Self-Reference, the Moebius and Klein Bottle Surfaces, Multivalued Logic and Cognition

Diego L. Rapoport
Univ. Nacional de Quilmes, Buenos Aires, Argentina, Argentina
diego.rapoport@gmail.com - http:www.unq.edu.ar

Abstract
We present a theory that surmounts the Cartesian Cut through self-reference, torsion geometry, multivalued logic, paradox, cybernetics, time-waves, quantum physics, the Moebius and Klein bottle surfaces, philosophy and semiotics. We introduce a Time Operator, and discuss its role in self-control, chronomes, will and a third-order time derivative. We apply the theory to visual perception and the problem of brain hemisphere integration for stereoscopic vision and its relations to micro and macroscopic non-local entanglement, torsion vortices and anticipation.
Keywords : Time Operator, Paradox, Klein bottle, cognition, anticipation

1 The Cartesian Cut : Introduction

While current science has been built in terms of the Cartesian Cut in its manifold expressions, we have unveiled a lifeworld that surmounts this cut which stems from incorporating into the very foundations of the constitution of space,time, thought, cognition and perception, the essential phenomenon which is the basis for consciousness: self-reference (see Appendix 1). In second-order cybernetics this self-reference trascends the cut between observer and controlled system by the semiotic codification through a primeval distinction (in the sense of the calculus of distintions of Spencer-Brown) of the torsion geometry associated to the anholonomic variables (controlling variables that cannot be separated from the system that they control). These were the variables which Pattee considered to precisely -we say, paradoxically- encode the Cartesian Cut [18, 20]. This fuses subject-with-object into an implicate (in the sense of Bohm) meta-algorithmic (see [9]) process-form which is the Klein bottle (Kb)[20]. Departing from this primeval semiotic codification of torsion (see Appendix 2) through a distinction on a plane, this introduces two states: the 'empty' undistinguished state which is given by the plane itself of all potential undistinguished states (the plenum [20][23], rather than the void in Spencer-Brown's take of his calculus of distinctions [27], in spite of being empty to perception) and the 'distinguished' state codified as the distinction sign. The cleavage of the state of all potentialities under the distinction sign generates a process through the sign as a boundary that sets an 'outer' and 'inner' domains and thus the distinction becomes a logo-physical generator; this establishes a non-dual process of content and context mutual transformation, in which the distinction is both operand and operator,

and form and function fuse. By functioning as a boundary, this transversion of the sign-boundary is an abstraction of osmosis, which is related to torsion [21]. In terms of logic, the first appearance is to associate it with Aristotelian-Boolean logic; on raising this distinction through self-referential paradox we obtain the Kb [20]. This leads to the generation through time-waves of a 4-state logic which generates the most general connective-free multivalued matrix(-tensor) logic, which contains as special cases quantum, fuzzy, modal logics [20]. This reverses completely the historical Western tradition of disregarding paradox completely as nonsensical, which we have thus be proved at the basis of logic. This is possible because content and context conform an holonomic process-structure, rather than distinct related instances. In this theory, logical operators are describable through nilpotent hypernumbers and as quantum field operators [20]; nilpotence is essential to the universal semantic rewrite system and Nature's Code due to Rowlands, Hill [24]. It is remarkable that with this concept of distinction and its interpretation as a boundary, we can construct numerical systems in the so-called boundary mathematics [8]. To construct the complex numbers as spatial forms, only three distinctions are necessary to generate them. Thus this conception under this extra provision of three distinctions allows to construct the number system which allows to treat time and subjectivity : the imaginary numbers [20]. Furthermore, the time oscillations which in this theory with a single distinction and the Kb generate the 4-state imaginary logic of the calculus of distinctions which itself generates matrix logic, appear without recurring to the paradoxical equation that leads to the Kb, as an oscillation of empty state and the *phase form* (which appears to be its self-inverse) created by the juxtaposition of the three distinctions. If we think of each spatial distinction and its meaning as a boundary initiating a process which has a time interpretation as is the calculus of distinctions, then we have three different time distinctions associated to these three spatial boundaries. The first distinction creates a primeval cleavage, space, and the process of going through it: velocity; the second distinction creates a cleavage on the velocity, i.e. acceleration as a process through it, and finally the third distinction creates a cleavage on the accelerations which as a process introduces the time derivative of acceleration, thus a third order time derivative on the original plenum undifferentiated empty state is associated to the three cleavages which allow us to construct matrix logic, and hence relate it to quantum field theory and the Kb [20]

