Complexity Dynamics Shaping Life

Helmut K. Loeckenhoff
Independent Research
Loeckenhoff.HellK@t-online.de

Abstract
Science attempts to understand *life systems*. While physical systems are signified by status, life systems are evidenced by function and organ. As *anticipatory systems* their behaviour relies on embodied memories of their past and probable future. *Complexity and semiosis* act as drivers of evolution; *anticipation* as constituting principle of life systems. Complexity implies *unfolding* and *re-enfolding* guiding differentiation and growth. Semiosis generates *intent* and *meaning*, ensuring viable simplicity. Interacting, they open potentiality and fields of probability for development. The dynamic entailment of *complexity* and *meaning* structures all life systems up to mental constructs. - An overarching concept embraces the patterns of life. It sheds light on the fundamental changes concerning life conditions in society and ecology .
Key words: Life Systems; Evolution; Transdisciplinarity; Complexity; Meaning;

1. Prologue: Faces of Complexity, Semiosis Anticipation and Life

Systems sciences conceptualise life by *systems dynamics*, namely feed back, equilibrium, (ultra-)stability and viability (Beer 1981). Life systems are addressed as *complex adaptive systems*; depicted against thermodynamics as *dissipative* structures. Viewed from Systems Biology (Maturana, Varela 1987) life processes form structure; structure shapes processes. Operationally life systems are discerned e.g. by the interaction with their inner/ outer environments and metabolism. -. To unfold life's qualities, specific models are constructed by specialized scientific disciplines. Reflecting the world as perceived, to understand life phenomena demands shared frames integrating specialized disciplinary attempts. Multi-aspectual reality requests a transdisciplinary approach. Still at the beginning, it has to specify its epistemology, experimental verification and validation.
Scientific inquiry has always been intertwined with *epistemology* (Churchman C West 1971). Departing from research into '*relational complexity*' R. Rosen paved the path for fundamental research into (anticipatory) life systems. The base epistemological approach to modelling life addressed relational *complexity* lately called 'relational science'. Rosen discerned two differing but related models for (non-animate) *physical* respectively for *live systems* connected by a 'modelling relation' (Rosen R. 1985, 1991, 2012; Rosen J., J.J Kineman 2005; JJ Kineman 2007). *Biosemiotic research* follows epistemological approaches basing on Pierce (Pierce 1969, 1991, 1993) and his understanding of 'sign' by (e.g. Barbieri 2007, Hoffmeyer 2008 , Kull (Kull 2012) and others. The research of S. Brier (Brier 2010) connects to *cybernetics and systems* research, including cybernetics of higher order, autopoiesis and *cyber-semiotics*. Related

International Journal of Computing Anticipatory Systems, Volume 30, 2014
Edited by D. M. Dubois, CHAOS, Liège, Belgium, ISSN 1373-5411 ISBN 2-930396-19-9

aspects of *endo- and exo-physics (-science)* are discussed (O.E. Roessler 1988) partly controversial. The inquiry of S. Vrobel (Vrobel 2009, 2011) carries particular significance for the extended and deepened understanding of *human perception and human cognition.* In turn,, on the pragmatic side, all these activities indirectly may lead to more elaborated hypotheses of *learning* and of innovation attuned to the characteristics of the human mind.
The intricate entailment of complexity, semiosis and emerging anticipation (2) opens an *overarching view* to the phenomenon life. Departing from systems thinking, the paper approaches life less from formal mathematical/physical but from *evolutional/biological* considerations. Out of complexity *viable simplicity* arises (3) If mosaically the scaffold highlights salient patterns in the *individual, social and societal* (4) conduct. On that base, how to understand, to *guide* and *eventually to control* the fundamental worldwide change (5) ? Pragmatic, feasible concepts need rest on a *transdisciplinary* ingress briefly discussed in the conclusion (6).

