quotation from “King Lear”.) This applies to the laws of conservation of energy and matter (actually their common essence), and to the principle of “omne vivum ex vivo” in biology [except for the very first beginning]. It follows that epigenesis (embryology) is subject to this principle, but evolution (tautology) is not. [“Tautology” because Darwinian evolution can be stated as a tautology: “the fit survive”, “the survivors were fit”.]

9. Number is different from quantity. Numbers come from counting, quantities are measured. Numbers can be absolutely accurate, quantities are subject to

experimental error. [Accounting and book-keeping is different from physics and chemistry.] Number systems are digital, quantitative systems are analogue. [But this applies only to integers. Fractions and especially irrational numbers are not discrete, but fill the number line continuously, like a measurement.]

10. Quantity does not determine pattern. But pairs of quantities can, through ratios or differences. Example of an island with two mountains on it; if the water level rises, it can become two islands. [An example of “quantity turning into quality”.]

11. There are no monotone values in biology. “More” is not necessarily better; there is an optimum, with either a deficiency or an excess being harmful. [The Goldilocks effect.] Money seems to be monotone, but actually an excess is toxic. [This may be relevant to the existence of intransitivity.]

12. Sometimes small is beautiful. (Modified quotation from E.F. Schumacher.) An elephant and a shrew are adapted to their size; so is a dog and a flea. The sad case of a polyploid horse who could not stand up or eat enough. This comes from the fact that length grows linearly, area as the square, volume as the cube.

13. Logic is a poor model of cause and effect, because there is no time dimension in logic, while time is important in causality. The electric buzzer can operate physically as the switch is alternately closed and opened, but the Cretan liar paradox in logic, which seems to have the same structure as the buzzer, pays no attention to time.

14. Causality does not work backwards [except perhaps in quantum physics?], but logic can, again because of the time factor. So purpose and teleology are not permitted in science. [Even for conscious planning beings?] But cycles are common—thus “effect” can contribute to “cause” via feedback, positive (runaway) or negative (control).

15. Language, because of its subject-predicate-qualifier-object syntax structure, asserts that “things” have “qualities”. But in reality, qualities are relative to those of other things, never absolute. Only differences count.

16. Stability and change. For an acrobat, or an organism maintaining homeostasis, stability is the result of self-balancing change. This is the dialectical synthesis of Zeno and Heraclitus.

17. We perceive only differences. Examples are: binocular vision, the discovery of Pluto, synaptic summation in firing neurons, Macbeth’s hallucinated dagger, algebra and geometry confirming each other, the complementarity of two sexes, beats in combining sounds of two different frequencies, moire patterns, how to define “left” and “right”, description and explanation. [These examples seem to illustrate mainly complementarity, not inability to perceive single items.]

The Criteria of Mental Process.

1. A mind is made up of parts not themselves mental. It is immanent in the organization of the parts, and emergent from this organization. Since an electron is thought to be an indivisible particle, it cannot include a mental process. [Bohm in his deterministic theory of quantum phenomena endowed an electron with a mind—receiving information about the second slit from its antenna-like wave; but he had to assume that the electron is a complex composite, not an elemntary particle.]

2. Interaction is always triggered by a difference. Our eyeballs move in vision; we see outlines, therefore we draw them; we are unaware of slow changes, e.g. In climate.

3. There has to be collateral energy entering the process, although.its entry is triggered by the mind acting as a relay, switch, gate—like turning on a water tap. [Cf. My essay on “The Three Essences”, which proposes a double relay: information moves energy which moves matter.]

4. Cycles are operating, characterized by positive and negative feedbacks. This is compared to the governor of a steam engine.

5. Coding the observed difference. This is the mapping-naming step, already mentioned above, which I include as symbolization. [But all minds are not sYmbolic, according to Deacon, only human minds. Others operate by iconic and indexical relationships.]

6. There is a hierarchy of logical types (classes of classes of classesaccording to Russell and Whitehead). [But this is part of the sYmbolic mind system, which presumably animals do not have. Therefore I have trouble understanding his next point.] Examples of cross-species communication, e.g. Dog-ape and dolphin-human. Out of the hierarchy of logical types arises context, meaning, and understanding. It also functions in human and animal play, [which is like experimentation in acquiring meaning].

The two great stochastic processes.

1. These two processes.are genetic change and somatic learning. Lamarck was wrong in thinking that acquired characteristics are directly inherited. This would lead to too much instability (perhaps a total collapse) of the genetic system, geared to preserving structure. The weissmannn barrier between the genetic and the somatic systems in organisms prevents this. Somatic learning is transferred to the genetic level only through the operation of natural selection: those possessing a favourable trait (for a particular environment, perhaps a recently changed one) leave more descendants for the next generation. Some kind of selection process must always intervene between the conservative (stability) system and the change (flexibility) system. There is an optimum balance between them, on which selection operates.

2. Epigenesis and evolution are another example of two stochastic processes—the first frequently occurring, fast, and pre-programmed, the second composed of rare and slow steps subject to contingency. In embryonic development, the entry-point of the sperm into the egg marks the median plane of the bilateral symmetry in a frog. [Cf. My essay “The Master switch.]

3. Homology and recapitulation. This led Ernst Haeckel to formulate his statement that “ontogenesis recapitulates phylogenesis”. Some homologous organs in different species represent a distortion of the underlying grid.

4. Adaptation can be compared to addiction. Both are processes of accommodation to a new ingredient in- the environment (a climate or habitat change or a new drug). But adaptation is functional and addiction is dysfunctional. [Perhaps adaptation is initially dysfunctional too, but is necessary, because the organism cannot change the environment, but we can get off the drug.]

5. Structure (form, pattern) and process (change in the former) are another pair of stochastic processes. They form a zig-zag progression in many cases when ascending to higher levels. [Cf. My essay “Rise and Run”.]

WHERE ARE THE BOUNDARIES OF MIND?

Both Bateson and Prigogine point out that, in going from non-mind to mind, three transitions occur: 1. from description in terms of particles to description in terms of ensembles; 2. from connections by the rules of static logic to explanation in terms of dynamic (i.e. Time-based) causes and forces [and I would add intentions and purposes]; and 3. from rare and occasional encounters to dense and frequent interactions. These three transitions mark the boundary between the Pleroma and the Creatura according to Jung [and perhaps between the Res Extensa and Res Cogitans of Descartes.] The frequency and density of interactions makes possible both conflict and cooperation, but ultimately reciprocal cooperation [tit-for-tat], since other "games" are not survivable in evolution.

I infer from Bateson's book ("Mind and Nature") that he considers mind to dwell in all forms of life, so that life and mind are synonymous. Even the physical side of life (metabolism and physiology) imply the presence of "mind" i.e. Connections and communication). [Jantsch also speaks of metabolic. Genetic, epigenetic, hormonal, and neural mind, to which I have added the immune-system mind.) On the other hand, for Bateson, mountains, stones, and electrons do not operate according to rules of "mind". This is especially true of electrons, which are indivisible—the essential "particles".

This would invalidate Bohm's image of an electron particle using its wave aspect (both of them objectively "real") to navigate by, functioning as antennas to inform the particle of the presence of the second slit in the twoslit experiment. However, Bohm postulates that the electron is not an indivisible particle, but a whole complex system. This would restore validation to his theory. But is that plausible?

Perhaps Bohm would say that the electron unfolds from an underlying implicate reality. Then our whole unfolded (observable) universe may be alive and permeated by mind, emerging as a thought from the eternal God. There may be several layers of implicate reality, perhaps an infinite number of layers, each unfolding from the one immediately below and enfolding back into it. And if electrons are composite systems, perhaps their parts are composites too, even ad infinitum. There are no ultimate indivisible "atoms" of matter, just as space and time are indefinitely divisible. The whole of nature is a Living Whole, created in the image of God. There may be differ~nt rules and laws in each layer, as different from each other as quantum physics is from classical physics, but fitting harmoniously together.

Then Bateson's view of mind and nature has to be extended to be "infinite in all directions", using the phrase of Freeman Dyson. There are no boundaries at all in a seamless Universe.

CONSILIENCE: THE UNITY OF KNOWLEDGE.

(Book by Edward O. Wilson, Alfred A. Knopf, New York, 1998, 3 3 2 pp.)

The unity of knowledge is a worthwhile goal, but Wilson intends it to mean the derivation of everything, including the social sciences, the arts, ethics and religion, from physics via chemistry, biology, brain physiology, and psychology, in that order. Perhaps it could be done, if the phenomenon of emergence (of new qualities at each level) is properly taken into account. That is, after all, the upward loop of the Great wrap-around, in my philosophy. However, the downward loop ("downward causation" in the words of Roger Sperry) should also enter the picture somehow. Reductionism and holism should be suitably combined, as Wilson himself states (but occasionally forgets), and Hofstadter in "Escher, Goedel, Bach" aptly illustrates, by composing a large letter A from a lot of lower-case a's.

The alternative is to consider the world composed of separate hierarchical levels, each with laws of its own, as Arthur Koestler tried to do. Of course, the laws of the lowest (deepest) level, i.e. Physics, continue to apply also in all levels above it; and that is also true about every intermediate level. Yet each level also has higher-order laws of its own. Perhaps this alternative is not so very different.

But the book is mainly interesting for the cases and examples it provides, which contain much new (to me) information and insights. I will name a few below.

1. The different visual and sense worlds of animals, e.g. Butterflies see ultraviolet, bats use sonar above our sound frequency range, and electric eels have a sense we lack entirely.

2. Recently developed nano-technology and atomic-level imaging. (If we ever see an electron, will we observe its indeterminacy?)

3. A good theory must be falsifiable, parsimonious, fruitful (heuristic), replicable, elegant, and quantitative.

4. The scale of credibility: a theory ascends from interesting to suggestive to persuasive to compelling, and finally to obvious.

5. A proof is that which convinces a reasonable man. A rigorous proof is that which convinces an unreasonable man.

6. The Meselson-Stahl experiment which established how DNA replicates itself, distinguishing between 3 alternatives. (The double helix unwinds and each strand builds its own supplement.)

7. The metaphor of Ariadne's thread, enabling Theseus to find his way in and out of the Labyrinth. This is compared to a scientist probing by reductionism, and eventually ascending back to the starting point by synthesis. Things get very intricate in the heart of the labyrinth where the Minotaur dwells.

8. When Karen Quinlan fell into a coma after taking in alcohol and certain drugs, it was established after her death that most of her brain was intact, only her thalamus was completely "burned out". This helped establish the importance of this brain relay station, which connects sense input and motor output. (Could she think?!?)

9. The triple brain: (a) The hindbrain: pons, medulla, and cerebellum (the reptile brain)

regulates heartbeat, breathing, the sleep-wake cycle. (b) The midbrain or limbic system: amygdala (emotion), hippocampus (short-term memory), hypothalamus (temperature regulation and basic drives), and thalamus (awareness of all senses except smell); these structures constitute the mammalian brain.) The forebrain and cortex (some of it a human addition) is the seat of consciousness, a collector and integrator of sense information, and director of muscle movements. (The “reptilian” and “mammalian” designation is my addition).

10. The neural circuits in the brain create competing scenarios of interpretation and of possible decisions to act, but there is no centre or headquarters that has the final word. This is like Dennett’s “demons” with no “Cartesian theatre”.

11. Without the guidance and stimulation of emotion, rational thought slows down and disintegrates, as shown by Damasio in analyzing the accident that befell Phineas Gage. After his forebrain was partly destroyed, he could reason out what he should do, but failed to act because of lack of motivation. The remnants of his forebrain did not receive messages from the thalamus.

12. The results of some ESP experiments could be explained by the ability of the subject to sense the electrical patterns in another person’s brain, the way a CATscan does. (But even at a distance?)

13. In wakefulness, neural circuits that use the neurotransmitters norepinephrine, dopamine, and serotonin predominate; in sleep, the balance shifts to those using acetylcholine. In brief we go from amines to cholines. Interestingly, the amines activate the sYmpathetic nervous system, the choline the parasympathetic. Perhaps in day dreams and in old-age mental confusion, both are almost equally active.

14. The human language instinct consists of precise mimicry, compulsive loquacity, near-automatic mastery of syntax, and the swift acquisition of a large vocabulary.

15. A unit of culture, a meme, is linked to a node in semantic memory (as opposed to working memory). Such a node begins as a concept (a noun), these are assembled into a proposition (a sentence), then assembled into a schema (a whole way of working).

16. Birth order greatly affects a child in a family. Later-borns are more apt to be rebels than the more conforming first-borns.

17. Heritability is defined as the percentage of the variation in the trait due to heredity. It is usually determined by studies of identical and fraternal twins.

18. The OGOD principle (one gene—one disease) does not always hold. Some diseases depend on several or many genes, and some gene mutations do not cause any disease.

19. Cultural universals gleaned from hundreds of societies from Human Relations Area Files: 67 were found, from age grading to weaving, including body adornment, cleanliness, dancing, ethno-botany, food taboos, gift giving, hospitality, inheritance rules, kinship nomenclature, luck superstitions, marriage, penal sanctions, religious ritual, sexual restrictions, status differentiation, and tool-making.

20. Epigenetic rules are at the basis of cultural universals. They are the basis of “prepared learning”. The cultural customs are learned behaviour, but along the lines of genetic preparedness. Roughly similar customs are found in societies completely

isolated from each other, as in the Old World and the New World.

21. Colour words are hierarchically ordered: black and white (in languages with only 2 colour words), then red, green or yellow, blue, brown, and either pink or purple or orange or gray, added on in succession as the colour vocabulary expands. (It makes me think of colour charts for paints or book covers, with so many other hues in our industrial culture. Or even just adding violet, mauve, magenta, carmine (for shades of purple), or aquamarine, navy, azure, turquoise, and teal (for shades of blue), plus beige, ivory, and lime.

22. Territoriality is not an unavoidable “instinct”, but develops where there is “lateral pressure” (a word from North and Choucri, not this book), a combination of high population density and shortage of resources. So it is one of the “epigenetic rules”, or genetic predispositions, appearing only when the environment favours it.

23. Incest avoidance is a strong cultural universal. One theory about it is the Westermarck hypothesis: that siblings brought up closely together (“sharing the same potty”) do not develop sexual attraction to each other. But primitive people also knew that children born from incest have a higher probability of being defective. However, accidental incest abounds in the literature, e.g. Sigmund and Siglinde (Siegfried was not defective!), Oedipus and his mother, Arthur and Morgan—in history (Egyptian rulers), and in religion (goddess Isis marrying her son Osiris).

24. Theory of the family: the closer the genetic relationship of the family members, the higher the degree of cooperation. This is the inclusive fitness of sociobiology. This also determines patterns of conflict, e.g. With step-parents.

25. Economic models are not based on bio-psychological knowledge, and thus often fail. People are not always rational utility maximizers.

26. The Hardy-Weinberg principles of the distribution of genes in a population: we can predict the percentage of individuals possessing different pairs of alleles of the same gene, AA, Aa, or aa, if we know the percentages of the alleles, A and a, in the population. This is a probability formula based on Mendelian genetics. It applies only if natural selection does not favour one of the alleles. But sometimes (as in sickle-cell anemia), Aa is adaptive, AA is less so, and aa produces disease.

27. Satisficing (a compound word of “satisfying” and “sufficing”): In making up our mind quickly when necessary, we do not seek the optimum option, which would take time, but only the nearest peak that is good enough. This is reminiscent of Stuart Kauffman’s ideas on species evolution choosing the nearby peaks of fitness.

28. Gene-culture co-evolution: The brain can generate metaphors easily and move them from .one context to another. This is the genetic origin of art.

29. Myths (and fairy tales) have only a few common themes, which form the cultural archetypes: creation, journey, evil forces, the hero, apocalypse, the tree or river of life, the goddess, the virgin, the awakening kiss, the trickster (Dionysus), the monster, the serpent. Are these based on the “prepared learning” of epigenesis?

30. Are the cave paintings in Southern France a case of magic through art, to achieve a successful hunt?

31. The beauty of a face is enhanced by exaggerating certain features which are pleasing (e.g. High cheek-bones and large eyes). The same is true for sexual preferences in

butterflies and the colours they prefer in a mate.

32. Ethicists are either transcendentalists or empiricists. Wilson greatly prefers the latter. Ethical rules and systems do not come from above as “natural law”, but grow from the survival experience of societies.

33. Prisoner’s dilemma is a good model for how people learned to cooperate in paradoxical situations. (But he fails to cite Axelrod’s work.)

34. Power hierarchies are common in both animal and human societies. The alpha male is on top, and above him is God.

35. The creation myth based on science is more beautiful and inspiring than any of the ancient myths.

36. Migration and interbreeding have been important influences on human genetic and cultural evolution.

37. We are acquiring new powers for self-directed evolution via bio-technology (genetic manipulation), but are not at all sure how far we should go in using it, beyond the minimum of eliminating diseases.

38. Economists need to do full-cost accounting, to take the environment into account.

Metaphoric thinking in “PhiLosophy in the Flesh” by George La koff and Mark Johnson, Basic Books, 1999.

A NEW DEFINITION OF LUCID DREAMING?

In last night's dream, I was in the company of several men I know from the peace movement, including Arnold Simoni, who died recently. They told me that a new group had been formed, because of the extreme danger stemming from the Kosovo war, to take over the world in order to save it. It was a high-level conspiracy; this was only one cell of it.

They wanted me to join. I agreed (just as I had recently in waking life to a Y2K plea from Philip Isely). I was led through a busy hotel lobby to a back room, in which there was a hidden door which one of the men opened with a secret whispered word. We entered a spacious suite of several office rooms, well-equipped, including some machines I had never seen before. We sat down at the boardroom table, where they began to explain to me the plans. I noticed beside my seat (and beside no one else's) a flower corsage. I thought: "Is that because I am a new member, or because I am the only woman here?"

First item on the agenda was the name of the new organization. The chairman proposed "The World Communist Party", and everyone nodded their silent agreement—except me. With some fear and trepidation I spoke up. "I don't agree with that name. The Communists were undemocratic." They protested, saying that they would be democratic. I was not convinced. I said I thought this was a movement to save the world from war, not to overthrow capitalism. They were unreceptive to my arguments.

At this point I became aware that I had the power to steer events in the story, quite unlike in the real world. Yet I did not identify the story as occurring in a dream. It was more like what a novel-writer feels like when his/her fictional characters acquire a life of their own, and yet the writer can still to some extent steer them.

I chose a story end not in my own interest, conventionally speaking, and yet reflecting the despair that I feel about this war.

In the dream, which from this point on I would call lucid, I said that I refuse to join the movement. They all looked grim. Then I asked about the corsage. I said that I did not want to be identified as a woman; only as a fighter for human survival. The chairman, and Arnold, said that is not what the corsage is about. They explained that the pin of it is connected to a needle that would inject cyanide into my veins if I refused to join. I could not be allowed to leave their secret suite to tell the world about the conspiracy. Do I still refuse to join? Realizing they would never trust me anyway after this, I steadfastly refused to join, as long as they killed me painlessly. Yes, they said, it is instantaneous. They pinned it on, and after a brief convulsion, I blacked out.—Immediately I woke up.

I want to argue that the main characteristic of lucid dreams is not knowing that you are dreaming, but knowing that you have the power to steer events, just like the writer of a novel. Why did I deliberately steer it to my death?

Because, I am afraid of the widening and escalation of this war, which I would like not to witness.

THE NINEFOLD PATH OF MIND.

This is based on the thesis that “mind” is a form of communication (transfer of meaningful information) present in all living beings. (The theory of pan-psychism.) It is expressed in the five types of mind (metabolic, genetic, epigenetic, hormonal, and neural) posited by Erich Jantsch in “The Self-Evolving Universe”, with my addition of self-defence, language, writing, and technology. It is best explained in a diagram. Each higher organism or mind includes the ones preceding.

Mind	Life-forms
Metabolic	Proto-life: protein only
Genetic (RNA and DNA)	Archeo and true Bacteria (prokaryotes)
Epigenetic (homeo-genes)	Eukaryotes: protists/algae/plants, and fungi/invertebrate animals
Self-defence	Alkaloids in plants, immune systems in animals
Hormonal	Auxins in plants, hormones in animals
Neural	Animals, from worms to mammals
Language	Humans
Writing	Historic humans
Technology (printing, Xerox, Internet)	Techno-humans

Some would add a tenth mind: telepathy; but this has not been substantiated. Anyway, it is not clear where it would be included; perhaps at a much earlier stage than language, perhaps after technology.

BRAIN WAVES.

(From Anna Wise, “High Performance Mind”.)

The four types of brain rhythms (electrical firing patterns of whole assemblies of neurons) are beta waves, alpha waves, theta waves, and delta waves.

Beta waves represent logical thinking, concrete problem-solving, focus on the outside world, waking state, consciousness, planning, judging, making lists. (But not self-consciousness—observing oneself doing it.)

Alpha waves, observed when awake subjects have their ~ eyes closed, represent visual scan (i.e. Readiness to receive sense data), (meanwhile) day-dreaming, fantasizing, visualization. This is the bridge between the conscious and the subconscious.

Theta waves represent the meditative state, the sUbconscious, memories, sensations, emotions. They occur in dreaming (REM) sleep. Probably the brain integrator assembles these elements into dreams.

Delta waves represent the base: the fully unconscious, intuition, empathy, personal radar. They occur in deep sleep, interspersed with spikes. (Perhaps the spikes remind us to breathe, which we may forget to do in the sleep apnea disorder.)

In ordinary living we buzz around with nothing but a splayed beta. We gain a connection with our inner self by semi-closing the beta splay and introducing some alpha, which gives us self-consciousness, and a partial bridge to the subconscious [and the superconscious?]. But it takes, as well, adding some theta and splaying the delta to become a fully “awakened” mind, which integrates all levels from the unconscious through the subconscious to the conscious.

In that awakened state, we gain focus, clarity, and unity. The diagram (below) looks vaguely like a human figure.

In the metaphor of the multiple bodies of the esoteric school, perhaps beta can be identified with the dense body, alpha with the etheric body, theta with the astral body, and delta with everything above that.

THE INTERPENETRATION OF THE WORLDS.

(A meditation.)

In my essay “Alternative Cosmology”, I wrote about virtual fermions, such as electrons, positrons, and quarks, which may be responsible for the accelerated expansion of the universe which has been observed.

What about virtual photons and other bosons? These too are popping in and out of the “vacuum”, like transient sparks. According to A.G. Cairns-smith (“Secrets of the Mind”), consciousness may be due to a cloud of virtual photons surrounding the discharges of some communicating neurons in the brain. It’s only a guess, of course, but an inspired and inspiring one. Photons, like other bosons, are particles of force (in the case of photons, of electromagnetic force), not particles of matter. “May the Force be with us” (Star Wars.) “Let there be light” God’s Word (Logos) in creation.

Virtual photons, representing thought, feeling, and freewill, are short-lived; photons of (physical) light are “real”, which means long-lived. These represent the mental and the material world, respectively—mind and matter.

But mind may be short-lived (some psychologists think that conscious experience is “spotty”, not continuous, like the saccades of the eye) only in the material-biological world, where time flows regardless of anything we may do. According to the theory of special relativity, time is a dimension of the space-time continuum, but different from the three dimensions of space, because it is imaginary (expressed as ict, where i is the imaginary unit, the square root of minus one). In space-like time (eternity, or ct), this is reversed: the mind is long-lived (real) and matter is short-lived (virtual).

The long-lived eternal Mind is God (En Sof). But It manifests also in the material realm, where It is immanent, while in the eternal realm It is transcendent. (I say “It”, because the Godhead has no gender, En Sof is pure spirit.) En Sof manifests in the material world through the Parzufs or Emanations.

We are sparks (virtual light particles) of the divine essence (Ousis). (Sparks as virtual photons, Ousis as real photons—genuine Light.) Ousis may be the actual genuine quint-essence, the fifth force of nature proposed for the new cosmological theories of the material universe, and the fifth “essence” assumed in my scheme (see the essay “The Three Essences”): matter, energy, information, and meaning.

El Kether (the top Parzuf, a symbolic hair from En Sof’s symbolic forehead) is the mediator between the eternal world of Mind (Spirit) and the temporal world of (physical) Matter. There may be multiple El Kethers, one for each of the multiple universes. En Sof certainly has enough hairs on Its (symbolic) (God)head to supply all the universes.

The two worlds (eternal/spiritual and temporal/material) interpenetrate, like Avalon and Glastonbury in the legends of King Arthur. (See “The Mists of Avalon” by Marion Zimmer Bradley). We reach through the worlds for the Holy Grail of Eternity like Galahad, in the process dying in the physical world. Galahad the pure one was the son of a virgin (Elaine) (but not a virgin birth) and the super-knight Lancelot, the son of Viviane, the Lady of Avalon. (“Lady” as the female synonym of “Lord”, a semi-goddess.)

Lancelot loved Guinevere, a creature of Glastonbury. He SHOULD have loved Morgan, the intended successor of Viviane, but also the Great Whore and a Witch, the originator of Evil—mother of Mordred, who destroyed Camelot, and was born of an incestuous union of Morgan with her half-brother King Arthur. (But Viviane had arranged it, in a clairvoyant vision of the

future.)

I want to fuse Avalon Druidism with Kabbalah Judaism, with elements of Hinduism (especially the Dance of Shiva and the Evil-for-the-greater-Good of Kali) , Taoism (the eternal flow of Nature from Ousis to Gaia), and Christianity (with its message of divine and human nonviolence). The confluence of the world religions (and of religion and science) is more than the peaceful coexistence of two or more incompatible solitudes, but an interpenetration of worlds, like the superposition of quantum states, of particles and waves, of Bohm's enfoldment and unfoldment. It is what bosons do. It is like Buddha's Enlightenment, in which the virtual photons of consciousness turned into the steady Light of Eternity.

ASPECTS OF GODHEAD.

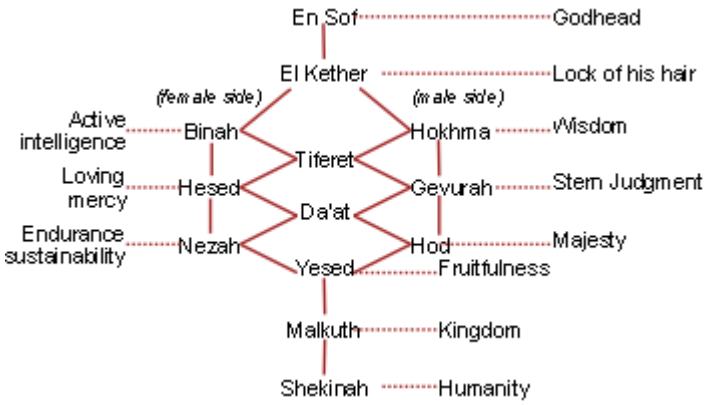
Love and Power are the principal components of the Godhead (En Sof). They are still united in En Sof and in Kether—they split apart in the great symmetry-breaking (bifurcation) into feminine (Binah) and masculine (Hokhma) as the Emanation into Parzufs begins. Then the vessels break in the primordial catastrophe, but the feminine and masculine lines continue. We have Hesed and Gevurah as the second divine Love (the feminine principle) is the Goddess, the great mother. Power (the masculine principle) is God, the stern father. Hokhma the father represents Wisdom, Binah the mother is Active Intelligence. One can say, along with Kant, pure or intellectual reason (Verstand) and practical or moral reason (Vernunft). This is somewhat like rationality and reasonableness; the latter appears in the legal concept of “what a reasonable person would have done”, while the former figures in the economic or game theory concept of “rational decision-maker”, assumed to maximize personal utility. `

In the second stage, the Loving Mother Hesed tempers with Mercy the Stern Judgment of Father Gevurah. This is why Christians pray to the Virgin Mary to intercede for them with God. Hesed understands the. power of forgiveness and reconciliation. She would approve of Bishop Tutu’s Truth and Reconciliation Commission in South Africa, while Gevurah would prefer the trials of war criminals at international tribunals. But even he might shrink from revenge executions of genocide perpetrators in Rwanda. .

The mystical union of the two pairs produced Tiferet, the Flower that is worshipped by many as encompassing again the renewed combination of Love and Power, the saviour of the world.

The male-female pair recurs once more, in Hod, the male Majesty, as in a king, and the female Nezah or long-term sustainability, as in biological fertility. These two then together produce Fruitfulness and the Kingdom (the kingdoms of life on earth). Their descendant Shekinah then accompanies humanity to its self-inflicted exile from nature, becoming the Holy Ghost, again gender less as En Sof in the beginning. The symmetry~split is healed in the divine realm, but continues as sexual reproduction in most of the Five Kingdoms.

Summarizing: The Goddess has active intelligence, mercy and sustainability, and represents the Love principle that draws together elementary particles, atoms, cells, and organisms together in cooperation and symbiosis. God has wisdom (near-omniscience, somewhat tempered by allowing scope for human free will), stern judgment (e.g. of fitness by natural selection), and majesty as ruler of the Universe; He represents the Power principle that provides order and stability. It does indeed require both Mother and Father to bring up the unruly children that humans are.



SYMMETRY RESTORATION - ABOVE AND BELOW.

Parallels can be drawn between the symmetry breaking at the dawn of the Universe (the first few nano-seconds), when the unified force field gradually broke up into the four forces of nature, and the Kabbalistic doctrine about the Godhead (En sof) giving rise to the Emanations or Parzufs. The analogy does not quite hold: there are four forces and ten Parzufs (by some accounts). However, in the creation of other Universes, the Unified Field (En Sof) could have broken up in other ways, making up quite different forces and laws of nature. Our Universe is not necessarily unique; it may just be the only one (or one of a few) in which we humans can exist. So, by the anthropic principle, we need not be surprised at the fine-tuning to permit our existence. There is also the fact that string theory as a Theory of Everything (TOE) requires ten dimensions, 3 of space, 1 of time, and 6 curled up.

The cosmic symmetry-breaking was a series of sequential bifurcations, as the forces broke off one by one. (The term “bifurcation” is used later in prigoginian theory and catastrophe theory). Gravitational force broke off first and more fundamentally; gravitation or general relativity theory has not yet been reconciled with the unification theory for the other 3 forces, called GUT or Grand Unification Theory.

Therefore, I identify this bifurcation with En Sof’s creation of El Kether, the One sYmbolized by a hair from En Sof’s forelock—a poetic image only, but indicating the great distance between these two faces of deity. El Kether is more like the common conception of God (still genderless spirit, both Father and Mother), while En Sof is totally incomprehensible to the human intellect. I tend to think of En Sof as an ocean of light (again only a metaphor), the way the Prince of Darkness in the story “The Dark Land” by c.S. Moore (in the collection “The Venus Factor”) appears finally as an all-enveloping ocean of darkness, although It or He can also produce intelligible emanations of Itself. In the story it is described as a tremendous infinitely hot dark void, crushing and roaring—perhaps like the ylem of the Big Bang or the central singularity of a giant Black Hole. Perhaps it had come from light—the supersymmetric transformation of the Bose-Einstein condensate at the end of the universe. It was En Sof engaged in creation. From bosons to fermions. From energy to matter. From Omega to Alpha.

The next force to break off from what remained of the Unified Field was the strong nuclear force, which holds quarks together in the proton and neutron, and then holds protons and neutrons together in the atomic nucleus. I identify this with the first pair of Parzufs, Hokhma (Wisdom) and Binah (Active Intelligence). These are obviously the deities of cognitive functions, or of God’s omniscience (a pale reflection of it). We also see here for the first time a splitting of genderless spirit into its male and female aspects. The male version of cosmic intelligence is more like pure or abstract reason; the female version is more like practical or concrete reason. The former is like pure science for its own sake, the latter is like applications guided by an ethical sense. The splitting of atoms certainly requires, in our experience, a high sense of ethical responsibility. This pair seems to embody Sophia, the Spirit of Wisdom, trying to both understand and guide the Universe.

The ethical sense is further elaborated in the next pair of Parzufs, Gevurah (Stern Justice) and Hesed (Loving Mercy), again a male-female part. However, instead of being complementary like the first pair, this second pair represents a contradiction: sometimes justice and mercy clash, as we see today in the contraposition of the International Criminal Court idea and the Truth and Reconciliation commission idea as ways of dealing with the crimes of genocide. In Kabbalah doctrine, this clash is represented by “the breaking of the vessels”, the protective envelope which sheathed the emerging Divine Emanations. This was like the Fall of original Sin, but much earlier in the story of creation, only reflected later in an “as above, so below” manner.

It also reminds me of the breaking of the mirror carried by angels in the beginning of the

“Snowqueen” story by Hans Christian Andersen. A fragment of the broken mirror got in the boy Kay’s eye, and he lost his sense of good and evil as a result. His moral sense was restored only by the love of his girl-friend Gerda, and only then could he spell “Eternity” with ice-blocks in the cold realm of the Snowqueen, and return home. It is a gender-reversal of the familiar theme in fairy stories of the prince bringing his bewitched beloved (Sleeping Beauty or Snowwhite) back to life by a kiss.

Is the creation of this second pair of Parzufs and the breaking of the vessels a parallel of the separation of the electroweak force into the weak nuclear and the electromagnetic force? The former is related to radioactivity and the latter to chemistry—so perhaps to death and life. But that may be too far-fetched. possibly this force separation should be postponed to the appearance of the lower Parzufs.

Between the two pairs of Parzufs (the pre-Fall wisdom and Intelligence and the post-Fall Justice and Mercy) is the gender less Tiferet, the Flower. I take it to represent Jesus who reconciled the Emanations separated by the Fall, being able to reconcile Justice and Mercy —Christians would say by His own sacrifice. Tiferet also, of course, recombines the male and female principles—Anima and Animus, according to Jung. As well, Jesus-Tiferet can heal all the previous sYmmetry-breaking and be in direct touch with the Unified Field. This action is the “above” instance of symmetry restoration. The “below” version comes later in the story.

The next pair of Parzufs, Hod (Majesty) and Nezah (Long-lasting Endurance, or we would now say Sustainability) represent the male and female aspects of living Nature, with the awesome wonder of Life and its property of surviving immense catastrophes through episodes of near-extinction. Perhaps this is where the comparison with the electroweak bifurcation would best fit in, as the nuclear forces dominating the Sun and the chemical forces dominating the Earth could cooperate, while remaining separate. For this pair too is reconciled by another genderless deity, Da’at, which symbolizes Death and Renewal, probably through the mechanism of sexual reproduction. Thus the qualities of divine genders get translated into the sexuality of plants and animals. “As above, so below.” Here we have the second instance of sYmmetry restoration.

The story of the Parzufs does not end there, as the symmetry-breaking of the Unified Field does. Hod and Nezah, the Father and Mother of Life (the Sun and the Earth?) give birth to Yesod (the Root), also called in other faith cultures Kundalini or Qi or Chi, and located, as the lowest Chacra (Root or Muladhara), at the Coccyx or the tail-end of the spine. And Yesod in turn begets Malkuth, the Kingdom, easily interpreted as the Five Kingdoms of Life on Earth according to Lynn Margulis. The corresponding Chacra, appropriately enough, is the Swadhisthana, located in the loin, and symbolizing the animal sexual function.

There then remains the last and most endearing (to us) Parzuf, Shekina, which, according to legend, accompanies humanity into exile—originally the Jews into Babylonian exile, but symbolically all humans into self-imposed exile from Nature and from God. I think of Shekina as “she and her kin”, or alternatively as the Holy spirit. She (or It since genderless) is our moral conscience calling us back from a life of sin, though not abandoning us even as we sin. Emanating from the Highest on High, the Spirit calls us to return home as the prodigal son.

The higher Chakras also have their analogies. The Navel or Solar Plexus may represent animal instincts or the reptilian brain, the Heart may be the mammalian brain, the Throat human speech, the Brow human abstract or symbolic thought, and the Crown spiritual connections. Shekina is in charge of the last three or four.

