Engaging with Questions of Higher Order
cognitive vigilance required for higher degrees of twistedness

This paper refers to three annexes: Twistedness in Psycho-social Systems: challenge to logic, morality, leadership and personal development (2004); DNA Supercolling as a Pattern for Understanding Psycho-social Twistedness (2004); Functional complementarity of higher order questions (2004).

Introduction

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Introduction

This is an exploration of how significance is associated with being what is metaphorically described as "straight" (or droit in French) as opposed to being "bent", "twisted" or "warped" -- notably as in "going straight". Following the French, this may well be interpreted as "right-thinking". Specifically it is concerned with how higher degrees of "twistedness" are encountered in social interaction and in arguments in support of certain strategies. Is it reasonable to expect a straight answer to a straight question under such circumstances? What might be the nature of questions and answers of higher order?

The aim in this exploration is to recognize how twistedness works and the conditions under which its complexity is of "positive", as opposed to "negative" significance. This argument aims to clarify the nature of more complex forms of understanding that may appear "twisted" to others and may, or may not, indeed be usefully associated with "richer" or "higher" forms of cognitive insight --whether exemplified by "holiness" or "perversion". The argument relates to structural insights summarized in a separate paper (Strategic Opportunities of the Twice Born: reflections on systemic camouflage of mass deception, 2004).

The approach here is through two lines of exploration. The first is through the extensive work on the phenomena of coiling and knottedness that are fundamental to magnetic, bio *** and specifically to DNA replication. The latter is related to the preoccupations of biosemiotics. In this connection, it is also appropriate to note here the importance of various forms of "coiling" in the symbolism of different cultures, whether the caduceus, the ouroboros, or more generally the coiled snake and its "satanic" associations dating back to Adam and Eve. The ambiguity of serpentine associations is illustrated by the symbolic status of Moses's Snake: "Just as Moses lifted up the snake in the desert, so the Son of Man must be lifted up, that everyone who believes in him may have eternal life" (John 3:1-16).

The second approach is through a review of current investigations into the taxonomy of questions and the insights of work of Arthur Young (The Geometry of Meaning, 1978; The Reflexive Universe, *** as a template for interrelating higher order questions beyond conventional taxonomies.
Helicity or twistedness as a fundamental pattern in nature

As noted below, helicity plays a fundamental role at all levels of the organization of matter, whether in the organization of galactic nebula, solar dynamics, dynamics of plasma in nuclear fusion technology, capillary structure (notably in the case of disease), as well as in the very structure and dynamics of DNA in biological cells. The purpose of presenting information here on helicity -- from a seemingly unrelated variety of fields -- is to provide clues for the subsequent discussion of the possible psychological implications of helicity, twistedness and knottedness.

Cosmology and solar dynamics: As noted by L. H. Ford (Twisted scalar and spinor strings in Minkowski spacetime, 1980) with respect to the organization of spacetime, twisted field configurations in Minkowski spacetime are normally associated with a nonsimply connected space; however, it is shown that it is also possible to construct such configurations in a simply connected space.

According to C. R. DeVore (A quantitative accounting of the magnetic helicity released in solar eruptive events, 2000), the helicity, or twistedness, of magnetic fields appears to be a key component of explosive activity on the Sun, manifesting itself in both eruptive prominences and delta sunspot flares. Simulations show the buildup of helicity in the solar corona due to the nonuniform rotation of the Sun, in amounts consistent with those observed to depart in the form of magnetic clouds imbedded in the solar wind.

Electromagnetic fields: Research in space physics, astronomy and astrophysics over the last decade, increasingly reveals the significance of magnetic fields in these areas. These are induced by the motion of ionized matter, known as plasma, which is present in various forms nearly everywhere in the universe. The properties are described by the fluid theory called magnetohydrodynamics that is basic to research on nuclear fusion. As noted in Topological Structure of Electromagnetic Fields in Conducting Fluids:

This interaction of plasma and magnetic field can create an astonishing variety of structures, which often exhibit linked and knotted forms of magnetic flux. In these complex structures of the fields huge amounts of magnetic energy can be stored. It is, however, a typical property of astrophysical plasmas, that the dynamics of magnetic fields is alternating between an ideal motion, where all forms of knottedness and linkage of the field are conserved (topology conservation), and a kind of disruption of the magnetic structure, the so called magnetic reconnection. In the latter the magnetic structure breaks up and re-connects, a process often accompanied by explosive eruptions where enormous amounts of energy are set free.

Magnetic helicity is a function of the vector potential and the magnetic field. It measures the topological linkage of magnetic fluxes. It also manifests itself in the twistedness and knottedness of flux tubes. Through such helicity the linkage of a flux tube with all other flux tubes is preserved when the tubes are filled with infinitely conducting plasma. As noted by J H Hammer (Theoretical aspects of magnetic helicity, 1985):

Even when finite resistivity and magnetic reconnection are allowed, one finds that the global magnetic helicity (accounting for all linkages) is still approximately preserved on the reconnection time scale. Local topological changes (tearing, etc.) that destroy local helicity invariance are allowed as long as the global linkage is preserved.

Abstract The inter-relationships between magnetic helicity, magnetic reconnection, and dynamo effects are discussed. In laboratory experiments, where two plasmas are driven to merge, the helicity content of each plasma strongly affects the reconnection rate as well as the shape of the diffusion region. Conversely, magnetic reconnection events also strongly affect the global helicity, resulting in efficient helicity cancellation (but not dissipation) during counter-helicity reconnection and a finite helicity increase or decrease (but less efficiently than dissipation of magnetic energy) during co-helicity reconnection. Close relationships also exist between magnetic helicity and dynamo effects. The turbulent electromotive force along the mean magnetic field due to either electrostatic turbulence or the electron diamagnetic effect, transports mean-field helicity across space without dissipation. This has been supported by direct measurements of helicity flux in a laboratory plasma. When the dynamo effect is driven by electromagnetic turbulence, helicity in the turbulent eddies is converted to mean-field helicity. In all cases, however, dynamo processes conserve total helicity except for a small battery effect, consistent with the observation that the helicity is approximately conserved during magnetic relaxation.

Mark Richard Dennis. Topological Singularities in Wave Fields. 2001 [text]

It is remarkable that, if any wavefield is chosen at random (out of an appropriate ensemble), these singularities occur naturally throughout the field, out of the random interference pattern, and part of the work described here is an exact mathematical calculation of the densities of dislocations in general kinds of random wavefield, as well as the statistical distributions of geometric properties such as curvature, speed (if they are moving) and twistedness. These calculations apply to the threads of silence in a noisy room, or the threads of darkness from light emitted from a thermal radiator (ie a black body).

Bellan Plasma Group of the California Institute of Technology [abstract]

What spheromaks are: Spheromaks are plasmas with very large internal currents and internal magnetic fields that are aligned so as to be in a nearly force-free equilibrium, i.e., the currents are very nearly parallel to the magnetic fields. The spheromak equilibrium is a "natural" state since magnetic turbulence tends to drive magnetically dominated plasmas towards the spheromak
Why spheromaks are interesting: Spheromaks are inherently three-dimensional and involve the concept of magnetic helicity which is a measure of the twistedness of a magnetic flux tube. Spheromaks have been proposed as the basis of magnetic fusion confinement schemes and as a means for refueling tokamaks. The physics of spheromaks is closely related to the physics of astrophysical jets.

**Meteorology:** Cyclones, twisters and willy-willies: The largest type of thunderstorm on the planet is known as the supercell. All supercells have an overall rotating structure that contributes heavily to the development of tornadoes, hurricanes and typhoons. They are formed from violently rotating giant whirlwinds of air and dense cloud spiraling at over 120 km/hr around a central ‘eye’ of extreme low pressure. In the United States tornadoes are referred to as twisters and in Australia as willy-willies. They have been termed “the greatest perversion of nature”. In the northern hemisphere, hurricane winds circulate around the center in a counter-clockwise fashion.

**Geometry and topology:** Fundamental to all the above domains in which helicity plays a vital role, is the connection to the branch of mathematics known as topology. The equations describing a simple helix, a coiled-coil and a coiled-coiled-coil, are all of the same essential form.