2. Complexity and Semiosis Spawning Anticipation

According to the latest hypotheses in cosmology, life on earth began with the Big Bang or alternatively with a new turn of the Oscillating Universe. Irrespectively *all* evolutional principles leading to life need already be existent in the very beginning, unfolding in a long and non-linear self-referential process of evolvement. During gradual expansion (yet discussed)) of space and time, matter and with matter systems appeared. Systems displayed dynamics opening ever more complex relationships, *networks, nesting, entanglement, entailment.* Departing from phenomenological circumscriptions, further analysis reveals formal *and* systemic networking constituting *complex systems.* Development under prevailing conditions is assumed to follow the *arrow of time.* Initially evolution seems governed by constraints given by formal and physicals laws; in later stages additionally determined by unfolding restraining principles within complexity dynamics itself. With (pre-) life forms *semiosis dynamics evolve.* They ascribe *meaning* to (dynamic) systems, *actively selecting* courses of (directional) evolvement. With evolution in time and history, self-organising *directionality* ex post and ex ante can be observed. *Competing* and co-operating (symbiosis) for resources those systems survive and develop, which, by their qualities, can attract and exploit a sufficient part of scarce resources. The in biology so termed *natural selection* decides which line of systems will outlast, prevail and proliferate.
Further analysis of the process may discern several developmental processes accompanying. The sequence of developmental stages will change *direction*: some strains of complex systems will disappear, others will thrive and eventually branch. Niches will form. Synchronously natural selection acts as a selective *feed back.* In a per se complex process feed back constitutes preconditions of *learning* and a *memory* necessary for learning. *Learning* is understood in the sense that past events are *evaluated, assessed* and stored for further (re-)action. That prompts first *coding* and subsequently a *memory* in which the past experiences are comprised into *mental models.* They contain the essential qualities of the system itself, of its environments and the

interaction as well as the option and action spaces open. The evaluation of action and option spaces provides specific models of possible and *probable futures* of the system itself in its relevant inner and outer environments. These models permit *anticipation* concerning the reactions of the entire systems net relevant in specific actions. Option and action do not remain passive. Fostered by the same learning process the behaviour of systems becomes *pro-active*; mere passive adaptation is complemented and/or replaced by *intentional* and *purposive* action. The quality of *targeting*, of *action planning and control* (in the widest sense including learning) becomes the decisive faculty for continuation.

The rising complexity of all constituents of the entire system enforces a *distribution of control* as well as a *directive centre* for over-all evaluation, assessment and decision. Such structured control systems *separate* from the system itself into controlling institutions in principle operationally independent. Information and information processed based decision reaction and action stimulate ever more complex forms of communication. Mutually life systems acquire rising complexity and exert purpose and intent. Also mutually influencing the brain and social communication develops. Signal systems emerge into pre-languages and languages. With language as the decisive step evolution into human society constituted by language based communication is open. It leads to mental constructs, to civilisation cultures and a particular mento-sphere of e.g. religion, ideologies expressing beliefs, convictions and claim resting upon them.

In short: from the evolution and control point of view *Life Systems can be conceptualised as systems with a separate (central and dissipated) control based on memory, anticipation and learning.* Life systems contain a model of themselves comprising the own past and possible future. They are constantly updated by learning. *Life System are anticipatory learning systems*, or, in terms of complexity concepts (a unified theory still missing) as *Anticipatory Adaptive Systems (AIS).*- For an overarching scaffold from system dynamics to mental constructs see Fig.1, 2; ch. 5.

Anticipatory systems presuppose a complex apparatus of perception, cognition, assessment and decision setting and following priorities. Responding to ever more challenged and complex tasks of control *consciousness* evolved. (The 'I' and the 'self' not discussed here). The emergence of consciousness and in particular *higher consciousness* can be seen as a consecutive development of the above mentioned *central control* governing the distributed control apparatus. As the first step of separation gained degrees of freedom for option and action control securing efficiency and effectiveness. The second provided with higher consciousness a potential of gradual emancipation from reality as perceived and experienced. In the world of *mental constructs* as ideologies and religions the impossible and the contra-real can be conceived. Deception and lie, rather early practices already with lower animal species, may become self-deception and a loss of reality. Proper internal feed back – in particular balancing negative feed back loops – are overruled. The deterioration of control sensitive to internal/external environments may but consequently lead into anomie, decline and extinction. This can be shown for the individual life unit as well as for all levels of social and societal systems.