The participatory constitution of the geometry of space and time discussed above stands in sharp distinction with the the Cartesian cut conception in which space is exterior to the subject and a mere container of objects, while time is also considered to be external, though in General Relativity it is constrained by relations with the space variables. In Aristotelian thought, the cradle of Western scientific thought, we have as its backbone a dualist conception which expresses itself in the two-valued logic and the principle of non-contradiction, which is no longer valid in matrix logic nor the calculus of distinctions with paradox. This eliminates subjectivity from the universe [20]. Hegel's stance is that the elimination of time is related to the principle

of non-contradiction, consistently with the findings in our work that its violation leads to time-waves. Further, in matrix logic time appears as an operator, TIME, which is the matrix representation of the commutative square root of minus one which is the basis of imaginary numbers, an anticlockwise (clockwise, alternatively) $\frac{\pi}{2}$ rotation in the cognitive plane of all cognitive (vector) states [20]. In this logic, a cognition operator, M, that arises from the commutator of the False and True Operators -not (dual) scalars as in Boolean logic- (also a logical momentum which yields quantization of any cognitive value and the self as a fixed point of any cognitive state) decomposes as M = TIME+SPIN. A torsion vector appears in two guises: as the coefficients of the self-referential structure produced by these operators, and as a superposed state of the difference between the normal unit vectors to a Moebius surface, i.e. it is given by $S_- = (1\ -1)$, while the anticommutator of these operators yield their sum with coefficients hence given by the other superposition state given by the sum of the normal unit vectors; see Appendix 3. Now, $M = |S_+ >< S_-|$, the tensor product, and the direct sum modulo 2 yields the Kb in-formation matrix, $\mathcal{H} = |S_+ > \oplus |S_- >$, which is non-other than the Hadamard gate of quantum computation; both play a major role in the theory [20]. From the association of spin with torsion [20] and being that TIME is a rotation on the cognitive plane generated by the true and false (2-vector) states, it is clear that cognition is represented by a vortex structure-process projection on two-dimensional cognitive space!

2 Light, Torsion, Chronomes, Hemilateral Synchronization and Anticipation

If thus time is subjective as in Hegelian dialectics, in the concrete realization of this stands the process of photon absortion by the subject. But the photon is no 'external' particle to the subject, as the classical formula would like us believe but is the physical particle which is the core of the self-referential process of fusion of object with subject (inasmuch as the geometrical fusion is the torsion). Indeed, when we visualize a photon, we are actually visualizing our seeing of the photon, the absortion process by which we complete the objectification of the photon as an independent emmiter, object-in-space-before-subject which now when absorbed becomes the fusion of object-with-subject. Self-referentially, the photon (as a life-world) is the observation of the link between the photon (as an element of objective reality) and the perception of the photon (i.e. the Fibonacci type reentrance of a form into itself in the calculus of indications; the 'atom of thought' as in Johansen's conception [9]); see [20].

In this perspective no machine is psycheless. Indeed, any artifact or machine embodies purpose through *design*, a fact rarely acknowledged -but crucial to a permaculture approach to life-, which is the intent of control and thus anticipation. The identification of a subject with the reification of this *projected-embodied* psychic character is a regressed form (fetishism) of animism, all too common and a major