As noted by Vanessa Robins (Computational Topology at Multiple Resolutions: Foundations and Applications to Fractals and Dynamics, 2000):

Extracting qualitative information from data is a central goal of experimental science. In dynamical systems, for example, the data typically approximate an attractor or other invariant set and knowledge of the structure of these sets increases our understanding of the dynamics. The most qualitative description of an object is in terms of its topology --- whether or not it is connected, and how many and what type of holes it has, for example.

It is in this context that particular torsion coefficients are identified to measure the twistedness of the space in order to provide such qualitative information.

It is topology that has been able to clarify the nature of helicity and the contraints on twisting and knotting operations that occur in each of the domains. As noted by Jason Cantarella, et al (Influence of Geometry and Topology on Helicity):

The helicity of a smooth vector field defined on a domain in 3-space is the standard measure of the extent to which the field lines wrap and coil around one another; it plays important roles in fluid mechanics, magnetohydrodynamics and plasma physics. In this report we show how the relation between energy and helicity of a vector field is influenced by the geometry and topology of the domain on which it is defined.

Topology has also explored more complex forms of helicity and supercoiling that are not currently identified with any physical phenomena.

**Knottedness:** The theory of knots is a major area of topology. The genus of a knot is an expression of the degree of "knottedness" of a curve. In geometric topology, genus is the number of holes of a surface. Usually this means the maximum number of disjoint circles that can be drawn on the surface such that the complement is connected. [text] Higher dimensional spaces: knottings inside n-dimensional space have been described by Greg Friedman (Spinning constructions for higher dimensional knots, 2003):

- Simple "spinning" is used to construct 4-dimensional knots from 3-dimensional knots, but can also used to create an n+1 dimensional knot from any n dimensional knot.
- Superspinning of classical knots about spheres
- Frame spinning about other manifolds, notabbly to construct inequivalent knots that have the same complement
- Twist spinning, beginning with an n-dimensional knot to obtain an n + 1-dimensional knot
- Frame twist spinning achieved by adding some kind of twisting to the other spins
- Deform spinning including roll spinning
- Frame deform spinning by combining frame spinning and deform spinning

**Capillary vessels:** The nailfold (the skin overlapping the fingernail at its base) is used in certain forms of medical diagnosis. Certain diseases cause permanent changes to the shapes and densities of nailfold capillaries and therefore nailfold capillaroscopy is important as a tool for diagnosing and monitoring these diseases. For example, B F Jones, et al (A proposed taxonomy for nailfold capillaries based on their morphology) propose a taxonomy for nailfold capillaries that cover six descriptive classes: cuticulis, open, tortuous, crossed, bushy and bizarre. The authors note that earlier studies found that mentally ill patients, and particularly those suffering from schizophrenia, differed from healthy controls in having a decreased number of capillaries and an increased number of bizarre shapes. A standard had been proposed for capillary structure based on their length, thickness (on a scale of 3), twistedness (4 scales) and plexus (5 scales), although rare structures (described as bi-lobed or triple-lobed and stunted) were excluded at that time .

**Biological DNA:** DNA is a double stranded molecule composed of two polarized strands which run in opposite directions and wind around a central axis. As the double-stranded circular DNA twists around each other they form supercoils -- the axis of the double helix may itself be coiled up in the form of a helix. This supercoiled DNA contrasts with relaxed DNA. These phenomena will be explored in greater detail below. The DNA's coiled structure expresses a clear magnetic imprint. Replication occurs at radio frequencies, although little is known about DNA's electromagnetanetic activities.
Psycho-social twistedness

In a separate document (Twistedness in Psycho-social Systems: challenge to logic, morality, leadership and personal development, 2004) a review is provided of indicative web resources descriptive of "twistedness" in psycho-social systems. The document is organized as follows:

- Socio-political twistedness
- "Twisted logic"
- Twisted morality
- Psychological twistedness
- Psychoanalysis of twistedness
- Twistedness in psychotherapy
- Kundalini
- Spiritual twistedness
- Symbols of twistedness
- Myth and twistedness

Possible isomorphism between "natural" and "psycho-social" twistedness

The question is whether the undifferentiated sense of "twistedness" experienced in people, groups and psycho-systems in general can be explored through the topological frameworks that are valued in providing understanding of the natural systems indicated above. Such a more orderly approach to twistedness might well offer insights that would make it possible to distinguish:

- useful twistedness in contrast to dysfunctional twistedness
- forms of twistedness that are not readily identified or described
- role of twistedness in psycho-social processes
- unforeseen ways of identifying with twistedness
- complex forms of twistedness that may be assumed incorrectly to be dysfunctional because of the difficulty in distinguishing them from simpler forms that are indeed dysfunctional

There are several indications of the possibility of such isomorphism. These are consistent with the theory of general systems, notably the work on living systems theory of James Grier Miller (Living Systems, 1978).

John Fudjack (Saving Face: An Answer to the Puzzle Presented in 'Losing Face'. The Enneagram and the MBTI, 2000) points to the possibility of a vital link between the operations of DNA and those of consciousness, by reference to the puzzle of an Escher painting:

Not only can one see it as a mobius strip (a unilateral ribbon), it can also be viewed as a 'supercoiled' bilateral ribbon - achieved by winding the two-sided ribbon edge to edge with itself! Why is this of significance? Because if ccDNA (which are bilateral ribbons) can be coiled in this way, we'd have an example of a naturally-occurring biological structure which can transform itself from a 'one-sided' (ie, 'paradoxical') figure into a 'two-sided' ('non-paradoxical') figure by splitting - and, conversely - from a 'two-sided' figure into a 'one-sided' figure, by coiling.

Such a structure may thought of as isomorphic with consciousness - which has a similar capacity, by virtue of its liminocentric structure, to be both paradoxical (at its 'extremes) and linear (under ordinary conditions). (See The Structure of Consciousness: Liminocentrivity, Enantiodromia, and Personality. 1999). A number of theoreticians, in their attempt to understand under what physical conditions consciousness comes into being, have sought to find a physical structure with which it is isomorphic. And the puzzle that I have presented for your consideration begins to suggest one way in which the DNA molecule might possibly be viewed as such a structure....

It is Hofstadter's belief that the strange loops into which the mind is capable of twisting itself will 'eventually turn out to be at the core of AI [artificial intelligence studies] and the focus of all attempts to understand how human minds work.' [Douglas R. Hofstadter, Gödel, Escher, Bach: an Eternal Golden Braid, 1979]. So when seeking physical structures isomorphic to this one must look, he argues, for physical structures that are somehow themselves 'paradoxical'.

In this connection, Fudjack notes Hofstadder's example of the "looping back between informational levels' that takes place in DNA", before adding his own: "bilateral ribbons supercoiled into mobius strips". Such reflections assist reflection of the possibility of parallelism in the organization of the personality and the universe. Fudjack is exploring the addition of a third axis to the two that are basic to the Myers-Briggs Type Indicator (MBTI) [more].

Another example is provided from an anthropological perspective by Lee Drummond (American Dreamtime: A Cultural Analysis of Popular Movies, and Their Implications for a Science of Humanity: A Theory of Culture as Semiospace. 1996):

The second general point I would like to make about the proposed fit between quantum mechanics, cosmology, and cultural anthropology is that developing the analogy offers a way out of the language-centered theories of myth and culture that have dominated anthropological thought for so long. I find the image of the mind and culture as a holographic engine so appealing because it unites the world of human experience with the complex and dynamic, sentence-infused physical world of spacetime described by quantum mechanics and cosmology.
Long before its recent retooling for a linguistic capability, the (for the time being) human mind/brain was "hardwired" to produce convincing, compelling experiences of a life lived in a web of interlinked spatial and temporal dimensions. Life is lived somewhere, and that somewhere is the thoroughly cognitized surround... of a social world. Because this world generated by the holographic engine of the mind is both infused with meaning and spatiotemporal, I would like to call it a semiospace. "Culture," as conceptualized in the present work, is semiospace, and since the former term has acquired some very weighty and unwelcome baggage during the brief century of anthropology's existence as a field of study, I would happily see it replaced by the latter, or, not to be too proprietary here, by some term that would capture the unique fusion of meaningfulness, generativity, and dimensionality that is the signature of human existence.