The argumentation proposes complexity and semiosis as the main drivers of evolvement in general and of the evolution of life systems and (human) systems relying higher consciousness in particular. Perhaps it is therefore that complexity sciences have been assumed as the 'science of all sciences'. The protagonists of bio-semiotics as the 'Examination into the signs of Life and the Life of Signs' (Hoffmeyer 2008) have been more reluctant. The mutual impact of semio-dynamics is missing or given a lower categorical status. Life a result of *complexity dynamics* can only be conceptualised from the complementarily mutual impact of *semiosis dynamics*. From the point of interdisciplinary investigation into evolvement it seems sensible to see their duality as essential models in the evolution of life. Anticipation emerges from their mutuality.
Though they cannot be examined here, four closely affiliated fields of research should be named. The first concerns the *principles evolution* follows, and which for themselves are subject of evolvement. The principles complexity and semiosis are subjugated and no exception. Second, to understand life systems the closely *entwined evolvement of matter, physiology and mind* up to the sphere of pure mental constructs need be further explored. The inquiry raises, third, sophisticated queries into *epistemology*, e.g. on the power of explanation, of explication and of causation by analogy reasoning. Fourth, it concerns the influence of *the physiology and psychology* of human perception. Such research ought enrich and corroborate the above argumentation. The results will indicate modifications for cases of actual application.

3. Life: Simplicity Out of Complexity

To summarize: Evolution is seen as the process of *unfolding* (Nalimov, 1985) obeying the principles of the universe and of life in particular. Concerning the evolvement of life the main driving principles are caught in the models of complexity and semiosis dynamics, closely co-acting and co-efficient. Their mutual interaction spawns anticipation Within that context complexity dynamics can be understood as an *helical* process unfolding these principles by *material manifestation*, and by re-enfolding manifestations following the same principles into 'simplicity out of complexity'. (The diverging concepts of un-/enfolding and re-entry are not discussed). *Rhythm* and *recurrence* shape the processes. All these principles act as *driving* and *forming* forces as well as they function as *constraints*. The interplay of drive and constraint is essential to the development of simplicity out of complexity. With each act of unfolding new more complex systems, the world becomes more entangled and crowded. The increasing complexity and density of existing systems act as an additional constraint, allowing new manifestations of complexity only when there is space available, item actual effective complexity is lowered . Evolvement enforces *simplicity* first, by *constraints* acting as an ex-ante form of natural selection. These formal preconditions keeping down actual complexity are, second, complemented by *semio-dynamics*. As shown above, life systems necessarily are systems following purpose and intent, constraining and directing complexity dynamics by intentional choice. They do so within the borders of *natural selection*, guided by experiences in the past and by anticipation towards the future. A closely entailed and nested network of evolutional 'simplicity principles'

holds complexity evolvement at bay. The phenomenon can be observed on the individual level, the species level and in the life sphere in general. It governs the single reproduction cycle as well as general evolvement.
On the *social and societal level* simplicity out of complexity aligns to *behaviour* securing effective and efficient *handling*. It concerns events, processes. It relates to any situation that needs be handled. Consequentially it affects any institutions, rules, laws, non-written precepts etc. that govern *institutional* behaviour in society on all levels. Actual complexity confronts the acting individual with alternatives which it has to choose and to decide from. To simplify the situation to be met and to *reduce the choices* to translucent alternatives, humans perceive by *models weighting such qualities*, which are or could be of consequence. A model per se embodies already the *meaning* that the situation to decide carries for the decider. Within the thus diminished complexity the actual *intent* of the decider reduces the complexity to alternatives transparently enough to decide towards the purpose. Shamanism and evolving religious systems for example responded to the need for orientation in an non transparent complex world of uncertainty. Shamans reduced complexity by value and assessment systems (including the Decalogue), specifying desired action. All rules and regulations, where ever originated from, follow the same objective to *enable sufficient information* to decide for feasible choice. On the organisation level *'institutional choice'* sets the marks for complexity reduction, for the *codification and institutionalisation of societal functions*,. The civil society e.g. needs a institutional web different from that fitting a dictatorship. In the economic sector rules are designed to prevent that too much complexity stimulates misuse and fraud. Not least the failure to set those rules co-sired the latest crisises – and prolongs it. Viability in business (Beer 1981) is determined by the degree e.g. organisation and supporting ICT succeed to hold complexity at an acceptable level. Accordingly the double faces of *innovations* are tested, whether they might increase already high and costly complexity in company processes and for the customer, or might simplify them.