driver of technological inventions, as well as of all kinds of undesirable events. At a larger scale of humankind and in the antipode of largely low degrees of freedom (until nanotechnologies appeared) materials turned machines or artifacts by purpose, we consider events which as A. Young rightly remarks are associated with light [32]. It is this psychic distinction field that creates events as the unfoldment of a Kb, acting as a major social and historic field creating patterns and processes, thus embodying forms and functions, physis, physics and psyche. Since control is related to purpose we have a big-scale coherent anticipative field which conforms a Zeitgeist (spirit of the epoch), actions over resources and a self-action of humankind, the Kb in a social and historical scales. Yet, purpose is associated to the time operator, TIME. Surprisingly, it has been found that there exist time regularities and patterns (*chronomes*) in history (revolutions, war, peace, etc.), culture and its manifestations (design, architecture, philosophy music, creativity on the most diverse fields of psycho-social action), ideas (memes, ideologies, religions, etc.) which have been ascribed to psychological archetypes in the work of sophiologist-mathematician Emil Páles [17], whose work found antecedents in the work of sociologist Sorokin [26]. So, again, the psychic element 'exteriorizes' as well as being the interiorization of 'outer' phenomenae -cosmological chronomes-, but as we would argue, it is a Kb; we shall discuss this further in the case of visual perception. The study of chronomes is a field which was pioneered -starting with Pavlov!- in the former USSR by several researchers grounding the ideas of 'chosmism' (Chizhevsky, Vernadsky, Kondratiev, Kozyrev, etc.) and today is a growing field of knowledge which may lead us to a completely new understanding in science with amazing findings which not only indicate the existence of standing time-waves acting on all systems, but furthermore manifest nonlocal cosmological correlations; see [4] and references therein, [25] and [11]. Earth's relation with the Sun, Moon and the stars is a source for several chronomes. These findings point out to the universality of anticipative, incursive and hyperincursive phenomenae in the sense of Dubois [2].

In this context, quantum jumps play an essential role since they represent what is present to cognition and perception, i.e. differences (which produce differences, as in G. Bateson), as we also know well from physics and visual perception [22]. We have characterized quantum jumps in terms of singularities of the torsion potential described by the differential of the logarithm of these scalar fields produced by the node set of them so that concerning spacetime fields, it is in the two-dimensional Riemann sphere representing the complex plane -and thus a real $2D$ manifold- as also is the cognitive plane of matrix logic and the plenum on which the primeval distinction creates the holonomic structure-process which fuses 'outer' and 'inner' realms, that quantum jumps, cognition, visual perception and logic are grounded on a plane from which through holography the full structure can be retrieved. This is linked to the nondual character of interior and exterior as is the topology of the Kb. It is most remarkable that the Kb appears to be the solution of representation of topographic maps on the neurocortex. As for the interiorization of the visual field

in the neurocortex, it is a well known fact that that there is a distorted map of the body surface in somatosensory cortex, known as the 'homunculus', and that in the visual cortex there is an orderly map of visual space; furthermore, symmetry properties of simple cell receptive properties lead naturally to the construction of the Kb [30]. So the geometry of visual space has a representation at the visual cortex, and furthermore, at the fundamental level of cells, the topology of the Kb is naturally present; furthermore, the topographic representations of the sensorium are arranged topologically, and most remarkably, there is experimental evidence that supports that these maps can be represented by the Kb, while the associated analytical topographic map is the complex logarithm [23]. Interesting enough, a point of departure -yet, not the only one [23]- is the 2-dimensional Gabor function (of importance in holography) [13], commonly used to model the receptive-field profiles of simple cells [14], which make up a substantial percentage of visual cortical neurons. The Gabor function yields a topological representation which is the Kb which is already present at an holographic representation of vision of the neurocortex. We have shown that these topological representations of the neurocortex, i.e. part of the brain, are also fundamental to the mathematical functionality of the mind through logic, establishing an interesting link between the brain and its inner topological and functional structure, with the mind [20]. Several cues are used for the formation of the perception of depth, such as occlusion, rotation of objects (so a perceptual spin is relevant to the formation of depth perception which has already appeared as SPIN), etc., the most important is believed possibly to be stereoscopic vision, i.e. the image formed by the joint use of two eyes. It appears that stereoscopic vision only leads to the formation of three-dimensional images if the two eyes actually sense asymmetric images for each of them, in the contrary there is no distinctive image but a blank homogeneous state [6]. This indicates that the actual concrete perception of a geometry requires an inhomogeneity at its basis, i.e. torsion, self-reference. This is most remarkable since stereoscospic vision is the basis for the conceptual emergence of symmetry with which physics is constructed, and this findings points out that this is only possible from actual asymmetries (which conceptually are based on the manifestation of differences) which if lacking only an homogeneous perception is formed, i.e. no structured perception of inhomogenities, only the triviality of sameness. This perceptual homogeneous plane where no distinctions are present is the one that is associated with the physical symmetrical vacuum, the plenum which we have already presented. So here we have the appearance that depth to be perceived as an original dimension, a difference that makes a difference is necessary as in the conception of G. Bateson, and this is the basic asymmetry between the images of each eye [6]. It is in the field of mathematical psychology in which it has been theoretically and experimentally verified, that visual perception follows the organization of visual 'internal' geometrical representations [20] [7] that they are described by a psychometric function dependent on the observer. Furthermore, that time dilation and space contraction are related to the baud rate of in-formation processing (which