The Dreamtime world of virtual experience and multiple reality is a (very large) domain of semiospace, and as such is inherently dimensional. That domain's semiotic dimensions are composed of the opposing concepts that generate culture, as described in the following sections, rather than of the familiar physical opposites of up/down, right/left, earlier/later, etc.

Conceptualizing the mind/brain and its cultural productions as a tremendously intricate, self-generating holograph opens the way for a cultural analysis based on a notion of culture as a fundamentally spatial and dynamic system, again, as a semiospace. The notion that culture possesses a fundamentally spatial nature or dimensionality is a minor, regrettably neglected theme in anthropology. Over thirty years ago, however, the brilliant anthropologist Edmund Leach (who was originally trained as an engineer) proposed, in a work fittingly entitled Rethinking Anthropology, that his prominent colleagues stop typologizing ("butterfly collecting") and psychologizing indigenous societies and begin applying a mathematically-inspired structuralism to them.

Victor Turner offers structural anthropology a response that helps recuperate the agency of the speaking subject, while at the same time providing theatre scholarship with a unique perspective on the critical social role of performance. Turner believes that both ritual and theatre, like law and taboo, function as types of monitoring systems for given societies. Ritual and theatre differ from law and taboo, however, in that they uniquely offer the community different degrees of self-reflexiveness and metacommentary. Turner defines ritual and theatre as stemming from a universal process operant in all societies, that of the social drama, which unfolds in four stages, "breach", "crisis", "redressive action", and "outcome". Turner stresses that performances do not derive from or reenact the entire social drama, but that they evolve specifically from the third stage of redressive action, the ritualized responses to crises, which often come in the form of a recognizable, performative process similar to trials or the practice of shamanism... Likewise religious practice, dance, and theatre have evolved as crucial aesthetic elements in the maintenance of group cohesion... The performances offer commentary on the major social dramas within any social context, affording the members of a group insight into "their most salient opinions, imageries, tropes, and ideological perspectives"... Turner believes that many subgroups with differing identities exist within every society, and each subgroup produces its own specialized versions of performance that attempt to account for their own life experience. The performances therefore supply an essential component of the individual's and the group's attempts to provide themselves with meaning. Turner ascribes to individuals great creative and expressive freedom in their performances, going so far as to shift the structural view of social life as a closed noetic system to one that is evolving and inspiraling. In this light, performance for Turner reflects Saussure's definition of la parole as affording linguistic change. Within Turner's model,

Individuals can make an enormous impact on the sensibility and understanding of members of society. Philosophers feed their work into the spiraling process; poets feed poems into it; politicians feed their acts into it; and so on. . . . The cosmology has always been destabilized, and society has always had to make efforts, through both social dramas and esthetic dramas, to restabilize and actually produce cosmos. (UP 17-18)

If the structures underlying a given belief system were so firmly in place that they precluded critique or alteration from within the system, then Turner's model for performance would be unworkable. Turner therefore grants individual participants and observers an increased role in the creation of value and meaning, above the prescriptions of culture emphasized by Levi- Strauss.

In another example, Thien-Thi Nguyen (Hyper-rationalism, 1998-1999) relates the degree of rationalism to twistedness understood in terms of a "2nd derivative" as a self-reflexive process of control (reminiscent of Hofstadter's preoccupation above and anticipating the discussion below of the work of Arthur Young):

The mind is the center. Everything else is its vehicle. So it is all a matter of control of the center. One holding the center in hand is able to ungrasp selectively to allow parts of the control to communicate. But there is a solution, even if it involves a reach instead of a firm hold. So what we're really looking at is a 2nd derivative of the function: \( f = (\text{importance of control}) \)

A wise man recognizes the 2nd derivative. A wise man may need to live amongst those that are either unwise or oblivious to the self-filling [sic] wisdom of wisdom (and thus wise in their own orthogonal way), and so this wise man must depart from his insight and lower to the level of ... diplomacy. For diplomacy can keep you alive while wisdom can keep you ahead ... these two are dualities of every relationship no matter if on the social scale or the atomic.

He sees the "2nd derivative" as a "meta-view". This raises the question of how many degrees of self-reflexiveness merit consideration. But prudently he usefully notes:
This whole fascination with pseudo-mathematical underpinnings to consciousness still resonates somewhat in my understanding of myself and others. But, I've learned that it's often inaccurate. Still, a random thought here and there triggers pathways that lead back to fundamental equations. And control is always important.

DNA supercoiling as a pattern for understanding psycho-social twistedness

The insights above regarding "twistedness" reflect an intuitive "global" comprehension of complexity which calls for deeper and more detailed understanding how twistedness works and why it may be vitally important in some psycho-social processes -- as well as being highly problematic in others. Part of the difficulty in approaching this matter is that "twistedness" is in most cases used unthinkingly as a pejorative term to characterize a pattern which is felt to inhibit right-thinking and clarity. The argument here is that, given its importance at every scale in nature, from the organization of nebula to the organization of the human cell, there is a case for distinguishing various forms of twistedness and understanding their function. This could be especially valuable to reconciling apparently irreconcilable understandings in society.

A review of twistedness in DNA is provided in an annex to this paper (see DNA Supercoiling as a Pattern for Understanding Psycho-social Twistedness, 2004). This is used as a basis for the discussion below. The annex has the following components:

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Understanding of how DNA works has been much enriched by concepts from topology -- as a branch of mathematics that deals with structural properties that are unchanged by deformations such as stretching and bending. This use of mathematics is especially important because there is no experimental way to observe the dynamics of enzymatic action directly, notably with respect to knotting and coiling of DNA (see De Witt Sumners. Lifting the Curtain: Using Topology to Probe the Hidden Action of Enzymes, 1995; Xiaoyan R. Bao, et al. Behavior of Complex Knots in Single DNA Molecules, 2003).

Potential significance of DNA coiling for reframing psycho-social twistedness

The merit of focusing on the nature and function of twisting in DNA is that it provides a rich natural template. It offers a sense of the degree of complexity that it may be required to master in order to comprehend how twistedness "works" in practice. It might also be argued that, as a process active in every human body and inherent to human life, humans may well have some kind of profound intuitive understanding of how it works and the "rightness" of such working -- however " twisted". Some of the very explicit dynamics of this process may also offer patterns for understanding how the inhibiting effects of "twistedness" may be addressed when they are perceived to be a constraint on human development.

Conceptual links, associations and perversions: There is a case for considering how human identity might be described in terms of a structure isomorphic with DNA. Argument have already been made for a degree of equivalence between "genes" and "memes" -- but perhaps not to the point of clarifying their respective roles in mantaining human invariance and identity (see Francis Heylighen. Structure of Memes, 1994) [more | more]. It could be worth exploring how semantic links are made and broken, whether within the individual psyche or within a group. Such processes could be related to some form of replication -- notably the form of transcription associated with traditional "word-of-mouth" transmission of secret knowledge. On the other hand there is a recognition of "perverted" links, notably associated with sexual innuendo and double entendre, as perceived by those on the straight and narrow.

Creativity and innovations: Since DNA replication may be understood as fundamental to cell replication and growth, there is case for considering how an analogue might model human creativity and innovation. How do new ideas emerge to nourish the psyche? Could this be understood in terms of zipping and unzipping? Susan Blackmore (The Meme Machine, 1999) explores the question of "dismantling meme-complexes" and "watching a meme unzipping other memes" (see Walking from the Meme Dream, 1996) -- which she uses as part of a meditative technique for "unzipping" (revealing) the illusory quality of the self or sense of self. Blackmore asserts: "Just as the design of our bodies can be understood only in terms of natural selection, so the design of our minds can be understood only in terms of memetic selection." [more]
Degrees of corruption: For those "going straight" it is one thing to speak of a twisted or corrupted mind (or morality), and another to provide formal expression for it. How might degrees of twistedness then be distinguished? How "bent" or "warped" can a person be -- or a group? How is a mind, perceived as twisted and corrupt, to be distinguished from one that is more complex without necessarily being corrupt? Presumably true corruption is to be associated with particular forms of knottedness -- of a type that does not permit the undoing or unzipping necessary for healthy replication? But, whilst "simplicity" of a certain quality may be highly valued, how is the creative twistedness of some innovations and innovators -- such as Leonardo da Vinci (left-handed, homosexual, use of mirror writing, etc) -- to be distinguished from corruption? Or is it the corrupt nature of their twistedness which somehow catalyzes the creativity that emerges paradoxically from it?