4. Patterns of Life: Individual, Social , Societal

Social *communication* turned out the decisive step to humanity. It fostered consciousness and higher consciousness. It helped to build of social networking and to raise of ever more complex forms of *society*. As in any other phases of evolvement predecessors of communication paved the path. Notable initial clustering, grouping and positioning formed spatial relations, inducing *networking* manifested in physiology and control in particular of the developing *nervous system*. Between life systems ever more complex signals were exchanged. In the course of increasingly complex group formation, *signals* grew into *signs* carrying *percepts, concepts* and *meaning* (Pierce 1969, Rattasepp 2012, Kull 2012). Signs transferred meaning for sharing or for discourse. *Language* graduated from *proto-language* into languages with fully matured syntax and semantic.
The base interplay between complexity and semiosis behind can be sketched only. Non-guided complexity would have suffocated itself, leaving neither base nor space for

further evolvement. The hidden orders controlling the re-enfolding of complexity into simplicity are found in the rules governing complexity dynamics. The lie in particular in the non-linear laws of *chaos* (Mitchell 2009, Johnson 2007). As observed the quality of elements constituting systems, and the ways of their interaction, determine the systems behaviour concerning the kind of alignments. They regulate the phases suitable to emerge and to change. They set the *points of time* and the *duration* of those phases. The rules effective here are depicted essentially in chaos concepts.

Complexity dynamics in se display *inherent order*, ruling actual behaviour of complex systems as well as their evolvement. Actually complex systems can fluctuate between chaotic situations with but hidden potential for order, and clearly ordered states,. They often *oscillate from chaos to order* and in reverse. To these rules and the chaos/order they create *meaning* can be assigned. Meaning allows systems *purposefully to control,* that is *to adapt* in the widest sense. It is therefore that complexity concepts define life systems as Complex (actively and passively) Adaptive Systems (CAS). Securing continuing flexible adaptability, life happens between order and chaos, as life evolves between chaos and order. That relates to all levels and phases.

Setting positions and distances in space and time, the rules of complexity determine also the forms life may grow into, the multidimensional *geometry of life* and its dynamics. (The 'geometrisation' of the scientific world (Nalimov 1984) presents a chapter of its own.) In terms of complexity the dynamic of life exists and thrives at 'the edge of chaos' obeying the laws of *self-similarity.* Known as *fractals* self-similarity lies behind the forms of leaves and limbs, roots and even technical devices derived as robots. It shapes the cells of the brain as well as the *mental processes* it creates and transfers. Among the rules of complexity self-similarity most evidently connects complexity dynamics with *autopoiesis* and, in broader terms, *self-reference and self- organisation* in life systems. Returning to the initial statement: life re-enfolds to simplicity which is unfolded in complexity. It manifests the dance between unfolding and enfolding, and also to interaction between *complexity and semiosis.* Life creates complexity constrained by purposiveness so that simplicity can emerge in higher forms of behaviour (and learning). Further research will inquire deeper into the intricate entailment between complexity, semiosis and autopoiesis. Essential seems detailed grasp of the dynamic relationship between complexity and semiosis. In essence they mutually condition, constrain and complement each other. The interaction leads cogently (?) to life (Life only needs possible, not optimal conditions). Disturbances will cause life's extinction, when the complexity of the semiotic sphere as in ideologies looses the connection to life reality and is not sufficiently controlled any longer.

The investigation of well known social and societal phenomena under the auspices of complexity opens insights into the *fabrics of society.* Co-evolvement and co-evolution breed various kinds of very differing forms of *co-living*, that is mutual *competition and/or cooperation.* They range from reciprocally benefiting *symbiotic* networks to e.g. predator-prey relationships and to outright *parasitism.* In the realms of society increasingly *parasitism specifies societal relations* from governmental rules to institutional choice to domestic and foreign policy.