we shall elaborate in terms of ATP's metabolism) Hence, there is no 'pure objective' cognition of an object: Visual perception and cognition depends on contextual interpretations by the subject. Furthermore and most surprisingly, they depend on cultural and theoretical constructs, to some extent (-yet, as disgressed in [23], there is a *universality* in perception, embodied in the Kb and the complex logarithmic map, as topographic representations of the sensorium). Thus, the classical Cartesian formula is untenable and perception is not secondary to cognition, the subject is a full participant in the construction of the proper visual model. This 'interiorization' of the geometry by the subject with its dual operation of projection for the construction of the 'exterior' geometry of space and time can be still be linked with the metabolic rate of the production of ATP (adenosine triphosphate) in the brain's visual area which is still linked with the quantity of light absorbed in the retina (which is related to quantum jumps and torsion, and thus to the quantization of 'outer' spacetime). When general human metabolism (and the V5 area of the neurocortex which is believed to be associated with motion detection) is fast, time runs slow; conversely, when the metabolic rate is relatively slow, time runs relatively faster; see Harms [5] and references therein. This has support as we said already in the fact that there is a related 'inner' geometry of vision in which there is a limiting velocity of percepts processing, and is widely known to occur in extraordinary situations of stress such as high velocity drivers perceiving the 'outer' world through a time dilation and space contraction, accompanied with their relative visual V5 metabolic states may speed-up, compared to observers in other frames at lower speeds relative to c. In the Kb function-form of the neurocortex, quantized 'outer' spacetime is thus transformed into 'inner' quantized perception and thus a minimal instant is associated to it, through which motion and all differences come to be. Then, at that minimal instant there is no motion. Motion must be then the perceptual differences that exist from one instant to the next. Thus, motion may only take place between the instants in time. Here the instants are given to us not by the frequency of light entering the eye, but the processing speed of these instants by the V5 area [5]. We would like to propose that it is that at the limiting velocity of ATP production and visual geometry hyperbolic space, in which cognition appears due to the quantization of time, with associated limiting values of acceleration and control, that TIME, cognition M and SPIN operate. Let us return to the problem of depth, its identification with time as can be perceived in the Necker cube, and following the phenomenological philosophies of Merleau-Ponty and S. Rosen; for references see [20]. Stereoscopic vision which establishes depth perception brings to the fore the problem that in order to obtain a synchronous visual flow in both left and right brain hemispheres, which is needed to account for its coherence, the temporally delayed signals of both eyes' left and right visual hemi-fields (which are processed in different hemispheres), should be integrated with anticipated versions of their complements in order to close the time gap existing with the firing of neurons in the separated hemispheres and recurrent visual control [10]. As we have repeatedly elaborated in this