Organization of memory: It is curious that the mind typically receives information sequentially -- notably in the case of text and eye movement in general. A comparison might be made with the topologically challenge of packing more than a metre of sequential information into a nanometre cell. There is an absolutely essential need for a system of folding and packing, and "organization" of some kind, that might be compared to supercoiling To achieve this the link configuration must be minimally modified -- giving rise to twisting and writhing. Activating memories -- to achieve memetic expression (currently of concern in the USA in relation to the mumentic threat of terrorism) may be associated with a process resembling zipping and unzipping. On the other hand it is understandable that pathology of memory and processes of the psyche may be associated with knots that cannot be unravelled -- as recognized by Ronald Laing (Knots, 1970) and in the "engrams" which the auditing process of scienology claims to "clear".

Packing into a "globe": The topological dilemma of fitting DNA into a cell might perhaps be compared with:

- insight packing in an integrated psyche as a consequence of an individuation process (in depth psychology terms) engendering a "whole person" -- characterized by significant non-linearity (otherwise expressed as the challenge of Sphereland for Flatlanders)
- packing of traditional knowledge into the coherent belief system of an oral culture with limited carrying capacity for collective memory -- in the conventional textual sense
- knowledge packing in an integrated global society as a consequence of the forms of information system foreseen for the emerging "global brain" of a knowledge society
- packing humans on the limited surface of the planet, where high density packing might be sustained by occasional localized unpacking reminiscent of transient zipping and unzipping (perhaps prefigured by holidays)

Perception of "evil": Fundamentalists of different persuasions claim to be skilled in identifying "evil" and the "coils" of the "serpent". There is a case for honouring their perception of "coils" as a perception of levels of what amounts to complex supercoiling. This coiling may indeed threaten those on the "straight and narrow" with unforeseen change. Framed in this way the question then becomes how to distinguish fruitful from unfruitful change -- a challenge dating back to the Garden of Eden. But is coiling necessarily associated with evil -- especially if supercoiling is such an intrinsic feature at the cellular level? DNA can only be "straightened out" by "denaturing" it -- transforming it into a form that is biologically inactive, and impossible within the confines of the human cell.

Biological cell as the "Garden of Eden"

It is worth reflecting on the degree to which creation myths, or the dynamics of the Garden of Eden, map metaphorically on to the organization and dynamics of a generic biological cell:

- the two antiparallel strands forming the DNA helix, might well be understood as "Adam" and "Eve" -- eternally intertwined -- rather than being labelled "Watson" and "Crick" (after their "discoverers")
- the role of the "serpent" might be understood in terms of DNA supercoiling
- the "temptations" offered by the "serpent" might be understood as the "strange attractors" associated with energy instability evoking unzipping and zipping, delinking and relinking, as part of the replication process through which knowledge is transmitted -- accompanied by the archetypal pattern of writhing and twisting into unusual configurations
- the time in the Golden Age "before the fall" might be understood as the temporal condition of potentiality prior to any cell "division" (Note the role of the coiled organization of information in engendering other cells)

It is curious that the idyllic, paradisical Garden of Eden might be so intimately close -- ever present and active -- in reality, rather than so distant and "lost" as suggested by mythical accounts. Its dimensionality in spacetime does not appear to have been considered, or the manner in which the human being embodies it and is engendered by it - despite numerous web references associating "DNA" with the "Garden of Eden". (for example: Jeremy Narby. The Cosmic Serpent : DNA and the Origins of Knowledge, 1999)

Helical organization of knowledge

Attempts have been made at various times to provide a helical organization of knowledge. One example was a particular model of the periodic table of chemical elements. Helical boring has long been of importance to ballistics, just as twist has been essential to strength of ropes and cables. Modern technology, notably in relation to electronics, has led to the discovery of products requiring helical organization:

- Dual helical antenna for variable beam width coverage for use in emitting signals in times of conflict to overcome jamming.[more]
- Hot cathode emitters may be coiled, coiled coil, triple coil, etc. filaments for use as hot cathode emitters

The fundamental status of the helical structure of DNA has given further legitimacy to attempts to organize insight in a helical manner:

Helical pathway in therapy: J O Prochaska and J C Norcross (Stages of Change. Psychotherapy, 38, 443- 448). have produced a model of stages of change model (see Figure 3-4), which is a helical structure representing phases of change, repeatedly connected over a temporal course. Inspired by that model, Stephen Christopher Shaw (The Client's Helical Path: a grounded theory of unsuccessful therapy experiences, 2003) has articulated a model from interviews with clients who have had unsuccessful therapy experiences (and
It is these questions which may be more complex forms of the ones that have been taken up. The experiential dimensions may be particularly well-recognized as clients pass, or cycle, through the former, they advance with respect to the latter; similarly, as clients advance with respect to the linear dimension, they necessarily cycle through the former processes.

Towards higher order questions: varieties of questions

The earlier exploration of twistedness led to recognition of domains in which it was fundamental (as with DNA), and where its challenges had been taken up -- whether through helical structural organization or through an understanding of processes organized helically over time. Comprehension of the dynamics is exemplified by the challenges of controlling the three-dimensional movement of a helicopter. The experiential dimensions may be particularly well-recognized by those of more disciplined kinetic intelligence (acrobats, martial arts practitioners, etc.). Arthur Young has been most helpful in generalizing the understanding of the requisite cognitive skills in his emphasis on learning-action cycles.

This context leads to the focus of this paper, namely the nature of the questions required to distinguish and engage effectively with the more complex forms of psycho-social “twistness” that increasingly inform much socio-political action -- for the better or for the worse. It is these questions which may be expected to identify new opportunities and to guide new forms of action -- as well as being
Inherent to the cognitive vigilance necessary in a turbulent conceptual environment in which most strategic agendas can be framed as "twisted" from another perspective.

**Questions in the context of information retrieval:** Formally a question may be understood as a speech act of requesting information on the truth value of a set of propositions. This is problematic since the definition is pragmatic rather than syntactic when questions may also be the centre of focal attention in syntax. Furthermore, defining a question in mere formal terms tends to be either too language-specific or redundant.

For John G. Keyes (*Using Conceptual Categories of Questions to Measure Differences in Retrieval Performance*, 1996):

A question is a formalized request for information. The form of the question communicates the degree of current knowledge towards a given information need. A question such as "Are X and Y related?" implies a different level of knowledge on the part of the asker than does "How are X and Y related?" In the first instance there is uncertainty as to whether the relationship exists, while in the second the relationship is presumed. In this way, the question reflects the cognitive model that the asker has developed in regard to his need for information. Because the cognitive state of the asker dictates the form of the question and also governs the appropriateness of answers for filling his information need, it could be expected that the form of the question would have an effect upon what answers are appropriate and relevant to the information need as stated.