The disciples of Maharishi who founded the method of Transcendental Meditation, claim that humans can get in direct touch with the Unified Field, and greatly increase the coherence of

the entire community, e.g. cutting down crime rates. The more advanced siddhi Program can even cause meditators to levitate, i.e. rise from the ground. If El Kether represents gravitation, reaching beyond It to get to En Sof Itself could cause levitation.

Much of this “reasoning” by analogy and metaphor is pure phantasy. My left-brain integrator is working overtime. I don’t have a shred of empirical evidence. Yet the story resonates at many levels, and I allow myself to dream, without mistaking the dream for reality.

MIGHT AND LOVE.

In the Book of Job, God proceeds to impress suffering Job with His might: “Where were you when I created the world?” And goes on to describe some mighty creatures and natural wonders. Granted: Job was not there and could not even approximate these feats. But God does not impress me, in this story, with His love, only with His might. He is willing to gamble with the Devil for Job’s soul.

Power or might is almost the opposite of love. Possession and exercise of power, even the power to create the Universe, does not prove love. God did not really answer Job’s question, which was why he had to suffer when he had always been virtuous. He still has not answered our complaint about the mass sufferings of our time.

LOVE IS NOT ENOUGH.

“Matter is gravitationally self-trapped light.”

Attraction (Love) draws light together into denser form. But overdone, it leads to a black hole singularity, a denial of matter and a trap for light. Love is not enough, or, better, too much love is too much.

There must be structure.

A marriage should not be fusion, but an “I-Thou” dialogue between two mutually respecting personalities.

VESSEL BREAKING AS SYMMETRY BREAKING.

Before the unified field was the vacuum field.
Before One there was Zero.
The unified field (the One) was the white-black hole,
when the boson condensate turned into
a fermion singularity which exploded
in the Big Bang. The fermion pressure was immense.
The black hole swallows all;
the white hole emits (creates) all.
Then En Sof emits the Parzufs:
First Kether, then the pair Hokhmah/Binah,
the power of Truth, Wisdom and Intelligence,
the Platonic sphere of pure Being.
The unified field (En Sof) creates Kether
when gravitation separates from the four forces.
Uniform ten-dimensional space separates
into space and time. There was no time before.
The ten Parzufs are the ten dimensions.
The time dimension becomes imaginary,
but more real than ever, as the universe evolves.
Next comes the pair: strong force (Hokhmah)
and electroweak force (Binah), Father and Mother,
Yang and Yin. Male and female He created them.
But then the vessels break, six of the ten dimensions
become curled up and not extended,
and further Parzufs are less perfect.
The electroweak force breaks into weak and electromagnetic,
the next pair, Gevurah and Hesed, justice and mercy,
the two faces of goodness, male and female.
Photons separate from electrons, bosons from fermions,
energy from matter—a sudden decoupling.
Ours is a beautiful but fallen world.
Time and not Eternity.
The Fall is not the fault of Adam and Eve,
who were not yet there,
but a cosmic accident, since creation is difficult.
Life emerges with Yesod and Malkhut,
but it is fragile, vulnerable, time-bound, mortal,
because of the Fall.
Shekinah, the light of consciousness,
though foreshadowed in animals,
comes to complete bloom with humans.
The link between the eternal pair (Hokhmah/Binah)
and the secular pairs (Gevurah/Yesed and Hod/Nezah)
is Tiferet, the flower and the beauty.
(Thus Beauty comes after Goodness and after Truth.)
Tiferet is Jesus, the Way, the Tao,
the nine incarnations of Vishnu, even Rama and Krishna,
the bridge between the divine and the human,
between the unbroken and the broken,
between the eternal and the mortal,
between the begotten and the created.
(His mother Mary was mortal, His father was not.)
The other Parzufs are the Holy Spirit
which permeates the life forms.
The Shekinah especially follows

the doubly fallen humans:
once fallen through the cosmic accident,
continually falling through their own sins.
The fall creates time, i.e. obscures eternity.
But colours are more interesting to us
than black-white splendour.
We like the rainbow spread of possibilities.
We prefer becoming to being, like planning a trip.
The rainbow reflects (?!) both happiness (sunlight)
and sorrow (rain, like tears).
The prism of life spreads out the divine in space,
as also otherwise in time (as waves and cycles,
as terminations and resurrections.)
We prefer to be in time on the wheel of life
rather than in the Nirvana of eternity.
But that is only because we are ignorant
of the eternal bliss of pure Being.

TRUTH VERSUS GOODNESS, POWER VERSUS LOVE.

(A meditation.)

The Hebrew God, the God of “The Bible Code”, is the very opposite of the Socinian God, who is not omnipotent but is all-loving; the Socinian God whose nonviolent coming I so eagerly await. The God of the Bible Code threatens me with disasters about to happen soon unless I can change it, or change (myself). The Socinian God loves me unconditionally.

Can I accept a revelation that offends my ethical sense? It’s a case of Truth versus Goodness. I have worked long and diligently to invent my God of Love, not Power.

Must I now yield my favorite theory to hard evidence? This is especially hard for me, who has always put hard evidence first, but who is appalled at the Hebrew God’s vengefulness, His advocacy of genocide, His heartlessness to Job and especially Job’s wife and children. And my incident with the card that fell down (see the essay The Fifth Yoga) is also evidence. And some people doubt the evidence of the Bible Code.

Yet I suppose that He is both Truth and Goodness originally, and both Power and Love, as the unified En Sof before the creation, and even as Kether, His deputy to this Universe. But when He/She splits into male and female, I much prefer active intelligence to cold wisdom (seeking rather than omniscience), I prefer merciful love to abstract justice, life-like perseverance in process to majesty of achievement; in other words, Mother to Father.

Unless they procreate to produce the Flower of Supreme Beauty, the Tiferet of Jesus.

WHAT IS GOD'S PURPOSE ?

If God’s purpose is to induce large-scale harmony in the universe, I can think of two ways of doing that (but there may be others): macroscopic quantum coherence (as in plasmas, helium liquids, superconductors, lasers, holograms) and life (myriad forms, perhaps some on other planets).

Macroscopic quantum coherence results when fermions, such as electrons or protons, associate in pairs (Cooper pairs) which make them into bosons because their half-spins complement each other to form whole-number spins. You might think of them as pairs of lovers merging in a higher unity. This can then go on to higher and higher numbers associating together in this manner, eventually forming macroscopic structures, which can then move together in an enhanced manner, giving rise to such “frictionless” phenomena as superconductivity, superfluidity, phase coherence, and holistic images.

Life forms achieve coherence and harmony in a completely different way: by organizing, from the bottom up, first simple molecules into macromolecules, then these into cells, then cells into whole organisms, and some organisms into eco-systems (multi-species) and others (bees, ants, humans) into societies (same species). Life is a multi-stage “subsidiarity” phenomenon, where each level performs the functions best suited to it. It is hierarchically organized, but with a lot of autonomy at the bottom level. It is based on a combination of differentiation (e.g. of cells during embryonic development) and integration (holistic cooperation).

Are there other ways to organize macroscopic harmony? Angels, perhaps? We should keep our minds open.

Is God’s purpose harmony or diversity? A blinding white or a play of colours? In a mandala these are united—the creating centre and the created resplendent variety around it at the periphery. It is forever unfolding, like a kaleidoscope, and again enfolding into the Mystery Centre of the White Hole. While a Black Hole never returns anything that it swallows, this White Hole never swallows what it emits, in eternal creativeness. There is implicit order beyond comprehension.

FOREVER SEEKERS.

The reason why we remain seekers and not finders in scientific and religious quests is becoming apparent to me: it is because life is a process, not an attained goal. Our individual life, and the general universal Life is a journey, a path, not a final resting place in some beatific vision. Would we have it otherwise? A.J. Muste said “There is no way to peace; peace is the way.” The same can be said about life, and about all quests. The Pilgrim’s Progress is never complete, but goes on and on.

The fundamental reason for this is that life unfolds in Time, not in Eternity, where goals have been attained. But while we live, we have no access to eternity. (Perhaps mystics have.) Pro-entropic and anti-entropic structures (like us) possess an arrow of time which purely mechanical or equilibrium structures lack.

Newly emerging buds in spring are a part of the flow of life, the flow of Tao, and (not “but”) falling leaves in autumn, when their sterns have been deliberately cut by a natural process, are both parts of life. Time does not stand still in the bloom of Summer, when already at the Mid-Summer Night Solstice the spirits of winter dance, nor in the snow and ice of winter, when already at the Winter Solstice we hear the angels sing.

Would we have it otherwise? I am not ready for a static blissful Nirvana—not yet.

THE ACE.

The Ace is the beginning and the end,
the Alpha and the Omega, birth and death
reunited and reconciled, as plus and minus infinity.
In the Ace the vulgar numbers blend,
e'en Kings and Queens hold their breath,
awed and quite muted by the Heaven's serenity.
The Ace means the hand of God that lifts,
reaching through the cloud to bring us gifts:
wands or clubs for primal vitality,
swords or spades for courage in adversity,
pentacles or diamonds for wealth and good fortune,
hearts for love and family, to each a heaping portion.
Inventors of playing cards knew the deepest truth:
knew the strange grand wraparound, the transition smooth
from the big back to the small, from God to the human,
circularize the number line, continue the lumen
quite around the Moebius band to meet itself coming,
all the while spheres' music soft carries on its humming.
But Hearts are trump, as Love prevails in the game of life,
so use your courage and your wealth to substitute for strife.

DO YOU CHERISH THAT OF GOD WITHIN YOU?

(Meditation on a Quaker query.)

Divine sparks of Godhead emanations descended into flesh
Same essence in all minds but different manifestations
The Godhead is individuated at Its extremities
and unified at Its centre
We too are differentiated yet integrated
if only we could see the connection clearly
When the Son of God meets the Son of Man the circle closes..
The Godhead is the Ovum of the Universe
Yet there is a crack in the Cosmic Egg,
a crack in everything, which is how the Light gets in
Simplicity of the Godhead Essence (Ousis)
and complexity of the living flesh converge,
like plus and minus infinity in the plot of the hyperbola,
like the super-hot and the super-cold in magnetism.
But this physical picture ignores the moral universe.
Turn from Kant's pure reason to his practical reason,
from the starry heavens to the beauty of the moral law.
The Categorical Imperative assumes reverence for (human) life and the unity of essence as underlying principles.
But we don't share the distant Godhead's essense,
who is Holy, wholly Other. Yet the Emanations, Sons and Avatars, Prophets, Spirits, Angels and Saints, mediate.
Can there be shadings of essence? Or only quantum jumps?
Or a Jacob's ladder? (Like a DNA ladder.)
Descartes was wrong; we can't start from introspection.
The room of the mind is too dim except at the centre of attention; the dark walls and secret rooms of the un-conscious remain inaccessible.
We know less about the inner space than about outer space.
Yet in a sense we know NOTHING BUT the inner space,
the illuminated part of it, the outer layer.
Except—to come back to it—the divine spark of light
mysteriously shining deep inside.

PROSERPINE.

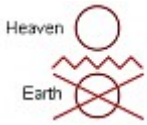
Pluto captured Proserpine,
Demeter's black-eyed daughter.
By maneuvres serpentine
and black magic he caught her.
Demeter sued in Olympian court,
custody requested.
Pluto would not his wife deport,
would hold her sequestered.
Court ruled that she should spend
summers with her Mother Earth,
winters husband's wishes tend
when earth suffered warm's dearth.
Now pluto(nium) holds Earth in thrall,
threatening to burn us all
with hell-fire so extreme,
that Pluto seems to reugn supreme.
Proserpine, the halfway creature,
daughter of Earth but Hell's dear wife,
wavers, flounders in half-states,
like quantum cat, 'twixt death and life.
When we look, we'll know Fate's choice.
"Look in summer", whispers Voice.

ENGAGING THE POWERS (From book by Walter Wink.)

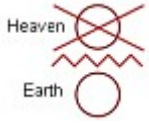
According to Wink, there are 5 worldviews, each involving heaven and earth and their interconnection:

1. The ancient worldview; as above, so below.

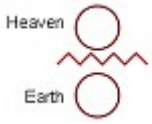
2. The spiritualist worldview; the soul is good, flesh is bad. According to the Gnostics, the soul entrapped in the body needs release; and the earth was created by an evil demon.



3. The materialistic worldview: the world is an illusion. All there is, is the world, matter, and the body.



4. The theological worldview: there is an uneasy coexistence or separation between religion and science.



5. The integral worldview: heaven and earth, sould and body, are two aspects of a single reality.

Satan (Principalities and Powers) is the world-encompassing spirit of the Domination system (racism, sexism, nationalism, militarism, authoritarianism.

But the Powers are not necessarily evil: they are needed to provide order, some structure to overcome chaos. So the Powers are good, but fallen (misused), and must be redeemed.

Hobbes got it wrong; human nature is not necessarily evil.

Rousseau got it wrong: human nature is not necessarily good.

Marx got it wrong: economic structure may not lead to evil.

The basic myth of the Powers is the myth of redemptive violence. God's way is the spirit of creative nonviolence, as personified by Jesus. But the Church became part of the Powers.

In the Babylonian creation myth, Marduk killed and dismembered the Mother Goddess Tiamat, and created humankind out of her blood. Here creation itself is an act of violence. The origin of evil precedes the origin of things. Chaos is prior to order. Evil is prior to good, ontologically. The Biblical creation myth is the opposite: the world and humans were created before evil entered the world with original sin. [I would call the murder of Abel by Cain the original sin. And we are all descendents of Cain. As such, we must be healed or redeemed. Not so much to send our souls to heaven, but to save the world from violence.]

Babylon is an early agricultural society. That is when the Domination system originated, according to Riane Eisler (The Chalice and the Blade). Hunters and gatherers lived in partnership societies (the Garden of Eden?)

But Sveva Caetani has another view of evil: as a tiny insignicant incubus, a homunculus. It is more like a virus than like a predator or raptor. There are three kinds of evil, classified by

Osgood's semantic differential categories: good-bad, strong-weak, active passive.

The Manichean devil is bad, strong, and active. (Predator.)

The Augustinian devil is bad, strong, passive. (Entropy.)

The Caetani devil is bad, weak, but active. (Virus model.)

Girard's theory is that the only early human societies that survived the chains of feuding (revenge killing, "eye for an eye") were those that learned to scapegoat—to load the evil on a sacrificial animal. The usual interpretation of the crucifixion of Jesus is that he was the scapegoat for our violent sins. But Wink's interpretation is that he was teaching us nonviolence, the opposite (alternative) way of life, which can also interrupt the chain of ongoing revenge, by absorbing the evil. (This is also the view of Jim Douglass in "The Nonviolent Coming of God.") This would save us, but only if we learn and practise it. In this sense, HE IS THE WAY. But we must all be healed. This would be redemptive nonviolence.

Creation—Fall—Redemption. This kernel of Christian moral theology is also found in the Jewish Kabbalah in the doctrine of the breaking of the vessels. The new meaning of the phrase "The Son of Man" is a redeemed, regenerated human being, a new species in cultural evolution.

COSMIC ENCOUNTER GAME: THE TEN POWERS.

In this game, about which I have written before (see “Ten Powers in the Game of Cosmic Encounter”), the ten powers that players have are summarized as follows:

The name in the game	My name
Mutant	Regeneration
Mind	Knowledge
Zombie	Immortality
Empath	Empathy/Harmony
Macron	Power to (do)
Chronos	Time travel
Void	Power over (others)
Virus	Reproduction
Philanthropist	Altruism/generosity
Oracle	Prediction

Three of these ten powers are biological: regeneration (regrowth after injury or amputation), immortality (possessed only by unicells and by cancer cells), and reproduction.

Five are mental/rational/technical: knowledge, time travel (redoing the past—probably impossible), prediction (knowledge of the future), power to, and power over.

Two are moral/social: empathy and altruism.

(I might add two comtemplative ones: beauty and spirituality.)

Which of these do we humans possess?

Biologically we have reproduction, regeneration only to some extent (not as much as invertebrates), and immortality not at all (it would be a disaster).

Technically, we have, partially only, knowledge, prediction, and the two kinds of power. We will never have time travel.

Morally we partially have empathy and altruism, but we could use more. (Sociopaths don’t have any.) Empathy (consciousness of others) is shared only by humans and some other primates. Altruism is practised e.g. by ants and bees, but purely by sociobiology, without much awareness.

The rational/technical powers are usually considered masculine, the ethical/social feminine. Wisdom (Sophia) is a compound of both.

Counting the biological powers as 1, 0.5, and 0 respectively, we have a total of 1.5. Among the technical, we have 0.5 for 4 of them and 0 for one, a total of 2. For the ethical, we have 0.5 for each, a total of 1. Summing it up, we have 45% of the possible powers.

God is:

- Eternal (has immortality, so needs no regeneration or reproduction),
- Omniscient (knowledge, prediction, time control)
- Omnipotent (power to and power over),
- Loving (has empathy and altruism).

His score is 100%.

Our score of 45% must be an overestimation!

THE GOD HYPOTHESIS.

According to Richard Morris' book "The Universe, the Eleventh Dimension, and Everything" Four Walls Eight Windows, New York, 1999), there are several "fine tunings" of the laws of nature in the universe, without which life would not have arisen and we would not be here.

For example, the neutron is slightly heavier than the proton, and so the neutron decays but the proton does not (in measurable time). And hydrogen is necessary for star formation and for life. Who would want a universe full of nothing but neutrons and electrons?

Again, if the strong nuclear force which binds atomic nuclei together were 5% weaker, deuterium could not be formed; and its formation is a step in the formation of helium and any heavier elements, i.e. in nucleosynthesis in general, both right after the Big Bang and in the centre of dying stars. Stars and living forms would never arise out of hydrogen alone.

Continuing: If gravity were a little stronger, stars would burn out very fast; life on any planets would not have time to originate or evolve. If gravity were very strong, nascent stars would explode like huge bombs.

If the electromagnetic force that binds molecules together were a little weaker, liquids and solids would not form; only gases would exist. If the e-m force were a little stronger, no nucleus bigger than a single proton would form. Again, there would be only hydrogen in the universe.

If the energy levels in beryllium and carbon nuclei were a little different, the carbon nucleus could not ever be formed in the interior of stars. I seem to remember having read about other such cases of "fine tuning" e.g. of certain fundamental constants.

Morris considers this fine tuning "almost as if intelligently designed". But then he explains it by hypothesizing multiple universes, most of them without higher elements and without stars or life; we inhabit one in which life is possible, because otherwise we would not be here to observe it. This is the anthropic principle.

This is a plausible explanation, but it is not the only one. God the intelligent Creator is also a possible hypothesis, and seems rather more plausible than multiple universes. Why is the God Hypothesis so unacceptable to scientists? If we are ever to achieve a synthesis of science and religion, we will have to abandon this dogmatic reluctance. Even the Big Bang itself looks like an act of creation. ("Let there be light") It was originally so greeted when it became accepted rather than Fred Hoyle's universe of continuous creation that had always existed. The eternal fact is not the universe, or even many of them, but God alone. (That is my preference, anyway.)

MORAL UNIVERSALS.

While cultures differ in their moral values, there are some values that are not arbitrary preferences, but are necessary preconditions for the very existence of societies: values such as absence of pain, and survival. Without respecting each other's right to life and basic physical security, people would live, if at all, in a Hobbesian state of nature, which is not a society. Such a state probably never existed, because it is not survivable. Every baby born has to first establish a sense of basic trust in its Eriksonian psychic development, before striving for higher values. The basic trust is sometimes betrayed, as when girl babies are killed at birth in China. Basic trust is not always justified, but without it there is no life, personal or social.

Some moral universals are identical for all existing societies, as is the case for the basic survival trust outlined above. There are other values that are always dealt with in all cultures, but not necessarily in the same way. Examples are: (1) Sex, marriage, and family customs. Here, all societies have rules, sometimes very strict, but they differ from one society to another. However, there seem to be some universals, such as the tabu against incest. (2) Property rights and regulations, e.g. some pastures and agricultural lands are privately owned, while elsewhere they are communally owned. (3) Every society has a law or dispute resolution system, but some are oriented to punishment, others to rehabilitation and community healing.

An important group of moral rules that exist everywhere are injunctions against stealing, telling lies, and breaking promises or contracts. These are basic to the maintenance of societies and are the same everywhere. They can all be modelled by cooperation in a Prisoner's Dilemma or other collective dilemma games, such as the Tragedy of the Commons and Collective Goods. In these dilemma games, maximizing individual utility leads to social disaster, and therefore this selfish behaviour has to be curbed, either by punishments (a kind of side-payments in the game), or by rules of social solidarity or the expectation of reciprocity from others in long-term repeated interactions. This eventually leads to altruistic behaviour, norms of equity or fairness, the Golden Rule, and the categorical imperative of Kant, but this is a big jump.

Following the rules that break the dilemma in so-called social dilemma "games", as described above, is the mark of moral reasoning and behaviour on Kohlberg's stage 5 (social contract). When we get into altruism, equity, the Golden Rule, and the categorical imperative, we are into Kohlberg Stage 6, described as principled conscience. At Stage 6 we may even make exceptions to Stage 5 rules, such as the injunction against lying. For example, a woman in the Netherlands hiding Jews from the Nazis in World War II is, not only permitted, but obligated to tell a lie when the Gestapo ask her if she is hiding Jews.

Moral rules are sometimes broken, as we all know. People lie or steal or cheat for selfish reasons. A society is robust enough to bear a certain amount of "defections" before breaking down, but there is a limit. However, the important thing probably is that the liar, cheater or thief know that they are breaking the rules, i.e. the rules are still recognized as carrying authority.

Rules about inter-human violence partake of both aspects, rules that are everywhere identical and rules that are everywhere legislated, but not in identical fashion. "Thou shalt not kill" is probably the most important and authoritative of the Ten Commandments. Yet Cain slaying Abel is one of the first acts reported in Genesis. All societies proscribe killing for individual reasons, but many permit or even extoll killing in war, as capital punishment in the justice system, and some permit it in duels and blood feuds. Some others allow abortion and infanticide in special circumstances, or abandoning old people no longer able to care for themselves. The norm against killing seems to be a nearly universal norm, but with exceptions, some of them (especially war) leading to very large loss of life.

The basis of universal moral norms in general is to foster or improve human well-being and diminish harm to human beings. This is based on the desire to live in ordered societies based on cooperation and some imagined original social contract. Living in societies is probably essential to human survival, since solitary life is thought to be unsustainable. (Even Robinson Crusoe eventually got together with Friday.) However, it eventually evolves into the recognition that all humans share the same essence, which requires the same respect as our own. This concept of compassion or agape was well-expressed by Gautama Buddha

when he said “Just as I am, so are they; just as they are, so am I”.

Again, the rules derived from the basic social contract are at Kohlberg Stage 5, while the principle of shared common human essence is at Stage 6. To Stage Sixers it is an axiom to recognize the shared common human essence, so obvious that it needs no proof. However, it is not a real axiom, since it is not at all obvious to all humans. It seems as if morality begins at the social pragmatic level and then evolves into something higher, something which filled Kant with awe along with the starry heavens, like a holy mystery.

What makes moral rules authoritative? Moral values are not “facts” in the usual sense, “ought” is not equal to “is” (that would be the naturalistic fallacy). Yet one can reason about moral values, derive one from another, as in geometric theorems and axioms. We often ask for rational justification of moral behaviour; Fred Bird of Concordia University, Montreal, makes this one item in his list of moral universals. Wendell Bell cites Lee’s five criteria for authoritative value assertion: (1) There must be serious evidence (not only subjective preference). (2) The value must be referentially relevant (the evidence must concern the same value that is asserted). (3) The value must be causally relevant (when one value is being derived from another, they must be causally related). (4) The assertion of the value must pass empirical testing.

Bell describes three models of how to deduce values from each other: (1) Commitment to the highest value, then deriving other subordinate values from it. (2) The ends-means model, i.e. Russell rationality: the goal is chosen by mere preference, then reason guides us to choose effective means to reach the goal. (3) Lee’s epistemic implication, comprising the five criteria already cited above.

It remains to mention two more universal values included by Bird: (1) Individual moral responsibility, which excludes such excuses as acting under orders. (2) The entire area of human rights, and what all should be included there, which is still very controversial. Many people feel that the civil and political rights in the U.N. Universal Declaration of Human Rights are more important, even on a higher plane, than the social and economic rights. Others argue about the relative importance of individual and group rights. We obviously do not have consensus yet, though we may be slowly approaching it. In any case, the Universal Declaration does not yet represent universal moral values in our present world. Even quite apart from non-compliance problems, we are not yet even agreed on definitions.

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BEYOND SOCIOBIOLOGY.

Steven Pinker (“How the Mind Works”) explains the human mind and behaviour through genetic evolutionary theory and sociobiology. All of this, regarding our feelings toward kin, sex partners, children, friends and enemies makes eminant sense. Until, in the last chapter, he comes to our esthetic values and scientific curiosity—why we do things that have no survival value. He admits that the evolutionary theory goes only so far, and that humans often do additional things—like the play of children (and adults).

Much of this, as well as our sense of ethics, comes from one root, in my opinion: our sense of self and our sense of others as selves in their own right, of the same essence as our own self. An article in the November 1996 issue of Discover magazine (“The Tarzan Syndrome” by Karen Wright, pp. 88-102) describes the research by Daniel povinelli on ape behaviour when presented with a mirror. The orangutan, especially, seems to be aware that he is an “agent” initiating his own movements, and therefore a self. Other apes do not show this behaviour under the same circumstances, nor do monkeys, dogs, cats, or any other species tested.

Human infants show this self-recognition behaviour at an age from 18 months to 2 years; but in their case, it is tied to a recognition of the selves of other persons. The name for these tied concepts is “a theory of mind”. The recognition of the selves of others similar in essence” to one’s own is called “empathy”. It is apparently something specifically human. It may even be tied to the origin of language. Children learn language at about the same age.

When Pinker and others explain altruism by the inclusive fitness theory of sociobiology (“selfish genes” trying to perpetuate themselves in the next generation, through our close kin if not ourselves), this goes only so far. It does not explain sacrificing oneself for genetically unrelated friends, or for a cause that would benefit humanity as a whole. But if we recognize the minds of others, through the faculty of empathy that we possess, an explanation of such extended altruism is at hand. Our inborn faculty of empathy, or what I call “the Principle of Common Essence”, is the root from which Agape (all-encompassing love) can spring. For some people it is founded on religion, but it need not be; it is a free-standing moral sense, akin to Immanuel Kant’s categorical Imperative. Various world religions embody it in different wordings of the Golden Rule.

Of course, the faculty that enables us to see others as ourselves also accounts for the formation of enemy images, if our own minds plot intrigues against others; by the process of projection, we then perceive that the others are plotting against us. The perception of others as ourselves can be pernicious (the very root of war) as well as beneficial., as in creating universal love. Both good and evil stem from the same primal energy source.

Now about sociobiology itself: I would extend inclusive fitness to be even more inclusive. All humans share about 99.9% of the base-pairs of DNA, so I should have the evolutionary urge to preserve and perpetuate the entire human genome, i.e. to want to so act as to prevent human extinction, and be willing to lay down my own life to promote this goal. Is that false reasoning? Maybe I somewhat prefer my own kin, especially my children, but not by that much.

Thus I would argue that human behaviour extends in several respects beyond the part that is explained by the Darwinian principles of sociobiology: art, science, play, and ethics. These non-survival-oriented behaviours do not prolong, preserve, or pass on life, but they make life worthwhile. In the movie “Dr. Zhivago” (the name means “life” in Russian), Dr. Z. says to his love Lara that they need not take part in the revolution that will liberate humanity, because the revolutionaries are doing it so that love like theirs may freely flourish. He seems to be saying that he and Lara are the end value, the revolution merely a means value.

What would life be without art, music, and scientific curiosity? The genes should serve the brain, not vice versa. Perhaps the selfish genes served their purpose for previous species, by making bodies (gene products) pass through the sieve of natural selection; but in the human case, the roles have switched. We now evolve through cultural evolution, which is a million times faster than the natural kind. And the instrument of cultural evolution is the brain, not the gene.

MORALITY BASED ON THE PRINCIPLE OF COMMON ESSENCE (PCE).

The Principle of Common Essence (PCE) is based on the fact (an actual experimental finding) that humans, unlike most other animals except orangutans, perceive that other individuals of their species have minds and inner experiences like their own. This has been called “a theory of mind”.

I argue that for humans this is the basis of morality, ethical systems, and conscience (the moral sense). However, it can also be the basis of the formation of enemy images, by the psychological principle of projection. In other words, the PCE and the theory of mind can be the origin of both Good and Evil: the knowledge of other minds is what came, mythically, from eating the fruit of the tree of knowledge in Eden. It is both our glory and possibly our fatal flaw.

Walk past a store window and see a dressed figure there. First you think that it is a mannequin, but then it moves, and you perceive a person. What a difference that makes to the perception! Hear a recorded message on the telephone, and then a real voice comes in. Again, what a fundamental switch in perception! We might see the person as a friend or a foe, but never as a thing. This is the difference between Martin Buber’s “Thou” and “It”.

So what consequences does this have for our systems of morality? How ought we to behave toward these perceived, unique, non-fungible persons? I will consider here only the positive side, how we ought to behave, not the negative evil side.

First, since we ourselves do not want to be harmed (I exclude suicidal persons), we should avoid harming others. “Do no harm” is the first principle of medical ethics in the Hippocratic Oath, and should be the first principle of behaviour by any other individual. It is Gandhi’s “ahimsa”. However, it is not clear-cut.

We SHOULD shoot down the crazy pilot out to drop Hbombs on an enemy who is capable of retaliation (or even not capable), because of the much greater harm that would come from the accomplishment of his self-assigned mission.

Some kind of rational moral calculus enters here, a consequential ethic. This can slide into the utilitarian principle of aiming at “the greatest happiness of the greatest number”, but again caution is required here before completing the slide, as pointed out in the discussion of the second principle derived from the PCE.

This second principle states that, because our own mind strives for happiness, therefore we should strive to increase the happiness of the others who are so like us. This is the positive side of not doing harm.

However, should we agree that it is moral to kill a limited small number of human beings in order to increase the happiness of many other human beings? There are several difficulties: 1. It may not be possible to quantify “happiness” (utility). 2. The utilities of different individuals cannot be simply added; they differ in quality. 3. Even if we ignore the first two points, and if the sum of utilities would then come out positive, and thus conform to the utilitarian principle of “the greatest happiness of the greatest number”, our moral sense feels uncomfortable about totally sacrificing some individuals for a marginal increase of happiness of the many others. Perhaps the many others are just racially prejudiced against some minority and want to see them eliminated, in order to feel happier.

The term “marginal increase in happiness” pinpoints the difficulty. On a semi-quantitative utility scale, death or slow torture is zero or negative, while happiness at the upper end yields diminishing returns, like giving one extra dollar to a millionnaire. Maybe there is even

an inflection point (sharp change in slope) at some point, as in Alcock's life expectancy vs. GNP per capita curve for nations.

Perhaps this could be operationalized by using the product of individual utilities rather than the sum. Then any individual's zero makes the product zero (or anyone's negative utility makes the product negative*), while the sum would be hardly affected.

However, there is still an exception. If not killing the crazy pilot about to drop H-bombs will kill millions of people (even more if retaliation is triggered), then our moral sense indicates that he should be killed. It is as if the zeros add up, unlike in mathematics.

PCE moral calculations are not purely utilitarian, nor do they totally exclude evil means, as in n ethics. Moreover, the calculations are often imprecise, espacially if probabilities rather than certainties of outcome are involved, or even more so if the uncertainty is so profound that estimates of probability cannot be made at all.

Do we have to conclude that the human moral sense based on PCE is inborn or intuitive, as the term "conscience" implies? Is conscience, like consciousness, an emergent quality of a complex brain? Is it then not truly amenable to ordinary rational moral calculations?

What about extensions of PCE to non-human creatures? This would involve discounting, again an imprecise, nonquantifiable notion. Plants count less than animals, insects less than mammals, bacteria the least, unless useful to humans. This is anthropocentric, but perhaps unavoidable. Perhaps the PCE must pay attention to a scaling down of the common essence in other creatures. This then depends on comparisons with the HUMAN common essence, taken as the standard. Are we justified in doing this, just because of who we are? This is no absolute measure of value, but this is the PCE we are born with. We are not capable of a superior, God-like perspective.

The extended PCE which we have been considering is summed up as "respect for life". It can never be absolute, as the previous discussion shows. Moreover, we need to kill some of the members of the living world in order to eat and to defend ourselves and our crops against diseases. That it should be done with an "apology", as native hunters do, seems hypocritical. The prey surely never give permission. The commandment "thou shall not kill" in the Old Testament was meant to apply only within the Hebrew community, as the rest of the Scriptures makes clear. Empathy then did not extend even to all humans.

So what is moral conscience? It seems to operate intuitively, through the emotion of empathy, based on a theory of mind in other persons or even other living beings. It is not rational; by this I do not mean that it is irrational, but only that it cannot be entirely encompassed by quantitative reasoning, although partial attempts can be made, as was done here. However, the reader will note that when the moral calculations came to an impasse, I had recourse to the intuitive moral sense.

Conscience can be ignored, but most humans when acting against it do know it, are aware of doing evil. There are a few defective humans who lack this sense of guilt; they are called sociopaths. In minor matters, many people put themselves first, discounting neighbours and especially enemies. The New Testament warns against this, urging us to "love your neighbour as yourself" (i.e. equally, without discounting), and even to love our enemies and return good for evil (turn the other cheek). We can conclude that the NT version of the PCE (Christian ethics) urges us never to discount other human beings. It is to be fervently wished that nominal Christians would apply this in practice.

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- This does not work, because if an even number of individuals are killed, the minuses would cancel out. Better stick with the zero.

COMMENTS ON BROTHERS KARAMAZOV.

The main point of this long Dostoyevsky novel, which the plot mainly illustrates, is that, without belief in God, moral rules would disappear, and “everything would be permitted”. While I happen to believe in God (as of quite recently), I strongly disagree with this argument. For most of my life, I have lived without belief in God, and I have committed no murder or robbery or any other grave crime for the sake of my personal selfish benefit. Except for the occasional small lie, and many sins of omission, I have been no worse than the average Christian.

But my objection to Dostoyevsky’s claim is not derived from personal experience, but from fundamental ethics. Avoiding doing harm to other people is not, for me, based on God’s prohibition of such behaviour. And I would be ready to generalize this principle to apply as an obligation to all people. The basic principle for avoiding doing harm, and for promoting the well-being of all people as far as possible, is the principle of common essence; the fact (which I accept as an axiom) that all people share the same common nature or essence as myself, namely a thinking and feeling mind, and that therefore they must not be harmed if I don’t want to be harmed myself.

This is very close to the Golden Rule: do unto others as you would have them do unto you. The Golden Rule, for me, is directly derived from the Principle of Common Essence. And while it is preached by all the world’s religions, it does not depend on God’s commands, it is morally self-evident. It was formulated as God’s command because in this form it would be more understandable and seem more binding to people who were not philosophically inclined. But for those persons who are so inclined, it can stand alone, on its own merit.

Standing on its own merit, the Principle of Common Essence is a more valid justification of moral behaviour than than using religion as its basis. Religious justification is at least partly based on fear of punishment in life after death, which is less praiseworthy than doing good and avoiding doing evil for its own sake. Religious justification based on love for God is somewhat better than that based on fear of God, but still depends on a relationship, on second-hand knowledge, not on intrinsic merit alone.