article, control is linked to purpose and thus to anticipation. The relations between this synchronization and the topographic analytical (complex logarithmic map) and topological (Kb) topographical maps of the sensorium, and the appearance of vortices and Brownian motions in the neurocortex are elaborated in [23]. Remarkably, Kampf's proposal for a solution of this problem (which en passant we remark that is fundamental to the establishment of a physiological process which sustains multivalued logic as the perception of the two possible instances of the Necker cube -or still, the 2D projection of the tetrahedron- requires as both unfold in time through depth perception) is to invoke anticipation, as conceived by Dubois [2]. Kampf: "representational simultaneity, as a brain process spread over spatially distant loci, is achieved by temporally bidirectional interactions of neuronal processing on a quantum scale. Absorber effects between the presumed 'advanced' and 'retarded' signal components are proposed to generate standing time-waves pattern which might be speculatively assigned to the carrier process of an internal psychophysics of the representation of visual space." Furthermore "absorber effects appear, on the operational side, as anticipations of future states of the system". Kampf's proposal then stems from the transactional interpretation of quantum mechanics (TIQM) due to Cramer [1]. In fact, the absorber theory which was the basis for TIQM, attempted to explain the EPR paradox in a straightforward way. It rests on the idea that a 'handshake' -we prefer the term 'identity transparency'- between the ordinarily transmitted signal and an anticipative effect deeply rooted in the quantum world is fed back from the 'absorber' to the 'emitter'. Coupled in-between the 'retarded' and 'advanced' components in the collapsing wave function of the quantum event under measurement, this process appears to an external observer as a seemingly time-reversed transaction. Kampf presents arguments for the significance of advanced signals as an anticipative feedback for the synchronization of spatially distant retarded processes which he derives from an analogy between the synchronization of neuronal activity and that of chains of coupled oscillators on different scales (including a cosmological one). Thus Kampf argues for the existence of a time-loop that accounts for this synchronization and control. He further notices that the mathematical roots of this can be rooted in the standard quantum-mechanical procedure for calculating the 'collapse' of the wave function, by computing the square of the probability amplitude which is done by multiplying a complex number $\cos t + i\mathrm{sen}\, t$ by its conjugate $\cos t - i\mathrm{sen}\, t$, where t stands for the time angular variable i.e. by phase conjugation, which is the basis of holography as elaborated by P. Marcer and W.Schempp [15] and which we note that in matrix logic is the transformation of a cognitive state (see Appendix 3) of the form $< q| =< (\cos^2 t \;\; \mathrm{sen}^2 t)|$ into $< q| =< (\cos^2 t \;\; -\mathrm{sen}^2 t)|$ [20]. In the case of $t = \frac{\pi}{4}$ this is the TIME transformation between the superposed states. These topological entangled states form an orthogonal basis which is the transform by the Kb in-formation matrix $\mathcal{H}$ of the Boolean orthogonal vectors $< 0|$ and $< 1|$ and conversely, $\frac{1}{2}\mathcal{H}$ transforms $< 0|$ and $< 1|$ into $< S_+|$ and $< S_-|$ and these four states generate all matrix logic [20]. Thus, for these states, we can 'interiorize' the

transaction as an action of TIME which generates the laws of thought, or conversely, the Kb logic produces the time-loop that sustains hemilateral synchronization. We already argued that the neurocortex cell visual representation is both supported by holography and the Kb [20], and that the latter is a classical-quantum-classical transformer which sustains multistate logic which is related to quantum fields, transforming the average of the cognitive operator M on cognitive states to the average of the logic spin operator SPIN (related to the perception of depth) on two-state wave functions; furthermore, we can substitute and have SPIN acting on cognitive states and M (cognition operator) on quantum states and this identity is still valid, so we can both have $< q|\mathrm{M}|q >=< \psi|\mathrm{SPIN}|\psi >$ and $< q|\mathrm{SPIN}|q >=< \psi|\mathrm{M}|\psi >$ where $< \psi| =< (\psi(\uparrow) \;\; \psi(\downarrow))|$ is the spin-up spin-down quantum state; this identity stems from the decomposition M = TIME+SPIN, and the fact that TIME is a distinction operator, i.e. $< q|\mathrm{TIME}|p >= p - q$, so that the average $< q|\mathrm{TIME}|p >= p - p = 0$; TIME appears to be unchanged for unaltered states of consciousness.. So indeed, quantum effects, time loops as in the Kb lift of the paradoxical lift of the calculus of distinctions giving thus the periodic reentering of a limited space domain through time waves, and anticipation which are the very embodiment of the holographic structure of the Kb as in [20] are present in the mind-brain (we use this term because of the exchangeability of cognition -mindlike- and SPIN -brainlike- observables described above). Entanglement is due to the action of the non-orientable topology of the Moebius surface, or still by the torsion introduced by the cognition operator, which also represents the non-duality of True and False. One can enquire still if this quantum entanglement is related to the 'interiorization' of quantum entanglement at a cosmological level, a question which Kampf does not raise (perhaps due to the lack of a Kb logic), restricting the arguments to the possible parallels of both cosmological (which we suggest to be alike the Kozyrev phenomenae and the mind's topological entanglement and chronomes; see Appendix 5.) The natural answer is represented through the Kb which has no inside nor outside, but a form-function which transforms a local interior to a local exterior holographically. Thus, absortion at one hemisphere of the cortex of a photon is entangled with the anticipative emission of a photon of the other hemisphere producing synchronization , and this transaction is 'interiorized' in the laws of thought of multivalued logic matrix or still in the calculus of distictions in which we incorporate paradox through reentrance of a Kb limited domain defined by a quantized distinction, a QRLD as we called them. In this transaction the torsion geometry of cognitive space is essential, since itself produces a superposition state, $< S_+|$ which stems from the non-orientable character of the Moebius band and shows up defining the cognition operator; from $< S_+|$ the other superposed state $< S_-|$ is produced through the TIME transform, and together they form the cognition operator (and the Kb in-formation matrix $\mathcal{H}$) which encodes the transformation of cognition to spin observables and conversely. This 'interiorization' process, in the Kb logic is identical to a cosmological entanglement, of which the Kozyrev astronomical observation which we have already pointed out that it