Keyes provides a useful overview of various approaches to developing a typology of questions:

- **Lehnert (1977):** (1) why questions, (2) how questions, (3) yes or no questions, (4) occurrence questions, which ask about some general act or sequence of acts, and (5) component questions, which are essentially fill-in-the-blank type questions.
- **Lehnert (1978):** (1) causal antecedent, (2) causal consequent, (3) concept completion, (4) disjunctive, (5) enablement, (6) expectation, (7) feature specification, (8) goal orientation, (9) instrumental/procedural, (10) judgmental, (11) quantification, (12) request, (13) verification
- **Graesser and Murachver (1985):** sought to identify the knowledge sources and basic processes that contribute to question answering. The first component of this architecture is question identification, which includes identifying question functions and statement elements. They identified seven question functions: (1) WHY, (2) HOW, (3) ENABLE, (4) CONS (i.e., what is the consequence of), (5) WHEN, (6) WHERE, and (7) SIG (i.e., what is the significance of). Each question function is identified with one of three statement elements: (1) intentional actions, (2) events, and (3) states. According to this scheme for example, WHY, WHY, and WHY are different question categories that have different symbolic procedures. In combining question functions and statement elements, they identified a total of 21 categories with different symbolic procedures operating on the knowledge structures.
- five conceptual categories of questions based on their semantic representations: (1) Verification, (2) Concept Completion, (3) Causation, (4) Association, and (5) Disassociation

Keyes argues that:

The above models all attempt, in one way or another, to capture and categorize the subtler nuances of human communication. If the categories are too broad, then much of the communication will not make sense. Elaboration and subtlety are prerequisites for any system that would attempt to model more fully the human question answering process. In information retrieval, however, the goal is more pragmatic: to improve system performance and to facilitate end-user acquisition of relevant information. Since what is sought is improvement rather than complete viability, one may be able to make progress with a lesser degree of sophistication. Because the user is usually concerned with elaborating a partially known information need, the types of questions asked in information retrieval settings can be viewed as a subset of the types of questions humans asked. In a sense, the user is aware of what he does not know in this setting. Consequently, his questions will reflect this and will be structured in a way that specifies his information need.

Xin Li and Dan Roth (*Learning Question Classifiers*) have developed a machine learning approach to question classification, recognizing that locating an answer may depend on filtering out candidate answers based on an understanding and categorization of answer types. For them:

In order to respond correctly to a free form factual question given a large collection of texts, one needs to understand the question to a level that allows determining some of the constraints the question imposes on a possible answer. These constraints may include a semantic classification of the sought after answer and may even suggest using different strategies when looking for and verifying a candidate answer.
accommodate virtually all inquiries that occur in a discourse: the categories in the taxonomy, Graesser which have been added:

Arthur Graesser's Taxonomy of Inquiries has foundations both in theory and empirical research. It uses Lehnert's 13 categories to accommodate virtually all inquiries that occur in a discourse:

2. Goal Orientation For what purposes did John take the book? Why did Mary drop the book? Mary left for what reason?
3. Enablement How was John able to eat? What did John need to do in order to leave?
4. Causal Consequent What happened when John left? What if I don't leave? What did John do after Mary left?
5. Verification Did John leave? Did John anything to keep Mary from leaving? Does John think that Mary left?
6. Disjunctive Was John or Mary here? Is John coming or going?
7. Instrumental/Procedural How did John go to New York? What did John use to eat? How do I get to your house?
10. Judgmental What should John do to keep Mary from leaving? What should John do now?
11. Quantification How many people are there? How was John? How many dogs does John have?
12. Feature Specification What is an example of X? What is a particular instance of the category? What does interaction mean?
13. Request Would you pass the salt? Can you get me my coat? Will you take out the garbage?

Rhodes' Typology of Questions (1995):

- Content-directed questions (intended to obtain information about subject matter)
- Student-directed questions (intended to obtain personal responses from students)
- Rhetorical questions (self-expression, obtain effect, or a means of giving directions)
- Ambiguous questions (intended to obtain information, but the nature of the question is not clear)


- Problem finding: Is there a problem? What is the nature of the problem?
- Problem selecting: Prioritize identified problem
- Knowledge/skills proving: Ask to perform the task
- Finding feelings: Questions about the feelings and attitudes about the problem
- Cause findings: Questions about the cause of the problems

The 13 conceptual question categories used in Wendy Lehnert's QUALM in which questions can be mapped by an inferential analysis procedure. The taxonomy proposed by Lehnert is primarily based on a theory of memory representation called Conceptual Dependency:
16. Judgmental The questioner wants the answerer to judge an idea or to give advice on what to do. What do you think about the new taxes? What should I do to stop the fight?
17. Assertion The speaker expresses that he or she is missing some information. I don't understand what this message on the computer means. I need to know how to get to the Newark airport.
18. Request/Directive The speaker directly requests that the listener supply some information. Please tell me how to get a printout of this file.

Aschner, Gallagher, Perry, and Afsar (1961) identified the following five categories of thought processes:

1. Routine (R) questions. These refer to procedural matters, structure of class discussion, and approval or disapproval of ideas. Are there any questions?
2. Cognitive-Memory (C-M) questions. These require the use of recall or recognition in order to reproduce facts and other items of remembered content. What are the five steps in Knowles' self-directed learning model?
3. Convergent Thinking (CT) questions. The tightly structured framework of these questions requires the analysis or integration of given or remembered data, leading to one expected result. Based on this model, what are the goals of education?
4. Divergent Thinking (DT) questions. These questions permit an independent generation of ideas, directions, or perspectives in a data-poor situation. Why is learning necessary?
5. Evaluative Thinking (ET) questions. These questions are concerned with values rather than facts and convey a judgmental quality. Is this approach worth the effort? (pp. iv-viii)

As is evident from the variety of initiatives in relation to the taxonomy of questions, "question and answer" (Q&A) is an active area of research. It is powerfully stimulated by the challenge of improving online search methodology. Some researchers have formulated vision and roadmap statements to guide future investigation:

- Jaime Carbonell, Donna Harman, et al. produced a Vision Statement to Guide Research in Question and Answering (Q-and-A) and Text Summarization (2000) which distinguished four "sophistication levels of questioner": "Casual "Template "Cub "Professional Questioner" Reporter" Information Analyst"

Problematic questions and missing dimensions

The vision and roadmap statements raise the question of whether they have framed the approach to questions in a manner that omits certain dimensions.

**Problematic questions**: Art Graesser's previous research had identified 12 problems with questions that frequently occur in surveys (Graesser, Bonmaredy, Swamer, and Golding, 1996; Graesser, Kennedy, Wiemer-Hastings, and Ottati, 1999). Many of these problems have been incorporated in various analytical coding schemes of survey methodologists. Art Graesser, Katja Wiemer-Hastings and Roger Kreuz (The Gold Standard of Question Quality on Surveys) report on the development of a computer tool (QUAID: Question Understanding Aid) that assists survey methodologists who want to improve the wording, syntax, and semantics of questions on surveys.

At present, QUAID can handle 6 of these problems with some degree of correspondence with human experts, so we will focus on these 6 problems in the present paper. These problems are:

1. **Unfamiliar technical term**: There is a word or expression that very few respondents would know the meaning of.
2. **Vague or imprecise predicate or relative term**: The values of a predicate (i.e., main verb, adjective, or adverb) are not specified on an underlying continuum (e.g., try, large, frequently).
3. **Vague or ambiguous noun-phrase**: The referent of a noun-phrase, noun, or pronoun is unclear or ambiguous (e.g., items, amount, it, there).
4. **Complex syntax**: The grammatical composition is embedded, dense, structurally ambiguous, or not well-formed formed syntactically.
5. **Working memory overload**: Words, phrases, or clauses impose a high load on immediate memory.
6. **Misleading or incorrect presupposition**: The truth value of a presupposed proposition is false or /inapplicable.

Adam Stone (Typology of Questions Faced by Policymakers, 1996) notes that issues in which criminal courts perceive a role for regulation, involving "new" types of questions, pose problems which exacerbate many of the difficulties inherent in the policymaking role for courts generally -- and, by extension, for wider policymaking arenas. For example:

- **No Control Over Questions**: Since courts cannot exercise control over the controversies presented to them, the cases by which they make policy may not be representative of the issues.
- **No Outside Sources**: Courts generally lack resources and authority to conduct outside research into the often highly technical questions posed by new technologies.
- **Adversarial Science**: The adversarial nature of court proceedings gives little weight to the best available science, instead pitting opposite extremes of scientific findings against each other as well as including the potential for biased experts and misleading questioning and opinions.
Lay People: Judges, juries, and lawyers are generally unqualified to devaluate highly technical and scientific claims. Further, since Daubert in 1992, the courts and themselves evaluating more and more scientific evidence as the peer review standard has been further eroded.