The core problem seems systemic: *negative feed* back is either intentionally *impaired* or in many cases replaced by *positive feed back.* Salient *check and balance* by logic, technical and socio-logical mechanism are no longer sufficient or are purposefully eliminated. Critical also proves the change of *values*, or even their loss to superficiality. The raise of overwhelming government bureaucracy and an often simultaneously exaggerated superficial individualism weaken the civil society. Complexity is reduced by rigid, inflexible governmental rules often adverse to life and not kept compliant with the self-organising values of the community. The resulting tendencies to suppression inertia and in severe cases to *anomie.* They undermine stability as well as the potentials for evolvement, often in soft, tacit and hidden forms scarcely detectable.

5. Anticipation for Guidance, Control, Evolvement

In the *triangle of complexity, semiotics and anticipation, complexity* dynamics yields the driving force. Its provides the logical/formal rules and constraints. *Semio- dynamics* assign orientation, direction and targeting. *Anticipation* underfeeds actual guidance and control by active memory. It manifests feed back and permits feed forward. Anticipation capacitates the controlling helix to function as a process of *continuous learning*: of adaptation passive and proactive.
A reference for the argumentation following, figure 1 roughly delineates the evolvement form system dynamics in general to life systems (Complex adaptive Systems CAS) to mental constructs. Ch. 2. of this paper led the grounding. Since closely connected, figure 2 depicts the set proposed transdisciplinary models. The concept will be addressed in detail in ch. 6.

Fig. 1. Anticipation Towards Control

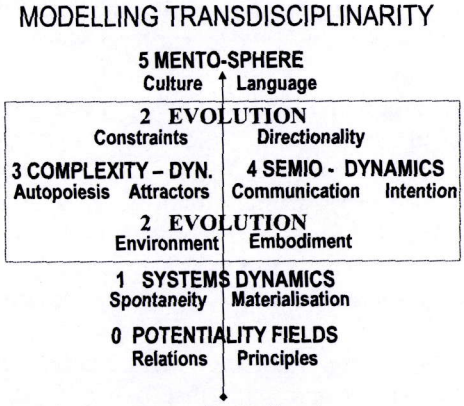

Fig. 2 Modelling Transdisciplinarity

The *anticipation supported process* of *control learning* embraces all aspects of the 'related actual universe' of all life systems. It implicates status, function and organs; space/time span, distance; regulations, rules, principles, and comprehensive controlling and learning processes. Actually the process of guidance, control and learning is of

extremely complex nature in its constituents, its networking and its modes of operation. Simplicity out of complexity needs not only adapt to very different systems to be controlled. It needs also govern equally complex separate and distributed control systems. Indispensable proves an extraordinarily *high flexibility* and *adaptability* of the control systems and the related efferent systems. They need control e.g. the multiple impacts of an action in various fields provoking a variety of possible reactions and consequences differently networked. Moreover, they must take into account the action capacities of the active systems changing with operation. These provide but examples for an highly complex life reality hidden by on the surface of but simple forms. - A kind of *evolutional race* can be observed, apart if related to the competition on resources and life niches. It takes place between ever rising complexity and the control systems/operation of such complexity in search of simple forms practicable in life.

All these phenomena can be found on any ontological level. They shape the strata of physiology structures, of organs and of individual life units. They cast referent control systems and controlling processes. As addressed in the previous chapter, societal life systems with consciousness and higher consciousness are constituted by the same base principles. In social/societal systems the entire triangle connecting complexity and semiosis towards anticipation attains a particular complex quality – and simplicity.

As aforementioned, in societal systems the guidance and control system as a whole is separated and *distributed* as well; distribution extending to the physiological embodiment as to the psychological and in the behavioural field (Schwaninger 2000, 2001, 2006). The same holds valid also for *anticipation.* In the societal area but consequently evolution and its principles manifest in *history.* Following the previous line of reasoning social anticipation is part of organisational and *social learning.* Social/societal anticipation rests on social experience and the communication of assessed experience in the relevant societal fields. As societal learning does, anticipation, its relevant processes and their results depend on an *institutionally complex and complex networked* social system. It contains processes by which public opinion, public *identity* and public expectations manifest. Nodes of the networks can be observed in *Zeitgeist*, in *tradition*, in *group identity* as *nationalism, clanship*, in political convictions etc. The increasingly rapid change *affects essentially the societal memory processes*, namely tradition. Losing the *myth* weakens *identity* where it would be most needed for, a connection negatively used in ethnic politics. Just in times of fundamental, rapid change it proves ever more difficult to uphold and to retrace the historical, cultural and ethnic roots. Even more important, missing roots interrupt the process of societal tradition and learning. Public opinion is often manipulated and therefore rapidly changing. With short term changes in public judgements and prerogatives, the base of identity and with that of anticipation becomes less secure grounded and volatile. Information Communication Technology (ICT) affects anticipation in differing, not yet sufficiently investigated ways. Emotionalisation, ethnisation and idolisation loosen the tie to the rational and factual base of anticipation. So does the emotional re-rise of religious or pseudo-religious bind as e.g. in some 'green' movements.