Perhaps, by believing and acting on the Principle of Common Essence, we humans are somehow be creating God in our image. Job in the Old Testament was certainly morally superior to God in that chapter. By “teaching” ethics to an amoral God, we help to create Him with more admirable qualities. At Teilhard’s Omega Point, we shall merge with Him, and He will create us at the Alpha Point, in the Great Wrap-around.

However, for those who are not willing to accept the philosophy of the Great Wrap-around which is quite counter-intuitive, I would say: just skip the previous paragraph. The argument for moral behaviour based only on the Principle of Common Essence can stand alone, just like the principle itself.

MEDITATION ON THE PRINCIPLE OF COMMON ESSENCE.

The Principle of Common Essence (perceiving other people as selves like ourselves) is very new in evolut1on.

It is shared by humans only with one species of apes. And not every human has it. It is probably a common perception, but selfish humans do not act on it; they disobey the1r innate conscience. Some others use the PCE pr1nc1ple to build enemy images evil plotters like themselves. The PCE is still unstable, not well established. Most philosophers reject it as an axiom, consider people to be bas1cally selfish.

Positive PCE needs confirmation, stabilization, consolidation. Is this what the successor; species, “the Son of Man”, will achieve? Some enlightened individuals already have achieved it, like Buddha and Jesus, pav1nq the,way for the future. This is more important than “the Blue Light” of collective meditation, as outlined in “Alien Child”.

If only we can stay alive that long. In lucid dreams, I can change the end of a story. In reality I can’t.

The PCE requires leaving space for other persons to exist and exercise freedom. It does not mean overwhelming others with compassion and help which they may not want. Freedom is a necessary complement to love. Don Bryant called this creation of lacunae in one’s sphere of interests “the crypt of disinterest”. These lacunae or krypts in our spheres is not really a loss, because the friends admitted to use it give us space in their spheres for our use. It is a reciprocal gift of frienship and love. Everyone gains, love being a non-diminishing entity. The sharing of crypts creates a bond, like the chemical bond forming molecules by sharing electrons between atoms.

The attractive forces (call them love) dominate the universe, from atoms to humans. God, too, has left for humans a crypt of disinterest (which makes him somewhat less than omnipotent) in order to make room for human free will. To honour the giver of this gift, it is our duty to use it wisely and lovingly, in turn.

ARMAGEDDON AND THE PEACEABLE KINGDOM.

In the book of that title (Herald Press, Waterloo, Ont, 1999, 288 pp.), Walter Klaassen contrasts the Biblical interpretation of the End of Time by fundamentalist Christian writers and TV forecasters and Klaassen's own interpretation. The details of the story told need not concern us, but the sharply contrasting views of God and of Jesus are remarkable.

The fundamentalists see God and Jesus as vengeful toward all unbelievers, destroying them several times in cruel battles and castings them into the eternal lake of fire. Only then can the faithful live a happy life in the New Jerusalem. Klaassen sees God and Jesus as loving and merciful, preaching peace and nonviolence to the world. Both views are claimed to be based on the Bible, but Klaassen shows over and over again how the fundamentalists distort the message, quoting sources out of context, etc. I am not a biblical scholar to judge how faithful to the text Klaassen's interpretations are.

These two views of God correspond to, and vividly illustrate, the rightwing and leftwing ideologies concerning the nature of reality and the principles of good and evil. The God of wrath is not at all the same God as the God of Love.

By rightwing and leftwing I mean something similar to Eckhardt's categories (derived from analysis of attitude questionnaires) of compulsion and compassion. These are not the same as "conservative-radical", although Eckhardt would regard it as such, but I have a different view. The Conservative-Radical scale to me is something inherent in nature, and existing in a delicate balance; "conservative" denoting homeostasis, like preserving the integrity of the genes that have proved their value in evolution; while "radical" means the flexibility that allows for adaptation to new conditions. Both are necessary, both are good.

But the fundamentalists (though sometimes called "neo-conservatives") do not "conserve" anything useful; e.g. they are not "conservationists" in the ecological sense. The contrast between fundamentalists and true Christians like Klaassen is a genuine contrast between Evil and Good. But to prove my goodwill, I would not condemn even the fundamentalists to the Lake of Fire.

THE MISTS OF AVALON.

I feel enchanted with the polar opposites of Morgaine and Gwenhwyfar (whom I prefer to call Morgan and Gwen), between whom Arthur was a plaything, swinging this way and that. Both Morgan and Gwen were religious fanatics, the kind that only bring grief to the world. So many people end up dead in this story, reminiscent of Hamlet.

Morgan really is a witch and a harlot, as accused. Gwen is a spoiled brat and a schemer. Morgause is a black witch, and in many ways like Lady Macbeth. Nimue is like Ophelia, in her drowning death, and like Sarka who killed herself after betraying her lover. Accolon was like a suicide guerrilla fighter, the follower of fanatic Morgan. Niniane was the victim of murder followed by cover-up. Did Raven fly like a raven? (Echoes of “The Crack in the Cosmic Egg”.)

I feel enchanted and yet repelled. If these are the mysteries of Pisces and the Moon that one learns in Initiation (I am of that age), I would rather stay uninitiated, stay with Aquarian Enlightenment alone. At least in this life.

Magic images reverberate with archetypes (the Holy Grail, Excalibur, the Round Table, the Holy Thorn. It is like recognizing old friends from the Arthurian legends in a new guise, seen from the viewpoint of the women in the drama, as if indeed the Goddess was more important than God. These images are seductive, reverberate in the soul; but for the sake of tolerance and peace, I must resist them. They created war and racism in the first place and made us into killers. In fact, the Holy Grail killed directly when touched by the “unprepared”, like the Ark of the Covenant in the Bible story.

The legends of Arthur and Camelot are woven intricately into the story of Morgan’s long life. Women play large roles in it (Igraine, Viviane, Morgause, Morgan herself, Gwen, Raven (who saved all her life’s energies through a vow of silence in order to spend them all in performing the miracle of the Grail), Elaine, Niniane, NimueElaine is the maiden who seduced Lancelot by pretending to be Gwen, and gave birth to Galahad, who alone had a full vision and touch of the Grail before it killed him. Mordred, son of incest, was not deformed physically but morally, and destroyed his father’s reign of peace in Camelot by his lust for power. Gwen, after a lifetime of resisting temptation, finally fled with Lancelot, but ended up in a nunnery. (The last two themes appear in a changed context in the musical play “Camelot”.)

The Beltane fires and the phrase “the king stag slain by the young stag” reflect real-world struggles among animals for alpha-male status and sexual supremacy, and also the legends recounted by Frazer in “The Golden Bough”; as well, perhaps, some of Sigmund Freud’s theories. There is a fascinating mix of Druid and Christian mythology: the Grail was both part of the Druid Holy Regalia and the cup from the Last Supper of Jesus brough to Avalon by Joseph of Aramathea. Another unexplained dual image is the near-identity of Avalon and the Island of the Priests in Glastonbury: the Tor had a ring of stones in one world and a bell-tower in the other, and Galahad, reaching for the Grail, reached “through the worlds”. But Avalon was drifting farther and farther away, as Christianity was winning over Druidism, Gwen over Morgan. And the Fairy kingdom, in which time passes differently, was even beyond Avalon, with still more powerful magic. Morgan at the very end recognized that the Virgin Mary could be the new image of the Goddess, and was reconciled to Viviane being buried in Glastonbury. But not until she had killed Kevin, the Merlin of Britain, for “treason”, since he recognized the same truths before she did. Kevin was not only a better harp player than Morgan (though both were good), but better in religious insight. While Gwen and Morgan were religious fanatics, bot Merlins, Taliesin and Kevin, were reconcilers.

It is also interesting to speculate on the history, as successive waves of invaders and cultures washed over Britain: first Druidic Celts, then Romans, then Christian Celts

introduced by newly converted Roman Emperor Constantine, then Saxons who were invading in Arthur's time, whom he defeated but later formed alliances with, and finally, beyond the story, Normans.

I am still trying to figure out the significance of the name changes: how Lancelot was originalle named Galahad and then gave that name to his son; why both Arthur and Mordred (deadly rivals, father and son, King Stag and Young Stag) were originally named Gwydion. Could it mean symbolically the transformation of brother to lover, son to destroyer, the innocent to the sinner?

Was Mordred violent because he was an abandoned child? Why didn't Morgause kill him in infancy as Lot wanted? While she was power-hungry, still she loved children, her own and fostered ones. Or was Mordred violent because of genes damaged through incest? The same old nature-nurture argument. Was Arthur good because he was a much-wanted child?

There are themes of young women married to old men: Igraine to Gorlois, Morgan to. The characters keep calling each other "cousin" and "kinswoman"; they were all related, like the royalty of Europe before World War I. Gwen finally returns to the convent of her childhood, safe between walls. She had been so afraid of the open sky, of committing a sin, of nature—so tense that she was unable to complete a pregnancy, though she conceived several times. Morgan, who slept with almost everybody, had no shame except for the initial incest with Arthur that in the end proved fatal to Camelot, produced only one child with great difficulty, and aborted the second when she was already too old. Since her live birth produced the moral monster Mordred, she could be compared to Rosemary in "Rosemary's Baby". Rosemary was the "Black Mass" reflection of Mary, mother of God rather than the Devil. Mary had to be a virgin, while Rosemary had to be a non-virgin. Morgan was a virgin before the Holy Marriage of Beltane, but not at Mordred's birth.

THE HOLY GRAIL.

The Holy Grail stands for an ideal to be reached, but almost impossible to reach. Its original meaning is the cup from which Christ drank at the Last Supper (which was a Passover Seder), and in which next day Joseph of Aramathea caught Christ's blood from his wounds as he was dying on the cross. Various legends have the Grail deposited in various places in England or France, among them the fabled land of Avalon. However that may be, this holy object became involved in the legends of King Arthur and his Knights of the Round Table.

All of the Arthurian knights sought the Holy Grail, but is was to be attained only by one completely pure in heart. Lancelot was the foremost among the knights, but he could not attain the Grail because he was far from pure; he entertained an adulterous love for Arthur's wife Guenevere. However, on his trip to the Castle of the Grail, he met a beautiful maiden, who tricked him into sleeping with her by pretending to be Guenevere. The maiden wanted to bear Lancelot's child, which she did. He grew up to be the young knight Galahad, who was perfectly pure, and was able to achieve the Holy Grail.

The reason I retell this story is because I want to make an analogy. Humankind strives to achieve the Omega Point of Teilhard de Chardin, but is not pure enough to do it. Human crimes include war, genocide, and grievous damage to Mother Earth. What will have to happen is a qualitative change, like a generational or even species change, to a new pure creature called the Son of Man. Only then can the Holy Grail of Omega (transformation to divinity) be achieved. Present-day humans are like Moses, never to reach the Holy Land because of our sins. Nevertheless we can be thankful that our progeny will. Like Lancelot, we will be tricked into begetting Galahad.

THE MANY FACES OF EVIL.

These reflections are based on 2 books and 3 plays recently read or seen: Sveva Caetani's "Recapitulation", Ira Levin's "Son of Rosemary", the musicals "Westside story?" and "Dracula", and Shakespeare's "Macbeth".

"Westside Story" and "Macbeth" represent the (unfortunately) very common evil of war and violence, both in the "rumble" of two rival gangs in New york City and the war against a tyrant (who slipped into evil on the slippery slope of ambition and the drive for power) in ancient Scotland. These patterns are evident nowadays in Somalia and Rwanda, in Sudan, Sri Lanka, Kosovo, and about 30 other places in our world. We have learned nothing. Lovers who try to bridge the two sides (like Romeo and Juliet, or Tony and Maria) still end up in tragedy; Lady McDuff and her "babes" still get murdered in theaters of war and genocide. Even escalation and the security dilemma is illustrated by a line from Westside Story: "We agreed that the rumble will be only fist fights, but we'd better bring our knives, in case they try to jump us."

The above is "natural" evil, all human-made. "Dracula" and "Son of Rosemary" are supernatural evil, engineered by Satan himself in his "Mega-Chess game" with God. This Devil captures beautiful women as his brides; this face of evil bears a super-sexual character. Joe/Satan will rape Rosemary for eternity among the flames of hell; Dracula transforms virtuous women into the Undead (vampires) like himself, to help him transmit evil to further victims. Dracula's bite is like the transmission of rabies, a fatal disease of the brain. Perhaps the virus destroys the brain's endorphins which make us love life, thus breaking the "addiction" to life and make us desire death and spread it, by infecting others.

The idea of a virus (rabies or otherwise) brings us to Caetani's concept of evil as a tiny incubus that dwells in the dark shadow of human souls. This is not a "strong" devil, like raptors and predators, but still an active one. An Augustinian Devil, not a Manichean one like Dracula or Joe. Entropy rather than a force (a Principality and Power). Either way, destruction occurs, meaning the undoing of structure; and violence, meaning the undoing of values. Structure and value come from algorithmic or logical depth—the need for very long programs for their creation, and programs which a computer would have to run for a very long time—and perhaps never halt. This is why we value structure—it is rare and precious like gold, only far more so. It is the basis of life. Even "the golden touch" actually destroyed life.

But is the mega-chess game of Good and Evil actually more symmetrical than we think? Why do we identify Life with Good? It may be seen as an addiction; once we take a breath, take food, we cannot stop without horrific withdrawal symptoms. This has continued, since only the lovers of life survived. Life is a profound disequilibrium, tending to perpetuate itself, spin quite out of control. Yet it creates manifold patterns of beauty, like the fractal runaway patterns of the Mandelbrot set.

The Devil wants destruction, including of himself. So he cannot last—but that is what he wants. Equilibrium is the only possible final goal; life cannot experience "they lived happily ever after", since it must be forever on the move to avoid falling into equilibrium. Equilibrium is eternity; not "eternal life" exactly, because it is unconscious, featureless, but still the final goal and resting place.

God said "I lay before you Life and Death; therefore choose Life, so that you and your children may live." But why choose life? Only the endorphins of our addiction make us take that choice. Surrender to Death may be momentary ecstasy.

I am suddenly appalled at what I am writing. If God can give me messages, as he has, so

can the Devil. I am being seduced by the likes of Dracula, his seductive whispering. I will not become his bride. I do choose life, and always will. Get thee behind me, Satan.

The Good-Bad distinction is universal, transculturally valid, as Charles Osgood has shown in his idea of the semantic differential, experimentally confirmed. The Good-Bad distinction is even more valid than the other two distinctions, Strong-Weak and Active-Passive (or as I prefer, Fast and Slow). This is because Good-Bad is the distinction between Life and Death. It is God and Satan. We cannot be neutral or treacherous in the Universal Mega-Chess. Even though God betrayed Job on a bet with Satan. The Universe will not cater to us forever. But for now, we must nourish and defend Life. Get thee behind me, Satan

The strong Good-Bad divide dictates reverence for life. It must not be betrayed, not now since we have come so far. Otherwise life is fragile. Mina must resist Dracula, for Love and only Love is stronger than Death.

PRIMORDIAL ENERGY.

Good and evil, love and rape flow from the same energy, primordial and undifferentiated. It is simply the opposite of Non-being. They call it Mana or Chi or Kundalini in different cultures.

But then comes the symmetry-breaking into good and evil. In the Tarot Higher Arcana the stages are represented in three cards: the High Priestess witnesses (or creates) the original symmetry-breaking in the white and black sides of her throne; the Chariot learns to control the two forces in the drive to fame and glory in war; and Strength learns to tame the lion, i.e. to control evil by good nonviolently.

It is the same lesson as taught in “The Nonviolent Coming of God” (Jim Douglass) and “Engaging the Powers” . The lion must come to lie down with the lamb in the end, as in the beginning. The shadow WILL unite with the light.

THE CROSS, THE CROWN, AND THE CRONE.

An old hymn says “carry the old wooden cross, and exchange it at last for a crown”. Follow Christ through suffering and sacrifice, to become at last not only the King of the Jews, but the Crown of Creation. Suffering CAN redeem, sacrifice CAN be accepted—be “made sacred (literally). Unhinged through spreading fluctuations, a system CAN ascend to a higher order, through a Via Dolorosa. We live at the edge of Chaos, and must pass through it to a higher Order at each turn of the spiral, on the way from Alpha to Omega. That is the essence of the Creation in which we participate.

Are we humans a Crown species, or even THE Crown species? The tree of evolution has many tops of branches—the flowers, the insects, the mammals. I used to think that it was hubris to consider ourselves unique. I thought that God or Nature had other options if we fail. But what if insects are really not another option? What if the tape of evolution rewound would be extremely unlikely to produce another option capable of going to the Omega point? What if there are no other options in the solar system, in other solar systems, in other galaxies, in the whole universe, in other multiple universes? The thought does not arouse hubris, but the awesome humility of responsibility. I think of the picture of Hope, the pale green draped figure sitting on the globe of the world, head hung low, blindfold across the eyes, plucking the only remaining string of her harp, the other strings all broken. Is Hope street really a dead-end street with no exit?

If God really depends on our co-creation activity for His very existence, we are in trouble. At any moment, the whole system may crash into non-existence, to not only end, but to have never been, sub specie aeternitatis.

My friends and hosts this week, Ruth and Walter Klaassen, live on Crown Crescent in Vernon, B.C. This has given rise to this somewhat incoherent reverie. So far there are no houses higher up on this mountain above Lake Okanagan. It is like Summit Circle in Westmount in Montreal. I could be proud to be here, but the heights make me dizzy. Pride is the deadliest of the deadly sins, and the nausea of non-being (Sartre) goes with the dizziness of responsibility. You climb Mount Everest and you pass out from lack of oxygen.

The Crone is the Third Person of the Holy Trinity of the Goddess religions. The Virgin, the Mother, and the Crone—the three ages of woman. She has many names—Demeter (Mother of God), Kali (agent of destruction), Gaia (the living Earth). She is the Mother who bears children, but often eats them, in repeated Great Extinctions, and in steady small extinctions all along. The Earth also means the soil which receives the dead and recycles them to new life. The Crone does not go Alpha to Omega, like Her Divine Spouse, but in cycles. Their combination creates the Holy Spiral of evolution, whose symbol is the DNA molecule—a structure of supreme sacred beauty. The Holy Writ of the Word (Logos) is written on it, in four-letter words like Love and Life and Hope and Fear. The Crone and God (Sophia and Yahwe) created it, but She can wipe it out with just a swish of Her tail. It might even be Holy Wisdom (Hagia Sophia) to do so.

The Way of the Cross may lead to ruin rather than to the Crown. O God, O Goddess, what must I do to keep ascending the Spiral—though dizzy with nausea? How can I keep close to You, to be nourished but not devoured? I love you and I fear you, but love has not yet cast out fear.

GNOSIS.

“Gnosis is knowledge of the sacred, attained at the threshold of ecstasy.”

understanding is more than knowledge of facts condensed into laws of nature. Theories deal with the mechanisms operating behind the laws, and imbue them with meaning beyond mere data and laws (regularities).

But gnosis is even more than understanding. It is “the faith that passeth understanding”.

Some try to reach the peak of ecstasy by feats of technology. This is like “scaling” Mount Everest by being landed on its summit from a helicopter. “Transcendental meditation” is psycho-technology, not the true Rama Yoga, which takes concentrated effort for many years. “The Cloud of Unknowing” illustrates this in Christian mysticism. One has to pass through the darkness to reach the light. A caterpillar does not turn into a butterfly without total reorganization in the chrysalis.

IMPERMANENCE.

We have a bias to preserving what we have rather than gambling to obtain more. Accept the gift of this life. Eternity is not for us. Accept change. Don't hang on to synapses strengthened by habitual use—experiment with creating new ones, no matter how difficult it is.

We are impermanent, like sparks or raindrops. We are bits of fire and bits of water, but not the whole fire, or the ocean. Accept that. Be a link in a chain through time, of generations and ideas. Let go of immortal soul. We are part of the flow of Tao. Regard it as a blessing to live at all. Think how improbable that was a priori. It could have been otherwise. The odds were immensely against it. It is a pure gift of Grace. How DARE we ask for more.

MEDITATION ON ASCENDING AND DESCENDING.

Intransitivity is the heart of Escher's painting "Ascending and Descending". Yet cycles are also intransitive, and nature is full of cycles. To escape from being perpetual motion machines, cycles need a pump, with external input of energy to operate it.

For blood circulation, the heart is the pump. Not the "heart" as in "the heart of the matter", or "the compassionate heart", but "heart" as a physical muscle, a living pump.

Where does the heart pump get its energy? From glucose and oxygenj from bread and breath. Both bread and breath come ultimately from green plant photosynthesis, i.e. from the Sun, our glorious star.

Where does the Sun get its energy? From hydrogen fusing to helium. The hydrogen comes from original nucleosynthesis in the Big Bang. This event wound up the spring of the clock which is our Universe. The clock which repeats its cycle like any clock.

Where did the Big Bang get its tremendous energy? Speculatively, at least, from the supersyrometry transformation of the super-cold Bose-Einstein condensate at the end of the

Universe to the super-hot singularity of the Big Bang. From an immense White Hole to an immense Black Hole. From bosons which can be at the same place at the same time to fermions which cannot. From energy to matter.

Where is the pump for the supersyrometry transformation?
Who but God can make Zero (spin) into One?
The Heart, the Sun, the Big Bang, the Transformation, God. "Let there be Matter" in addition to Light.

COALITIONS WITHIN COALITIONS WITHIN COALITIONS.

This mediation was prompted by threeo things: the statement at Project Ploushares board meeting that PP is a coalition of churches and belongs to CCIC (Canadian Council for International Cooperation); reading the December 1999 issue of Scientific American; and my previous essay on Kabbala hierarchies.

Examples of multi-tiered coalitions abound:

1. Parishes within churches within Project Ploughshares within CCIC within Canadian NGOs within world NGOs.

2. Individuals within families within neighbourhoods within towns within metro within countries within continents within the world. (The subsidiarity structure.)

3. Quarks within hadrons within nuclei within atoms within molecules within substances.

4. Organelles within cells within organisms.

5. Species within genus within family within order within within kingdom within life on earth.

6. Stars within galaxies within clusters within universe within multiple universes.

7. Explicate order within implicate order within super-implicate order

The Kabbala Parzufs also form such a hierarchy. En Sof the unimaginable rules all universes; each universe has its own El Kether (a hair from En Sof's head. Then, concentrating on our own universe, the deities bifurcate into Gods and Goddesses, the highest pair ruling galaxy clusters, the next pair ruling galaxies, and the third pair ruling star clusters. The Root corresponds to stars, in our case the Sun, so often venerated as Ra or Sol, the source of life. Fruitfulness rules planets like the Earth, in our case Gaia. Fruitfulness gave rise to Kingdom, i.e. the five kingdoms of life on Earth. And Shekinah is the Holy Spirit inspiring humanity, even in exile.

Starry heavens and the moral order—the two miracles that inspired Immanuel Kant.

"Roots and Wings" = stars and living planets (Helios and Gaia, with Pluto and Poseidon added.

Astronomy and cosmology involve mathematics, but change only one letter in MATH and you get MYTH.

Psyche (Mind) does the four life-creating tasks to regain Eros (Love), and then learns to speak—acquires language. Aphrodite is the wicked mother-in-law; seductress like Venus in Tannhauser.

Mind and matter converge at the Omega point, or bifurcate if we go the other way. This convergence occurs at even higher energies than the unified field of the four forces of nature. And Omega is En Sof, in 10 or 11 dimensions.

HIROSHIMA AND AUSCHWITZ.

This was Rabbi Irwin Zeplowitz's talk at the 1999 Hiroshima Day commemoration at City Hall in Hamilton, Ontario. After his deeply moving speech, I wrote the following:

"And the third event—the future so close—the candles to celebrate the coming of the Millennium turned to blood-curdling horror for all—the instant-acting virus carried by a gas in each and every home on Earth. Instant Armageddon by ancient Satan and modern human technology.

(This is a reference to the book "Son of Rosemary"). God was strangely inactive to his loss in "Mega-chess". He relied only on fragile Rosemary—a very thin reed of hope to lean on. And her future was worst of all: for ever raped in the eternal embrace of Satan himself."

Then came the next item in the City Hall ceremony, as if in answer to my despair. It was a reading from Psalm 37, done as responsive reading:

"Do not fret because of the wicked, or envy those who do evil. For they soon wither like grass and fade away like the green leaf. Trust in God and do good, dwell in the land and there find safe pasture. Find your delight in God, who will grant the desires of your heart." And so on.

I walked home, deeply moved by God's answer. He still believes in me, though I so often doubt. I still get answers!

Humming in my mind was the song "Oh Rosemarie, I Love You" followed by (from the same operetta) "When I'm Calling YouI will Answer Too"

RESPONSIVE PSALM 37

Do not fret because of the wicked, or envy those who do evil.
For they soon wither like grass and fade away like the green leaf.
Trust in God and do good,
dwell in the land and there find safe pasture.
Find your delight in God,
who will grant the desires of your heart.

God will make your vindication shine like the light,
the justice of your cause like the noonday sun.
Be still before God apd wait patiently,
do not fret because some prosper in evil schemes.

Let go of anger and abandon wrath.
Do not fret—it can only do harm.
Those who do evil shall be cut off,
but those who look to God shall inherit the earth.
In a little while the wicked will be no more,
you will look where they were and their place will be empty.

But the meek shall inherit the earth,
they shall enjoy fullness of peace.
Salvation for the righteous comes from God, their refuge in time of trouble.
God helps and delivers,
and rescues from the wicked those who seek shelter.

CYCLES ARE NOT (OR ARE?) PERPETUAL MOTION.

As the water cycle on the Earth is run by the Sun, as are all the numerous other cycles of the biosphere, so something must run the Great Wrap-Around supercycle, which states that we create God while God creates us. Or more generally, that Nature creates God while God creates Nature. (These statements attempt deliberately to be time-less, because they describe a process in eternity.) A cycle cannot run itself, because that would constitute perpetual motion.

Perhaps En Sof, (God Transcendent, God the Creator, Brahma), runs the supercycle, which circulates from Kether (God Immanent, God the Sustainer, Vishnu) to Nature (Tao) and back. This puts En Sof in the position of First Cause, or Prime Mover, as in Deism. The question, as always, becomes “who or what caused or moved Him?” An infinite regressBut the answer may be “He alone always existed—He is the only Thing there is (in the eternal order). There is no one here but Heand His thoughts, in the form of the supercycle.” An impenetrable mystery. Try to compute it, and the machine never stops.

But there is an alternative. The prohibition of perpetual motion comes only from thermodynamics, which is a time-bound system, not one that applies to Eternity. The super-cycle, unlike other cycle, COULD run itself. It would then embody essential intransitivity, like the three worlds of Roger Penrose. (The Platonic World, the Physical World, and the Mental World. A small part of the Platonic World creates the Physical world, as mathematics applies to physical phenomena; a small part of the physical world creates the mental world, in the consciousness of animals and humans; a small part of the mental world creates the Platonic world, as the human mind can comprehend abstract mathematics. The whole cycle [supercycle?] is essentially intransitive.)

Intransitivity is conceptually related to self-reference, as in “all Cretans are liars” or “this sentence is false”. This is basically the kind of truths that are not provable theorems according to Goedel, and that a computer could not solve even if it ran forever—i.e. non-computable truths. So even in this alternative, we do not escape a deep Mystery.

THE SACRED AND THE PROFANE.

We step on fallen leaves in autumn, in tumbled heaps of dead or dying bodies allover the lawns and sidewalks. These are the same leaves that had brought so much hope in spring, and that faithfully performed their life-giving functions all summer, by helping turn sunlight into living tissue for their own trees and indirectly for us. Many of the dead and rejected leaves are still exquisitely beautiful in their shapes and colours, red maple leaves like those on the Canadian flag, and brown and yellow oak leaves. others are curling at the edges, or already completely desiccated.

We step on them on the sidewalks, or sweep them or rake them out of our way, or put them into bags ready for the garbage pick-up. There are far too many to give each a decent funeral, or any thanks for tasks well performed. They are just so much garbage (as indeed our own dead bodies will be, in spite of funeral rites). There is no dignity, let alone worship.

As I walk along on the way to performed my (oh, so important) tasks, I no longer know where the boundary lies between the profane and the sacred.

HOPES AND FEARS.

Our fear of death is attenuated if the ego weakens enough to merge with humankind.

But it is reignited as we contemplate the possibility of human extinction.

It can be eased by the hope of an improved successor species.

Yet all life is fragile, the Earth and Sun will not last forever. At the bottom of hope we still find despair.

The universe will run its course without us. Therefore be reconciled—finally merge your smaller and larger ego with the entire universe.

With the universe, as it races toward its dark cold heat death?

No, possibly toward the supersyrnrnetric transformation and a new Big Bang beginning.

There is no eternal progression to either doom or salvation, only a vast supercycle.

This is because we and the universe are in the temporal order, not in the eternal order.

But eternity is in the everlasting present moment. Live today and taste Eternity, which only Love can spell.

THE BRIDGE. (A Meditation.)

It feels different somehow to theorize and to know from scientific evidence. I know now, from my own Fifth Yoga experiences and from the Bible Code, that you exist, my God. I am in awe—both fear and wonder. Yet how do I relate to Thee? There is still no sense of Presence, but I must reach out.

“Can you change it?” (The terrible future.) But who are we, so weak and puny? I have tried, but I have also sinned grievously, by omission and commission.

How do I relate to the new knowledge? I have emerged from the birth canal, but I have not yet met my Mother and my Father, though I know you are here. What must I do differently now when Iam in the Light?

Knowledge surpasses facts (as data interpretation surpasses raw data); understanding (theory, a flash of insight) surpasses knowledge (laws and regularities); but Gnosis (total insight, a meeting of minds as Thou), which surpasses all understanding, must be gained on the edge of Ecstasy—they say. I would not know.

Lo, He has built a Bridge, a path, a rainbow bridge across the chasm that separates us, a passage for the light to reach us and guide us, though attentuated by time, space and sin. (As light from early galaxies at the edges of the universe.) (As Shekinah is to the Godhead.) The saints helped build it; Mark and Esther passed over it.

So what is so shocking? I have known about You, even written about You, composed poems for You. But there must be a more vivid reality. People who lose a vivid faith are said to feel lost, shocked. Finding faith can be a shock too. Though in Amazing Grace it was different.

PROGRESSIVE REVELATION.

Prophets follow one another:
Abraham, Moses, Jesus, Mohammed,
Baha'ullah, Rama, Krishna, Buddha,
each bringing lessons from Great Mother.
They run in straight lines, though culture-bound too.
still in the main agreeing.
And lo! they converge, in from the blue,
to the White Hole of Pure Being.
Species follow one another,
bacteria, amoeba, yeast and louse,
moss to fern to fir to flower,
bee and butterfly, robin and mouse.
Each reveals its own truth and power,
from dog's sense of smell to human sight,
from the sonar of bats to the song of whales,
to the Omega point when we get it right.

ABBY AND ROSEMARY.

Compare Abby (“The Seventh Sign”) and Rosemary (“Rosemary’s Baby”). Both gave birth to babies who had cosmic significance, but they reacted very differently to the birth.

Abby died for him, her own baby son, in order to give him a soul and save the world. Rosemary did not know that she was carrying Satan’s baby, not even after she bore him, while she was bound and unconscious, unable to make any decisions. But when she found him, and after she got over the initial horror, she bonded, she decided to love him and bring him up. Mother love prevailed over love for the world.

All through the difficult pregnancy, Abby tried to save her baby from the danger of miscarriage (which had occurred in a previous pregnancy), and of the powers plotting to destroy him. Rosemary suffered unnatural pain in the first trimester, as if a devil’s claws were ripping her insides. After a period of reconciliation and coexistence in the second trimester, she suffered in the third trimester paranoid fear that someone would harm her baby.

Both Abby and Rosemary ended up with a wild chase just before delivery. Abby was trying to avert the accomplishment of the Sixth Sign, the execution of an innocent man. (Was this Jesus on the cross?) She almost succeeded, but in the end failed. Then only her own self-sacrifice remained to prevent the last and Seventh Sign from being fulfilled, namely the birth of a baby without a soul. She gave her own soul to him and died. Rosemary was running to escape from her pursuers, the band of witches who had arranged her rape by Satan after drugging her first, They finally caught up with her and drugged her again into unconsciousness for the delivery.

Abby saved the world, as even Jesus could not. Rosemary’s baby condemned the world, and Rosemary went along with it, undoing all the good that Mary’s baby had done—undoing the Sixth Sign in the seventh. Abby compensated for the failure of the Sixth Sign by enacting the Seventh—and then cancelling it with her own death.

So what happened with Psyche on the Sixth Day of Creation? (See “Psyche’s Labours Revisited” in this essay collection.) Was she Mary, Rosemary, or Abby? Psyche was giving birth to humanity, after the kiss of Eros that awakened her on the Fourth Day. Was the baby the first soul to be retrieved from Guv, or the last, or the Devil, or Christ? She did not know —hence the hesitation. It was a risk to be taken. Unlike other animals, created on the Fifth Day, this baby was begotten, not created. There is no biological parallel any more; we are into theology.

Psyche was giving birth to Good and Evil, with unknown and unknowable consequences. The newly begotten being was related both to animals and to angels and devils, to principalities and powers. In the end, he was related to both parts of a dualistic God, even Ahura Mazda and Ahriman. At this great symmetry-breaking, Psyche and Eros were powerless to direct cosmic evolution any further themselves, and had to abdicate their powers to their newborn sons and daughters. The ultimate generation gap had opened. The Gotterdammerung had come.

RE-ENCHANTMENT WITHOUT SUPERSTITION.

How do we combine science with spirituality? Metaphorically, how do we go from Glastonbury to Avalon without wandering off all the way to Fairy country?

Steven Pinker (“How the Mind Works”) says that we can never solve fundamental questions, such as what is mind, consciousness, meaning and free will,and how they emerge from the physical brain, because the brain was designed by evolution for solving problems that concern survival, not for fundamental philosophy. It may just be beyond our ken. This leaves the field free for speculation and imagination, which so many have done over the ages, and I have followed in their footsteps.

We are able to ask the questions which science cannot answer, but we are unable to arrive at provable, credible answers to our questions. Yet we should not stop the imaginations process, which is so interesting, in engaging our native curiosity. only one proviso: do not take the answers arrived at by imagination as the final truth, do not treat it as dogma. Play with it, enjoy the possibilities, explore the connections and implications, but do not take it seriously, as proven facts.

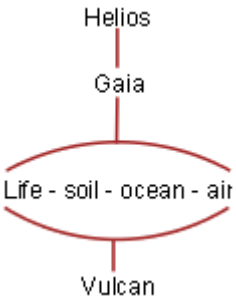
Thus we can live a re-enchanted life without succumbing to the mumbo-jumbo of arbitrary magic. We can dream, but know that we must wake up.

GAIA ANATOMY AND PHYSIOLOGY.

(Mainly from “Gaia’s Body” by Tyler Volk.)

Gaia (the living Earth) is between Helios (the Sun) and Vulcan (the deep Earth). They form an interacting trinity. Gaia is composed of the biosphere, the geosphere ithosphere), the hydrosphere (oceans), and the atmosphe . This means life (the biota), the land (soil, but not the deep rocks, mantle and core), oceans, lakes and rivers, and the air up to beyond the stratosphere. Gaia the Earth Goddess does not include the whole solid planet, only the surface layers. (Music of the spheres.)

These four main pools or reservoirs (life, soil. ocean,. and air), interact much more closely than does the Trinity, through cycles, feedbacks, and fluxes. We can visualize the four pools (also called matrixes) as horizontally connected, with the three deities of the Trinity as vertical, at right angles to the pools.