Always Ex-post-facto: Courts always face questions in which alleged wrongs have already been committed, possibly on a wide scale. While legislatures sometimes, if not always, face the same situation, it is not inherent in their structure that they do so.

Decision by Analogy and Precedent: While this was discussed above and will be pursued in depth in the next section, it is important to keep in mind this crucial problem. Courts are, by all accounts, at least somewhat bound by precedent. Models differ in the extent to which this is perceived as a determining factor. Nevertheless, decisions on "new" issues under the shadow of precedents may prevent courts from developing to meet the demands of technological change. This is a non-normative statement though, as lack of adaptation by courts themselves may be perceived to be a good thing, allowing development of the law to be completed by democratically controlled legislatures.

These factors combine to create a court system which faces many ongoing and inherent problems when it must grapple with highly technical policymaking questions. Of course such potential confusion offers many opportunities for deliberately misleading strategies by those responsible for framing the questions.

**Incorporating the temporal dimension**: James Pustejovsky, Janyc Wiebe and Mark Maybury. (*Multi-perspective and Temporal Question Answering*, 2000) respond to the above question answering vision (Carbonell et al., 2000) and roadmap (Burger et al., 2002) with the concern:

Although a range of question and answer types are described, the ability to interpret a question and provide an answer with respect to different perspectives and the ability to answer questions involving temporal dimensions are largely unaddressed. This position paper argues for the importance of multiple perspective and temporal question answering and attempts to outline some aspects of the problem that would be important to capture on the Q-and-A roadmap.

**Questions leading to deeper understanding**: Benjamin Bloom (*Taxonomy of educational objectives: the classification of educational goals*, 1956) created a taxonomy for categorizing level of abstraction of questions that commonly occur in educational settings. Bloom’s taxonomy of questions forces a person to interact with the text on a deeper level, and develop a more thorough understanding. Generally speaking, the complexity of questions can then be evaluated according to the type of mental process they entail. Their complexity also depends on the features of the question (any kind of ambiguity, degree of objectivity/subjectivity, implicit/explicit data, ...) and the features of the answer (nb of elements required, type of analysis required, ...) [more]. Bloom's taxonomy of questions offers an indicator of progress from simple questions of fact, through synthesis of multiple facts, through analysis based on synthesis, to a level of judgement or critical thinking:

- Knowledge (simple recall): utilizing WHY-questions (see below) to inform the client on the topic and then asking those questions to solidify knowledge.
- Comprehension (familiar with meaning/can make use): utilizing concepts such as "explain, describe, compare, contrast, define, locate, match" to enable the client to explain and further understand the information.
- Application (applying abstraction to a new example): now the client uses the information to apply it to new situations by responding to requests such as "show, what else, choose, sort, classify, name some other..., instead of..."
- Analysis (break idea into constituent parts): now the client breaks down the information into parts and looks at how they relate back to the whole via concepts such as why, how, alike/different, order, identify, etc.
- Synthesis (creation from existing elements or principles): at this step the client takes the knowledge and creates something new. Words of direction for this step might include: create, suppose, what if, write a story, draw a picture, make, think of, predict, and how many ways...
- Evaluation (formation and substantiation of a judgment): the client assesses the information learned, states an opinion and critiques based on his/her previous knowledge. Words like: decide, judge, discuss, choose, recommend, give your opinion, state your preference, explain, will help them to complete this step.

Richard Paul (*Critical Thinking: how to prepare students for a rapidly changing world*, 1993) created a taxonomy of Socratic questions in support for problem based learning (PBL). The taxonomy is not a hierarchy in the traditional sense. The categories build upon each other, but they do not necessarily follow a pattern or design. One question's response will lead into another category of questioning not predetermined by the facilitator. In keeping with the problem based learning (PBL) philosophy, this aspect of the model is most conducive! The role of the skilled facilitator is to keep the inquiry "train on track", but, also, to allow participants to "travel to a viable destination" of their own design. Paul suggests six types of questions that probe reasons and evidence:

1. Questions of clarification
2. Questions that probe assumptions
3. Questions that probe reasons and evidence
4. Questions about viewpoints or perspectives
5. Questions that probe implications and consequences
6. Questions about the question

The particular function of critical thinking has been expressed as follows (from *Questioning Deeply: Raising and Pursuing Root or Significant Questions*):

Critical thinkers can pursue an issue in depth, covering various aspects in an extended process of thought or discussion. When reading a passage, they look for issues and concepts underlying the claims expressed. They come to their own understanding of
For with the dialectic and Plato, the importance of the distinction between two forms of question and tradition of philosophical questioning is challenged by Adam Phillips (An Answer to Questions, 2000) in his comments by A J Ayer's (Language, Truth and Logic, 1936; Logical Positivism, 1959) problematic view of questions as a logic positivist:

For Ayer, logic is a form of hyperbole that can show us the starkest of truths: a question is something that can be answered. If there is no way of answering, then it is not a question that has been asked. "We enquire in every case," he writes, what observations would lead us to answer the question, one way or the other; and, if none can be discovered, we must conclude that the sentence under consideration does not, as far as we are concerned, express a genuine question, however strongly its grammatical appearance may suggest that it does.

For Ayer, genuine questions have answers; for the psychoanalyst I describe, the problem with the question is its need for an answer. The philosopher and the psychoanalyst seek different satisfactions. The psychoanalyst wants to persuade us that there is a satisfaction in asking, and going on asking; the philosopher wants to get his asking right. The philosopher and the psychoanalyst agree that people ask, and ask for, what cannot be asked. For the psychoanalyst this is the point, for the philosopher this is the problem. What is not in question is the value of questions, and the value of asking questions about questions. The traditional pursuit of philosophers that Ayer was so dismissive of has been a quest of (and for) questions. What Freud did was to redescribe questions as part of the rhetoric of demand. To ask a question is simply a way of acknowledging to ourselves and other people that we are lacking something.

Higher order questioning

The concern above with problematic questions and missing dimensions raises the question of whether the "information retrieval" stimulus is unduly biasing the approach to questions. It is clear that there are domains of questioning (as in Stone's court case example) where it is the capacity of the questioner, answerer and audience which is as much at issue. However any understanding of questions of a "higher order" is challenged by Adam Phillips (An Answer to Questions, 2000) in his comments by A J Ayer's (Language, Truth and Logic, 1936; Logical Positivism, 1959) problematic view of questions as a logic positivist:

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Tradition of philosophical questioning: J D Casten (Plato: Memory of the Gods, 1994) notes, with respect to the methods of Socrates and Plato, the importance of the distinction between two forms of question and answer. "The maieutic method has often been confused with the dialectic method, the dialectic often dubiously understood to be the method of question and answer" [more | more]. According to Casten:

- **Maieutic**: In the *Theaetetus* (149a-151d), Socrates compares himself to a midwife, where the mind may be "in some labor with some thought it has conceived" (151b). Socrates had also noted that "Diotima's own method of inquiry [was] by question and answer" (Symposium, 201e), and other philosophers are noted as using the method as well, e.g. the Eleatic stranger "asking questions, as Parmenides himself did" (Sophist, 217c). Although never explicitly stated, such a method, where the instructor (theoretically) does not hand over knowledge, but assists the student in discovering things for themselves, is congruous with learning being a form of recollection. In this way, we can see the Socratic, or maieutic, method as being a means of agitating and prompting a recollection of the eternal. Such does not necessitate our participation in an exterior dialogue for the gaining of knowledge, as it is noted that "thinking and discourse are the same thing, except that what we call thinking is, precisely, the inward dialogue carried on by the mind with itself without spoken sound" (Sophist, 263e). Thus, one might carry on a maieutic soliloquy with one's self, drawing out wisdom with one's own inner voice, as if in prayer.