is a cosmological example of a chronome, a time-structure-function which also can be interpreted through the TIQM and also which has been verified that exists not only in cosmological scales but also as quantum entanglement between solar and geophysical phenomenae as proposed and experimentally verified by Korotaev [11]. In fact, the random vortical spacetime motions do have a correlate in the neurocortex [23]. Remarkably, the Kozyrev phenomenae can be explained also through the same geometries that the mind-brain operations associated with matrix logic and a QRLD, i.e. in terms of torsion through spacetime (Brownian motions; see Appendix 6) fluctuations [21] -which we observe that thought unless programmed is a random motion- and spin-torsion fields [28]. In fact, the random vortical spacetime motions do have a correlation in the neurocortex which are associated to growth (i.e. physis) [23]. This leads to enquire on how QRLDs, say a cosmological one (with a corresponding cosmological Planck constant) [16] may be entangled with a meso or microscopic domain (with an appropiate Planck constant)- as already the human 'homunculus' representation already achieves- with a neurological domain so that the entanglement that synchronizes stereoscopic vision through logical torsion entanglement or through an emission-absortion transaction, forming a self-referential loop in which the QRLDs are intertwined. A natural solution perhaps can be found in the fractal structure provided by nested QRLDs in which 'interior' domains reenter through 'exterior' ones and viceversa: an heterarchy of Kb. It would be interesting to consider this in regards of the fractal structure of time [31].

3 Conclusions

We have briefly presented a conception which surmounts the Cartesian Cut, based on vortical torsion fields and the self-referential appearance-construction of spacetime related to quantum jumps, and the non-orientable topology of the Moebius and Klein bottle surfaces in matrix logic and the calculus of distinctions. We have proposed a TIME operator and related it to will, self-control, and third-order time derivatives, which can be further related to a universal phase of a spinor field, life, self-organization and syntropic processes, and to the Myth of Eternal Return as a self-referential process [23]. We discussed the relations with the cell's ATP energetics, perception and the quantization of time. We proposed an explanation of hemilateral brain synchronization in terms of chronomes produced by torsion fields, an heterarchy of Klein bottles and anticipatory sytems.

References

[1] Cramer, J., Rev. Mod. Phys. **58**, 647-688 (1986).

[2] Dubois, D.M., "Review of Incursive, Hyperincursive and Anticipatory Systems,- Foundations of Anticipation in Electromagnetism,Computing Anticipatory Sys-

tems, CASYS'99, Third International Conference, *AIP Conference Proceedings 517, pp.3-20, 2000.*

[3] Eganova, I. A., "The World of Events Reality: Instantaneous Action as a Connection of Events Through Time", in *Relativity, Gravitation, Cosmology*, V.Dvoeglazov (ed), pag. 149-163, (Nova Sc., New York, 2004).

[4] Halberg, F. et al, "Chronoastrobiology", Biomed. & Pharmacother.**58** (2004).