To get to know Gaia, we must follow the fluxes and cycles of the elements (CHNOPS, plus also Ca, Fe, Na, K, Mg, and a few others) between the 4 pools, as well as sometimes in much slower cycles with Vulcan (deposition on the seafloor, subduction deep into the mantle, and upwelling in volcanoes). Secondly, we must follow the causes for the cycles. Sometimes an element like carbon or nitrogen cycles many times within the life pool (as in tropical rainforests between the canopy and the under-growth without much involvement of the often rather poor soil) before exiting into the air or being entombed in deep rocks. The so-called cycling ratios can be calculated. Thirdly, we must find the keystone species in each eco-system composing Gaia which, like the keystone in an arch, stabilizes the whole ecosystem. (Or an element or a pool or a cycle may be the keystone.) Fourthly and finally, we should compare how the whole operates now with life present, and how it would operate without life. In the latter case, it would often spin out of control, i.e. exceed some boundary.

A brief aside about keystone: it has been said that three concepts of structure are important: template, catalyst, and keystone. The acronym might be T(I)CK. Taking the second one first, “catalyst”, in the sense of Stuart Kauffman’s self-catalytic networks, suggests very early protein-only life, “template” suggests RNA-DNA life, and “keystone” refers to eco-system relationships, as discussed above. The last, falling in place, converts TIC (an involuntary movement) into TICK (makes it “tick” as a coordinated movement).

There can be five alternative views of the parts of Gaia:

1. The biomes or eco-systems: tundra, forest, desert, savanna, marine environment, etc.

2. The taxa of living creatures: archea, bacteria, protists, fungi, plants, animals.

3. The pools (matrixes, reservoirs), already mentioned: life, soil, ocean, air.

4. Guilds, according to function in the whole: photosynthesizers, respirers, denitrifiers, nitrogen fixers, etc. Their working parts can be characterized as “the little enzymes that run the world”.

5. The chemical elements, especially CHNOPS..

The distribution of the elements in the primary pools holds some surprises: carbon is mainly in the sea (as dissolved bicarbonate ion), secondly in soil (as solid calcium carbonate), thirdly about equally in life (as a multitude of organic compounds) and in the atmosphere (as carbon dioxide). Nitrogen is mainly in the atmosphere and a bit in the ocean (as dissolved nitrate ion). The amount in life, though crucial in proteins, is too small in comparison. Sulfur is mainly in the ocean (as dissolved sulfate ion). Phosphorus is mainly in soil (in phosphate rocks), secondly in the ocean (as dissolved phosphate ion), and only marginally in life, where it plays a vital role in supplying energy in ATP and preserving and transmitting information as DNA and RNA. The surprise is that life is a much smaller reservoir than the other three, even for carbon and some other vitally important elements.

Reviewing the history of Gaia, we note that the initial energy supply came from Vulcan, for the Archea surrounding the deep-sea vents where new ocean crust is upwelling from the mantle and methane and hydrogen sulfide abound, and only later switched to Helios when photosynthesis began. Other deities sometimes get involved: e.g. Fortuna in dealing out the happy contingencies when the road forks, and Shiva when the great extinctions strike—but so far recovery has always followed. (Shiva’s dance of creation and destruction is always well balanced.)

Why are the cycles always balanced? One answer is that the unbalanced ones have disappeared by natural seiection. However, the complete answer is that large-scale coordination has occurred over time, through the joint action of both competition and cooperation, as if by an invisible hand. (Like a market?) (Or like Axelrod’s “tit-for-tat” reciprocity?)

James Lovelock, the originator of the Gaia concept, wrote an evocative paragraph in “The Ages of Gaia”, p. 27. A partial quote, slightly modified, follows: “As we move in towads the Earth from space, first we see the atmospheric boundary, then the borders of forests, then the skin of animals and the bark of trees, [then the cambium layer of the trees], then cell walls and membranes, and finally the membrane of the nucleus and the DNA [wound on histone rods]. We see a succession of boundaries; each time what is inside is more alive than what is outside. Thus there are degree of aliveness, which is why “life” is so difficult to define.

Some thinkers (e.g. Teilhard de Chardin} define an additional sphere after the litho-, hydro-, atmo-, and biosphere, namely the noosphere, the sphere of mind and knowledge, in which we humans specifically consider ourselves to be operating. Volk says “we are the first and only eukaryotes who can fix nitrogen without the help of the ancient prokaryotes.” But how long will we be able to do it when the fossil fuel reserves run out? We, the newesr guild that claims to know all the other guilds, have not yet learned to operate in closed and balanced cycles.

The social evolution of our societies is very turbulent and unfinished, in rapid fluctuations of quasi-chaos, but perhaps eventually destined to settle down to an ultrastable structure (a long plateau in the fractal Devil’s staircase). The “end of history” of this major crisis is nowhere in sight. It might even involve the evolution of a successor species if this one fails.

DARWIN AND KROPOTKIN.

Darwin's "survival of the fittest" emphasizes competition.
Kropotkin's "mutual aid" emphasizes cooperation.
Both operate in the world of living nature.

It comes down to Leonard Cohen's dilemma: either:
"I will help you if I can, I will kill you if I must", or
"I will kill you if I can, I will help you if I must".

Two very different combinations of Darwin and Kropotkin.
These are choices for both predators and viruses.
These are choices for creatures big and small.

Which of cohen's alternatives predominate in nature?
Think of symbiosis, comensuality, parasitism, predation.
They are all there, weaving the eco-systems.

Good and evil, undifferentiated or at least unjudged.
Not a dichotomy, not even a spectrum, but a complementarity.
A net of pluses and minuses—to us—but simply links.

THE AGES OF GAIA.

(From book by James Lovelock.)

The ages are best divided into the Archean (4.5 eons ago to 2.5 e.a., where 1 eon = 1 billion years), the Middle (2.5—0.7 e.a.), and the Modern. (0.7 e.a. to the present). It sounds almost like the eras of human history (ancient, middle-ages, and modern times), but it is on a very much longer time scale. The first two parts are what is commonly called the Precambrian, divided here into the Archean and the Proterozoic; the third part is the Phanerozoic, starting with the Cambrian and then including all that followed up till now.

In the Archean, the Sun was faint but increasing, conditions were reducing, and the atmosphere was largely carbon dioxide. The sky was pink and the ocean was brown. The forms of life were largely archea, the original bacteria using existing organic compounds for energy production. Then at about 3.6 e.a., the Eubacteria appeared, and some of them, the cyanobacteria, started photosynthesis, using sunlight to split water, taking in atmospheric carbon dioxide as food, and giving off oxygen as a waste product, which was a poison to most of the other bacteria, which were anaerobic. At this transition point, the composition of the atmosphere started to change: carbon dioxide went down, and methane went up.

The oxygen was still being absorbed by the many reduced compounds in the rocks and in the ocean, e.g. ferrous iron going to ferric, sulfide going to sulfate, ammonia going to nitrate.

Carbon dioxide and methane are both greenhouse gases warming the Earth like a blanket, but the increase in methane was less than the drop in carbon dioxide, and so the average temperature dropped, counteracting the gradual increase in the incoming solar_radiation. The temperature dropped from 250C to 12-150C.

Then at 2.5 e.a., as the Earth entered the middle age, oxygen started to appear in the atmosphere as a gas. The anaerobic bacteria either died out, or went into hiding in anoxic places; many are still around. At this point, methane dropped again to its original level, and carbon dioxide was still decreasing while oxygen was. increasing. Oxygen is not a greenhouse gas, and so the temperature dropped again, once more counteracting the solar increase and keeping the Earth at a comfortable 12vC.

In the Proterozoic (middle age), oxygen gradually rose up to its steady level of 21% of the atmosphere, while carbon dioxide was still slowly decreasing. This became a process of stabilizing the Earth's temperature in a range comfortable for life, in spite of the gradual increase in solar heating. The first Eukaryotes formed, and some started using oxygen for respiration, as did the aerobic bacteria. Carbon was being withdrawn from the atmosphere by forming solid calcium carbonate on land and by forming calcium carbonate shells of phytoplankton organisms in the ocean, which then sank to the ocean floor. Possibly, the greater weight on the ocean floor started the movement of tectonic plates on the Earth, which continues to this day, disassembling and re-assembling the continents.

Also, the salinity of the ocean was stabilized at this time, by the formation of evaporite lagoons near the seas, protected by stromatolite cliffs on the sides and algal mats on the top from being washed out to the sea. This process formed salt deposits on land and kept the ocean salinity comfortable for marine life. (Another possible mechanism for stabilizing the salinity of the ocean is the falling of comets (iceballs) to the Earth. See Scientific American, Jan. 1998.)

On the whole, the Proterozoic was an age of stabilization and homeostatic control of conditions, while the Archean had seen two major sudden transitions or crises (early photosynthesis and the build-up of oxygen to 21% of the atmosphere).

The Cambrian and Post-Cambrian age saw some major sudden changes again, some of them catastrophic. The Eukaryotes proliferated and gave rise to multicellular creatures (Metazoa), i.e. the other kingdoms of life, f'r-o~i51$, Fungi, Plants, and Animals. Animal phyla particularly proliferated to many more than we see today; this is called the Cambrian explosion. Many early ones (for example those found in the Burgess shale and described by Stephen Jay Gould in "Wonderful Life") died out, perhaps by contingency rather than lack of fitness.

The plants became the main photosynthesizers, the animals were the respirers feeding on plants and on other animals (herbivory and predation), and fungi played the role of decomP9sers of wastes and dead bodies (i.e. recyclers).

When plants colonized the land, some of them became vascular to stand upright and reach ~or.the sun; this required stiffer trunks, and so trees produceawood, composed of cellulose and lignin. But for hundreds of millions of years in the Carbonaceous era, there was no organism that could decompose lignin, which was a new "non-biodegradable" substance, Whole tree trunks of giant ferns were buried, which caused another big drop in atmospheric carbon dioxide. The remains of the tree ferns eventually became deposits of coal, petroleum, and natural gas, which we are now burning for energy and liberating the carbon dioxide which did not get liberated in the Carboniferous era, thus adding the carbon dioxide to the atmosphere which should have been added a long time ago. The lack of it then caused a drop in temperature, and now its emission will cause global warming.

This cooling was one crisis in the Post-Cambrian age. The other crises were 10 great extinctions, perhaps due to meteorite impacts or to sudden changes in climate or in ocean currents or in the configuration of continents (e.g. formerly warm regions shifting to Antarctica). However, each time there was a fairly rapid recovery, proving Gaia's resilience. Yet quite often the species after the event were different from those before the event. There were winners and losers, yet long-range stability, though punctuated by catastrophes.

However, stability cannot last forever, and even ancient Gaia must die. Usually at the beginning and at the end of a plateau of regulation there are oscillations, as a stable attractor bifurcates and then goes chaotic. There have already been periodic oscillations, in the form of the ice ages and the interglacial periods. These can be expected to continue, until finally temperature regulation will fail. The Earth will then heat up far more than the minor global warming expected in the next century, which will still be only part of the ice age cycles. Conditions may get quite uncomfortable for most life forms, except for the thermophilic bacteria that live in hot geysers.

This failure is not likely to be due to human mismanagement, though this may speed it up. However, the final failure certainly will not be human-caused. A few millions of years later, the Sun will continue to grow brighter, into the range incompatible with life. After several more unmapped eons, the Sun will turn into a red giant like Betelgeuse and swallow up the Earth. It will be the end of the Sun's sojourn along the Russell-Hersprung main sequence.

All stable plateaus eventually end, as the Devil's staircase continues its inexorable fractal growth.

SYNTHETIC LIFE?

When I was young, I dreamt of creating life in a test tube. I gave up that dream when I realized the complexities involved. Creating life by giving birth to three children was so much easier.

Well, the creation of synthetic life has almost happened now, though it is not labelled as such. It all depends on the definition of life, and how much scientists are allowed to put in from existing life, and of course from their previous knowledge.

An article in Scientific American, March 1998, page 2526 (“Catching the Rays”) reports on the work of researchers at Arizona State University on “artificial cells”. This team used liposomes, with a “cell membrane” of double-layered lipid walls just like a real cell membrane. Into the liposomes was built photosynthetic machinery to capture sunlight energy to remove hydrogen from water. This consisted of a chlorophyll-like synthetic molecule featuring a porphyrin ring. There was also ATP to capture the energy for further use, and the enzyme ATP-ase. (I suspect that the enzyme was not synthetic, but put in from existing life; or at least the knowledge how to synthesize it—the amino acid sequence and the folding—was derived from existing biochemical knowledge.) When suspended in a solution of luciferase, which glows if illuminated by a red laser beam, the suspension gave off the yellow light characteristic of fireflies. The researchers plan to add actin and myosin to drive tiny “motors” to move cilia, and other enzYmes (NADH) to drive other biochemical reactions.

The liposomes may be simplified models of early protein “life”, without any self-reproducing or informationstoring molecules like RNA and DNA. Freeman Dyson postulated that such a stage existed at the dawn of life on Earth, and that only later ATP and other nucleotides polYmerized “by accident” to form nucleic acids which were precursors of RNA and DNA. They only had to undergo evolutionary selection to become “useful” to the next stage of life.

So have the Arizona researchers produced “life in a test tube”? It depends on whether we accept pre-RNA life as “life”, and whether the enzYmes incorporated are entirely synthetic. In any case, a remarkable achievement.

ENZYMES AND TEMPLATES.

The main three operators in the living world are proteins, RNAs and DNAs. In their functioning they are smoothly interconnected. It is diffucult to imagine how they could operate separately. Yet at the beginning of life, there had to be some separate origin for each of them.

The two main functions of these three classes of macromolecules are to catalyze the chemical reactions of metabolism (i.e. act as enzymes) and to store information for producing these enzymes and for their own reproduction (i.e. act as templates).

The conventional wisdom of the “central dogma of biology” (but we should beware of dogmas!) is that information flows from DNA through RNA to protein. However, protein promoters are needed for “turning on” the DNA genes (making the flow of information into a cycle), and retroviruses use a path from RNA to DNA.

Moreover, it has been found that RNA can act as an enzYme as well as a template; this has led to speculation about an “RNA world” at the dawn of life, to precede the present DNA world. Very recently it has been reported that even DNA can act as an enzyme.

Can proteins act as their own templates? The prions that cause mad cow disease and human K-J disease do. A prion is a protein that can change from its normal configuration (folding) to an abnormal one, and that then the abnormal prion can cause normal prions to change into abnormal ones as well, spreading the contagion. This is analogous to RNA or DNA reproduction.

Thus we can conclude that each of the three basic operators of life can act in both roles, as enzYmes and as templates. They differ only in their presently prevalent mode of action: proteins as enzYmes, DNA as templates, RNA as either, but mainly as templates.

What the three operators and two functions have in common is the utilization of their spatial configurations (creating pockets or lock and key mechanisms), as well as their chemical affinities (e.g. electrically positive or negative charges, affinity to water or oil). This property is shared by the functioning of the cells of the mammalian immune system. It is like a new higher form of chemistry, both at the macromolecular and the cellular level.

LESS AMBITIOUS DEFINITIONS OF LIFE.

Jill C. Tarter and Christopher F. Chyba (“Is There Life Elsewhere in the Universe?”, Scientific American, December 1999, pp. 118-123) cite a “Darwinian” definition of life: “Life is a self-sustained chemical system capable of undergoing Darwinian evolution by natural selection.” They also state that a less ambitious definition is needed for exploring if there is life on other planets: a metabolic rather than a Darwinian definition.

What that means is dropping the requirement for Darwinian evolution (the difficulty is: how long should we wait to observe this?), but retaining the criterion of stable and precise reproduction.

I would argue that even this is too ambitious. As it stands, it would specify the RNA world. I think that the preceding stage in biogenesis, the protein world, should also qualify. This was explained by Freeman Dyson, who considers RNA as an accidental contamination (a viral disease) of mutually-or-self catalyzing protein systems (as specified by Stuart Kauffman models).

There is no doubt in my mind that such protein systems preceded in time the RNA world, which preceded the DNA world and so on. Drawing dividing lines between non-life and life in this seamless sequence seems quite arbitrary. I prefer to draw the line at protein systems enclosed in some kind of membrane separating it from the environment (the Oparin requirement), i.e. a coacervate.

The predominant opinion these days is to draw the line at the RNA world. Even there, reproduction was not as reliably accurate as in the subsequent DNA world in which we still exist, because RNA is less stable chemically than DNA. Even then, reproductive accuracy was further improved by winding DNA on histone rods and placing it in a true cell nucleus as chromosomes, as happened in Eukaryotes.

But we normally define bacteria as living. Some viruses (retroviruses) still exist in the RNA world, and mutate rapidly, as the HIV virus and the flu virus do. Sometimes high mutation rates are useful in the struggle for existence, and speed up evolution; but stability is also desireable to maintain species identity. Usually a balance between change and stability is arrived at, at some most useful point under the circumstances.

To summarize, I prefer to define life as a “self sustained chemical system”, dropping the requirement of stable accurate reproduction as well as Darwinian evolution. The problem is: the definition would then include all prigoginian dissipative structures, such as the Belousov

Zhabotinski reaction, which is stretching the definition too far, even for my intuition. To avoid this, I would want to include in the definition the Oparin requirement for an enclosing membrane.

However, perhaps we should abandon the search for a definition, and accept the seamless nature of the biogenesis sequence.

BREATH AND BREAD.

“Lord, Giver of breath and bread”
(Inscription on the wall in Palais des Nations, Geneva.)

Oxygen from breath and carbohydrate from bread come together, travelling through the bloodstream superhighway, to give life to every cell and generating thought in the brain.

Breath, bread, brain, and breeding. A harmony of alliteration.

Death is the price we pay for the gift of life. My plastic sunflowers will never die, because they never lived.

Paying the price is like paying the tolls when exiting from the New York Throughway. Throughput is the pattern of life using breath and bread—and we move through on the highway of time, on the way to eternity. Then we are still—in Being, not Becoming.

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THE FLOW OF LIFE.

Be part of the multipeak landscape,
the waving sea of forming shapes,
the chain of schemes that will not retape,
the fractal forms of bays and capes.

Let life flow through you like a river,
yet stop and look at each time slice.
Be both a receiver and a giver,
with each experience quite beyond price.

Like a movie’s flow from frame to frame,
each moment eternal retains its name.

THE CENTRAL DOGMA.

DNA diplex, done up like a zipper,
fitting its mould like Cindy's glass slipper.
Cut out the junk with a razor-sharp clipper,
get blueprint for hand or a foot or a flipper.

m-RNA bracelet, with pendants hung loose,
keys searching for locks, all misfits refuse.
Little t-RNAs their places they choose,
deposit their loads at the end of their cruise.

Tape runs through machine as reading proceeds,
link after link in chain sequence succeeds.
Tail end keeps growing as head end recedes.
Protein coils up like a big ball of beads.

THE HOLY FLAME.

Life is a holy flame; if extinguished,
it cannot be relit: for you and me.
for our species, for our world.
A once-upon-a-time beginning, a magic never repeated,
a recipe never rebaked, a one-way door,
a steep narrow upward path, the day of creation.
The vertigo of lofty heights is in our souls and hearts.
If our hand falters holding the torch or passing it on,
there is no second chance, there is no mercy.
“Rise and Fall” the words flow smoothly from the lips.
Does one follow the other like the night the day?
Or is there a breakthrough to permanence?
A way of “being saved” (old-fashioned expression
in modern garb)—saved like a text in the computer,
to add to some vast storage of knowledge and wisdom?
Or is life merely a holding operation, a plaything
of electrons in the hardware making transient patterns,
without ever reaching a permanent memory?
We know no beginning and no end. We only guess
at things beyond our reach. Pass on the torch then,
let the holy flame work out its own salvation
in the fullness of time. Like an obedient
Child of the Universe, don’t hang on beyond your powers;
You and me, our species, our world.
God may have other options. His will be done.

THE JOY OF FLYING.

You sit protected ’mid your silken pillows;
you just awoke from deep transforming sleep.
Outside, the breeze the foliage gently billows,
where younger caterpillars, vague-remembered, creep.

The sun sends warm kisses from a deep-blue sky,
inviting you to dance, mid-air suspended.
You wish you could go soar like yonder dragonfly,
but dream-wish is not real, only pretended.

Yet this dream is so strong, it drives you wild,
wild with desire that will not be stilled;
you feel constrained like some womb-prisoned child,
whose wish to break away must be fulfilled.

What are these foils ’longside your body folded?
They were not there before your sleep began!
They are all new! Your body plan’s remolded;
you don’t just dream to fly—YOU CAN!

What holds you back is all this luxury silk;
discard its comfort, pry wings loose, be free!
Drink sweet flower-sap like honeyed nectar-milk,
soar high above in air, o’er land and sea.

If you can silky cords of custom snap,
you’ll taste the wine of many a new delight;
feel mighty surg~ of wings’ creative flap;
your spirit will take off in skyward flight.

WHY THE HOLY FLAME.

1. Flame and life process share the quality of being a flow-through system in which form is more important than substance, process is more important than the state of the system.

2. Combustion and respiration are both oxidation processes with the same end products —carbon dioxide and water; but the latter is much more closely controlled, slowed down to milk the energy out of it at every step rather than uselessly dissipating it; and it goes on at a lower temperature with the aid of highly specific enzymes. Combustion is wildflre, respiration is tamed fire.

3. Both combustion and respiration (flame and life) are totally dependent on atmospheric oxygen on Planet Earth, put there aeons ago by photosy~tnesis. Oxygen is an agent of destruction and of creation, like the Lord Shiva.

4. Flame and life are much more easy to maintain than to restart once they stop. This is much more true for life than for flame. Spontaneous generation of life is now impossible (though it had to happen at least once) and the dead never rise again. Fire can be started rather easily now with matches, but early humans had to maintain fires or pass lighted torches from place to place.

5. As stated above, fire can be passed from unit to unit: from torch to torch, candle to candle, one cigarette to anothe~. Life, too, is passed from unit to unit, from parent to child, from cell to cell. It does not start from non-life (except that first time): omne vivum ex vivo. “Passing on the torch” is a holy symbol, in relay races and the Olympics, in cultural transmission, and in war waged for holy causes (cf. the poem “In Flanders Fields”).

6. Both flames and living bodies are scenes of complex chemistry, though very different from each other. Both involve unstable intermediates such as free radicals, both involve cascades of positive feedback, both usually involve carbon and hydrogen compounds. Rapid turn-over dynamics prevail.

7. Both flames and life processes are far from equilibrium, far from indifference, far from static stability. Both are intensely involved in flux and change.

8. Both are quasi-chaotic systems, basically deterministic, but humanly unpredictable.

9. Both have constructive and destructive aspects wildfire and bonfire, flourishing and pestilence, depending on one’s point of view: do we want them to spread or not?

10. Both were either stolen from the gods or created by God in religious myth, and so have a deep connection. There is something holy, sacred, spiritually numinous about both. We burn candles in churches, protest vigils, and at festive as well as intimate dinners. We celebrate life in rites of passage ceremonies—birth, initiation, marriage, death. Yes, funerals are celebrations of life in in its passage through the generations. Individual flames flicker in and out of existence, but the Holy Flame goes on.

DICTY.

Dictyostelium is a slime mold, an amoeba, a protist, one of the first advances to a multicellular organism. It is unicellular when there is sufficuent food; it transforms itself to a multicellular form when food runs out. It then goes through several steps to form spores, that can fly in the wind to find other feeding grounds.

Dicty is the next example of cooperation or sYmbiosis in the biological world, right after the formation of a eukaryotic cell from sc~ral prokaryotic cells. (Dicty is eukaryotic.) Many other examples of sYmbiosis follow, e.g. lichen from an fungus and an alga, coral from a polyp and an alga, root nodules on legume plants containing nitrogenfixing bacteria. Dicty is also a transitional form between a protist and a fungus, in its unicellular and multicellular forms, respectively.

Another transitional form, the sponges are classed as animals, but the cell associations are still fairly loose, so that a sponge can be minced or even passed through a sieve,and the constituent cells will come back together again, like a slime mold. “Higher” animals cannot do that. (Does one get “higher” by LOSING certain faculties, such as regeneration?)

An animal or plant embryo develops first (if we define development as cell differentiation) and then grows in size. Dicty grows first, i.e. the amoeba-like cells proliferate without differentiation, first, and may only later differentiate (develop). It is a different build-up process.

Prior to coming together, Dicty cells, when starving, send out a cAMP signal (cyclic adenosine monophosphate) to each other, which calls them together to clump, first into a mound, then a slug, then a blob, which then grows a stalk with a spore-ball on top. The cells that form the stalk are destined to die, but willingly sacrifice themseves for the good of the colony. In growing developing embryos, death by apoptosis is also the fate of many cells. There is such a thing as deliberately programmed death.

The cAMP signal becomes linked to receptors on the cells linked to G-proteins (phosphorylases), which then communicate to the cell nucleus. Perhaps this is why bacteria cannot do it, because they lack a nucleus. It is interesting that the G proteins are (almost) the same in Dicty and in all multicellular animals including humans. It is a highly conserved structure in evolution.

There is also sex. Two amoebas fuse and form a new (2N) individual. (The amoebas are IN.) Eventually the fused cell forms thousands of clones, and in the end spores. This pattern is similar to that of a fungus, with its alternation of generations (1N and 2N), which continues,in plants, mosses and ferns with the role of the 1N stead1ly decreas1ng and that of the 2N increasing, until eventually in seed plants the 2N generation becomes uppermost. Animals too are 2N, with only the germ line remaining IN.

Amazing Dicty is a bridge in several different ways.

SENSORY EXOTICA.

(From book by that name by Howard C. Hughes, MIT Press, 1999.)

The book mainly presents biophysical details of the acoustic systems of bats and dolphins, the electric organs of some fishes, navigation systems (solar and magnetic) of birds, butterflies and bees, the smell-based pheromone systems of many animals for kin and sex recognition, etc.

All very fascinating; but I have a different agenda. A dog's world representation (wr), based mainly on smell, must be very different from the human wr, based mainly on vision. The bat's wr is based on sound perception, as is the dolphin's, but the two may be different. The fish, birds and bees may perceive a totally different world again, and different from each other. What would a soundscape or a smellscape be like? What is it like to be a dog, a fish, a butterfly? Not inferior or superior, but different. Would their dreams be sounds, smells, or electric rather than visions?

Which is the "true" representation of reality? The answer is: none of the above. Reality ("Ding on sich") is unknowable by any of us animals. We simply perceive (I almost said "see", from human habit) a different aspect of hard-rock reality. Our wr is Maia, as Hindus would say, or virtual reality, as computer buffs would say. The virtual reality is composed by the senses each animal happens to possess, with elaborations and sometimes confabulations by the brain.

The Ding on sich reality could be so weird (e.g. tendimensional) that none of us animals could even conceive of it. We just navigate through life by the signals, thank you very much. We are made for survival, not for philosophy.

God is ineffable—but so is the World.

THE DOLPHIN CLICK.

When diving under water, dolphins emit a sonar “click”, a very brief (0.1 milliseconds) burst of acoustic energy. The click is a wave-packet consisting of many frequencies.

Author Hughes in “Sensory Exotica” states that in acoustic signals duration and frequency purity are inversely related. The bat emits a rather long call, part of which has a constant frequency—a pure tone, like that produced by a tuning fork. The dolphin, on the other hand, produces a very short burst with a multitude of frequencies.

Hughes states that this is analogous to Heisenberg’s uncertainty principle: we can know either the position of a particle accurately whilenot knowing its momentum at all, or know the momentum but not the position, or any combination in between, as long as the product of position and momentum information is equal to h, the Planck constant.*

Dennis Gabor worked out what the optimum solution (combination) would be for a dolphin, to give the animal maximum information. The Gabor function (graph) contains about 3.5 waves, with the biggest amplitude at the centre, and looks much like the wave packet that physicists talk about.

In the wave packet of an electron, this tells us enough about the frequency to allow a fairly accurate guess, and at the same time, pins down a range of locations not too far from each other. The whole picture gives us an insight into why the uncertainty principle has to hold: with point-like precision of location, no wave would be apparent; with a long wave-train, no preferred position is apparent.

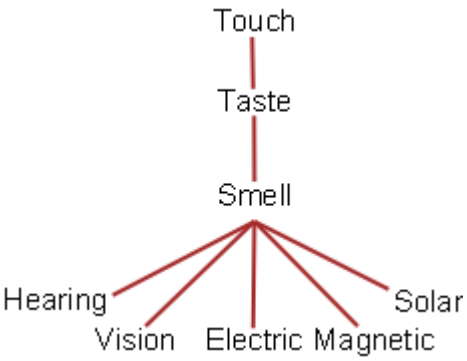
In a dolphin, the two factors are time and frequency. In an electron wave packet, the two factors are position and momentum. However, the uncertainty relationship is similar in structure.

*Planck’s constant h = 6.10^{-27}

EVOLUTION OF THE SENSES.

Sense organs help an organism to perceive its world. The most prinitive senses would probably be touch and taste: these senses depend on a direct contact with solids and liquids. The next would be smell, which depends on direct contact with gas molecules emitted by various objects. Then we have a branching out into hearing, dependent on sound waves; vision, dependent on light waves (only a small part of the electromagnetic spectrum); the electric sense of some fishes; magnetic perception of migrating or homing birds; and navigation by the sun (bees).

The 5 parts of this last branching, only the first two being familiar to us, are the most elaborate and more recently acquired. Different animals can see different ranges of colour (wave lengths). Sound can be used for echolocation, by bouncing bursts of sound from obstacles. (It used to be thought that sight operates that way: light rays emitted from the eyes bounce back from objects; but this was wrong).



THE MARSUPIAL FUTURE.

The question has been asked, on the CBC radio program “Quirks and Quarks”, if there is any further biological evolution of humans, what will we look like in another 100,000 years?

One problem is, if the brain gets any bigger, the baby’s head will not go through the birth canal. The solution might be to return to the marsupial way, of having the tiny fetus crawl up into a pouch to mature. It seems like an efficient way, and also quite interesting.

I like to imagine having a baby that way. You would not just feel intra-uterine movements and picture where the hands and feet are, you would be able to peek and see. You would bond early, talk and sing to your tiny joey, and have some fun together.

However, we are told that the tape of evolution, if rewound, does not repeat the same way. It is not likely that this marsupial future will occur.

Quite a pity.

JUNK DNA OR ROGUE DNA?

An article in DISCOVER magazine by Ayala Ochert, pp. 59-66, December 1999, entitled “Transposons”, describes the discovery that non-coding sections of DNA, constituting half of the human genome, and often called “junk DNA”, have a function after all. Half of the junk DNA, (a quarter of the genome) consists of so-called transposons or “jumping genes” (not really genes, but never mind). These elements have a tendency to move to a different place on the chromosome, or even jump to a different chromosome.

This would create havoc in 99% of cases, and therefore mechanisms evolved to prevent it, to somehow sequester or protect the functional coding genes from disruption. One such mechanism is to store the genes in tightly coiled chromosomes, which get temporarily uncoiled only when being copied onto RNA for protein production, or when DNA is being copied prior to cell division. A second mechanism is the methylation of the DNA, deactivating it, and undone only when promoters “turn on” the gene for protein expression.

However, these mechanisms promoting stability are not wholly impervious. The residual transposon activity is the key to the natural variation needed for evolution. The 99% of deleterious variations are eliminated by natural selection, but the remaining 1% may lead to a useful variation that is preserved; perhaps even a new species, if a homeobox gene is affected. (See “Sudden Origins” by Jeffrey H. Schwartz. Wiley, New York, 1999, 420 pp.) Natural selection is a cruel culling process, but occasionally it produces a pearl.

So are transposons junk, or rogues, or agents of change? We need some such free-ranging elements to preserve flexibility and prevent ossification by too much adherence to the status quo.

Anyway, I feel sure that a function will yet be discovered for the remaining one-quarter of the genome still unaccounted for.

AVOID IMMORTALITY AT ALL COSTS - IT IS LETHAL.

Death came into the world along with sex (and oxygen), in the early Eukaryotes. (See “A Means to an End: The Biological Basis of Aging and Death” by William R. Clark.) The protist Paramecium is an early example. It includes oxygenmetabolizing mitochondria (and therefore oxygen free radicals that degrade DNA), and it uses conjugation (a sYmmetrical form of gene exchange, a precursor of sex). When two paramecia conjugate, they form a new nucleus, and the old nucleus of each must then gradually die.

In the original life forms, the Prokaryotes (bacteria), there is no nucleus; the DNA is dispersed in the cytoplasm in the form of plasmid rings. Bacteria can divide indefinitely, with only starvation or accidents bringing about death. Bacteria do conjugate occasionally, but there is no “old nucleus” to disintegrate. Only Eukaryotes have true sex and true death.

Leonard Cohen sings: “it’s like sex, or it’s like death, or something in between, I guess”. (From “It’s Closing Time” on the disk “The Future”.)

In multicellular animals, only the germline cells, and very early embryo totipotential (undifferentiated) stem cells, are potentially immortal (but not as such, because they recombine their genes in various ways, like a complex golden braid). The whole soma (body) must die after reproduction, like the old paramecium nucleus. Only the germline is important in evolution. Death is the price that must be paid for variation that natural selection can play upon. The soma tests the fitness of the genes against the environment, but otherwise it is disposable, from the selfish gene’s point of view.

Genes originated in “the second origin of life”, according to Freeman Dyson (“Infinite in All Directions”), from pre-existing all-protein life—mutually catalyzing cycles according to Stuart Kauffman. DNA and RNA formed by the “accidental” polYmerization of energy-storing nucleotides like ATP, and became information-storage devices instead of storing energy. They have been ruling the roost ever since, because they can reproduce. Proteins became only their products, their helpers, and their slaves. But perhaps the dictatorship of the selfish genes is coming to an end, as genetic evolution yields place of honour to cultural evolution in humans, which is about a million times faster. Now the brain becomes predominant over the gene. Yet it must die. Should the rules be changed? Can they be? will they be?

Returning to the original story: In multicellular animals, after reproduction, senescence sets in, probably under the influence of the diminution in sex hormones. Some species, like mayflies and salmon, die soon after reproduction. They produce lots of young, but do not give them care (R strategy). Others (birds and mammals) live longer, reproduce in their youth, in order to give care to their offsping (K strategy). Senescance is like a slow death program; apoptosis (programmed cell death) is the fast one. But cancer cells can achieve immortality and continued growth, yet only at the cost of killing the whole organism, including themselves; so it is not true immortality, except in laboratory cell culture.

Devil to Faust: “I grant you one wish.”
Faust to Devil: “I wish for immortality”.
Devil to Faust: “Your wish is granted.”
And every cell in Faust’s body turned into cancer.

———————-

We are gaining a great deal of knowledge about senescence and death. If one day we could achieve immortality for ourselves, it would be a disaster, even greater than human cloning. We would have to stop having children, to avoid overcrowding. Our sex drive would probably

atrophy. Can you imagine a world without children and without lovers? We would in fact become a cancer on Mother Earth.

Don't yield to that temptation, the lure of personal bodily immortality. It is a fate worse than death. "Go gladly into that darkness", think of your children. Preserve the eukaryotic ethos.

——————————-

Crossroads decision of a pre-senescent cell: obey the signals and head toward apoptosis; or ignore suppression factors, resurrect telomerase, rejuvenate—i.e. transform into a cancer cell. What a temptation! I presume that even cells are addicted to life, though of course not able to perceive alternatives or make decisions. But look at long range: You will go down with the betrayed organism, and it serves you right!

It is sweet and decorous to die FOR your body, not later WITH it.

——————————

Carcinogenesis is like a false conception, a rejuvenation, but it produces only a monster instead of a child. The Fountain of Youth can spout forth POISON, not Aqua Viva.