- **Dialectic**: In the *Phaedrus* (265d-266c), two "procedures" are discussed; one of bringing "a dispersed plurality under a single form" (265d) and the other, a reverse, where one may "divide into forms" (265e). Together, this splitting and splicing, the cutting and weaving of forms, comprise the dialectic method: "the pair of arts... of universal scope, the art of combining and that of separating" (Statesman 282b). Although one or the other of these two aspects, pluralizing or unifying, is emphasized at various times, we must remember that "the dialectic art never considers whether the benefit to be derived from the purge is greater or less than to be derived from the sponge" (Sophist 227b-c), "binding... together... [and] separating... off" (Sophist 227c) being equally useful.

For Hans-Georg Gadamer (The Hermeneutic Priority of the Question, Excerpted from Truth and Method, 1975):

It is clear that the structure of the question is implicit in all experience. We cannot have experiences without asking questions.... The essence of the question is to have sense. Now sense involves a sense of direction. Hence the sense of the question is the only direction from which the answer can be given if it is to make sense. A question places what is questioned in a particular perspective.... Among the greatest insights that Plato's account of Socrates affords us is that, contrary to the general opinion, it is more difficult to ask questions than to answer them....To someone who engages in dialogue only to prove himself right and not to gain insight, asking questions will indeed seem easier than answering them. There is no risk that he will be unable to answer a question. In fact, however, the continual failure of the interlocutor shows that people who think they know better cannot even ask the right questions. In order to be able to ask, one must want to know, and that means knowing that one does not know.... For this reason, dialectic proceeds by way of question and answer or, rather, the path of all knowledge leads through the question. To ask a question means to bring into the open. The openness of what is in question consists in the fact that the answer is not settled. It must still be undetermined, awaiting a decisive answer.
Interesting questions: The much-cited approach by Benjamin Bloom to facilitating student understanding of "deeper" questions also raises the question of how "interesting" questions are to be defined -- as opposed to "uninteresting" ones. This is an explicit concern for mathematicians, for example. How are "significant questions" or "non-trivial questions" to be distinguished from "trivial questions"? To what extent does a liberal arts education facilitate the identification of "significant questions", as is claimed? On the other hand, paradoxically, it might be argued that needing a definition of an interesting question might prove to be a mark of inability to use any answer to formulate one.

It might be argued that it is the uninteresting nature of the questions to which society is mainly exposed, notably as a result of dumbing-down by the media, that evokes psycho-social dynamics to expose people to more interesting questions. These may be associated with substance and other forms of abuse and the challenges to which they give rise. It might usefully be asked to what degree the questions to which young people are exposed -- in facing the prospect of adult life -- are perceived by them as interesting.

It might also be argued that a nation may respond more enthusiastically to a leader that exposes them to more interesting questions. It could also be argued that a society that fails to engender interesting questions through its own cultural creativity effectively evokes such challenges through the problems to which it is then exposed (making for "interesting times" as envisaged by the old Chinese curse). This is perhaps a way of understanding the emrgence of "terrorism", "global warming", "AIDS", and the like.

Multiple intelligences: The challenge of identifying interesting questions is also closely related to the challenge of the "super-gifted" -- and of how their insights may best be evoked and related to the challenges of society. It is in this light that it is useful to ask what kinds of question might be asked by the different "intelligences" identified by Howard Gardner (Frames of Mind: the theory of multiple intelligences, 1984) and indeed how is a "question" to be understood from (within) each such perspective:

1. Linguistic intelligence: This is demonstrated by a sensitivity to sounds, rhythms, inflections and meter, a special clarity of awareness of the core operation of language. Such gifts are particularly characteristic of poets; but are said to be universally relevant in order: to use rhetoric in order to convince others; to remember information mnemonically; to explain something clearly to others (even when what is being explained is mathematical, logical or whatever); and to understand language itself. This intelligence is shown to be rooted in the left hemisphere of the brain; and although the right-hemisphere may be used to learn both to read and to speak, such ability will be somewhat restricted.

2. Musical intelligence: Such intelligence has as its centre the relating of emotional and motivational factors to the perceptual ones; music is a way of capturing and communicating feelings and knowledge about feelings. Musical ability is centred in the right-hemisphere of the brain and varies widely among individuals and cultures. It seems to be used in exploring and interpreting other forms of intelligence.

3. Logical/mathematical intelligence: This is developed first from the ability to recognize classes or sets of physical objects; and later by conceptualizing classes or sets of objects or ideas in the mind and understanding logical connections among them. Central features are: the ability to identify and then solve significant problems; memory for repetitive patterns and the ability to compare and operate upon such patterns mentally; and an intuitive feel for logical relationship.

4. Spatial intelligence: An accurate perception of the physical world, an ability to transform or modify these perceptions, and the recreating of certain aspects of visual experience without relevant physical stimuli - these are all part of spatial ability. Centred in the right-hemisphere of the brain, spatial skills are typical of cultures where tracking, hunting and visual recognition of the environment are paramount; but present-day Western culture requires it no less, whether for the architects or the mathematical topologist or the molecular biologist.

5. Bodily-kinesthetic intelligence: Skill in controlling bodily movements and in the ability to manipulate objects combine in this intelligence, which has been valued in many cultures as the harmony between mind and body - the mind trained to use the body properly and the body to respond to the mind. It reaches its height in dance, which has supernatural connotations in some cultures, and in other performing roles. Low bodily-kinesthetic intelligence is equated, in India for example, with immaturity.

6. Personal intelligence: These are centred on the concept of the individual self and may be considered as: Access to one's own feeling life - this is the development of the internal aspects of a person and the ability to detect and symbolize complex and highly differentiated sets of feelings. Ability to notice and make distinctions among individuals - to read even the hidden intentions and desires of others and to use this knowledge to influence their behaviour. Development of these intelligences leads to self-maturity and to personal knowledge of one's self as a unique individual.

The last form of intelligence also raises the question of the nature of questions formulated by emotional intelligence as explored by Daniel Goleman (Emotional Intelligence, 1996) defined as "the ability to monitor one's own and others' emotions, to discriminate among them, and to use the information to guide one's thinking and actions".

Cultural mindscapes: Just as an "information retrieval" perspective may respond primarily to the questions of only some of the above intelligences, a further complication is introduced by the cultural framing of the questioning process as explored by Magoroh Maruyama (Mindscapes, social patterns and future development of scientific theory types, 1980). He distinguishes four epistemological mindscapes:

- **H-mindscope** (homogenistic, hierarchical, classificational): Parts are subordinated to the whole, with subcategories neatly grouped into supercategories. The strongest, or the majority, dominate at the expense of the week values, policies, problems, priorities, etc). Logic is deductive and axiomatic demanding sequential reasoning. Cause-effect relations may be deterministic or probabilistic.

- **I-mindscope** (heterogenistic, individualistic, random): Only individuals are real, even when aggregated into society. Emphasis on self-sufficiency, independence and individual values. Design favours the random, the capricious and the unexpected. Scheduling and planning are to be avoided. Non-random events are improbable. Each question has its own answer; there are no universal principles.

- **S-mindscope** (heterogenistic, interactive, homeostatic): Society consists of heterogeneous individuals who interact non-hierarchically to mutual advantages. Mutual dependency. Differences are desirable and contribute to the harmony of the whole.
Maintenance of the natural equilibrium. Values are interrelated and cannot be rank-ordered. Avoidance of repetition. Causal loops. Categories not mutually exclusive. Objectivity is less useful than "cross-subjectivity" or multiple viewpoints. Meaning is context dependent.


It might usefully be assumed that within each of these mindscapes the nature of both question and answer are understood differently from that within the currently dominant intellectual paradigm conditioning search engine design. Frameworks distinct from those of Howard Gardner and Magoroh Maruyama also merit attention (see Systems of Categories Distinguish Cultural Biases, 1993).