[5] Harms, J., Kybernetes **32**, No. 7/8, 2003, pp. 113-1128

[6] Hubel, D.H., *Eye, Brain and Vision*,(Freeman and Co. New York, 1988).

[7] Indow, T., *The Global Structure Of Visual Space*, (World Scientific, 2004).

[8] James,J., "'A Calculus of Number Based on Spatial Forms", Ms. Sc. thesis, Univ. of Washington, 1993.

[9] Johansen, S., *Outline of a Differential Epistemology*, English trans. of the Norwegian (Univ. of Trondheim, 1991), to appear; ibid., Casys'07, Int.J. Comp. Ant. Sys. **22**, 2008, 141-158.

[10] Kampf, U., "Possible Quantum Absorber Effects in Cortical Synchronization", in Vrobel, S. and Rossler,O., *Simultaneity: Temporal Structures and Observer Perspectives*, (World Sci., Singapore, 2008); ibid. in Casys, Int.J. Comp. Ant. Sys. **22**, 2008.

[11] Korotaev, S.M., "Experimental estimation of macroscopic nonlocality effect in solar and geomagnetic activity", Phys. Wave Phenomena, **11** (1), 46-54 (2003); ibid., Int.J. Comp.Anticip. Systems **22**, 2008, 31-46.

[12] Kozyrev, N.A., "On the possibility of experimental investigation of the properties of time", in *Time in Science and Philosophy*, pp. 111-132, Prague, 1971; www.chronos.msu.ru.

[13] Liebling,M., Blu, T. & Unser,M., "Fresnelets: new multiresolution wavelet bases for digital holography", IEEE Trans. Im. Proc. **12**,1 (2003), pp. 29-43.

[14] Marcelja, S., " Mathematical description of the responses of simple cortical cells", J. Opt. Soc. Am. **70** (1980), pp. 1297-1300.

[15] Marcer, P. & Schempp, W., "The brain as a conscious system", Int. J. of Gen. Sys., 27, 1/3, 231-248 (1998).

[16] Nottale,L., *Scale Relativity and Fractal Space-Time*, (World Scientific, 1993).

[17] Páles, E., *Seven Archangels: Rythms of Inspiration in the History of Culture and Nature*, Sophia Foundation, Bratislava, 2009.

[18] Pattee, H. H., "The Physics of Symbols:Bridging the Epistemic Gap", BioSystems **60**(2001) 5-21.

[19] Pitkanen,M.,*Topological Geometrodynamics*,(Luniver,Beckington,UK, 2006).

[20] Rapoport, D.L., "Surmounting the Cartesian Cut Through Philosophy, Physics, Logic, Cybernetics and Geometry" Found. of Phys., http://www.springerlink.com/content/h168352020762932/ .

[21] Rapoport, D.L., "Torsion Fields, Cartan-Weyl Space-Time and State-Space Quantum Geometries, their Brownian Motions, and the Time Variables", Found. of Phys.,**37**,nos. 4-5, 813-854 (2007); ibid. "On the unification of geometric and random structures through torsion fields", Found. of Phys. **35**, no.7, pags. 1205-1244 (2005) .

[22] Rapoport,D.L., "Torsion Fields, Propagating Singularities, Nilpotence, Quantum Jumps And The Eikonal Equation", in *CASYS09, Conference on Anticipative Systems 2009*, D. Dubois et al (eds.), Springer AIP Conference Proceedings 1303, Berlin, 2010.

[23] Rapoport, D.L., "Surmounting the Cartesian Cut Further", in *Quantum Mechanics*, J. Groffe (ed.), (Nova Science, NY, in press, 2010).

[24] Rowlands, P. *From Zero to Infinity*, (World Sc., Singapore, 2008).

[25] Shnoll, S., arXiv.org physics/0602017 (2006).

[26] Sorokin, P. A., *Social and Cultural Dynamics*, (Bedminster, NY, 1962).

[27] Spencer-Brown, G., *Laws of Form*, (Bohmeier, Leipzig, 2010).

[28] Stanislavovich, B., "On Torsion Fields", Galilean Electrodynamics, **12**, Special Issue 1, p. 5-9, (2000).