——————————

As human individuals, we face the same choice: accept the species genetically programmed death, or try for immortality (not yet possible, but maybe just around the corner). Maybe we no longer need to die, as our genes tell us to do. We can resist apoptosis signals. In our new paradigm of ultra-fast cultural evolution, we may be able to reprogram the genes to avoid death. The newly dominant brain may be able to overrule the selfish genes.

But we would head toward a culturally stagnant world. There would be only old (in terms of years of age) people, physically still vigorous, but mentally conservative, unable to innovate or create, as new young people would do. Not only genetic evolution, but cultural evolution as well, would grind to a halt. A perpetual plateau is worse than the Devil's staircase of perpetual crisis. We must live at the edge of chaos, or there i5 no life worth living. LIFE IS CHANGE.

Do we really want to become like bacteria, potentially immortal barring aGcidents or starvation? The ladder of life has led higher, to almost dizzying heights, but progress has had a price. My paper/plastic flowers will never die, because they never lived.

Small animals have faster metabolic rates but shorter lifespans. I am suggesting that an infinite lifespan would mean zero metabolic rate, as far as intensity of living experience is concerned. I think that our lifespan of 80 to 120 years is just about right. I am willing to die for it.

ADDICTED TO LIFE.

You take your first breath,
then breathe the sweet air
again and again, as long as you can.
Right until your death
that sweetness you share
with every creature and woman and man.

You sip mother's milk;
its soothing effects
you'll want to repeat; then add something sweet.
Food smoothing as silk.
Or its texture reflects
the roughness of fruit, of corn and wheat.

O sweet addiction to all of life's joys,
you can't let go of them,
they hold you in thrall.
You play with ideas, like a child with its toys,
colours of flowers, sparkle of a gem,
sound of sweet music, you love them all.

LIFE AS A TRAP.

The first life appeared spontaneously, though slowly and against immense odds. It was a giant fluctuation away from equilibrium. When a system gets too far from equilibrium, it loses its way, cannot find its way back. It even gets more and more complex through further fluctuations, each entrapped by a ratchet effect.

The strange thing that happens i~ that these increasingly complex forms start lasting longer and longer, instead of being fleeting; th~i reach a sort of hyperstability, suspended there in limbo, lonely and far away from home. And they start being selected for their ability to last. It is almost a tautology: those that last longer, survive and get to predominate in the population. And so the infection “takes” and becomes self-sustaining and self-perpetuating—this blight on the quiet waters, rocks and sands, this slimy layer of deviants from the natural order.

They start also getting selected for their lust for life, their desire to continue and spread. Those without that lust die out, those with it hang on and persist. Thus the instinct of self-preservation is born. It is a sort of an addiction: once you taste the drug a few times, you cannot do without it. You are trapped. Life is full of dangers and sorrows, but you stay with it, expose yourself to all its terrors, because you were selected for wanting it. You hang on “for dear life”.

It is profoundly nauseating to be part of this slimy contagion, but you cannot stop. You are trapped.

Perhaps some lucky accident will end it soon, and the Earth will be cleansed and purified, pristine and virginal, as on the first day.

LIFE'S TERRIBLE BEAUTY.

(The phrase “terrible beauty” stems from Yeats’ poem about the Irish rebellion.)

We are living constantly inundated with hormonal messages that make us happy, glad to be alive. These are the mind’s own drugs, the endorphins, and also the neurotransmitters norepinephrine and serotonin. If their flow diminishes or stops, we slide into depression, first mild, then clinical, and finally suicidal. All that then separates us from intentional death is the pain and the difficulty of the transition.

Deprived of the loud and persistent hormonal and neural propaganda. we realiz~ that life is really an addiction—to breath, bread, and breeding—that we are slaves to these cravings, and we want to be cured. As ancient Tibetan religion teaches, we want to get off the wheel of life, and resist the temptation to re-enter a womb and be re-born.

But the rebellion cannot last. Those who find the insight vanish into the night of death, and the next generation of the living inherits no trace of their truth. The joy of life is favoured by natural selection. The finders of the awful truth do not survive.

The fear of death, the pain of dying, the instinct of self-preservation are other tricks of nature to maintain our addiction to life. Nature is a drug pusher as well as a propaganda machine. We are children of such a mother.

All else but we addicts rests in sweet equilibrium. Only we are driven, condemned to this continual struggle against entropy. The ultimate genuine bliss is to be a balanced being, resting in eternity, albeit unconscious. But our devils drive us on into struggle and dependency.

Yet even as’I think this, I am overcome by the beauty of the flowers and the sweetness of bird songs as I walk along on this grassy path. I can see, hear, smell, walk, think. And my endorphins shout “Yea!” Again I hit the high, again I feel the rush.

Life is indeed a Terrible Beauty.

KINSHIP LINKS.

There are two kinds of kinship links: blood links and “in-law” links, which I prefer to call “love links”, because they arise from the cross-matings we all practice. From another viewpoint, there are inter-generational links

(parents and children, but also grandparents and grandchildren, uncles and aunts, nieces and nephews) and intragenerational links (siblings and cousins). Some languages distinguish paternal and maternal uncles and aunts, with different social roles. There are some relationships that are neither by blood nor by love: God-parents and adoptive parents, for example. (I am 1tsing the word “love” in a special sense here, love between a mated pair.) And of course there are some modern variants of “love” kinship: a common-law pair, ex-spouses after divorce, and a same-sex pair, as well as, always, casual or temporary lovers. Halfsiblings are related only half by blood; an adopted and a birth child in the same family are not related at all.

From these unit elements, we can construct whole kinship networks. In tracing a family tree, we necessarily omit all the side branches (of people who marry into the family); if we did not, we would not only soon run out of paper, but we would find that we have encompassed all of humankind. When we trace our ancestors backward, we find that eventually all presently living people share the same ancestors; how else could we accommodate the fact that we have 2 parents, 4 grandparents, 8 great-grandparents, then 16/ 32/ 64 etc., in an exponential series?

So there is a common network, the cousinhood of humankind. Everyone is in the network by blood and by love—actually by blood alone is sufficient. Some links are shorter, more direct, than others~ and these people we recognize as our kin in social terms. But we are all at most the 50th cousin of each other.

And then, as well, we should not exclude the network of friendship links—people related by common interests (such as colleagues or comrades at work), partners in play and sports/ schoolmates, members of interest groups, or just friends. This network of chosen ones rather than assigned ones intersects the blood-and-love network.

And so we have the interplay of C.S. Lewis’ “Four Loves”: Filia (or philia) for blood relationships, eros for sexual love relationships, amitia for friendships, and finally the all-encompassing agape—the love of one for all and all for one. It is a tightly linked redundancy-rich network, stitched together with different kinds of love. This is my vision of humankind.

TIME AND LIFE.

To repair a machine, like an automobile, you can turn it off, disassemble it to any level, do the repairs or replacement of parts, reassemble it, and it will work again, presumably better now. You cannot do that with an organism. It has to keep going ~t some level at least; very low when quick-frozen, hibernating, or as a spore. This is “suspended animation”, but it cannot be quite zero, because life is a process, not a state of the system. (As a compensation for this inconvenience, a living system is self-repairing to some extent, while an automobile is not.)

This is somehow connected to the fact that living organisms (as all entropic and anti-entropic structures) have an arrow of time, and machines do not. For a machine time can stop. Life has to ~~ep jiggling on top of the jet of through-flow of matter and energy to stay far from equilibrium as a Prigogine structure, or it will falloff.

Somehow, an anti-entropic unit is constrained to move along one of the dimensions of four-dimensional space-time at a more or less constant speed (but always at some speed), while having some (free will) choicas re movement in the other three dimensions.

The dimension chosen as “time” is not arbitrary; it is determined by the state-of-motion of the observer (as in Special Relativity theory), and chosen as the one marked as “ict” (i is the square root of minus one or the “imaginary” unit, c is the velocity of light in a vacuum and the upper limit of all velocities, and t is time measured in seconds) . The organism has to move along this selected dimension from birth to death, no reversals or even complete standstills being allowed. Correspondingly, evolution moves irreversibly from the simple to the complex, human history from the primitive to the “civilized” (?). Entropic units, like a heat engine, move from order to disorder, from complexity to simplicity, from structure to dissolution, from segregation to homogeneity at equilibrium, i.e. in the opposite time direction. Mechanical machines can move reversibly in time, except for ever-present friction.

If “i” is what distinguishes the time-dimension of spacetime (c being merely a conversion factor for the units used to measure space and time), then, in the complex number plane, time is the imaginary axis (usually depicted as vertical), and space (one dimension of it) is along the axis of real numbers. We can (just barely) imagine 3 real-number lines at right angles to each other run along x, y, and z dimensions, with the ict time dimension perpendicular to all three of them. We do not perceive the time dimension as space, because we are running along it, at constant speed, unavoidably. If we were an automobile, or even a piece of rock, this would not be so.

THE RED AND THE GREEN.

The green wave passes down the street
as lights change one by one,
it goes where friends and strangers meet
when each day's work is done.
And some can pass while others yield
in city street and open field.

For green means go and red means stop,
like leaves and flowers in the park.
Green is the forest and tt..: crop,
red flower is an added spark.
Green is the present's veneration,
red is the future's generation.

For flowers stop when fruit is borne;
the petals drop, their job is done;
and then in early autumn morn
the cycle ends that spring's begun.
And winter strips the leaves from trees
that fluttered in the summer's breeze.

New leaves say "go", drink in the sun,
make sweet juice flow to root and stem;
and when new growth has thus been spun,
the flower becomes the crowning gem.
The green and red, in joyous song,
show life is well and fit and strong.

The leaves are green, the blood is red,
and yet their pigments are related;
They cycle carbon while sun-fed,
and oxygen, as obligated.
Plants and animals, green and red,
each to its kind are truly bred.

The green are prime fuel-producers,
the red consume the stored-up fuel.
The plants are C02 reducers,
animals prey in struggles cruel.
Energy moves up the food chain
though we mourn for all the lambs slain.

The lights that change at the street crossing
reminded me of nature's ways;
while red in tooth and claw, engrossing
struggles fierce, where wild beast preys,
she also greens the spring's first leaves,
as hay is tied in summer's sheaves.

It's stop and go in nature's traffic;
let's flow with it the best we can.
things always end where they began.
The cycle rolls and is sun-driven;

tolls taken and blessings given.

RED AND GREEN REPRISE.

In a previously written poem, red and green traffic lights (“stop” and “go”) are compared to hemoglobin and chlorophyll, two chemically related biologically important substances, in animals and plants respectively. Each has a central metal atom, iron and magnesium respectively, surrounded by porphyrin units. These in turn are embedded each in its own protein matrix. While hemoglobin mediates oxygen traffic, chlorophyll mediates hydrogen ion traffic. Together, they control the flow of life, in its stop-and-go fashion.

Red and green are complementary colours. When light rays of these colours are mixed in the proper proportions, wavelengths and intensities, they produce white light, the brilliance of the Godhead. Red and green are also two of the three receptors (cones) in the eye. The third one is blue, the colour of the sky and of deep layers of water, a compound of oxygen and hydrogen.

Iron, the central element of the mass defect curve, the pivot between nuclear fusion and fission, part of the first trio of transition metals to take the place of a rare gas in the periodic table, the centre (molten or solid) of the cores of stony planets including the Earth, the symbol of the Iron Age of human development (a triumph of technology), the horrible Kali Yuga of war to follow the Silver and Golden Age of mythical antiquity, the central core of a burnt-out star—this iron also marks the two stages of the development of the Earth. The early stage had a reducing atmosphere, and therefore iron compounds were in the ferrous (divalent) state in the rocks and oceans; the colour of ferrous compounds, both solid and dissolved, is green. When enough oxygen had been liberated by photosynthesis, but before free oxygen accumulated in the atmosphere, iron compounds were oxidized to the ferric (trivalent) state; these compounds are red, like rust. The transition from a reduced to an oxidized state, leading to free oxygen in the air, was a great transition for life on Earth, giving a chance to multicellular organisms and eventually animals. It went from q reen to red.

Plants and algae remained green through chlorophyll, and still constitute the basis and foundation of all food chains, run entirely by the Sun. They also constitute the biggest biomass by far (think of rainforests, meadows, prairies, steppes, etc.). Animals turned red through hemoglobin in the blood (though some, like lobsters, have blue blood). They also became “red in tooth and claw” through predation, nature’s original sin, when green innocence was lost. What was gained was locomotion, the nervous system, and eventually intelligence. But nature signals “stop”, don’t go too far in that direction. The permanent “go” remains with the green.

THE WEB OF LIFE: COMMENTS ON BOOK BY FRITJOF CAPRA.

The elements in Capra's "web" include the following:

- Holistic Zeitgeist
- Process perspective
- Cybernetics (Norbert Wiener, John van Neumann, Claude Shannon)
- Jantsch's "early synthesis" (including Prigogine)
- Chaos theory
- Ecology
- Autocatalytic networks (stuart Kauffman)
- Symbiogenesis (Lynn Margulis)
- Mind and cognition (Humberto Maturana)

The holistic Zeitgeist manifests itself in several disciplines:

- Organismic biology
- Gestalt psychology (Wertheimer, Kohler)
- Deep ecology (Arne Naess)
- General systems theory (Ludwig van Bertalanffy)

Several tendencies manifest themselves:

- From self-assertion to integration (Carl Jung) -From the parts to the whole
- From substance to form or pattern
- From either mechanism or vitalism to organicism -From static structure to dynamic proces (Alfred N. (Whitehead)

Some other concepts introduced:

- Biosphere (Vladimir Vernadsky)
- Homeostasis (Walter Cannon)
- Feedback loops (negative and positive) (Magoroh Maruyama)

- Information theory (Norbert Wiener, Claude Shannon at Bell Labs)
- Cognitive science/artificial intelligence (Ross Ashby)
- Operations research (RAND Corporation)
- Molecular biology (Watson and Crick's DNA)
- Network patters
- Self-organization (Heinz von Foerster)
- Dissipative structures (Ilya Prigogine)
- Catalytic (enzyme) cycles and hypercycles (Manfred Eigen)
- Autopoiesis (Humberto Maturana, Francisco Varela, Santiago Group)
- Gaia hypothesis (James Lovelock, Lynn Margulis)
- Non-linearity and iteration (mathematics of complexity)
- Topology (Jules Henri Poincare)
- Phase space (n dimensions)
- Strange attractors (Ueda, Lorenz
- Butterfly effect (Edward Lorenz)
- Fractal geometry (Benoit Mandelbrot)
- Cognition (Gregory Bateson, Humberto Maturana)
- Food chains, carbon and nitrogen cycles
- Contingency (indeterminacy of bifurcation)
- Cellular automata (e.g. "the game of life")
- Boolean networks (stuart Kauffman, Santa Fe Institute)
- Self-organized criticality in sandpiles
- Micelles, coacervates, cells (oparin)
- Selection vs. creativity in evolution (Dawkins vs. Margulis)
- Weaving the bacterial web (free gene exchange)

- The oxygen crisis: photosynthesis and respiration
- Psychosomatic system: immune/hormonal/neural net
- Consciousness-selfconsciousness-language nexus

Capra's work represents a major synthysis of most modern scientific ideas. As such, it is difficult to summarize since full explanations would reproduce the whole book. It is as if an algorithm were as long as the text. Hopefully, this partial outline will trigger responses by those who know the authors and theories mentioned, who will tnen be able to make their own connections and fit the pieces together.

RED BLOOD - WHITE BLOOD.

In Dracula as in other vampire stories, there is a false myth about blood. Blood is a functional fluid, not a mysterious essence of life. Just as the heart is a pump, not the seat of deep feelings. Blood can be transfused, with proper attention to blood types. Even if Dracula takes a drink every night from a victim's neck, the blood system would soon regenerate new blood with no ill effects. Unless Dracula took too much too often. The Massai in Africa regularly drink the blood of their cattle, but the cattle go on living and thriving.

Yet "blood relationships" (kinship webs) entail basic DNA similarities, mainly because of the MHC (Major Histocompatibility Complex) in the white blood cells of the immune system, not the red blood cells which merely carry oxygen. The MHC is the "Self factor", by which the immune system recognize Non-Self as the enemy. The MHC is the most variable genetic feature. Animals can SMELL theirs. The MHC makes each individual human unique. Red blood cells do not even have a nucleus. They are just "flashy" when blood is spilled.

So blood is thicker than water, after all. It is the basis of the self, of individuality, of kinship relations, and hence of the phenomena of sociobiology. But this is because of the white cells, not the red.

POINTS OF VIEW.

Richard Dawkins in the November 1995 issue of Scientific American tries to see things from the viewpoint of genes, which try only to survive and reproduce, and disregard the suffering of the organisms within which they live; the latter are only the genes' "survival machines". This is certainly a neat reversal of ends and means, since we usually take the organismic point of view, according to which the genes serve the purposes of the organisms. (Reversals of ends and means are also seen in relations between money and consumable goods, and between the role of the state and the citizen~, as p~ted elsewhere.)

Janet Diamond in Discover, October 1992, discusses disease from the viewpoint of the virus, microbe, or other pathogen. Again, the microbe is interested in surviving and spreading. It mayor may not be in the microbe's interests to kill its host; it depends on its strategy for spreading, e.g. is there an intermediate vector (insect and/or mammal)?

A recent (1995) "Quirks and Quarks" program on CBC radio spoke about neutrinos as possibly constituting the entire "missing mass" in the Universe, in which case neutrinos would be far more abundant than our ordinary electron-quark matter. Another source discussed "neutrino astronomy" in which the Universe would be probed by neutrinos insteads of photons (light, radio, or X-ray astronomy). This would be bound to give us an entirely new point of view.

Since there are these radically different points of view, which is the most valid one, the most relevant, or even the absolute one? Or is "reality" totally dependent on the point of view, i.e. inherently relativistic?

Philosophers, historians, humanists in general, write explicitly from the human point of view, believing, in the Greek tradition, that "Man is the measure of all things". Theologians would be more apt to refer to God's point of view, which stimulated a Hebrew prophet to exclaim "Who is man, that Thou shoudst be mindful of him?" Neither considers the viewpoint of deep ecology, which sees humans as components of Life on Earth, and not its crowning glory or its most important part.

Questions of the most valid viewpoint are partly questions of relative importance: which is most salient in a situation, the gene or the organism? the pathogen or the patient? the neutrino or the photon? man or God? This is not merely a question of bigness (which is only one factor), but also which causes more of the consequences, which is more abundant, which originated prior in time, etc. But partly it is a question of meaning, and this is really assigned by our minds.

Yet our minds are flexible enought to be able to include alternative points of view, and thus to enrich our perspective. Thsi could serve us in good stead in considering political and ideological alternatives in peace and tolerance.

LIVE SYSTEMS VERSUS LIVING SYSTEMS.

Galtung (“Peace by Peaceful Means”, p. 71) says that conflict can exist only for goal-seeking “live systems”, by which I suppose he means humans, animals (and plants?). He further specifies that “live systems” are ones that experience the spectrum from “sukha” (happiness, bliss, fulfillment of needs) to “dukkt~” (suffering, frustration of needs). This latter specification might exclude plants, and also the other three “kingdoms” of life (bacteria, protozoa, and fungi), which lack a nervous system. But I am not too sure. This leaves only animals (including humans), which could be termed “sentient life”.

What Miller calls “living systems” is a different concept. Besides all five kingdoms of life, it includes also societies (of humans, bees, ants, etc.), ecosystems, maybe all of Gaia (biosphere), and perhaps sufficiently highly developed “artificial life”, computers based on silicon instead of carbon. Living systems are defined as possessing certain functions, such as absorption of nutrients, their utilization, elimination, energy-production and utilization, and reproduction. It does not have to have “experience” or consciousness as an ingredient, and therefore need not have a nervous system.

Question: Does life imply complexity or simplicity?

Answer: Complexity at the physical level of matter, simplicity at the spiritual level of mind—for God Thy Lord is One.

Development is unfolding of increasing complexity of matter in an anti-entropic direction. But Bohm would balance unfolding with enfolding—reaching an Omega Point of supreme simplicity when the soul merges with God in Nirvana. It is like the water cycle: vapour from the sea to clouds to rain to rivers back to the sea.

THE ROLE OF PLAY.

Children play to learn. Learning is a matter of trying various things in order to see which “works”, and then reinforcing that for future repetition. Children’s play builds motor skills and hand-to-eye coordination.

Adults also play to learn. Card games are experiments in combinatorial mathematics. Scrabble games and crossword puzzles are experiments in linguistics. Puns and jokes are word play. Chess and poker are different styles of playing war and politics; chess by rational zero-sum gaming, poker by bluff and deception and ;~ycho-logic.

Experiments in science and art are play—they lead to new discoveries in Truth and Beauty, like new ever-Stranger, ever more Charming quarks. Poetry is an experiment in language, with an infusion of right-brain thinking to leftbrain language production. Painting and sculpture are experiments with natural materials, painting in two dimensions and sculpting in three. Music is an experiment in sounds, interweaving wave forms of melody, harmony, counterpoint, and rhythm. Human relationships are experiments in love and hate, friendship and hostility, cooperation and conflict, with variations in quality and intensity and variations over time.

Embryonic development proceeds largely through laiddown design, but there are elements of play, for example in brain neurons seeking their connections, and living or dying in the attempt, a deadly game of “do or die”.

Evolution progressed through play. Trial and error produced restless variation, even after viable mechanisms existed; but the viable mechanisms themselves had to be first produced by Original Play with the almost endless combinatorial possibilities. The selection process was (is) external to this play, separating wheat from chaff like a giant threshing machine.

Evolutionary play could start only when there was excess capacity over that needed to maintain homeostasis against entropy—and the capacity required for this, to stay on top of the great balancing act, was considerable. There had to be a firm basis to underlie the experimentation, like the great volume of the sea on the top of which the waves can play.

Consciousness (Mind) was at first too dim (though in existence in the shadows) to direct the play of creating new variations. The variations remained largely random, with very little direction, leaving selection alone to winnow out the successful ones. The play was slow and laborious. But the novelty introduced by the slow play led to the emergence of ever stronger consciousness. The ability to be able to direct, or influence ever so slightly at first, the evolutionary play, the search for useful novelty, grew gradually—long before humans appeared.

Now that humans are beginning to master molecular biology and play with genes, externally, this ability to influence evolution has been greatly magnified. We are justifiably afraid of our new powers, as Prometheus was of fire, because we may foolishly destroy basic homeostasis through our ignorance; i.e. indvertently damage or extinguish life.

Play is the radical force in nature, opposed to the equally necessary conservative force of homeostasis. Play and curiosity is the basis of growth and emergence of nove1ty, of science and art, and of social innovation; but it must not be overdone. Children must be prevented from playing with matches, until they have learned what matches can do and what they are for. Conservation and “anti-gambling” regulations must have their say—though Life itself began as a giant Gamble. (Gambol?) A super-synthesis of orderly conservation and radical play is needed—conscious and conscientious ethical radical conservationism.

GENE SWAPPING AND KINSHIP STRUCTURES.

Gene swapping in early life forms (bacteria) created networks rather than genetic trees. The “tree of life” pattern was created only later, when Eukaryotes established the pattern of sexual reproduction. Then the concept of a species became meaningful, as groups became genetically isolated.

The Amerindian social system of overlapping tribe and clan structures is also a network, though of a different kind. Clans are internally linear by matrilinear descent, but extra-clan marriages crosslink clans among residencebased tribes. Thus every tribe contains people from all clans, but clans maintain cooperative relationships across tribes.

A person’s identity is double: it consists of blood links in clans (actually through mitochondrial DNA, though this was not known) and mate-links (or what I like to call “love-links”) in tribes. This dilutes the concept of a “nation”, just as bacterial genetic networks dilute the concept of a “species”. I would argue that this is beneficial, as cross-linking always is, in breaking up strict “we versus they” conflict boundaries.

BIOTECHNLOGY - PROS AND CONS.

In a way, human-created biotechnology (transplanting genes across species) is a return to gene swapping among bacteria. However, in Eukaryotes, which are much more complex than bacteria, it may not be appropriate. David Suzuki in his recent radio lectures “From Naked Ape to Superspecies” compared it to putting Elvis Presley into a Beethoven symphony, or “improving” a poem by inserting new words at random. This is because genes operate in a context, like words in poems, or musical styles in symphonies.

Suzuki (who is a geneticist and an ecological advocate) also cited other arguments against biotechnology:

1. In transplants of animal organs into humans, the animal cells do not remain confined to the transplanted organs, but spread throughout the body, creating a mosaic of cells from different species. This may ~ acceptable if the human patient is in desperate straits, but it is not “natural”.

2. Viruses may jump across species along with the genes possibly creating epidemics of new diseases.

3. New human-created species may escape to the environment, and may replace local natural species, as has happened with “exotic” flora and fauna in many places, like Hawaii and Australia. But the new ones may be more destructive.

4. Mad cow disease was a surprise: it was thought that feeding sheep brains to cows would be all right, since proteins are broken down by the cow’s digestive system all the way down to amino-acids, which are re-constituted into cow proteins. But apparently prion proteins behave differently. The disease spread from sheep to cows across a species barrier. It can also cross to humans (C.J.disease) if humans eat contaminated beef.

5. A nasty surprise was averted when a new substance beneficial to plant growth was found, by a graduate student who deserves a supreme kind of medal, tested it in living soil rather than sterile soil. The new substance kills the mycorhizal fungi essential to plant growth in nature. All the plants died in the experiment, as they would have if the substance had been approved for use in the field. It could have spread from field to field, thus depriving animals and humans of food. This graduate student saved the world. How many other nasty surprises are lurking in “unnatural” experiments? Don’t we know the difference between “in vitro” and “in vivo”?

Scientists working in the food industry argue that biotechnology is no different than the ancient process of improving species by selectuve breeding. Suzuki argues that it is in fact very different. Industrial scientists also see it as the only way that we will be able to feed a burgeoning human population. But, says Suzuki, not if an escaped new life form invades the environment. Surprise!

PEACE PROCESS AS A LIFE PROCESS.

According to current thinking, life is a non-equilibrium process. For an understanding of that statement, some explanation is required.

All physical and chemical processes tend to approach equilibrium, which is a state of minimum energy. For example, an iron rod heated at one end and then removed from the source of heat will soon have the same temperature at both ends, as heat flows from a high to a low temperature. similarly, when a concentrated salt solution is put in contact with a dilute salt solution so that they can mix, the salt concentration will eventually be the same throughout because the dissolved salt moves (diffuses) from a high to a low concentration. It is the same kind of process when water flows downhill, as all rivers do. All such processes end in uniformity (of temperature, concentration, or water level) where before there were differences. It is possible to reverse such processes only if energy is fed in, e.g. by heating one end of the rod or pumping water to a higher level. The science that deals with such phenomena is thermodynamics. The famous Second Law of Thermodynamics states that in spontaneous processes in closed systems (i.e. those where no energy is fed in), entropy always increases. Entropy is a measure of uniformity, and also of disorder, i.e. lack of structure or of differenc~s (in temperature, concentration, etc.). Another statement of the Second Law is that all natural process tend to go to equilibrium, which is a state of minimal free energy and maximum entropy.

The Second Law applies only to processes in closed systems, i.e. those into which no energy or matter flows in and from which no energy or matter flows out. An example of an open system might be a bathtub with open tap and open drain, so that water flows in and also flows out. Such a bathtub can maintain a constant water level, if the inflow of water equals the outflow of water; this can be regulated by adjusting the tap and the drain. The condition in which the water level remains constant is called a steady state it is not stric~ly speaking an equilibrium.

Physicist Ilya prigogine noted that when a system is open and far from thermodynamic equilibrium, it can maintain complex structures or patterns in both space and time. His example was a chemical system (the “Brusselator” because it was built in Brussels where he worked) in which precisely timed colour changes occur periodically. Another example is the formation of regular spatial stripes of colour formed in another chemical system. Yet another example is the heat convection pattern observed when a shallow pan of liquid is heated from below. prigogine called such systems “dissipative structures”, while they decrease entropy within themselves, they dissipate the excess entropy to their surroundings—because, of course, the entropy of the whole (being a closed system) must increase according to the Second Law.

Dissipative structures are models of the first very simple living cells. They create and maintain complex structures (low entropy) by exporting entropy (disorder) to the environment. The can only do so because materials constantly flow through (nutrition, respiration and elimination), and because energy is fed in, ultimately from the Sun. Such structures can not only maintain themselves (homeostasis) in a constant state like our bathtub example (with many feedback cycles added), but they can also slowly over time evolve toward more and more complexity, as life on Earth has done over the last 4.5 billion years. While evolution is seemingly in contradiction to the Second Law of Thermodynamics, this is not really so, because the entropy of the environment increases. Actually cycles are often formed in which are organism’s wastes become another organism’s input e.g. carbon dioxide breathed out by animals is used by plants in photosynthesis; but note that this cycle requires sunlight as another input, i.e. an energy inflow.

The point of this somewhat lengthy explanation is that life is a non-equilibrium process, a balancing act, like a ping-pong ball dancing on top of a water jet. While equilibrium systems

can be called “stable” (like a ball at the bottom of a valley—there is no tendency for it to move out of it), living systems have been called “hyperstable”; though always tending to fall toward equilibrium (which is death), they are supported in a high free energy state (which is life) by the constant influx of new energy and materials, as in the water jet.

Now I wish to transpose this metaphor to peace. Peace is sometimes seen by “realists” as the result of a balance of power, which is a kind of equilibrium. On the other hand, “idealists” tend to define peace as total social harmony, which is another kind of equilibrium. I want to argue that both are wrong.

Peace is a complex balancing act in a world full of conflicts. We cannot and should not expect the conflicts to end; they are a means which human society uses to remove injustices, adjust inequalities, solve problems, remove oppression—in other words evolve toward more viable structures. Conflicts are a way of negotiating our differences through hard bargaining. Sometimes the changes that arises out of the conflict process are harmful rather than beneficial, in which case they will probably lead to further conflict. Living organisms that evolve in nature are not always successful, and then they become extinct, as 99% of them have over time. The same can be expected to happen in social evolution through conflict. Unjust structures will die out while just structures will survive.

This selection process will occur only if the social system is evolving in a healthy way. It could go wrong and “evolve” toward injustice, but this would probably be selfdestructive in the end and the whole system would pass out of existence. Life is never assured; death is always a possibility.

While conflicts keep the social system open to change, they must not be allowed to degenerate into violence. Violence destroys living systems, biological and social, and this is very rarely beneficial—except when destroying something like a cancer cell. But in society, we should refrain from labelling even criminals “cancer cells” without a great deal of caution, because all human beings are valuable, if not to others at least to themselves, and extra care must be taken to protect the human rights of all.

What is emerging from this discussion is a definition of peace as a social order in which we deal with conflicts creatively and constructively. Peace is not the static equilibrium of a balance of terror in which conflicts are suppressed—creating havoc in the “collective unconscious”. Peace is also not a state of harmony and universal love, precisely because it is not in some final state of equilibrium (lithe end of history”), but is still evolving. Peace is a continuing process which is never finished. Margaret Mead put it well; “peacekeeping is like housekeeping; you have to keep doing it every day. II This again is like life; we cannot eat today and say “now it is done”, we have to eat again tomorrow. And so it is with peaceful resolution of conflicts, we solve one in Namibia and another emerges in Ethiopia. We have not yet learned how to deal with conflicts nonviolently in a consistent way, but we are learning. Change was non-violent (more or less) in Iran, the Philippines, Poland, Hungary, East Germany, Czechoslovakia We slipped into violence again in the Gulf War, and South Africa on its way to abolishing apartheid has slipped into communal violence. But we have not yet killed human society, though we still might. It’s like the dawning of life on Earth; it might have failed to achieve a take-off, as on Mars or Venus. Our incipient peace take-off might fail, but it might succeed. There never was a guarantee for life and there is none for peace. Death and equilibrium is easy—all you have to do is do nothing. But to keep that water jet going, you must apply effort and energy. Just like a garden needs constant car, so does peace. Never relax that effort. You will never launch a ship called Peace with a bottle of champagne and then go home and rest. You must cultivate carefully the art and science of peaceful conflict resolution, never flay in your effort, and never give up hope.

Life on Earth probably started many times only to flicker out again, until some primitive cells were persistent enough to stay with it and not give up.

Everything depends on patience and persistence and continued effort even if it seems hopeless. Let us keep peace growing, in order to keep life on Earth going.

HYMN TO LIFE

Don’t let the fire die,
Keep the flames high.
Keep the sparks flying
up to the sky

Keep the sap flowing,
keep embers glowing,
keep the wind blowing,
both far and nigh.

Keep flowers growing,
bright colours showing,
broadcast seeds sowing,
both low and high.

Keep birds a-singing,
keep bells a-ringing,
keep children swinging,
as I walk by.

March onward and on
at dusk and at dawn,
lines firmly drawn
down here and on high.

As sunlight is pouring,
the life force is soaring,
its gains is up-shoring,
the chains to untie.

So tell the great story
and bask in its glory,
both recent and hoary,
the torch hold on high.

DEEP PARTHENOGENESIS.

Abundant life ’round thermal vents
in vast underseas mountains,
are they the primeval events,
Earth life’s true fountains?

No Sun, no oxygen penetration,
just Earth’s own inner heat,
gives energy for integration,
initiates the rhythmic beat.

Only the all-nurturing Mother,
no need of Father’s fertilizing touch.
A solitary act, without the Other,
a self-sufficient act, holy as such.

Yet, wandering cells find their way up,
rising in water to the surface clear,
find less primeval energy to fill their cup,
accept Father Sun’s help to banish fear.

Soon there is oxygen and great upsurge,
they learn to live with poison, make it tame,
they spread and multiply, fulfill the urge
ignite the surface with life’s holy flame.

Some worms wander down, to depths forgotten,
they match up with the depth-adjusted cells.
In symbiosis life is new-begotten,
as back to Mother necessity compels.

The Mother and Child reunion is a mystic thing,
with Father’s bright light a mere strange interlude.
Deep silent dark a warm embrace will bring,
the oldest dream-time with a mystic mood.

THE INNER SANCTUM. (1970s.)

The sense of penetrating to inner secrets,
of opening forbidden doors to enchanted rooms,
of desecrating inner sanctums,
yet worshipping there in our own way.

Zoom in from the cell to its nucleus,
from the nucleus to its chromosomes,
to their genes, to the DNA double helix,
to the bases spelling sacred four-letter words.

Is that the inner sanctum? Not yet, proceed.

Zoom in from the molecule to the atom,
to ITS nucleus, a magnitude many orders down,
to its protons and neutrons, to their quarks,
to whatever we still cannot fathom.

Is that the inner sanctum? Or not yet?

Are there structures within structures,
boxes within boxes, mirrors upon mirrors,
fractally, indefinitely, endlessly?
Will we find a homunculus and start over again?

Protein and proton, neuron and neutron,
hydrogen bond and hydrogen bomb,
the new biology and the new physics,
the secret still lies behind closed doors.

Perhaps in the ancient realm of the mystic,
or in everyday life between the infinite and
the infinitesimal, between order and chaos,
between Being and Becoming, between God and Satan,

a four-letter word we all can spell—LIFE.

MINIMIZE OUR LOSSES.

Ursula Franklin, in her recent radio interviews conducted in connection with the appearance of the revised edition of her book “The Real World of Technology”, said, among many other interesting and insightful observations, that planning should be aimed at minimizing disasters, rather than maximizing gains (or profits). For one thing, in any cost-benefit analysis, we should always ask “whose benefits” and “whose losses”, for these may not accrue to the same parties; they certainly do not in cases of exploitation. In any equitable version of the utilitarian principle “aim at the greatest happiness of the greatest number”, the distribution” of happiness among individuals and groups in a society should be considered.