**Questions of praxis:** Another approach to distinguishing the qualities of higher order questions is through domains of praxis and the nature of questions to which they give rise, where the challenge is as much "art" as "science":

- **Existential, philosophical and spiritual questions:** these raise issues of dimensionality, the identity and capacity of the questioner and the questionee, and notions of relevance. At their most challenging they may take the form of paradoxes, exemplified by the questions implicit in Taoist "crazy wisdom" (cf Chuang Tzu) and the Zen koan. Koans are not rational questions with final linear conclusions, rather they are especially designed to open the mind that has been closed by habitual responses to the world and reality.
- **Terrestrial aliens:** these raise questions about the cultural and linguistic significance of the questions and answers, especially when the "aliens" are merely those of a different generation
- **Extraterrestrial aliens:** hypothetically these draw attention to problems concerning the nature of questions in non-terrestrial contexts and the possibility of other approaches to eliciting information (see Communicating with Aliens: the Psychological Dimension of Dialogue, 2000)
- **Sustainability:** the strategic dilemmas associated with sustainability place greater attention on the framing of understanding from which appropriate balance can be distinguished and maintained -- partly epitomized by the challenges of gardening (see Psychology of Sustainability: Embodying cyclic environmental processes, 2002)
- **Education:** this raises issues about acquisition of culture and the conceptual skills necessary to survive and thrive in an increasingly turbulent world (see Attitude Entrainment: Communicating thrival skills and insights, 2004)
- **Commerce:** here the focus is on questions that will detect (or frame) bargaining opportunities for trading advantage
- **Strategic and military:** the "war against terrorism" has demonstrated the inadequacy of the intelligence framing questions appropriate to the dimensions of the challenge (see Transforming the Encounter with Terrorism, 2003). As noted by George J. Stein (Information Warfare, 1995): "We do not yet have a strategy of information warfare, and we have not answered the higher-order questions of how we would reorganize, retrain, and reequip for third-wave warfare".
- **Personal relationships:** the amazingly problematic dynamics of personal relationships focus attention on the need for another order and quality of question
- **Kinetic:** dancing, wind surfing, skateboarding, martial arts ***
- **Creativity and aesthetics:** the questions associated with creativity, whether its evocation or in response to the aesthetic of its products, may be of a radically different type
- **Risk and threat:** streetwise **

Each of the above suggests the possibility of presenting each domain against a set of question types to distinguish the mix of questions on which each is dependent. In the case of sport, this might be done for a wide variety of sports (eg judo, mountaineering, snorkeling, paragliding, speleology). These concerns with disciplines very broadly understood are in sympathy with the approach of philosopher Paul Feyerabend (Against Method, 1975) for whom "all methodologies, even the most obvious ones, have their limits" (see Beyond Method: engaging opposition in psycho-social organization, 1981)

**Questions about questions:** There is therefore a case for asking questions about questions in ways for which information retrieval systems are not designed:

- If a question may be understood as an openness to uncertainty or to the unknown, how is a higher order question to be understood? To what kind of uncertainty is it open?
- How many questions (and of what type) are required to avoid vulnerability and an endangered integrity -- and how is this reconciled with openness to change (and mutation)?
- Is the relationship between fundamental questions, and their integrity as a set, to be understood in terms of a form of triangulation (analogous to that of topographical surveys)?
- Does each discipline effectively represent a key question, exemplified by each of the different "disciples", or "knights", at any archetypal roundtable?
- How are the complementarities within a set of questions to be understood?
- How does a question both emerge from a dynamic as well as engendering a dynamic?
- What is the relationship between a key question and vital feedback systemically understood as part of a feedback loop?
- How is the necessary set of questions to be understood under conditions where failure to ask the "final question" or "key question" in the set may leave one "exposed", in an unstable state, or susceptible to being attracted into a "learning experience" -- possibly unwelcome?
- How is nature of the "final question", prior to commitment to a high risk major enterprise or contract, to be understood? How then are meta-questions about the rules to be asked and answered? (Xavier Sallantin ***)

**Functional complementarity of higher order questions**
The challenge of interrelating higher order questions is addressed in an exploratory annex to this paper entitled *Functional complementarity of higher order questions* (2004). The annex has the following components:

- Introduction
- Semantic interrelationships between WH-questions
- Engaging with tendencies to twisting movement -- insights from helicopter control
- Measure formulae as the basis for a semantic template
- Qualitative operational relationships associated with learning cycle
- Cognitive instruction set for a semantic vehicle
- Set of measure formulae as a template for WH-questions
- Challenge of interpretation and comprehension
- Transformational questioning
- "Pathology" of Q&A: problematic answers to single-mode questions
- Existential dynamic in a "cognitive helicopter"
- Challenge of closure
- Reframing possibilities of closure
- Helicoidal coding

**Conclusion: "Music of the spheres" vs "Conceptual boneyard"

This exploration suggests that the so-called "music of the spheres" may well not be an aesthetic conceit. Each of the "spheres" through which these questions may be explored is a quite distinct cognitive/enactive mode that is necessarily insufficient unto itself. The integrity of each is only sustained through its role in sustaining a larger dynamic through what is usefully described metaphorically as "music".

The "music" is the evolving interplay between the modes -- each understood metaphorically as notes, melodies or instruments in that symphony. Music can of course be understood as precisely encoded (mathematical) relationships (à la Pythagoras) with properties such as harmony and the potential of overtones -- whose resources entrain and sustain the human spirit.

It is such resonances that effectively form the systemic feedback loops between the spheres -- a form of cognitive wind harp.

In total contrast to the harp metaphor, and with apologies to Douglas Adams (*Restaurant at the End of the Universe*, 1980), the seemingly disparate conceptual pieces of the living experience held by such a table of complementary concepts might be understood as the "conceptual boneyard at the end of the cognitive universe" -- a boneyard from which the life has been withdrawn. The bones being the leftovers from the consumption experience at Adams’ restaurant table! As the final resting place of Theories of Everything, this "boneyard" also has echoes of the legendary Elephants' Graveyard -- with the shadowy guardian of its magical book of spells, namely the lost treasure by which the planet is transformed, whether peacefully or violently [more]

The challenge may then be that of providing the connective tissue for the set of bones in the conceptual boneyard, putting flesh on it, and reanimating the whole -- perhaps in the spirit of Zen Flesh, *Zen Bones* (1959) or of the well-known Buddhist right mindfulness meditation on the skeletal bones in a channel ground. The living nature of reality may lie in the nature of the answer to the terrifying question we do not want to know we asked. Reality, as experienced in its most alienating forms, may then be the answer to a question that we have forgotten we asked -- or continue, unconsciously to ask, for lack of the capacity to learn from the response. The experience of reality is thus the receipt of an answer to a "lost" or "forgotten" question. In that sense reality is a knot of unanswered WH-questions -- a topological challenge.

"Fear and Trembling" "Where am I? What does it mean to say: the world?... Who tricked me into this whole thing and leaves me standing here?... Why was I not asked about it, why was I not informed of the rules and regulations but just thrust into the ranks as if I had been bought from a peddling shanghaier of human beings? How did I get involved in this big enterprise called actuality?... Is there no manager? To whom shall I make my complaint?" Thomas C Oden (Ed) *The Humor of Kierkegaard: An Anthology*, 2004

**Postscript: Questioning "terrorism"

The above arguments raise the possibility of a higher order of questioning in response to "terrorism" -- a manner of engaging cognitively, and with greater maturity, with what it is claimed to be:

- Who is providing the information defining the threat and urgent action? Who benefits from the threat? Who cultivates fear? Who is disguising an undeclared agenda by stressing the threat of terrorism? Who can offer insights to reframe threat?
- Why is terrorism being promoted as a threat? Why are the most insightful so easily convinced? Why do the most insightful delay so long in protesting poorly substantiated framings of threat?
- How do people acquire power in democracies enabling them to manipulate evidence in support of undemocratic agendas? How can genuine threats be distinguished from fabrications? How should people act in response to those promoting fear in society?
- Where are people to turn for undistorted perspectives? Where are genuine threats liable to come from? Where do people acquire susceptibility to threat?
- What can individuals do in an environment in which the most eminent are complicit in the distortion of evidence? What can be done by a society whose most healthy processes are undermined by paranoia? What are the real threats to well-being in society? What can most beneficially be learnt under the peculiar circumstances of collective paranoia?
• When should people consider evidence of threats to be unsubstantiated? When should they act in response to poorly substantiated threats? When will society acquire the maturity to avoid traumatization by threat?
• Which insights are most valuable in fruitfully reframing the challenge of terrorism?

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