[29] Stern, A., *Matrix Logic and Mind*, Elsevier , Amsterdam, 1992; ibid. *Quantum Theoretic Machines*,(Elsevier, Amsterdam, 2000).

[30] Swindale,N. V., Current Biology **6**, no. 7 (1996), 776-77; Tanaka,S., Proc. R. Soc. London (Biol) **261** (1995), 81-88.

[31] Vrobel, S., *Fractal Time*, The Inst. for Adv. Interdis. Res., Houston, Texas, U.S.A, 1998, http://www.if-online.org/Fractal

[32] Young, A.M., *The Reflexive Universe:The Evolution of Consciousness*, Robert Briggs Assoc., Lake Oswego (Oregon), 1976.

Appendixes

1. Self-reference is crucial as well to language and its geometry; see Doucet, J.A., "Language and Geometry", and "Sentences with Associated Geometry", and Dubois, D.M. & P. Julià,P., "On Two Different Conceptions of Language, Self-Referentiality and Consciousness", Lowenthal, F., "Language and Recursion", presented at CASYS' 09, Liège, 2009.

2. Torsion as the primitive distinction introduced in the undifferentiated plenum and thus establishing a locus and phenomenology, is the fusion of subject-with-object, as well as that of form and function, which biology and most notably, medical theories and practice tend to separate. This unfolds in several ways, one of which is its association to spin which is a field not only notable in physics, but as well as all pervasive in biology. Thus, as much as the primevally undifferentiated plenum has the potentiality of all forms and functions, it is by torsion cleaving this plenum that these come to manifestation. The Cartesian Cut attempts precisely to dissociate

between form and function, being the case that their gestaltic fusion is due to the simple fact that function -physis- is established due to inhomogenities that give rise to processes, which produce themselves forms and structures through symmetry, which due to the impossibility of being isolated from the environment of other forms-functions produced by other cleavages, tend to loose their symmetry and thus become processes. Torsion thus is associated with action, and thus it gives rise to quantization of the plenum, and thus the corresponding physical parameter is Planck's constant, which is not singular but multivalued as shown by Pitkanen [19] and Nottale's Scale Relativity [16]; the latter theory can be derived from torsion geometry without recourse to forward and backward derivatives [21]. Thus, the heterarchy of Kb stands for quantized *re-entering* limited domains (QRLD), with different quantization magnitudes which can be cosmological.

3. $[\text{False}, \text{True}] = 1\text{False} - 1\text{True} \neq 0; \{\text{False}, \text{True}\} = 1\text{False} + 1\text{True}$ from which the normal vectors to the Moebius band are obtained. Namely, the topological superposed states $S_- = (1 \quad -1)$ and $S_+ = (1 \quad 1)$; see [20].

4. Cognitive states are real valued vectors which we write as Dirac bras and kets formalism of quantum mechanics $< q| = (\bar{q} \quad q)|$, where $\bar{q}$ is the negation of q (the *real*-valued logical variable), i.e. $1 - q$ so that they are *linearly* normalized, related to the wave-state of two state quantum mechanics by the relation that the former are the complex square root of the latter, i.e. $q = \psi\bar{\psi}$.

5. Kozyrev and Nasonov discovered on observing through a telescope with a device, that there exists a radiative field associated with, say a star or galaxy, that cannot be shielded but with polietylene. In pointing the telescope to the future and current position of the star this radiation was also registered [12]. These experiments were repeated decades later by Lavrentyev with the same results and the theory is currently used to compute current positions of astronomical bodies [3].

6. The Schroedinger equation for ψ (where the torsion field $d \ln\psi$ describes the average motion of the universal Brownian motion generated by the torsion geometry together with the diffusion tensor associated with a metric), incorporates *both* boundary conditions on the past *and* the future that allow to consider the probability distribution $\psi\bar{\psi}$ which we interiorize as the logical variable q. If instead ψ satisfies the propagation wave and eikonal (nilpotence) equations of light rays ([22]), and furthermore we take ψ as quaternion-valued, the eigenstates of the *null* operator of matrix logic coincide with the twistor representations of these light rays [23], from which all cognitive states $|q >$ can be constructed. This clearly shows the relevance of pluripotence of 0 which appears to be extended, non point-like.