Focusing now on the principle that we should plan to minimize disasters rather than to maximize gains; it is not only an argument against capitalism and for conservation of nature (it certainly is that), it also resonates with other findings and principles in other realms of thought, and it is this which I want to stress in what follows.

In zero-sum strategy games, we search for “minimax”, or, from the perspective of the opposite player, a “maximin” outcome. This is a strategy to minimize losses: we seek an outcome where we stand to lose the least when our opponent chooses rationally for his own benefit. Thus selfish rationality already dictates an avoidance of disasters as the first priority.

In prospect theory (a modification of rational-choice theory to describe how humans actually behave), it is found by experiments that people consider it more important to avoid losses (keep what they already have) than to gain additional benefits, even if the expected utility (defined as utility times probability of its attainment) is the same, or even slightly less. From this originates the actual Scurve rather than the straight line, in actually observed behaviour.

Then there is the “precautionary principle” in applied ecology and technology (e.g. introduction of new drugs): in case of doubt that the innovation is safe, don’t do it, even if the benefits seem to be worth it.

Finally, consider Gandhian economics. It teaches that new technologies should not be introduced so quickly that they put people out of work. They can be introduced later, after adjustments have been made to safeguard full employment of all people who want to work. In other words, the guiding principle is benefitting people rather than increasing production efficiency. Since mass unemployment is a disaster, this is another example of planning primarily to minimize disasters.

Ursula Franklin herself used examples of the Mackenzie Valley pipeline hearings and the Conserver Society Commission as cases of planning to minimize disasters. It seems evident that the principle has multiple applications. What use would it be if we reach out into space or learn how to genetically control ourselves, if we thereby imperil our own species survival?

SCHRODINGER'S GAMES.

A recent article by Graham P. Collins claims that “for quantum prisoners, there may be no dilemma”. This refers to the famour Prisoner’s Dilemma game, in which the two players are led by their reasoning to mutually defect, while they would benefit more from mutual cooperation—if they were not tempted to unilaterally defect for selfish gain, or do so for self-defence against a possible unilateral defection by the opponent.

But in a quantum situation, they could each play a superposition of “cooperate/defect”. (This is analogous to Schrodinger’s cat, who is both dead and alive until somebody opens the box and looks.) Taking advantage of “maximum entanglement” (another quantum effect) of the two choices with each other, the dilemma vanishes. Among the new quantum choices available is one which lets each player reap the maximum benefit.

This is an interesting combination of two theories from very different fields. Interdisciplinarity pays off, as always.

AMBIGUITIES.

In many situations of social choices, it is uncertain which direction is “progressive” and which is “regressive”, even if these adjectives could be objectively defined. Some examples will make it clear.

1. Economic sanctions. These are often advocated as an alternative to war, e.g. in reversing cross-border aggression under collective security. Yet economic sanctions have been deplored as harming mainly civilians, especially children and other vulnerable sectors of the population. In this way, economic sanctions can be the very opposite of humanitarian aid given to famine-stricken areas. We can specify that food and medical supplies should be exempt from sanctions, but this often does not prove to happen in practice, e.g. in sanctions against Iraq. Are we trying to do two opposite things under some conditions, which thus cancel each other? Yet economic sanctions are undoubtedly preferable to war. Or, on the other hand, are they the same as war, waged by other means?

2. Landmines. Under the rubric of non-offensive (i.e. purely defensive) defence, we used to advocate the use of landmines as a weapon that by its nature cannot be used for offensive purposes, but only for defence of home territory, triggered only if someone invades it. Now it appears that unexploded landmines left over after a war kill and maim civilians, especially children. Are even “purely defensive” weapons inadmissible? Are they even more repugnant than some “offensive” weapons—offensive in intent?

3. Globalization. This is the lofty aim of all internationalists and world federalists. We aim to unify the world because humankind is one nation and all are citizens of the one world. Yet in these days globalization is often deplored as creating a world ruled by “free trade” and multinational corporations, in which the interests of individual citizens and local communities are crushed or at least marginalized. Perhaps the solution lies in globalization from below rather than globalization from above; or in proper application of the principle of subsidiarity, under which problems are solved at the lowest appropriate level, though some problems require global solutions.

4. Old growth forests and forest fires. On the one hand we are told that old-growth forests are valuable and must be preserved from logging. On the other hand we are told that forest fires are nature’s way of renewing forests that have grown too old in their succession, and that it is healthy to start over again. Whom are we to believe? Or are these two different situations and I merely misunderstand?

5. Family cohesion vs. nepotism. The family is the smallest and tightest social unit and should be given preference in our choices, as is derived from actual social practice as well as from the theory of socio-biology (favouring our genes, or aiming at “extended fitness”). Yet when government officials appoint their sons and daughters, nieces and nephews to government posts, this is called nepotism and corruption and frowned upon. I think that the distinction is that we should not practice “filia” (family loyalty) when we are in the service of a larger unit, such as the state. This should also apply to the case of U.N. officials and peace-keepers, who should forget thair national allegiance and serve only the world community.

6. Hydro-electric dams. These are an example of the use of solar energy in the production of electricity, since they utilize the differences in the altitude of bodies of water, originally created by the Earth’s water cycle. As such, hydro-plants do not contribute to global warming, as they use no fossil fuels. Yet environmentalists often protest against large-scale hydroelectric dams, because their construction disrupts the

local environment and its human and animal occupants. We need to consider the costs and benefits of alternative methods of generating energy, or the costs and benefits of making do with less energy.

7. Struggle. The word conjures visions of armed violence, but this is not necessarily so. It could mean political struggle, by lobbying to influence government or not re-electing the government if it does not yield to our demands. It could mean non-legal though nonviolent struggle, i.e. civil disobedience, if the above legal methods fail. But even in the absence of violence, is struggle desirable? Is it not better to put up with minor injustices in order to live a tranquil life? Unfortunately, minor injustices have a way of escalating into major ones. But conflict hurts (e.g. friendships may suffer, families can be torn apart), even if not physically hurting. Where lies the proper balance between resistance and non-resistance?

8. Crisis. By the well-known Chinese dictum, it is a composite of danger and opportunity. Whecher or not we like or detest crisis depends on whether we are risk-takers or risk-avoiders. In any case, we do not usually get to choose whether or not we are plunged into a crisis. The original meaning was the point in an acute illness when it is decided whether a patient will live or die—the peak of decision. It means the same for the world. Some find it exhilarating to live at a hinge of history. Others agree with the old Chinese curse “May you live in interesting times”.

There could be more examples of moral and existential ambiguities. Why do peace activists usually favour “choice” in matters of abortion, while opponents of abortion usually do not oppose war or capital punishment’? Who is really “pro-life”? Why do we often take a dim view of government, while deplorlng its absence in “failed states” like Somalia’? Why do we deplore racist and sexist terms, and then cringe at demands to be “politically correct”? There are some answers but distinctions need to be carefully drawn.’

We live immersed in ambiguities, as we always did. There 1S no substitute for clear and discriminating thought in place of following seemingly clear but misleading slogans.

ROADS OF DESTINY.

In O. Henry's short story "The Roads of Destiny", the young shepherd-poet David decides to leave home after an argument with his girl-friend Yvonne and walks down the road out of his village in France, walking all night and getting farther away than he had ever been. He comes to a T-intersection. Does he walk left or right, or change his mind and return home?

The three parts of the story describe the alternative adventures that await him along each road. If he goes left, he rescues a beautiful young lady from her cruel uncle, marries her, but is killed in a duel with the uncle when he challenges him. He is shot through the heart by a shot from the pistol marked as belonging to the Marquis de Beaupertuys the cruel old uncle.

If David goes to the right, he comes to Paris where conspirators are planning to assassinate the king. He is asked by a beautiful young lady to deliver a message to the palace, presumably to summon a relative to the sickbed of her father, but actually a message to the plotters. He is caught, but professes his innocence and that of the lady. They put him to the test: will he dress as the king and ride in the carriage instead of the king? He does, and is shot by the plotters, who use the ornate pistol that used to belong to the Marquis de Beaupertuys and still bears his name.

If David decides to return to the village, he makes up with Yvonne, marries her, then inherits the flock of sheep from his father. He is rich and should be happy, but he continues to write his poems and neglects the sheep. The wolf attacks often and the herd decreases. Yvonne is angry.

Finally David goes to a man in town to find out about the value of his poems. He is told they are not very good, and he should go back to shepherding. He buys a gun and shoots himself to death. The gun he buys bears the name of the Marquis de Beaupertuis.

For David, the three roads diverged at the T-junction and then converged, to give him death by a bullet from the same pistol, under different circumstances and for very different reasons.

In the Einstein-Podolsky-Rosen (EPR) experiment, two photons fly apart from the same "annihilation" event (electron-positron collision). After they are so far apart that they cannot communicate (because of the finite velocity of light being the maximum velocity possible), an experimenter flips the spin of one of the photons. Automatically the spin of the other photon flips. It would not flip unless the other one did. The two photons act as if they are still connected by virtue of their common origin.

The common origin of the twin photons (one is tempted to say "identical twins") is like the T-junction in the diverging roads of David's destiny. The roads seem to diverge, but they preserve a common "spin", in this case David's death by a shot from the same pistol. No matter which road he takes, regardless of any free-will decision, the end result, and even the means by which it happens, is the same. It is like that other story, the man who was to meet Death in Samara.

Are events "pulled" from the future or "pushed" from the past? Do things happen because of causes or because of intentions? Could it be that causes and intentions meet at + or— infinity? That the pattern is "hyper-circular" like a hyperbola rather than a circle? Or like a series of tangent spikes rather than a sine wave? (Would this be like epilepsy spikes versus quiet brain alpha waves?)

Circle and hyperbola (along with elipse and parabola) are conic sections. The bi-cone (two cones meeting at the common vertex) can be seen as our relativistic time horizons into the

future and into the past. Our “life-line” has to stay within the bi-cone; we cannot reach the time-space beyond this, again because of the finite velocity of light. But future and past are symmetrical in this scheme. In our living experience the time-symmetry is broken; the past is (theoretically) knowable, the future is not. This is because we are (anti)entropic creatures.

We can think in terms of circles (cycles), like the carbon cycle and the nitrogen cycle and the water cycle. Usually we do this in terms of causes pushing from behind, until “what goes around comes around” to the same starting point. But we could think about it in terms of purposes or intentions, as in Aristotle’s “final cause”—although traditional biologists would accuse us of the crime of “vitalism”. But the circle would still close.

An ellipse, being a closed curve, is little different from a circle, as far of being either a diagram of (lagged or advanced) causes or purposes. Yet there is one difference: along the ascending branch lies ordinary causation (where the cause precedes the consequence), but along the descending branch, we have a case of “downward causation”, as Sperry postulated for the operation of the human brain.

A parabola is divergent, like Chaos. The classic “chaos equation” is a parabola. The diverging branches do not even approach any line asymptotically, as the branches of a hyperbola do. It is a transitional case between an ellipse and a hyperbola, between closed conic curves and open ones.

Or is a hyperbola really not an open curve? If + or—infinity is a point (for us unimaginable) opposite to zero, a hyperbola and a tangent could be “closed” through it like a strange loop.

But back to David and his destiny. He could have escaped death each time. On the left road, he could have avoided challenging the uncle, lived happily ever after with his lady. On the right road, he could have denounced the lady and not posed as the king in the carriage. On the road back, he could have been happy with Yvonne and the sheep. But what he could not do on any of the three roads is to give up his poetry, or his addiction to poetic/romantic situations. He essentially died for his devotion to poetry and adventure.

This story (as well as “Death in Samara”) seems to indicate that Fate writes only the endings of our stories, while our freewill decisions fill in the interim details. This is intriguing, but not very believable. In situations described by chaos theory, “fate” writes only the beginnings of stories (e.g. the development of weather), while divergence (still deterministic, but not predictable) occurs later. But then, chaos does not start from a strictly identical T-junction or a common annihilation event.

The fair lady on the left road and the right road represents David’s poetry. When he contemplates her (or “it” on the road back), Yvonne (who represents real life) is forgotten. David’s poetry is his Nemesis, whether it presents itself as a victim on the left road, or a vampire on the right road, or a fatal addiction on the backward road. Poetically, he would rather die a romantic death for his fair lady than to live a prosaic life with Yvonne and the sheep.

PHASE CHANGE TRANSITIONS.

There are arguments whether, in some circumstances, change has to be sudden, even violent; or whether there can be a smooth, gradual transition along a continuum of states. The first can be symbolized as a black square suddenly abutting a white square; the second by a rainbow from red to violet.

The answer is, it can be something in between. How can that be? Well, the mode' is the change from an oil-in-water emulsion to a water-in-oil emulsion. I call it the mayonnaise model: as you whisk the oil into the vinegar, with egg as the emulsifier, you engineer this phase change. The difference is, of course, which is the continuous phase and which is the dispersed phase.

This is partly gradual, as the oil droplets in water get bigger and bigger, but also discontinuous as the oil droplets coalesce to become interconnected and the water becomes dicrete droplets. at first big and then smaller and smaller, again gradually. There is a distinct, though not very drastic, phase change, like the punctuated equilibrium postulated by Steven J. Gould in biological evolution of new species. Which of course is another matter of controversy.

Another image emerges as you sail on a ship from Helsinki to Stockholm. Finland is an emulsion of water in land, in the form of numerous lakes. The adjacent Baltic sea in this region is an emulsion of land in water, in the form of numerous islands. Yet there is a distinct boundary between land and sea. The mayonnaise conversion is in fact sudden and sharp. On the planetary scale, the Earth's surface is an emulsion of continents in oceans.

So how does innovation occur? Sometimes, in a revolution, we have to wipe the slate clean in order to write a new text. You can't make an omelet without breaking eggs, as Lenin said. Sometimes an absolute monarchy can gradually turn into a democracy, as in British history. At other times, the change occurs gradually, and yet there is a decisive moment at which the regime flips into a new configuration, though still containing islands of the old order.

How do we achieve this third possibility? By introducing islands of the new, more desirable order into the matrix of the old. That is, live in small communities as if the new order already exists. And then whisk vigorously, to achieve the mayonnaise transition.

FOUR TRANSITIONS COMPARED.

The transition between the Ediacaran fauna in the late Precambrian (600-530 mya) and the age of true animals (the “Cambrian explosion”) is described in an article in The National Geographic, Feb. 1998. The Ediacaran creatures (whether animals or a quite separate kingdom is still in dispute) were multicellular, but thin and filamentous, and lacked any internal organs or even a mouth and an anus, though some could move. They fed on floating matter in the ocean, or harboured green algae capable of photosynthesis. There was no predation, no “cleavage into the hunters and the hunted”. It was an age of innocence, “the garden of Ediacara (Eden)”. The Precambrian-Cambrian boundary was a time of indecision: which would prevail, egalitarian innocence or savage competition? It turned out to be the latter. This was Nature’s Original Sin.

In the Biblical myth, the original sin, in my different interpretation, was the slaying of Abel by Cain. This too was a transition from innocence to violence. Perhaps it was somehow initiated by Adam and Eve gaining the knowledge of good and evil, which led to the expulsion from Eden. Evil could not be perpetrated without knowing that it was an option. Good rather than evil would have been the default option, like a female embryo to which the androgenic rush never comes. Perhaps that was God’s original intention. Yet He knew that violence (the Principalities and Powers) could be redeemed through the nonviolent coming of Jesus.

In the transition from human prehistory to written history, the great event (besides the invention of writing) was the invention of agriculture, which led to a settled lifestyle instead of a migratory one. Hunters and gatherers lived together peacefully and cooperatively, without gender or class domination. Riane Eisler described this in “The Chalice and the Blade”. War, slavery, patriarchy, and tyranny of rulers over the ruled originated at this time. The industrial and communication revolution only accelerated and escalated what the agricultural revolution had wrought, because of rapidly improving technology. Again, the transition was from innocence to the cult of power.

And what of the present? From the Keynesian welfare state (not quite democratic socialism, but at least a mixed economy), we are now emerging into super-capitalisms, which started as Thatcherism and Reaganomics and proceeded to corporative globalization. The rich people prosper to an indecent extent, while the poor people suffer. The gains of previous centuries in terms of health care and education and social programs are disappearing. Is this transition also inevitable, as the previous three have proved to be? Or can we still be saved even before redemption becomes necessary?

CULTURAL AND BIOLOGICAL EVOLUTION.

The same issue of Scientific American (February 1998) contains two articles: one describing the evolution of birds from dinosaurs, the other of Viking longships from dug-out canoes. The journal itself makes no links or comparisons between the two articles, but obviously there are parallels between the evolution of biology and technology, between change in organisms and artefacts.

It has been estimated (elsewhere) that technological (cultural) evolution is about a million times faster than biological evolution. The reason for its faster speed is that it is Lamarckian: we can teach the next generation directly what our generation has learned, without going through the long and awkward sequence of random genetic variation sifted by natural selection. Yet the process stages are very similar, though speeded up, like a tape recorder on “fast forward”. As wings grew on proto-birds, so sails grew on proto-ships. (Both adapted to the winds.) Running bipedally in late dinosaurs was like rowing the canoes—involving hind-limbs and front-limbs.

On that scale, a millennium (1000 years) of cultural (technological) evolution is like an eon (1 billion years) of biological evolution. (One billion is a million times 1000.) Life on Earth developed over 4 billion years, technology over about 4000 years. I count that from 2000 BC to 2000 AD. Are we completing something here? A limit to technology? But life on Earth is not finished yet

Also, possibly technological evolution proceeded more slowly at the beginning. E.g. 1 million years ago (beginning of the genus Homo), it may have evolved only 1000 times faster than biological evolution. (Control of fire and some tool-making began.) That is still quite a jump in speed. Some 100,000 years ago (beginning of Homo sapiens), the rate may have been some 10,000 times faster than biological change, especially because of the invention of language. And 10,000 years ago, with the beginning of agriculture, the rate of cultural evolution may have been 100,000 times faster than biological evolution, And finally, 500 years ago, the industrial revolution may have jumped this up to million times faster.

Will the rate still accelerate in the future? Is that sustainable? We may decide that we have reached the limits of technology. We have already switched, or are switching, from emphasis on industrial machines to information providing machines (computers etc.) This may be halfway to an even more radical switch to spiritual evolution. This was already illustrated in Peter Russell’s book and video, “The Global Brain”, and is the basis of Norman Alcock’s prediction in “The Trumpets of Angels”.

This is also reminiscent of Digby McLaren’s “The Three Revolution of Homo Sapiens”. The agricultural revolution was 10,000 years ago, the commercial-industrial revolution began 500 years ago, the information revolution began 10 years ago, and the spiritual revolution is due to begin any time now, as Alcock predicted. Let us hope it is not too late.

The agricultural revolution may correspond to a change in the material conditions of life (from hunting and gathering to animal-tending and crop-growing); the industrial revolution corresponds to the control of energy-production (which the very early Promethean revolution, the control of fire, foreshadowed), the information revolution is obviously increased control of information (foreshadowed by the early invention of language, later writing, still later printing), and the spiritual revolution, as far as we can tell, will be about the evolution of meaning.

And thus we have a manifestation of the four essences, in sequence: first matter, then energy, then information, and finally meaning.

LIMITS TO TRUST.

Breakdown can be a part of reorganization. The micro-tubules of the cytoskeleton are unstable, constantly dis-assembling and reassembling in new configurations. Proteins are constantly being created and destroyed. Red blood cells last only a few days or hours, but are replaced. Even more spectacularly, a caterpilar turning into a butterfly has most of its tissues “dissolved” and totally re-formed. One has to have deep trust that the body or nature knows what it is doing, when submitting to these seemingly risky processes.

A forest fire, a great extinction—both can lead to renewal. It is difficult to trust in the midst of a cataclysm, especially since it need not necessarily lead to renewal, it just might, as a possibility.

Even Phoenix can finally be destroyed by fire. There are limits to trust, and we all know it.

FAMILY BREAKDOWN.

The cult of free love that prevailed in the 1960s did not usher in the Age of Aquarius and a paradise of flower-children, but instead an increase in mother-headed single parent families. It turned out that the lack of a father, especially under conditions of poverty, creates sons who lack a super-ego (which the father would provide), and therefore have a tendency to engage in random violence, criminal, political, or impulsive/acausal, i.e. senseless.

As a reaction to this, the “New Victorians” are restoring traditional “family values”, but under Protestant fundamentalism and right-wing capitalism, i.e. modes that represent or encourage totalitarianism. We are heading either to a Hobbesian breakdown of the social order or to Orwellian/Huxleyan brave new world of malignant or benign dictatorship, with reality distorted by official lies. Alternatively, there may develop a non-class war between the two worlds.

How can we restore democratic ethics under a renewed social contract?

The old human family system, though restricting sexual freedom, had valid reaso~ for its existence—reasons that we did not even know in the 1960s. Fathers create the superego in their sons. Without it, the male id of the sons, created by the fetal and pubertal testosterone surges, rules supreme. This can cause an increase in both sexual urges (even inappropriate ones like pedophily) and impulsive aggression. Child molesters are an increasing problem in the West. Nearly all aggression, both in Somalia and the streets of New York, is committed by young males.

Even the ego (and the attendant self-preservation instinct) is weakened, creating high risk acceptance, the drugs and alcohol culture, propensity for AIDS ~esulting from unprotected sex, and the high rate of suic~des. (All these symptoms are accentuated in ancient native cultures that are breaking down under the impact of invading and dominating cultures, as in Canadian native communities.)

Do we have to go through breakdown to get to breakthrough? Like a forest fire renewing the forest? Can we somehow have psychologically healthy young men and sexual freedom (or only mild limits) at the same time? “To everything turn, turn, turnthere is a time for everything under Heaven.”

The human family is biologically determined (i.e. selected by evolution), not God-ordained. It needs a father as well as a mother. (Some vertebrates need neither, e.g. fish and reptiles in general, some only the mother. But humans, with the prologed period of childhood, need both.) We tamper with the family system at our peril.

Without fathers we get Hobbesian breakdown, but with overly strong fathers we get patriarchy. We need the softening, lubricating influence of mothers, to moderate or counteract the social effects of testosterone extremes, in sons and fathers. The female cycle of the Moon maiden builds up and down in a sinuous (sine) wave, toning down the male dichotomy of the bi-polar disease of either/or: frenzy or conformity, rebellion or apathy.

She mourns when new lii_ fails to implant, but renewed hope follows with the next estrogen surge. It is like a self-limited pendulum, something sustainable, not an exponential explosion or relentless decay. (The “Key” equation is solved in the alternate mode.) Let the world belong to the Great Mother. She creates and destroys like Shiva/Kali, but not wantonly or senselessly. She is the eternal cyclic Tao.

Estrogen is like seeking love and intimacy. Luteinizing hormone (LH) is the climax of generativity, but also the beginning of darkness at maximum light (Darkness at Noon, or

Walpurgisnacht -festival of witches—at the summer solstice.) This is where the climax of orgasm should occur. If it does, progesterone nurturing sets in~ and the Maiden becomes the Mother. If it fails, the womb sheds tears of blood for the life never to be. (A soul disappointed in Guv, with nose pressed longingly to the glass separating it from being.)

In families, mothers provide models of nurturance and togetherness for both daughters and sons. Daughters can continue in that mode, but at puberty (initiation) boys have to break away, steal the key to the wild man's cage from under the mother's pillow. If at this point the father's discipline or the tribe's initiation ceremony overcomes the third testosterone surge (the first two, masculinizing and defeminizing, occur in the womb), the teen-age son's id is sublimated from senseless rape and violence to noble selfsacrificing heroism, for higher causes like patriotism.

However, this is still part of the war system. Abraham was willing to sacrifice his son Isaac when the Superfather God told him so. In turn, Oedipus (though unaware) killed his father. Biologically, most sperm cells are sacrificed. They engage in a competitive race with only one winner; the Wall excludes the rest. The mother's system is different; it weeps over unrealized children.

However, there are counter-examples. Fathers also sacrifice daughters, as Agamemnon did Iphigenia, inciting a repeated revenge cycle in that dysfunctional family. And Medea killed her own children when she was betrayed by Jason. Yet I feel that these are exceptions to the general pattern discussed here.

FOUR ANIMAL EXAMPLES.

Example 1. Certain hermaphroditic worms, when they meet for copulation, fight with each other to function as the male partner, i.e. to penetrate the other. The reason is that the female partner dies soon after liberating the fertilized eggs into the surroundings. Both partners are capable of functioning as either male or female, but being penetrated, while perpetuating the species, is fatal to the individual worm.

Example 2. Whiptail lizards are all female; there are no males. Reproduction takes place by parthenogenesis. Still, someting like copulation takes place between two females, each in the opposite phase of her estrus cycle. The one who is in estrus, i.e. receptive, acts as the female; the other lizard, being in the opposite phase, mounts the first. The stimulation induces the estrus female to lay eggs.

Do we have here examples of male conflict among worms (a fight to the death) and of female cooperation (make love not war) among lizards?

It’s not that simple. Consider Example 3, the black widow spider, where the female eats the male during or after copulation. And even more Example 4, the fish species in which the male has shrunk to being merely a dependent appendage within the female body, a parasite with almost no organs, a mere sac of sperms for the female’s use.

Females can be deadly or imperialistic, not only graceful Lesbians performing their alternating ritual dance. And males can be victims as well as conquerors, slaves as well as heroes. All the while, life flows on.

MAJOR TRANSITIONS IN THE PROGRESSION OF LIFE.

This essay is based loosely on the book by John Maynard Smith and Eors Szathmary, “The Origins of Life: From the Birth of Life to the Origin of Language”, Oxford University Press, London and New York, 1999, 180 pp.

The basic model of the 8 major transitions is on page 17 of the book. I have somewhat rearranged it, in order to include some ideas from A.L. Oparin (“The Origin of Life”), Freeman Dyson (“Infinite in All Directions”), Stuart Kaufmann (“At Home in the Universe”), Ilya Prigogine (on dissipative structures, as explained in Erich Jantsch “The Self-Organizing Universe”), Lynn Margulis (on the origin of the eukaryotic cell), Jay Gould (on punctuated evolution), James Lovelock (“Ages of Gaia”) and Terence Deacon (“The Symbolic Species”, on the origin of language).

I see the major transitions as follows:

1. From equilibrium physical non-living structures to Prigoginian dissipative structures, open systems far from equilibrium, able to locally concentrate negentropy and persist. These were largely autocatalytic networks or cycles.

2. From autocatalytic or mutually catalytic networks (mainly proteins with ATP and other nucleotides as energy sources (Kaufmann)) to being enclosed in membranes (Oparin’s coacervates).

3. From energy-storing nucleotides to information-storing nucleic acids (probably RNA) by polymerization (Dyson). RNA is both an enzyme and a gene.

4. From RNA to DNA, which is more stable. This involved a conversion from RNA working as both enzyme and gene to the system of DNA acting as a gene and protein acting as an enzyme.

5. From independent DNA replicators to their association in chromosomes. There is now a functioning proto-cell, a prokaryote (bacterium).

6. From prokaryotes to eukaryotes (bacteria to protists) by a large cell swallowing some smaller ones (Margulis). Chromosomes assemble in cell nucleus.

7. From asexual clones to sexually reproducing populations (a boost to the rate of evolution).

8. From single-cell organisms to multicellular ones (from protists to fungi, plants, and animals). This required circulation systems (sap in plants, blood in animals).

9. From solitary individuals to eusocieties with reproductive castes (ants, bees).

10. From looser mammal and then primate societies to human societies, via language (Deacon).

So I end up with 10 rather than 8 transitions, by adding steps 1 and 3. The last two (9 and 10) can be seen as parallel rather than consecutive. One may wonder why we do not include the invention of photosynthesis and respiration, but this belongs to a different series, as outlined in “Ages of Gaia” by James Lovelock. It would come between steps 5 and 6, chronologically. We will refer to it later, as step 5.5.

The 10 major transitions can be partially correlated with some other scales that I have discussed previously. One is from Jantsch, as his successive “minds” (read: information systems): metabolic mind, genetic mind, epigenetic mind, hormonal mind, (to which I have added immune mind), and neural mind (to which can be added symbolic or language mind). Metabolic mind would correspond to step 2 (and of course continuing in all that follows), the genetic mind to steps 3, 4, and 5, epigenetic mind (exemplified in embryonic development) to steps 7 and 8, hormonal and immune mind to step 8, neural mind to step 8 and 9, and symbolic mind to step 10. These stages overlap to a great extent, so that I am uncertain about these assignments.

Another scheme is that derived from Psyche’s four tasks, which can be interpreted as a.the sorting of macromolecules (proteins and nucleic acids) to get functional structures, b.the taming of the fire from the H-O combination to tolerable levels in respiration, c.introducing circulation of sap or blood to feed multicellular creatures, and d.the invention of sex and programmed death. Then a. would correspond to steps 1 and 2, b. to step 5.5, c. to step 8, and d. to step 7. These are somewhat out of order.

Finally, we might note that Mendelian heredity is atomic (not infinitely divisible, discontinuous), like matter and electricity, and unlike time and space. This is parallel to the concepts of digital as opposed to analogue in computation. The latter can lead to chaos because of the indeterminacy of initial conditions (since on the line of real numbers there is a super-infinity of points). It is known that digital disks and tapes are clearer than analog ones.

So when replicators entered into incipient life forms, they converted the system from analog to digital form. Replication and reproduction is digital like iteration in mathematics and in computation. All computers have clocks, as do organisms. Both iteration operations and reproduction consist of discrete steps called generations. Since life is basically a conglomeration of information systems, being digital makes the transmission of messages more clear and distinct. Cycles, like the Krebs cycle in oxidative respiration, are also discrete batch processes, although they run continuously like a conveyor belt.

MOOD CHANGES.

Moods change without an obvious external cause. I feel high today, but I felt low two days ago, each time without any obvious reason.

This probably relates to internal body states: levels of hormones and neuro-transmitters. But these levels, in turn, are influenced by mental moods mediated by the brain. We may get cascades or avalanches: low mood leads to low neuro-transmitter levels, which further lower the mood, whichetc.

A cascade is like an open circle, a spiral. (easily represented geometrically). It can point up or down. A circle (cycle) represents negative feedback (homeostasis), a cascade is positive feedback, a runaway mechanism like an avalanche; it may be good or bad, depending on what it is that is accelerating. An arms race is bad, a love stimulating more love is good.

A sudden change is a catastrophe in Thorn's sense, i.e. a mathematical discontinuity. It may be a disaster or a breakthrough to novelty. It may lead to a new species in punctuated evolution.

Today my mood is up, as if all angels are speaking to me. Maybe it's because the stressful week of too many events crowding my time is over. with new energy, I can enter another such week later.

CASCADES.

Epigenetic traits (preparedness for behaviour if evoked by the environment) are the basis of adaptability. They are examples of “ifthen” logic, of conditionality. Another name for this is “pre-adaptation”.They are the paths guiding us into an uncertain future.

How can mere genes do that? “All they do is make proteins”, I once said contemptuously. They work through complex cascades, it seems. My skepticism was quite inappropriate. I have grossly under-estimated the capabilities of both genes and proteins.

The cascades are physical causal chains, like Rube Goldberg contraptions: the gene product (a protein), may allow the admission of a hormone into a cell, which will change the shape of a G-protein, which will facilitate the phosphorylation of yet another protein, which may activate cAMP (cyclic adenosine mono-phosphate), which may reach the nucleus to turn on another gene to produce its protein, or to cause mitosis and cell divisionBy such means, genes can exercise profound control over phenotypic traits, be they diseases or behaviours, or inclinations to certain behaviours if the environment favours them.

Probably, most of our behavioural repertoire is organized this way. It makes me think of the phrase from the Gaia book, “the little enzymes than run the world”. The link between the genetic propensity to act in a certain way and the environment which triggers the pre-programmed cues and elicits the behaviour makes the old nature VB. nurture argument quite irrelevant. It was a question wrongly put.

However, genes are not just originators of cascades, but also targets of other cascades. These work via the promoters, activators, and inhibitors that determine when a gene is “turned on” to initiate protein production. Genes are not “prime movers”, but parts of the nano-mechanism. They are not the “stars” of the process, but coordinated team players in the drama. The cascades become cycles, a seamless whole.

Who or what started the process? A primal switch at the moment of egg-sperm fusion? But the gametes already have pre-set mechanisms that are merely activated by fertilization. God at the creation? The “blind watchmaker” of evolution? There are no final answers, though we are allowed to speculate.

REGIME CHANGE.

Some systems switch from one regime (mode of operation) to another, either sequentially (permanently) or in alternating fashion. It is like a phase change. Usually a switch makes them change from one regime to another; the switch can be irreversible or reversible.

Examples of alternating regime changes through a reversible switch are: the wake-sleep cycle of the brain, with the switch in the brain stem; the quiescence-mitosis cycle of the cell; the ice-age—global warming cycle of the Earth's climate; the estrogen-progesterone female estrus cycle; and the cycle of the seasons in moderate latitudes.

However, the change is not simple; neither is the switch. Complex intermediate events happen during each transition. The wake-sleep cycle is controlled by circuits which reach from the brain stem to the midbrain. The initiation of the cell cycle is controlled by growth factors and inhibited by other cellular messages. The climate cycle may be set off by the wobble and inclination of the Earth axis. The estrus cycle is controlled by a cascade of hormonal messages originating in the pituitary gland. The seasonal cycle is controlled mainly by the Sun, but the day-to-day weather system is chaotic—it may even be upset by the wing of a butterfly.

NATURE-CULTURE LINKS.

Natural evolution is a very slow process; it works on the geological, not the human, time scale. Cultural evolution in human history is much faster; it first went about 1000 times faster, by now about a million times faster. Because knowledge of previous inventions can be imparted to following generations through education, cultural evolution is Lamarckian, while natural evolution remains Darwinian. Nevertheless, since natural evolution has proceeded for many eons of time, it has accumulated a multitude of inventions with which cultural evolution cannot yet compete. Proper respect should be paid to nature's achievements in appropriate mechanisms of coping with problems.

Cultural evolution can be divided into two main streams: technological and social/structural inventions. Humanity has advanced rapidly in technological evolution, especially during the 20th century, but has been rather sluggish in social innovations, although many of these exist as well. This gap must be closed, and soon, if we want to continue to flourish.

Cultural evolution has filled some of the lacunae that natural evolution could not provide. Stephen J. Gould explains why animals never move on wheels: muscles can manage only pushes and pulls, not rotary motion. Whenever I see a person on a bicycle, I am keenly aware that a technological invention has overcome this difficulty in a rather elegant way.

There are many simple technological inventions that are nevertheless admirable for their ingenuity: the safety pin, the sewing needle, the paper clip, the clothes peg (the latter commemorated in a statue in Philadelphia), the lock and key,.screws and nails, screwdrivers and hammers, knitting needles, and crochet hooks. Somewhat more complex is the bicycle, the treadle-operated sewing machine, the spinning wheel, the for weaving, and the manual typewriter. All of these are merely combinations of levers, pulleys, wheels, and inclined planes, all called "simple machines".

There were chemical processes invented by early humans:

cooking food, tanning hides, metallurgy, glass-making, pottery. In agriculture came the plough, the spade and the rake. In the industrial age came engines, using energy from water, steam, or electricity. Means of transportation came in, like trains and automobiles, steamships, and later airplanes. Factories were equipped with manufacturing devices. Electricity led to communication devices like telegraph, telephone, radio, television, household electrical appliances, and night-time lighting.

We could all do very well without high technology, which uses electricity, electronics, nuclear energy, space rockets, and computers. I can understand technology only up to the second stage of manually operated machines, and perhaps somewhat heat engines. Beyond that, I just use them without understanding how they work, which is not very satisfactory.

How do these technological inventions substitute for the lack of our natural endowments? Sewing, spinning and weaving tools, as well as carpentry tools are extensions of hands, engines substitute for muscles, trains and planes extend leg power, computers extend brain power, especially in lengthy calculations, telephones and radios are extensions of ears, television, telescopes and microscopes extend the scope of natural vision. Many other examples could be named.

How are we doing on social inventions? Living together in groups was certainly an advance on a solitary lifestyle—which probably never existed, because our primate ancestors already lived in groups. Language is the primary distinction between humans and other primates, and is so basic that without it social evolution could probably not have occurred. Social communication skills further improved with the invention of writing, and later of printing.

(Much later of photocopying.) But the latter are still somewhat in the class of technological inventions.

Social grouping evolved from family clans to larger tribes, still based loosely on kinship and marriage. First these were quite egalitarian, but later chiefs emerged, first based on superior skills (including social skills) and knowledge, later becoming hereditary or following rigid rules of succession. Eventually, the chiefs of larger groupings became kings, combining the functions of secular rule and priesthood. Then kingdoms became empires, which grew territorially and fell apart periodically, to be replaced by others. There were slaves, serfs, free subjects, artisans and merchants, soldiers and mercenaries, nobles and clergy, kings and their courts, and emperors above all.

This was an evolution toward rigid hierarchies, a caste system that seemed unchangeable. Yet in time it started to break down toward more democracy and equality. Slaves were freed, kings were replaced by presidents and prime ministers, parliaments were elected, women were recognized as equal to men as citizens. “Sovereignty” was transferred from kings and emperors to the people. This transition is still incomplete in our world today.

There is also a trend toward global institutions, both governmental and non-governmental. In our day, the power of corporations seems to be greater than either, and also greater than most states. Wars are changing in nature, but still raging savagely, now often deliberately targeting civilians. Weapons of mass destruction could destroy everybody several times over in half an hour. Resources are being exploited faster than they are replaced. Streams, oceans, lakes, the air and the land are increasingly polluted, often with toxic or radioactive waste. Obviously the evolution described in this paragraph is going in the negative direction, and needs to be remedied or reversed.

All except the first sentence of the above paragraph. To achieve human unity is a praiseworthy goal, but must be combined with the democratic trend described in the previous paragraph. We must also evolve psychologically and spiritually, away from greed and power-hunger, toward compassion and nonviolence. In the future, if there is to be one, we must evolve toward a culture of peace.

CREB TO AYLA TO ...

From Jean Auer's books about earlt humans, "The Cave Bear"

Turn from past to future,
from memories to invention;
when present forms the suture,
cheer change before convention.

As talk did veer from hands to mouth,
women were more equal;
When the ice extended South,
there was a colder sequel.

From Creb to Ayla leads the path,
regret and expectation;
yet neither love nor righteous wrath
gives any consolation.

And whereto now? Oh who can tell?
The path should be unending.
for them, for us, has rung the bell,
from even to morn now blending.

O Lady Midnight, give us pause,
refusal unrelenting;
Yet morning light will give Her cause
to go beyond repenting.

From Golden Age to Golden Age,
through Kali Yuga passing;
from nimble youth to wise old sage
experience amassing.

As each of us proceeds through stages,
with losses and with gains,
so will whole species history pages
proceed to new domains.

So don't cry for the setting sun
or winter's grasping frost;
the morning will have soon begun,
replace spring buds now lost.

Feel no regrets that we won't see it.
Thy will alone, and so must be it.

SUDDEN ORIGINS.

This essay is based on the book by Jeffrey H. Schwartz of the same name (Wiley, New York, 1999, 420 pp. The sub-title is “Fossils, Genes, and the Emergence of Species”.

After a lengthy and rather tedious history of previous thinkers and experimentalists in the fields of paleontology, genetics, population genetics, embryology, and evolution, the author introduces his own theory in the last 70 pages, mainly the last 10. It is really a merger of Mendelian genetics and embryonic development with Darwinian evolution, with some novel and interesting insights.

Major mutations in dominant alleles are apt to be rapidly eliminated by natural selection, if they are deleterious, which they usually are. On the other hand, major mutations in recessive alleles can persist, because they are not expressed in the phenotype. They can even spread through the population in the heterozygous form. But eventually, when there are enough heterozygotes with the new trait, two recessives will meet in many individuals, and the mutation will quite suddenly become obvious. This may be the basis for observations by De Vries and Stephen Jay Gould (punctuated evolution) on the sudden emergence of new forms, and the lack of fossils of transitional forms bridging related species. It also answers the creationists’ objection to evolution, about the lack of usefulness of a partly developed wing or eye.

The homozygotes expressing the new trait may be different enough from the normal population that mating will not occur (a sort of a voluntary barrier, as may have existed between Cromagnons and Neanderthals in Europe). The mutated homozygotes may then be converted into a new species. Then the recessive nature of the mutated gene will become dominant. (He is not clear how that happens.) He is also not clear why the mutation would still not be deleterious; perhaps, if enough time elapsed while it was in a recessive state, environmental conditions may have changed, and the new species would now be pre-adapted for it.

If the mutation is in a Homeobox gene, i.e. a regulatory rather than a structural gene, the mutation may be quite large (the larger the higher the regulatory gene is in the hierarchy of the regulatory cascade). Homeobox genes are currently being identified in studies of embryonic development.

The shift in body form (e.g. the change from a fish’s fin to a tetrapod limb, or the creation of an eye where there was none before) may lead to a higher peak of fitness from a lower one (or it may not). But it must pass through a valley of lower fitness, a transitional form, where it is in danger of being eliminated by natural selection. It may succeed in passing through the danger zone if given enough time in the recessive state, where natural selection cannot act on it because it is hidden. This process really amounts to “a revolution from below”, a true subversion of dominators by the oppressed. Is this model applicable to human societies?

Recessive alleles spread by supporting each other when they meet, in a way reminiscent of tit-for-tat cooperators invading a field of “meanies” in game tournaments of Prisoner’s Dilemma games, according to Robert Axelrod (see his book “The Evolution of Cooperation”). Is this the way in which the oppressed or the innovators can subvert the dominant system, by mutual cooperation and solidarity?

Schwartz’s theory is quite appealing. It bridges previous debates between adherents of Darwinian concepts of continuous variation being acted upon by natural selection, and the discontinuous process of Mendelian genetics. As I see it, the dilemma was solved by including input from embryology. It is a great argument for interdisciplinary co-operation

among scientists. Narrow specialists would probably miss this insight.

SCIENCE AND HISTORY.

Science and history are like being and becoming. Science is eternally valid laws, history means evolving relationships.

You wonder what was happening in evolutionary transitions, too rapid to be recorded in fossils? Well, wonder no more: you are in the midst of such a period, between the fractal rungs of the Devil's staircase, becoming or collapsing.

Yet most of evolutionary time is spent on the plateaus. The steady state of Being is our Holy Grail in these troubled ("interesting") times, a diamond vessel we can barely imagine. Plateaus are the quiet oases away from the sandstorms of the scorching desert. The end of history, at least for a time, until the fever of becoming grips us again.

Yet without the storms of becoming, we would still be stuck in dead equilibrium, the only state in which science (thermodynamics) strictly applies for eternity.

FIVE THEORIES OF EVOLUTION.

While the theory of biological evolution is generally accepted among scientists as a factual history of life on Earth, opinions differ as to the mechanism of evolution. I can think of at least five versions: Darwin, Dawkins, Gould, Teilhard de Chardin, and Lovelock.

For Darwin, there are small variations in inherited traits, and those individuals possessing traits which enable them to most successfully cope with existing environmental challenges leave more descendants in the next generation than the ones with less ~uccessful traits. This is natural selection. Note: not necessarily a bloody struggle for existence, as some social Darwinists would have it.

Dawkins had the advantage over Darwin in knowing about the mechanism of inheritance, namely genes. (The rules of heredity were discovered by Mendel prior to the discovery of genes.) He developed the theory of the selfish gene, according to which it is the genes that struggle for survival, while the rest of the animal body is just the mortal coil that is shuffled off. (But the body is also the vehicle for testing the fitness of the genes.)

Gould asserts that evolution does not depend on small variations, as Darwin thought, but on big leaps of change (formation of new species, or even higher taxa), followed by plateaus of no change (status quo maintenance). This is punctuated evolution. Later. Jeffrey H. Schwartz (“Sudden Origins”, Wiley, New York, 1999) suggested a mechanism: big transformations occur when homeobox genes (which control the structural genes in a hierarchical arrangement) mutate.

The above three theories assume that there is no purposiveness or goal in evolution; that things happen mechanistically, by blind chance. Dawkins speaks of “The Blind Watchmaker” (the title of one of his books). Gould specically assigns a large role to contingency and good luck in survival success, rather than fitness. (“It depends on whose pool happened to dry up”) All this is in sharp contradiction to Biblical theories of special creation in Genesis, where God purposefully created living creatures and people.

The two following theories do not go back to creationism, but do assume that evolution has a goal, such as greater complexity or specifically human consciousness. These are theories of orthogonal evolution.

Teilhard de Chardin was both an evolutionary biologist and a Catholic priest. He conceived of evolution as ascending a ladder of ever-increasing perfection, in accordance with God’s will. Gradually, as the biosphere enveloped the Earth, topping the geosphere, hydrosphere, and atmosphere, a fourth layer is developing, the noosphere, the realm of conscious thought and knowledge. All this started from the Alpha point and will continue for many eons to the Omega point of God-like perfection.

Lovelock’s Gaia theory is more Earth-bound, so to speak. He sees the Earth itself as a huge living organism, maintaining balance or homeostasis provided by its biota, especially the lowly bacteria and other small organisms. Thus average temperature remains constant, in spite of fluctuations in solar radiation, ocean salinity remains constant, and the oxygen-carbon dioxide balance is maintained by the combination of photosynthesis and respiration. This homeostasis is not consciously aimed at, but develops naturally. If it had not done so (as happened on other planets), we would not be here to think about it. (The anthropic principle, often invoked by cosmologists when talking about the fine-tuning of certain physical constants.)

Which theory comes closer to the truth? I don’t know of any empirical tests that would decide between them. Darwin was handicapped by not knowing about genes. His main merit

stems from establishing evolution as a fact (though there were predecessors). I have a personal dislike of Dawkins' theory, because I think that the human brain now takes precedence over genes, in the form of cultural evolution. Calling genes "selfish" assumes some kind of consciousness for genes, which is a leap of credibility. (He would disclaim making this assumption, saying "the genes act AS IF they were selfish"). I very much like the Gould-Schwartz scheme, because it is in line with my theories of stair-like mechanisms. And I certainly would accept some parts of Teilhard's and Lovelock's imaginative schemes, while avoiding the "New Age" sheen on them. But all this is only a matter of personal preference, not scientific evidence.

BOTTLENECKS.

It is generally recognized that humanity underwent a great transition some 10,000 years ago, with the agricultural revolution and the transition to the Iron Age. Was it progress or regress? It facilitated a much increased population and the building of cities and empires, but also initiated slavery, patriarchy, and war. Perhaps the ancient Greeks and Hindu sages were right in saying that the Iron Age (Kali Yuga) was much more savage than the preceding Silver and (before that) Golden Age, a descent into darkness. But we moderns Se the Iron Age as a technological advance from the Stone Age, the Neolithic and (before that) the Paleolithic.

Be that as it may, there was probably an earlier great transition, some 50,000 to 100,000 years ago. This is foreshadowed in the Biblical story of the Flood and similar legends throughout the Middle East. This may signify the end of the last Ice Age and the flooding that may have followed from the melting of the glaciers in the subsequent global warming; or it may refer to the filling of the (previously dry) Mediterranean basin as the barrier from the Atlantic Ocean at Gibraltar (the Pillars of Hercules) broke open. The flood may have also submerged Atlantis, with its previous high civilization. Fantastic, but perhaps possible.

In any case, it is reasonable to assume that the Ice Age and its violent aftermath caused a severe bottleneck in the human population of that time, sparse enough already before that. Perhaps humanity came close to extinction, with only remnants of a few thousand left, as in today's endangered species. The remnant is symbolized by Noah and his family surviving in the Ark.

Yet with the recovery came renewal. New and much improved stone tools were invented, art flourished as in the cave paintings in Southwestern France. This may have been the time when language first fully blossomed, though there may have been precedents. Terrence Deacon also thinks that meat-eating (carnivory) and hunting began during the ice age, when vegetation supplies ran low; and hunting led to division of labour between genders (though still with equality). Since stable family bonds were needed for the rearing of children, and fathers spent time away hunting, the faithfulness of wives had to be maintained by marriage vows, which required elaborate language. And the reason why women did not hunt was the immaturity and helplessness of human infants, and this was because they had to be born early or the large human head could not pass through the pelvic bonesHow one thing leads to another!

Anyhow, this great transition marks the passage from the Old Paleolithic to the New Paleolithic, very different parts of the Old stone Age, recognized by archeologists. The Neolithic, of course, came much later.

Turning from the past to the future: Do we now have to go through another severe population bottleneck as another as another global warming is upon us? The bitter irony is that this catastrophe is largely caused by our own activities. The Bible Code predicts, disasters, and asks "Can you change it?" Perhaps not in time; our time-horizon is too short. Anyhow in the very long range, perhaps the remnant (may there be one!) will produce a new flowering of arts and skills yet undreamt of.

When micro-organisms are developing resistance to antibiotics, most of them die off because they fail to adapt to the new environment, but a few mutate and survive, and are then resistant to this antibiotic. The species successfully passes through a bottleneck in terms the population numbers in each generation.

If humanity is to undergo a transformation (biological or cultural) to an enlightened new lifeform in the face of threats from wars or environmental change, probably the majority will

succumb and die off, while the few enlightened ones survive and fix the problems. The Son of Man will supersede the Old Adam.

At the battle of Armageddon, predicted in the Book of Revelation, 'God will sort the sheep from the goats and only the sheep will survive to enjoy God's kingdom on earth. Many are called, but few are chosen. Note: Many are CULLED. God shows no mercy.

All the great extinctions in the history of the Earth were bottlenecks of this kind. Possibly there was a human bottleneck at the flooding of Atlantis, from which no written history was preserved. There may even have been several such episodes, one for each of the Ice Ages.

Is this good or bad? I cannot help feeling compassion for the goats, of which I am probably one. Strange, that most predictors of the doomsday culling assume that they are among the sheep. But this is punctuated evolution, and it is God's and nature's way. If you cry out in protest, no one will hear you.

THE SNOWBALL EARTH.

Apparently, some 700 million years ago, drastic cooling occurred on the Earth, causing the planet to be entirely covered by ice and snow—giant glaciers covering even the tropics. The cooling was caused by a draw-down of carbon dioxide from the atmosphere: the newly photosynthesizing algae in the ocean started to grow calcium carbonate shells (became foraminifera), and when they died, they sank to the ocean bottom, carrying the carbon they had drawn from the atmosphere down with them in these shells. The ocean floor, carried on the slow conv~ior belt of the moving tectonic plates, eventually subducts deep into the mantle, and the carbon with it. Some scientists even think that the tectonic plates started moving because of the weight of the calcium carbonate on the ocean floor.

Carbon dioxide in the atmosphere is a greenhouse gas, and provides a warming blanket by reflecting heat back to the earth's surface. cooling occurs in its absence or increasing scarcity. But then also intervenes the "runaway albedo" effect: as the surface becomes white with snow and ice (first in the polar regions), it reflects more and more sunlight back into space. This becomes a self-accelerating mechanism, a vicious circle, eventually freezing over the entire planet. This shows that natural Gaia cycles, usually benign in maintaining a steady-state balance, can turn malicious, and veer off away from a balanced state.

Early life in the ocean must have undergone a major extinction at this time. However, it managed to hang on at hot springs, deep vents at ocean floor rifts where new ocean floor is formed from the deep, and at fresh volcanic craters. In other words, geothermal heat sources (Vulcan) somewhat made up for the shortage of solar heat (Helios).

Because these islands of life were isolated, evolution accelerated. (This usually happens after a major extinction.). This was the time of transition from the Precambrian to the cambrian, which witnessed "the explosion of animals", a very rapid evolution of all the animal phyla, plus some that that died out later (preserved in the Burgess shale).

Eventually the runaway cooling process was broken. The tectonic conveyor belt returned calcium carbonate to the ocean floor at the deep vents (the very spots of life survival). Volcanic action resupplied carbon dioxide to the atmosphere directly from magma sources fed from deep in the mantle. Thus, slowly, the Earth's warming blanket of greenhouse gas was restored, and the glaciers retreated. The cycle may be repeated, if there are enough sea organisms covered in calcium carbonate shells. (Many organisms use silica shells.) The time since the snowball earth disaster has not been long enough to show.

Of course, a rapid deep freez~ could be produced by blocking the Sun's rays from reach1ng the Earth. Nuclear explosions of a few hundred hy~rogen bombs could throw enough soot into the air to trigger "nuclear w1nter", stopping sunlight from coming 1n for several years. Th1s 1S a short time geologically, but if photosynthes1s stops, there are no crops; animals and humans starve to death. When sunlight returns, it would find a frozen desert. L1fe might come back eventually, iL ~ome new, rapiy evolv1ng forms, perhaps more intelligent than the spec1es that wrought such destruction.

ATLANTIS.

Atlantis could have been real. When ocean levels were low in the Ice Age, sub-ocean highlands could have emerged as (extended) islands. Perhaps it could have been in the enlarged Azores or enlarged Canary Islands. Or in the Sargasso Sea. Or on the Mid-Atlantic Ridge, as a result of some volcanic activity.

But could there have been early human habitation? Or even a high culture, as reported by Plato? There could have been several waves of unknown ancient civilizations, in ice ages or interglacial periods, whose evidence has been totally erased by catastrophes such as floods. Human populations would have undergone severe bottlenecks or near-extinctions.

That is why so little is known about this possible pre-history. Yet myths and legends may indicate some ancient knowledge that somehow got through. There may have been several Adam-Noah cycles. We are the descendants of the multiple Noahs. Will the cycles be repeated?

PLANNED GRADUALISM.

The DNA in a seed or an embryo knows both the short range and the long-range of its structure, although they are not the same. It knows what it is, what it will immediately become, and what it will eventually be, with a complete knowledge of all the intermediate stages. Even death is preprogrammed.

Can we plan social development (e.g. a world legislature) that way? No, we are not as smart as nature. Although the Falk-Strauss paper nutlines some transition stages from an NGO assembly to an elected world legislature, the steps are tentative and vague, not predetermined.

We only know how to drastically change social structure by sudden revolution (whether bloody or velvet), which is a process that often destroys what is valuable along with what was obsolete (throwing out the baby with the bath water). And we do this with incomplete knowledge of the consequences. It could be breakdown rather than breakthrough. Yet we can't make an omelet without breaking eggs, as Lenin said.

But wait: The very first time nature did it, it was evolution, where steps of change are usually tentative and often fail. What the seed or embryo do is only development, carefully pre-programmed from past experience. We EVOLVE new social structures, not DEVELOP them.

Even evolution was probably "punctuated" (according to Gould), i.e. sudden, by revolution. Once done, the process gets easier; that is the explanation of morphogenesis. Finally it gets automatic, as in embryonic development.

So perhaps social evolution is not very different from biological evolution. Nature is NOT smarter than we are; it is just a "blind watchmaker" with lots of time. We can work a million times faster. Of course, we can fail through counter-intuitive unintended consequences, i.e. through lethal mutations, which are far more common than beneficial mutations.

Do we have a choice? Stagnating organisms or structures are fragile, vulnerable to changes in environment or circumstances. We'd better try "pre-adapting" before catastrophe strikes. (Indications are already here.) I am tempted to say "Damn the torpedoes, full speed ahead"—but I am trying to avoid military metaphors.

FROM PERNICIOUS TO BENEFICENT ANARCHY.

(This is a reaction to an article by Scott Turner, “Global civil Society, Anarchy and Governance; Assessing an Emergent Paradigm”, Journal of Peace Research, Vol. 35, No.1, January 1998, pp. 25-42.)

This paradigm change is a path from Hobbes to Kropotkin. In Hobbesian anarchy, human nature is assumed to be evil. In Kropotkian anarchy, human nature is assumed to be good. Perhaps imperfect humans had to pass through Leviathan (the state-centric syst~m) until they transformed into better beings worthy of cooperative anarchy. But maybe we are not there yet, and this paradigm change is premature.

We are not wholly evil nor wholly good. Leviathan need not be a dictatorial monster, but can be relatively democratic while enforcing (sometimes by force) generally agreedupon rules. A world government need not be a global Leviathan, but it is also not the final Utopia. Laws (as just as possible), administered with a minimum of force, are still necessary.

Unfortunately we do not have this. The international system is the best example we have of Hobbesian anarchy. Every state assumes that it may be attacked at any time by another state. This (partly rational) fear leads to costly and dangerous arms races, and often excessively destructive wars. But wait a minute—most wars by far are no longer international, but rather internaL Maybe the system is changing. The quantitative and qualitative growth of the role of NGOs also indicates this. NGOs do not necessarily cooperate with each other or with governments or the U.N.; but they are not as paranoid about assuming that others are about to do them in. And they “fight”, when they do, nonviolently, though sometimes competitively.

In nature, ecosystem equilibria consist partly of Darwinian competition (which is very violent in terms of predation), and partly of Kropotkian cooperation (nonviolent in commensualism and even more extreme in sYmbiosis, where organisms become indispensible partners to each other). Some relationships can pass from one extreme (parasitism) to the other (symbiosis) through mutual adaptation over hundreds of millions of years. This mix of conflict and cooperation in ecosystems is called coordination. It is not like the Garden of Eden (or Garden of Ediacara, where no creature ate another), not a final Utopia, but a smoothly operating system, running stably in interweaving cycles.

Yet what about the pain and suffering involved in predation and parasitic diseases? This would be unacceptable to compassionate human beings. Perhaps nature should not have given to animals a nervous system that can feel pain and fear. But Mother Nature knows nothing about ethics, like the unfeeling God depicted in the Book of Job, who merely boasts of his power, being quite devoid of love. We ethical beings feel that predation should be painless, being just a circulation of living matter through the ecosystem. Yet even plants (without a nervous system) defend themselves by extruding poisonous substances or having thorns. The instinct of self-preservation is essential for survival, or rather has survived because it was useful. No creature feels allegiance to the ecosystem as a whole. The element of struggle for survival is useful, ;ven at the cost of suffering.

By analogy, global human society, at this stage of its development at least, cannot do without some use of force (which means violence and coercion). Conflict and cooperation must still be part of the mix, even at the cost of blood, sweat and tears. But during our transformation into nonviolent saints, we can and should gradually minimize the use of force and conflict. Only by practice will we learn how.

That conflict too could be part of an overall harmony or coordination is a strange idea. But a network (“graph”) can have negative as well as positive links between its nodes. Such a

network is “balanced” in the cognitive sense (recognizing friends and enemies) only if there is an even number of negative links (the number of them does not otherwise matter). Positive links have no such limitations.

Tit-for-tat cooperators, made famous by Robert Axelrod in computer game tournaments using Prisoners’ Dilemma, (“Evolution of Cooperation”), use negatives too, in punishing the other player’s non-cooperation. But they must be forgiving in subsequent rounds of the game. Total cooperation, insensitive to the other player’s moves, would only invite exploitation, and act as a temptation and a trap to the other player, turning him less and less compassionate.

So NGOs don’t always cooperate, but they often do. They are not always democratic, but they sometimes are. However, mainly they have the fluidity, adaptability, and capacity to learn from experience that a global Leviathan, with his rigidity, cannot have.

We need a democratic and just world government (a much softened Hobbesian Leviathan) as well as a horizontal mix of NGOs, GOs, and other institutions (a complex Kropotkian anarchy) in the world today, somewhat along the lines of the outline in a previous essay, “vertical and Horizontal Integration”. Only in this way can we achieve the transition from a Hobbesian to a Kropotkian anarchy, as our moral nature gradually improves.

THE CIVILIZATORY HEXAGON.

The civilizatory hexagon is a model proposed by Dieter Senghaas, the German peace researcher. It consists of six principles practised (ideally) in a modern democratic state: monopoly on the use of force, rule of law, interdependence and affective control, democratic participation, social justice, and constructive conflict resolution.

Regardless of Senghaas' original intention, I want to use the civilizatory hexagon as a model of development of the modern democratic s~dte, with the six characteristics as consecutive stages of development. However, before expanding on this scheme, I want to preface this by discussing some previous stages in the development of human society according to anthropological models.

These models are taken from J.M.G. van der Dennen's book "The Origin of War". According to this book (page 347), Sahlins (1961) and Service (1962) proposed a scheme of social evolution in four stages: the band, the tribe, the chiefdom, and finally the state. A band is only a loose association of families, more or less residential. A tribe is a large collection of bands, gradually developing some structure; this ranges from non-segmentary to segmentary and from acephalous to more centralized. This trend to hierarchy (class distinction) and centralization is further emphasized in the third stage, the chiefdom, and then especially in the fourth stage, the state.

Thus development proceeds from an egalitarian group to accepting rank (based mainly on age and sex, but perhaps also on hunting or other skills), then stratification (i.e. class, status passed down in families), and finally establishing a ruling chief and then a king. (The latter is based on a scheme by Fried (1967), and Hunter and Whitten (1976).) The egalitarian order in bands and early tribes existed in hunter-gatherer societies. The beginnings of rank, stratification, and hierarchy were in agricultural-pastoral societies. The stage of building cities would go with the age of city states, followed by kingdoms and then empires, all being the early forms of the state.

Why did this trend toward hierarchy and centralization develop? I suppose Hobbes would say, to prevent the war of all against all, to cement society into order from a state of anarchy. However, the early egalitarian societies were not anarchic in Hobbes' sense, they were anarchic in Kropotkin's sense, i.e. peaceful. The image is that of Rousseau's noble savage, of Abel rather than Cain. (Although, according to the Genesis myth, humanity are the descendants of Cain, since Abel did not pass on his genes. But maybe he did, before he was killed. And Adam and Eve may have had other offspring.)

I would surmise that there were some individuals eager to acquire power, and they created the hierarchy. Perhaps, in the developing agricultural revolution, they wanted to protect their accumulated food supplies from robbers. Robbers would be the unsatisfied strivers for power and wealth. Thus Kropotkin anarchy gradually transformed itself to Hobbesian anarchy, as the noble savage became a prudent and cunning peasant. Then, of course, law and authority had to be introduced in some kind of a tacit or implied social contract. This was sanct-ioned by religion, e.g. in the Ten Commandments, especially "thou shalt not kill" and "thou shalt not steal".

So now we are ready to enter the Senghaas scheme. In the state, the most fundamental rule is the state's monopoly on the use of coercive force, i.e. violence. Notice that violence is not abolished, it is centralized ("kicked upstairs"). Anyone else using violence is a criminal or a rebel and must be punished. This presumably takes care of "violence from below" (though it never quite disappears), while "violence from above" recognizes no limits. This was the case in early kingdoms and empires, where the king or emperor decided everything, even had powers of life and death. If he was compassionate, he somewhat limited his own application

of coercive power to his subjects. If he was malevolent, he became a ruthless tyrant (Hobbes' Leviathan), and his subjects had to submit, unless a rebel could overthrow him—and perhaps the liberator would become a tyrant in his stead, as happened in many revolutions.

The next Senghaas stage introduces the rule of law. The ruler's power was now limited by some kind of constitution, explicitly written down, or informal and implicit. Thus began the opposite trend to centralization, namely a loosening of tyranny, and a transformation of subjects into citizens.

However, this initial change was merely legal. Some emotional response from the citizens was also needed. As the state society became interdependent economically (division of labour among cultivators, merchants, artisans etc.), it also developed political ties in the form of feelings of loyalty and allegiance toward the state. Patriotism was born (later to degenerate into exclusive nationalism). Treason became a greater crime than theft or even murder.

Then citizens began to demand a greater say in state decision-making. Democratic institutions were introduced: parliament, elections, political parties, citizen pressure groups. The head of state (king or president) became even more limited in power. Eventually, he or she only reigned symbolically, did not govern in fact, like the British Queen. However, presidents or prime ministers still governed in a fairly centralized way, even in federations like the u.s. and Canada.

Democracy developed gradually in Iceland and Britain, by revolution in America and France. Even in our own day, democracies and dictatorships coexist in the world. There have been waves of democratization, as well as regressions to dictatorship. And democracies are not perfect or ideal. There seem to be degrees of democracy; it is a continuum, not a bipolarity.

Next, majority rule in democracies was further softened by observing the human ~lghts of minorities, which could not be legislated away without the consent of the minorities. This was the origin of the human rights tradition and its various charters and declarations.

The next two stages are still problematic, although there are indications of progress. Social justice is not necessarily established by giving citizens the vote, as early theorists expected. There is a lot of manipulation of public opinion by powerful elites and the media. Economic capitalism produces social inequality in democracies. Democratic socialism aspires to providing justice along with freedom, but it has been in decline in recent years.

Finally, constructive conflict resolution has been rather rare. Conflicts in democracies are resolved somehow, but not always constructively. The prevalent mode has been settlement or compromise between opposing interests, using the adversarial model; not true transformation or reconciliation in the cooperative mode. Therefore settlements and compromises eventually break down, as the balance of power between interest groups shifts. Lasting reconciliation can come only from transformation of the interests themselves, from pursuing selfish gain to seeking the well-being of the whole society.

While Adam Smith thought that "the invisible hand" would channel selfish pursuits by individuals to produce beneficial effects for society as a whole, this applies only in some cases, as in free markets composed of many small producers and consumers. It is not a general rule for all social interactions, or even all economic transactions (e.g. when producers become oligopolies, i.e. large corporations). The opposite model is the Prisoner's Dilemma game, in which the pursuit of selfish interests by the players lead to suboptimal outcomes even for the players themselves. The invisible hand can be either benevolent or malevolent, depending on the circumstances.

Rousseau aimed at achieving the greatest good of society by having individuals suppress their selfish interests and voting directly for the greatest good of society. This was his concept of “the general will”. Ants and bees do this in their “eusocieties”, closely integrated as ant-hills and bee-hives. However, human society is not a eusociety, it is much less closely integrated; it values individual freedom, as long as it does not harm ,thers or society. J.S. Mill formulated this in his famo,,“s essay “On Liberty”.

Rousseau’s “general will” idea only led to wholesale suppression of minorities as “enemies of the state”, in the reign of terror that followed the French Revolution, which was repeated after the Russian Revolution. Robespierre and Stalin surely do not re~resent human progress. Yet the idea that individuals should aim altruistically at the greater good of society has merit. Can we try again, in a better spirit? We might succeed if we can evolve into more spiritual and moral beings. Then terror and suppression would be irrelevant, as we would engage in spontaneous altruism. But at present, human nature is not up to creating this Utopia, and attempts to do this prematurely have resulted in the major catastrophes of the modern age.

What about international society, the unity of humankind? This does not yet quite exist, although some enlightened individuals already consider themselves world citizens. There has been progress in international society, which is formally anarchic in the Hobbesian sense, but is in reality approaching the Grotian stage, with some influence of international law in some cases, while still far from the Kantian stage, which would be wholly cooperative like an ideal domestic society.

Also, an important result of peace research has been to establish the fact that democratic states hardly ever fight wars with each other, while they still fight wars with dictatorships. Possibly this is because democracies share the values of the civilizatory hexagon, even though these values are as yet imperfectly expressed.

Internationally, we are not yet even at the first stage of the civilizatory hexagon, the monopoly of power by a world government, i.e. a society of disarmed nations, with a transformed united Nations being the only agency allowed to wield corecive power.

Some peace advocates do not want to go that way, fearing a world dictatorship from which there would be no exit except revolution. A world dictatorship would be even worse than a national dictatorship, because dissenters would not even have anywhere to go as refugees. The preference, they say, lies in the total abolition of violence, and the application of Gandhian principled nonviolence as the road to justice. But perhaps the institutions of world government could be combined with the stages of the civilizatory hexagon, which, after all, are designed to prevent tyranny and give a greater voice to citizens, as well as other constituent units of a federation (nations, provinces, and municipalities). Principled nonviolence could be the last resort in case a tyranny arose, as a substitute for bloody revolution.

It seems that the first Senghaas stage for a world society (monopoly on the use of violence by the centre while nations are disarmed down to police levels) should be quickly combined with the subsequent stages. Rule of law certainly would go a long way toward preventing usurpation of power by a tyrant, a very urgent requirement. A feeling of allegiance in the form of world citizenship should follow, and perhaps would spontaneously follow, or even precede, leading to loyalty to humankind as a whole. Democratic institutions should include a lot of decentralization to nations and local communities, in structures of subsidiarity formed from the bottom up. Social justice between as well as within nations (especially overcoming the North-south gap) would have to follow in short order through deliberately arranged redistribution schemes. Constructive conflict resolution, while highly desirable, could perhaps be somewhat delayed until we learn how to do it, which would entail mental and spiritual re-orientation. Only after this has been achieved, would the Greater Peace be

established, transforming the world legal order into a spiritual one.

These are not easy tasks, but their fulfillment is necessary for a sustainable world-wide culture of peace.

This completion of human social development from hunter-gatherer societies to what could become our future follows an interesting path: from egalitarian and peaceful primitive societies, through over-centralized and turbulent intermediate stages (where we still find ourselves), to a final plateau of peace, justice and democracy at a higher wealth level than at the beginning. It is a vision worth working towards. Only then could we proclaim “the end of history”. Yet perhaps there are higher stages yet, to a thoroughly spiritualized world, in which violence and injustice would be unthinkable.

PANGAEA.

Once upon a time the Earth was One.
A single continent called Pangaea
floated on its giant plate
on the single ocean.

Long before the advent of humans
cracks had cleaved itJ and
made many out of one,
ex uno plures.

Gondwana—the old world
stayed long together,
but it too succumbed
to fragmentation.

What nature has done,
can humans undo?
In a spiritual unity of cleft continents,
restore Pangaea?

———————————————————————————-

Later addition.

Unfortunately, Pangaea was the time of
the Permian extinction.
Is there a warning in this?
After the Cambrian comes the Permian.

(Refers to the Cambrian explosion of animal life.)

RECENT READINGS.

Book	Main points
Lynn Margulis and Dorion Sagan “What Is Life?”	1. Most of Earth life is bacteria. 2. The great symbiotic mergers.
John R. Searle “The Rediscovery of the Mind”	1. Descartes’ dualism is wrong. 2. The mind is not like a computer.
Stuart Kauffman “At Home in the Universe”	1. Complex autocatalytic networks can yield order for free 2. In evolution we climb peaks of excellence.
Roland Peterson “Everyone Is Right”	1. Insights of all great religions are the same. 2. Esoteric theory of etheric, astral, etc., bodies.
Fritjof Capra “The Web of Life”	1. Holistic Zeitgeist. 2. Process perspective 3. Cybernetics. 4. Jantsch early synthesis. 5. Chaos theory. 6. Ecology. 7. Symbiogenesis. 8. Mind and cognition.
Richard Feynman “Six Not So Easy Pieces:”	1. Lorentz transformation. 2. Light cones. 3. Vector algebra. 4. Curved spaces. 5. Momentum and energy 6. Time is like space, but different.
Peter Hilton, Derek Holton, Jean Pederson “Mathematical Reflections”	1. Fibonacci numbers. 2. Pascal triangles. 3. Mod arithmetic. 4. Infinite sets. 5. Fractal geometry.
Karen Armstrong “The History of God”	1. Parzufs/Emanations 2. Ousia and energeia (essence and powers) 3. Axial age. 4. Breaking of the vessels (primal fall)
Timothy Ferris “The Whole Shebang”	1. The Big Bang. 2. The finite but unbounded universe. 3. Dark matter. 4. Cosmic hierarchy of structures. 5. Cosmic evolution. 6. Symmetry-breaking. 7. Inflation. 8. Many histories—many universes.
Ilya Prigogine “The End of Certainty”	1. The arrow of time. 2. Dissipative structures. 3. From particles to ensembles. 4. Nonintegrable wholes 5. Bifurcation and contingency. 6. Frequent and persistent interactions.
Antonio R. Damasio “Descartes’ Error”	1. Emotion is necessary for planning, even if reason

	is intact. 2. Motivation is needed for action. 3. The prefrontal lobe must be linked to the limbic system.
Roger Penrose “The Large, the Small and the Human Mind”	1. Computation does not require understanding, but the human mind does. 2. The mind can understand truths not accessible to computer or algorithm. 3. Quantum theory has puzzles (Z-mysteries) and paradoxes (X-mysteries). 4. The latter include wave collapse on observation; it requires a radical theory change. 5. The non-transitive 3 worlds: Platonic, physical, mental. 6. Macro-coherence in the brain? Collapsing quantum superposition differently, by OR function.
Gregory Bateson “Mind and Nature”	1. The map is not the territory. 2. Perception process is unconscious. 3. Divergent and convergent sequences. 4. Embryology and evolution are different 5. Number is different from quantity. 6. Logic is a poor model for causality. 7. We perceive only differences. 8. Mind is made up of non-mental parts. 9. Structure @ process. 10. Hierarchy of logical types.
Tyler Volk “Gaia’s Body”	

SCIENCE AND RELIGION.

Like twin peaks of the World Trade Center, science and religion, the two solitudes, reside in our minds. But there are tunnels and bridges, under and above ground, corridors and passages, sprouting from the solitary towers.

Through these passages stream powerful communication signals. What is taking place is the rapid evolution of the symbiosis of mental and spiritual structures, originally strictly separate but now finding unity in expressing the inherent beauty of the universe, our common home.

Symbiosis created lichens from fungi and algae, coral reefs from polyps and algae, and many other thriving communities in the living world. They line the forest floor and the continental slope with their living beauty.

Twin towers, lichens, and coral reefs are only metaphors, but science and religion, these complex human mental constructs, truly do approach each other. Science (especially physics) is getting less mechanistic and more meta-physical, especially in the realm of the very small (the quantum world or even more string theory) and in the realm of the very large (cosmology and the origin of the universe), while religion is getting less literal and dogmatic, and more ethical and spiritual.

This facilitates a dialogue, which may lead to synthesis. There is a sense of mystery and awe in both worlds, which may stem from the same source. God is ineffable, and so is the physical world, in the large and the small. We can never totally comprehend either God or nature, but we can worship them as sacred.

An example is the number of dimensions. Space has 3, the theory of relativity has added time to make 4; eternity may be a perception of timelessness, in which “time” is perceived as “space-like”. String theory postulates 26 dimensions in one of its variants, most of them curled up. Perhaps angels live in some of the extra dimensions.

There is so much we don’t know. Yet we want to reach out across the gulf of understanding —reach out for love and kinship. For we are the children of the universe.

STUART KAUFFMAN MODELS.

(Based on his book “At Home in the Universe”, Oxford University Press, New York, 1995,321 pp.)

We can have “order for free”, Kauffman argues. By “freeIt he means sporitaneous, but of course paid for in the usual thermodynamic coinage. He presents a series of increasingly complex models to show this. From this he concludes that self-organization in complex systems plays a role in evolution alongside of natural selection. Selection alone, while powerful, would not be enough.

“Order for free” is already obvious when we try to connect buttons with strings. (This is ordinary graph network theory.) As complexity increases (more strings for the same number of buttons), there soon gets to be an inter-connected “giant” that we can lift all at one, with only a few small button groups still left isolated. Before this level is reached, there were mainly small isolated islands of button groups. There seems to be a “phase transition” from a subcritical to a supracritical region, such as is also seen in the subsequent more sophisticated models.

I think that we have all experienced such transitions, e.g. in rank-ordering nations on some indicator from an alphabetical list: at first the cross-outs of nations already accounted for are scattered randomly, but eventually blocks of adjacent cross-outs appear, until the whole list is exhausted. But the buttons-and-strings model is better because it is two-dimensional, while our list of nations has only one dimension.

In the buttons-and-strings model, the transition is plotted as an S-curve, such as I have discussed elsewhere for economic development, and transitions to peace, justice, and democracy. (See the “Pentagon of Values” (1990) and “Pax Democratica” (1994).)

His next model makes the self-organization of order a notch more concrete. He constructs Boolean networks, where the nodes (able to take on the binary values 0 or 1) react on each other by the Boolean functions OR and AND. (OR means that the node flips from 0 to 1 if anyone of its links says 1, AND means that the node flips from 0 to 1 if all its feed-ins say 1.) In these networks, if the interconnections are too numerous, the networks are in a state of chaos, i.e. never stop flipping; this mode is called “supracritical”. But if each node is linked to only two partners, order emerges (the system is “subcritical”): a large core is “frozen” without ever flipping, while a few chaotic islands remain outside. This can also be achieved, with more than two links per node, if most of the links are in the OR rather than the AND mode.

As we change either the number of links or the ratio of OR to AND junctions, we come to a definite phase transition. This time it goes from a few islands of order in a sea of chaos to a sea of order with a few islands of chaos. It is like the inversion of an oil and water emulsion, as in making mayonnaise. It is best for living systems to be near the. transition (“on the edge of chaos”) in order to preserve flexibility while maintaining stability. Kauffman’s claim is that sufficiently complex systems naturally navigate toward that critical edge, and therefore that life emerges naturally and is not an extremely improbable event, as is sometimes argued.

Then he takes a further step toward concreteness. Instead of these abstract Boolean networks, imagine mutually catalyzing chemical reactions. (The abstract Boolean networks are already models of this, but now he makes it explicit.) .When a set of interconnected chemical reactions, some of which catalyze some others, gets complex enough, we obtain collectively autocatalytic sets. This may be how life first began:

Note that life does not depend, in its definition, on particular chemical compounds (proteins

and nucleic acids), but on reaction patterns. There may be other chemicals that would form such patterns, though we don't know any on this planet. But we should be cautious in jumping to conclusions about other planets.

When take-off to sustainability is achieved, we call this autopoiesis, or self-organization. "Order for free." Zero-order self-organization would be a self-catalyzed replicator, e.g. ribozyme RNA polymerase. First-order self-organization would be the collectively autocatalytic sets described above. These might be bacterial cells. Second-order self-organization might arise from links between these cells, through parasitism-predation to mutualism-synergy. An example might be the eukaryotic cell, or further on a lichen. A third-level might be multicellular organisms, a fourth level societies and eco-systems, a fifth level the whole biosphere. (Subsidiarity in action!) Here coevolution plays a pan, which Kauffman discusses in further models.

The cell needs to stabilize its order, through homeostasis (which is a network of negative feedbacks), but it also needs to preserve some flexibility (positive feedbacks, which it practices in mitotic cell division). However, Kauffman considers cells and organisms to be mainly in the subcritical regimes of order (with a few islands of chaos), while the biosphere as a whole is supracritical, because it is still growing and diversifying. (But it does have islands of order in the sea of chaos.) Local eco-systems may be just on the edge, as they maintain a rough equilibrium between speciations and extinctions.

In coevolution of different species in an eco-system, each species seeks fitness maxima in a changing fitness landscape. The landscape is shifting because of the very efforts of the different species, as they create or destroy niches for each other. It is in general impossible to find the universal fitness maximum. This is among the difficult computational problems, like that of a travelling salesman who wants to visit 27 cities by the shortest route. Even the fastest computer would take a time far greater than the age of the universe to find it. So in real life, we merely climb the highest fitness peaks we can find, not the very best—but this can be fairly good. In Kauffman's words, we seek excellence, but not perfection (which is unattainable).

One very concrete example of collectively autocatalytic networks is the interplay between genes and the protein promoters and inhibitors that turn the genes on or off during embryonic development (ontogeny). Each cell derived from the divisions of the fertilized ovum has the full complement of genes, the same for all cells; yet the cells differentiate to some 256 different cell types (in humans), because different genes are turned on (become expressed. i.e. make proteins) in each cell type. About 70% of the genes are turned on in all cells; these are the "housekeeping genes" which every cell needs for its own functioning. These 70% are in the largest "frozen core" of order, as in the Boolean networks; they are invariable. The other 30% are in the smaller "attractorvalleys", and are different in each cell type.

Kauffman explains the details. In Boolean networks there are "state cycles" that the network transits, but some of these are extremely long (it would take far more time than the age of the universe to transit them), so that they look chaotic. However, there are "attractors" and "valleys of attraction" to which the network eventually converges, and, surprisingly, in the midst of this "combinatorial explosion" to huge numbers, there are only a limited number of these valleys of attraction. He estimates them as 317, which is the same order of magnitude as the 256 different cell types. So perhaps each differentiated cell finds its own valley of attraction in the midst of all the chaos. This is perhaps the most spectacular example of spontaneous "order for free". Kauffman emphasizes that there is nothing mystical (by which he means mysterious) about it, it is part of the mathematics of these model networks.

Kauffman goes on to discuss the evolution of artifacts, like the automobile, which has some similarities to biological evolution. The fact that cultural/technological evolution depends on

human intentionality is not very relevant, because the consequences of our intended actions are often unpredictable, so that we do not get what we aimed for. Like biological evolution, cultural/technological evolution is still directed by “a blind watchmaker”, because we the watchmakers really don’t know what we are doing.

That relates to the question I asked when the unexpected events of 1989-91 occurred in world politics: who or what makes history? We not only did not consciously intend this, we did not even predict it. . Kauffman says: “History arises when the space of possibilities is too large by far for the actual to exhaust the possible.” History is the result of navigating blindly in the midst of vast combinatorial explosions. We do attain some peaks, but not the best ones, and the terrain keeps shifting. But tracking peaks on deforming landscapes is central to survival. We try to do our best, on the whole, some of us. So “who or what makes history?” You and I, and yet not you and I.

Since we cannot reliably predict the results of our actions, because we shift each other’s fitness landscapes like the competing/cooperating species in an eco-system, and since we can only move a step at a time and so cannot see where even the local peaks are, especially when the terrain is very rugged, we have to resort to certain tricks to navigate for survival. In biology, sexual reproduction was such a trick, because it allowed the species that practiced it to move more than one step at a time in the landscape (through recombination of genes) and thus perhaps find the local peaks—while risking falling into the local deep crevasses as well.

In cultural evolution, one trick is “simulated annealing”, going to an equivalent of “a higher temperature” to facilitate the search and then “cooling it” to stabilize whatever was found. (The analogy is the annealing of steel by heating and slow cooling, which freezes in a better crystal structure to give the steel a greater strength. But the simulation involves algorithms that I can’t quite follow.) Even this, Kauffman says, is too slow and laborious to apply in practical life, so what we usually do is “patching”.

In patching, we divide a big problem into a bunch of smaller problems, and optimize (or “satisfice”) each patch separately. This does not always give the best result (sometime ago, Kenneth Boulding warned against “sub-optimizing”), but at least it’s doable in the limited decision time that is sometimes available to us. The problem, of course, is deciding how big the patches should be. We have to attain the best balance between patching (subdividing) and “chunking” (combining problems).

Since big problems are usually “non-decomposable” into parts (i.e. strongly interlinked), there have to be compromises. All this is very relevant to the politics of subsidiarity. There we usually say “solve problems at the lowest level possible where there are no SIGNIFICANT external effects”. The questionable word is “significant”. In non-decomposable problems, how are we to judge this? There must be some arbitrary cut -off point. It is up to mere human judgment.

Another model Kauffman uses is “algorithmic chemistry” (which he playfully abbreviates to “alchemy”), in which strings of computer programs representing macromolecular chains are put into a “pot” and allowed to “react” with each other. Of course, the experiment is not done either “in vitro” or “in vivo’” but “in silico”. The “strings” can act both as “data” (being acted upon) and “programs” (acting on other strings. In the macromolecular analogy, the “strings” can be both “substrates” and “enzymes”. The whole model is a vast metaphor or analogy, from which insights may be gained.

All of Kauffman’s models are really such metaphors, as he himself emphasizes. The question in all such cases of using metaphors is really: are these similarities merely playful and superficial, or do they reveal deep underlying principles? Since many of Kauffman’s metaphoric models are mathematical in nature, I am betting on the deep principles.

The mathematics appropriate to complexity theory is combinatorial calculus and iteration, just as for classical Newtonian physics it is differential equations, for quantum mechanics Hamiltonian operators, for relativity Riemann geometry, and for thermodynamics/statistical mechanics factorials. The astronomer James Jeans once said that God is a mathematician. Perhaps this is not too far-fetched. At least it is one of God's many attributes.

HOW THE IDEAS OF RECENT THINKERS COME TOGETHER.

The recent thinkers included here, and the titles of their books, are as follows: John H. Holland, “Emergence”; Stuart Kauffman, “At Home in the Universe”; Ilya Prigogine, “The End of Certainty”; Roger Penrose, “Shadows of the Mind” and “The Large, the Small and the Human Mind”; John Conway (cellular automata; the game of Life); Douglas Hofstadter, “Goedel, Escher, Bach” and “Fluid Concepts and Creative Analogies”; Gregory Bateson “Mind and Nature”; Stephen Jay Gould, “Wonderful Life”. Others are mentioned in passing.

Prigogine shows WHY the emergence of novelty is possible, namely because of frequently repeated interactions in multiple particle systems with N of the order of Avogadro’s number. This marks a transition from thinking in terms of mechanics, which is time-reversible, to thermodynamics, in which the arrow of time appears. Yet even this is still time-reversible in principle, although highly improbable. However, in open systems far from equilibrium, true time irreversibility appears: rewinding and rerunning the tape of evolution would produce divergent results, as Stephen Jay Gould also shows.

John Holland shows HOW novelty is created. Even in seemingly simple systems governed by only a few rules, such as the game of checkers, neural nets in the brain, and cellular automata (e.g. “the game of Life”), give rise to combinatorial explosions of possibilities in subsequent states of these systems, leading to unexpected surprises, and thus the phenomenon of emergence. These are complex systems, in spite of the paucity of rules. Even language consists of only 26 letters (in English), music of only 8 notes of the octave, and the genetic code of only 4 codons. Yet all literature, all music, all life can emerge from this as a novelty, a surprise.

Stuart Kauffman supplements this by showing how the combinatorial explosions are controlled to create some stability, i.e. to proceed from chaos to order. We get this order for free, because of the properties of his network models. Life exists at the edge of chaos, but in the region of order. There is mainly homeostasis (a frozen core of order), but also islands of chaos to provide flexibility and adaptability in face of changing conditions. Organisms are in the subcritical region of order, ecosystems are right on the edge of the phase transition or near it, while the biosphere as a whole is supracritical, i.e. still evolving.

Kauffman’s models are still only models, not the real world. (“The map is not the territory”, said Korzybski, the founder of general semantics.) Holland stresses that, to . construct successful models, the scientist must distinguish between the features of the observed world that are important (salient) and those which are irrevelant, mere details. The same applies to making maps.

How do we do this? It seems that humans are particularly good at this, i.e. at perception of patterns, while computers can hardly do it at all. (This adds to Penrose’s conception that computers can only do algorithms, while humans can also grasp non-theorem truths, i.e. beyond Goedel.) The question is: by making such seemingly arbitrary distinctions, do we actually create a meaningful reality, as Maturana would say, while Popper’s World I reality (things in themselves) is only 2 jumble of details?

Do ordinary sane minds have a built-in filter to pick out only the significant parts from the immense stream of sense data? (Holland maintains that, in the visual field, we do it by our eyes jumping from point to point in saccades. He calls for all models to be “saccade-based”.) And does schizophrenia arise when that filter is lost? when the doors of perception (Aldous Huxley) open wider? Do we actually receive more information about World I in the schizophrenic condition? But if so, the richness gained is a negative benefit to us, in terms of navigating in our environment and of functioning in practical life. We must build models to think effectively. Only a reasonable reduction of overabundant data leads to practical

knowledge.

Thus, from the Brusselator to the Santa Fe Institute, we delve into complexity theory. But the search is only just beginning. The key seems to be the role of time. In developing game trees, in doing computer simulations of models, in the generation of deterministic chaos from simple equations, we use time steps in the mathematical method of iteration. This is the mathematics appropriate to complexity theory, just as the calculus and differential equations are appropriate to mechanics, and combinatorics and factorials are appropriate to thermodynamics. Computers must have clocks, and both ontology and evolution (Bateson's two main stochastic systems) proceed stepwise. This is why we living beings perceive time as flowing past QS, while an electron, if it were conscious, would not.

Mathematics intrudes into physics, as Penrose sees it, as only a partial stream from the larger Platonic sphere of thought and knowledge. Why do particular forms of mathematics fit the physical world so well? (Particularly if it is only a jumble of details?) But then, Penrose would have a small stream from the Physical sphere pass into the Mental sphere by emergence (the very mechanism that Holland and Kauffman try to elucidate). And then he would see a small stream from the Mental sphere pass into the Platonic sphere, in terms of the human understanding of mathematics, or abstract symbols in general. (See Terrence Deacon, "The Symbolic Species".)

Penrose's Three-Spheres model of what I call the World Process has one peculiar feature: it is intransitive. This seeming irrationality is made possible by the difference in the verbs connecting the three spheres. Just as in the intransitive children's game "scissors, paper, stone", scissors cut paper, paper wraps stone, stone breaks scissors, we are left wondering which is the strongest, so in the intransitive cycle: Platonic intrudes into Physical, Physical emerges into Mental, Mental understands Platonic, the verbs are different, but we a~} left wondering which sphere is the primary one.

There is no answer to this question; it is an indissoluble (non-decomposable) Trinity in Unity. It is an expression of the concept that Mind and Matter are coeval in eternity, although Mind is emergent from Matter in the temporal world. Since we necessarily live (because we live) in the temporal order, the concept of Mind as emergent from Matter is more congenial to us.

The cellular automaton of the game of Life (a computer model) can be abbreviated to "cellular life" to transfer its meaning from the model to the thing modelled. (The territory rather the map.) This becomes relevant to the World Process in the emergence of mind from matter, the understanding of symbolic systems by mind, and the discovery of the relevance of mathematics to physics. This connecting inter-sphere matrix of life (the ultimate concept in complexity theory) is itself part of the World Process cycle, and thus not an accident in the Universe. Yet God may have other designs as well, such as macro-coherence.

The Bible Code predictions of future imminent catastrophes are hedged by questions "can you change it?" This hints that the world is an agent-based simulation model (as in Holland's book), and that humans are independent free-willed agents. However, we operate in a state of very incomplete knowledge of the consequences of our actions, which may well be counter-intuitive and unintended. Preventing the end of the world is not as simple as in the film "The Seven Seals", where all Abbie had to do is "die for him". We might want to "change it", but we don't know how. Of course, there are also people who myopically look out only for short-term personal benefits, or even have total ill-will; these are the elements of sin, either by omission or by commission (Augustinian or Manichean devil).

Hofstadter made another advance in models: in his Copycat model, not only do the states of the system change, the. connections can change too. This is a development of his previous ideas in GEB that a number string can function either as data or as program, interchangeably. Now he adds a third function of such strings: as an id (identification) tag, in

an address. This is the idea of “fluid concepts”, that an entity can change its function (its connection to the system) in mid-stream. It reminds us of Kauffman’s self-catalytic (or mutually catalytic) networks, and of the fact that a ribozyme can function either as a template or a catalyst at different times.

Coming back to the human facility in picking out the significant features from a welter of details (needed in the creation of models and maps, but also very much a part of normal mental functioning), Holland turns to the function of a metaphor in creative thought, either by an artist or a scientist. This faculty can be called intuition, except that it also functions unconsciously in visual perception, which is already an elaborated interpretation of the virus field, not a passive photograph.*

Intuition is the basis of creativity, which is a mental faculty different from, and perhaps beyond, intelligence. In the concept of ever-subtler (less material) bodies in esoteric religions (e.g. Alice Bailey), we have the physical body, the etheric body (physiologic process, health), the astral body (sphere of emotion and reason), and only after that the intuitive body. (Three or four other “bodies” follow, up to the direct connection with God.)

Intuition (some would call it adduction) complements induction and deduction in the structure of the scientific method. It is the formulation of hypotheses for empirical testing, the recognition of significant patterns, the Eureka moment—so much like the artist’s inspiration -and both dependent on metaphor, the main trope in poetry. This is why mathematicians and physicists insist that their proofs and theories should be “elegant”, Le. have elements of beauty as well as truth. (Why did physicists initially call the Bottom and Top quark Beauty and Truth, respectively?) Intuition works by pattern recognition; metaphor finds pattern similarities in two or more otherwise unrelated objects.

Intuition seeks meaning, insight, understanding. All these are beyond knowledge (while remembering that knowledge lies beyonf data or facts). However, knowledge of facts and practice of skills (as in piano playing or bicycle riding or swimming) are prerequisites for mastery or understanding. The higher must always build on a solid foundation of the lower, just as a house is stabilized by its foundation. (Note: the above is a metaphor.)

The objective is improvement, not optimality. (I called my book on U.N. reform “Design for a Better World”, not the best.) Kauffman makes the same point: in evolution within an eco-system, species climb the nearby peaks in a mutually changeable landscape. Distant peaks may be even higher, but are invisible and thus inaccessible. “You can’t get there from here.” We seek a niche, not Nirvana.

*See also George Lakoff and Mark Johnson, “Philosophy in the Flesh” Bas1c Books, 1999, who say that we cannot help using unconscious metaphors.

FLUX.

Cleaving, leaving, interweaving,
travelling through space and time.
Briefly staying, random straying,
plumb the depth and heights sublime.

Restless spirit, mind to steer it,
will that traces worldlines,
strangely merging, new emerging,
wave ascends and soon declines.

Process flowing, patterns growing,
nothing stays quite like it was.
Down the snakes and up the ladders,
cheer the gain and mourn the loss.

Night and day, winter and summer
places change like ebb and flow.
Does there, past this steady drummer,
some ascending spiral grow?

Is the Holy Grail light shining
at some far Omega point?
Is there Being past Becoming?
will some Home the Path anoint?

Could be just a path down-winding,
ending in a pit of ash.
Life and death keep us reminding
how ascent precedes a crash.

But most likely flux eternal
churns out the fractal sets,
joining up the swings diurnal
in pervasive, tangled nets.

All becoming and extending,
process is the final word.
No beginning and no ending,
Moebius-like silken cord.

SCHEHERAZADE III AND DAISY WORLD III.

What do I yet have to tell thee?
I've told you a thousand tales.
Yet one more I must, lest this should be
the Arabian nights story that fails.
More than three years we have been married,
though you hated me so at the start.
Your passion to love has been carried,
led you your hate finally to discard.
History three thousand years or longer
is recorded in bones and clay.
Human time on Earth a thousand times stronger,
three million years and a day.
Life on Earth more than three billion years.
And did She get to love us better?
Perhaps decision time now nears
to renew the lease, though still a debtor.
Daisy world, do you love me,
or do you love me not?
If not, with wild woe I shall leave thee.
If yes, then let us tie the knot.

TRANSFORMATIONS OF AGGRESSION.

Many early bio-cooperation mergers exhibit transitions from parasitism through uneasy truce or coexistence to symbiosis, and finally to total mutual dependence. (This is also true of some later examples, but the earliest ones are really dramatic.)

1. According to Freeman Dyson (“Infinite in All Directions”), the energy-storage nucleotides ATP, GTP, etc., polymerized “by accident” to the first RNA, which acted as a virus on the pre-existing all-protein life. But because RNA could act not only as an enzyme like protein, but also could reproduce and store information like the later, more specialized DNA, it eventually became indispensable to early life. Ever since, proteins and nucleic acids have been so closely linked as to form an intricately interconnected undecomposable system. But they may have spent some time in an uneasy alliance, like an arranged marriage where the partners have to get used to each other.

2. The result of the protein-nucleic acid merger, namely bacteria (Monera) or prokaryotes, later formed a merger of their own, when 3 or 4 kinds merged into a eukaryotic cell (probably an early type of alga) (this merger was proposed by Lynn Margulis, 1981). The larger recipient cell may have been a primitive phagocyte, a greatly enlarged prokaryotic cell that had lost its cell wall, developed cell membrane convolutions and internal vacuoles, and. began ingesting food before digesting it internally. (This follows the scheme of Christian De Duve.) The inclusions were at first peroxisomes (which detoxified the oxygen then becoming more abundant in the atmosphere as a result of photosynthesis) and later mitochondria (which actually utilized oxygen in respiration, thus completing the cycle). Eventually centrioles were included (originally ciliated or flagellated bacteria, transformed into essential elements in mitotic cell division, pulling apart the chromosomes by means of their actin or myosin fibers). In plants, the incorporation of photosynthesizing blue-green bacteria gave rise to plastids, eventually chloroplasts, using a somewhat different photosynthetic mechanism. All these inclusions were probably due to the original primitive phagocyte swallowing the smaller components, which was followed by indigestion, as these smaller components persisted and much later adapted to their new surroundings, acquiring new functions. Again, symbiosis and a complete merger developed after the initial disease of indigestion.

3. Still later, green algae or blue-green bacteria invaded a fungus (a eukaryotic being) to form lichen. Both components, while giving up their independence, got to benefit from living together. According to one interpretation of the Ediacaran fossils from the late Pre-Cambrian (Wright) these creatures without heads, eyes, mouths, or guts may have been, like lichens, the result of a symbiosis between an early ancestor of animals and photosynthetic bacteria or algae. They could live without devouring each other, autotrophically, in the original “Garden of Ediacara” (Eden), in pure pristine innocence. The invading alga gets “confined” in the larger structure, like quarks in a proton. (It also reminds me of Mongol invaders of China under Genghis Khan and his sons getting assimilated into the larger Chinese culture.)

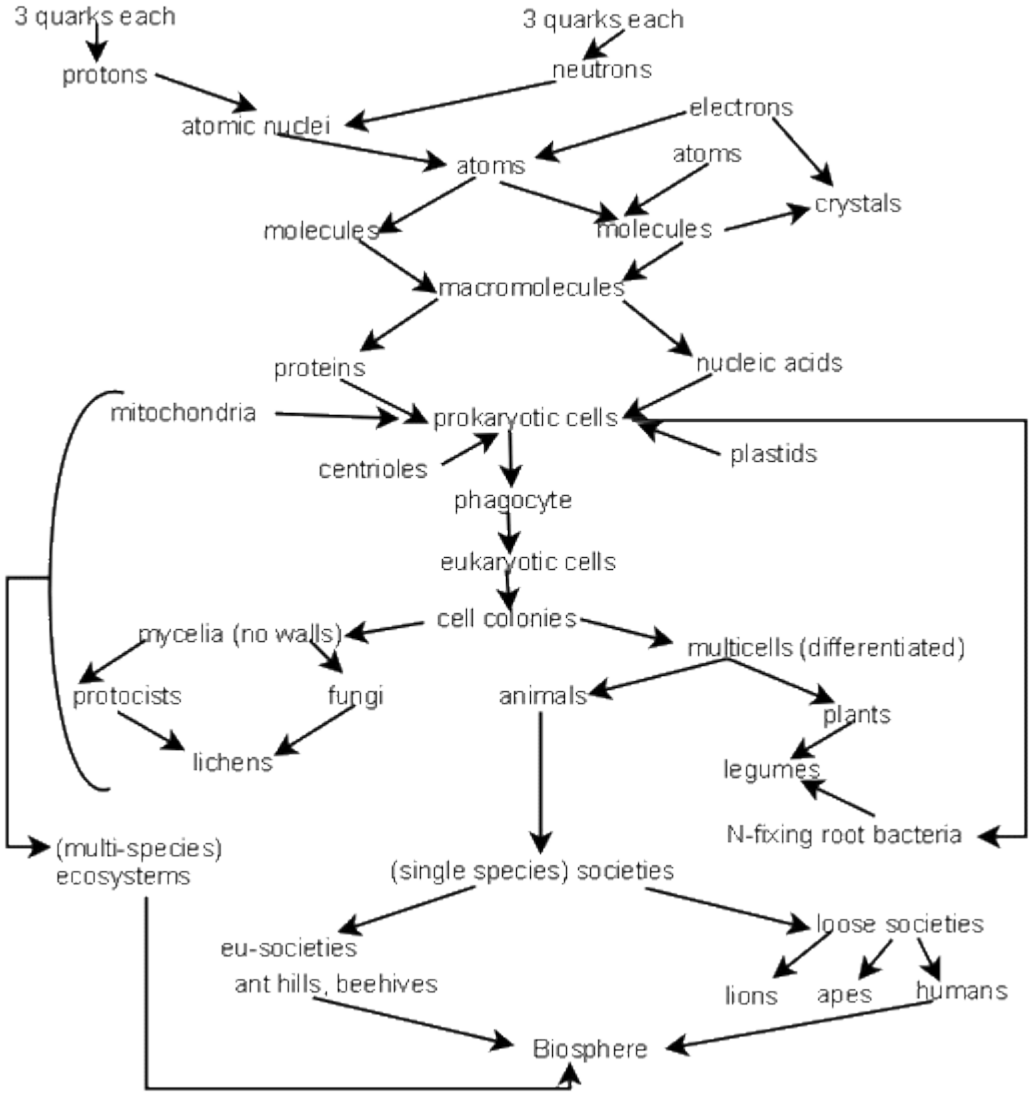
4. Nitrogen-fixing bacteria invaded the roots of leguminous plants, to the benefit of both as well as the larger eco-system. This structure actually fixes atmospheric nitrogen for the formation of protein in all the Kingdoms of Life on Earth.

5. Bioluminescent bacteria became incorporated in the cells of deep-sea fishes, helping to illuminate the darkness of the abyss. (“It is better to light one candle than to curse the darkness.” The logo of Amnesty International uses this illustration.) The bioluminescence enzyme in fireflies is called Luciferin. Perhaps Satan was the Light-bearer before becoming the Prince of Darkness.

6. Cellulose-digesting bacteria came to live in the guts of ruminant mammals, enabling them to subsist on grass. The grass itself adapted to being grazed by growing from the bottom (from the grass roots!) instead of from the tip, as most other plants do. Our own human guts harbour some helpful bacteria too; not to digest cellulose, but to help digest other difficult substances. When these helpful bacteria are destroyed by the use of some antibiotics, digestive disorders may result until the bacteria are re-introduced; especially, if some pathogenic ones invade in the meantime, using this "window of opportunity" .

There are far more examples than these, picked from the pages of Lynn Margulis' book "What Is Life?" It makes one wonder why competition is stressed so much in evolutionary theory, when cooperation contributes even more. (Kropotkin, the theorist of anarchism, has already pointed this out more than a century ago.) Even in human society, the game models treated in "Evolution of Cooperation" by Robert Axelrod show that the reciprocating cooperators often have an evolutionary edge on the selfish "meanies". Yet in economic theory, "economic man", to be rational, must be selfish. It seems obvious that radical rethinking is required. As Peter Russell pointed out in the video "The Global Brain", the "skin- encapsulated ego" must go. Vanish like the thick bacterial cell wall before the great cell merger could occur.

These biological mergers added to the earlier, smaller-scale physical and chemical mergers, are illustrated in the diagram below.



CONFERENCE DIALOGUE.

The time's too short.
Under the gun
we must abort.

B: We must resolve
problems to face
and not dissolve
in death's embrace.

A: Can't see a way
death to escape.
Call end of play.
Rewind the tape.

B: There is a way:
Accept the norm,
like cancer cell,
counter-transform!

TWO DREAMS.

The first dream was about a trip to Mars. (I had been reading an article on this in Discover.) I went as a tourist with a group of others. When we got there, we were shown the very laborious ways in which settlers already there were trying to carry on agriculture. Then it was time to go home. I urged some of my friends to be first in line, so that we would get on the first ferry. (Several were required to get us all home.) But no ferries were coming for a long time. Finally it was announced that there had been trouble getting the first one to take off from Earth. And now it was too late. “The window of opportunity” was gone: Earth and Mars had moved too far apart. We would have to wait for 7 years for the next opportunity. We all sat there stunned. It seemed that we would have to engage in that same kind of laborious agriculture we had just witnessed, when all of us were thinking “I would NEVER want to have to do THAT!” We sat in the big waiting room, and soft music began to play. A young woman minister who had been so optimistic and hopeful started to speak to us, but when the music played the tune “cool clear water” she dissolved in tears.

The second dream was about a trial. There was one judge, two assistant judges flanking him on each side, and the accused. (I never knew what his crime was. It was like a Kafka trial.) I was there as an observer or reporter. The stern old judge pronounced the death sentence. The accused (who looked a bit like my friend Alan Phillips) said he would appeal. The judge said there would be no appeal, and in fact the death sentence was to be carried out right away, within minutes. The trial was conducted in the open, on top of a small hill. The accused ran off down the hill intending to escape. But the two assistant judges called to him: “Come back! We will not agree to the judge’s sentence, and we are the majority.” The accused came back. But the chief judge objected, claiming to have sole authorityI don’t remember the end. Maybe I woke up too soon.

Interpretation: I am worried about humanity’s future. Perhaps we can never return to Nature from our technological expedition. Perhaps the Lord of the Universe is judging us harshly, while two archangels are still pleading for our survival. The end of the story is unknown.

WORD FLOW.

Know this: the last Word has not yet been said;
the first Word, unchained, to many others led;
but the story continues. For we are but a link,
not crown or cap, not source or sink
of nature's whole creation, its energy flow,
of elements far-ranging above and below.
We do belong here; there is no doubt of that;
yet we're not owners, nor those we begat.
We're passing through, leaving our mark,
as others did before: bee, rose, and shark.
Be not too proud, nor yet again too humble!
Sing praise aloud, lest hope and courage tumble.
Words must flow clear, deeds that will stand
in face of challenges, of life's demand
for steadfastness, resourcefulness, and reason,
like trees in forests, growth in every season.
Move through with joy! For we are not alone.
Seeds will be sprouting, some that we have sown.
Though we don't reap, yet they are our Word.
Past links to future with a silken cord.

HIGHLIGHTS.

In this conclusion within a conclusion, I want to highlight a few points which may be new. So much in these essays comes from summarizing the thoughts of others; but occasionally something new emerges. Perhaps this would include the following.

1. Supersymmetry transformation: from the Bose-Einstein condensate to the Big Bang fireball.

2. The master switch: the original impetus to fetal development following fertilization.

3. Freewill utilizing the stepwise increases in metabolic flux: aerobic respiration, then endothermy.

4. The windmill model of the sciences: from naive to Newton, then branching to relativity, quantum theory, thermodynamics, and complexity theory.

5. The metaphor of Psyche's labours as representing the evolution of life on Earth.

6. The love-union of mind and matter, or the fingers of God and Adam.

The first three points represents the beginnings, respectively, of the universe, of organisms, and of mind. The first two are illustrated in the cover design of this book—the Big Bang and the fetus—i.e. the new myths of creation. Both remain mysterious, but our hypotheses try to illuminate them. So does Point 5 regarding life, in a metaphoric sense.

Point 3 refers to epistemology rather than ontology, but the links with time are fascinating. As other essays also show, there is something "imaginary" about time, but not in the sense of "fictitious". The arrow of time is present in some scientific theories, but not in others.

Point 4 (Psyche's labours) is a bridge between myth and biology. The fit is remarkable. It gives insight rather than proving something new, understanding rather than evidence. What I mean by understanding is entering into the spirit of things rather than establishing facts.

Point 6 is a bridge from mind to matter, in a post-Cartesian merger. It is neither quite monistic nor quite dualistic, but fractal (dimension between 1 and 2), like intertwining fingers of God and Adam in the passing on of the vital current, or like the embrace of lovers.