Recent research and practice points to the impact of *expectations* (including angst and fear) on public anticipation. In the political structure of *party based democracy*, the

volatility of anticipation increases with the decline of the party system in the political sphere. In general, what early has been named as 'directedness from outside' (instead from inside as by tradition and value systems) takes effect to the same effect. Additionally anticipation is increasingly and intentionally constrained by an ever denser nets of rules and regulations; by bureaucracy, lobby, by any groups with vested interests. People are induced to anticipate what they are indoctrinated to expect. Bureaucracy, constraining already per se, is misused to that effect. The health care systems developing into a business with health as well as illness is but one most obvious example. As the EU and the Euro demonstrate from the very beginning, rationality of anticipation has been stifled and overridden by neglect of facts, political egotism and short sight. Society often forgets to remember, to learn and to remind. The resulting stagnation, decline and deterioration are observable. Anomie like outbursts as happened (atomic energy, Stuttgart 21) exhibit but symptoms and add to the general downturn.
The existential need for funding and orienting anticipation signifies the beginning of religion (shamanism) and sciences (topology, astrology, alchemy). Divination is as old as culture: tea leaves, flight of birds, the sticks of I GING, Pythia, the haruspex, and nowadays think tanks. If think tanks in the political area try to follow a rational approach they may be outvoted regularly by short sight political tactics. Economics developed econometrics, complemented recently by behavioural economics and emotional finance (Sedlazek 2011). Their insights did not prevent crises. Reliable and more successfully practiced are planning and control (controlling) methods in business management. In the area of social welfare anticipation and control efforts have failed in practice instead inducing ever higher cost for comparably ever lower performance.
Summing up: Actual civilisation actually tends to separate anticipation from their natural base. Politically often blindfolded it loses grounding with its faculty to anticipate sufficiently reliably or even to give useful orientation. Reality is often lost or neglected. Most crucial, the capacity to remember and remind as to learn is dangerously diminished and socially obstructed.

6. Conclusion : The Transdisciplinary View

The triangle connecting complexity dynamics, semio-dynamics and anticipation pertains to all life phenomena. (see fig. 2. above) *Disciplinary* investigation provides useful specific results and must not be discarded. Referring to the interlocking and interaction of all sectors of life an overarching *transdisciplinary* frame is asked for Fig 2. above). A set of transdisciplinary models is apt not merely to connect the disciplinary views by a shared set of models and a shared semiosis. More important, it anchors particular models and their inherent intent to a networked set of concepts connected to evolution. To be explicit: Complexity and the above triangle are not rendered here as a 'new attempt to explain the world'. Nor is the set of transdisciplinary models hypothesized as more than a framework and a scaffold, both a useful base for a research dialogue (see fig. 2 in ch. 5). Complexity is serving as an essential aspect to begin with. Big bang or a phase of an oscillating universe: complexity as any other principle governing subsequent evolution exist in model (0): the primeval void or *Potentiality*

Field. 'Materialisation' into perceivable units takes place: the quantum zoo, elements, molecules etc. In model (1) *Systems/Cybernetics* act both as driving force when building structures, processes, and consequentially (?) Life Systems. Unfolding complexity governs differentiation; re-enfolding it creates simplicity in shaping spaces for *Life* conceptualised in model (2): *Evolution.* Two main driving principles in evolution are proposed as mutually interacting and driving. Model (3) describes *Complexity Dynamics* shaping and directing/constraining evolvement. Model (4) investigates the role *Semio- Dynamics* play in the emergence of Life, from early *coding* to purpose and intent essential to all Life systems. Life systems, as shown, are *Anticipatory* systems. Arguably (Self-)consciousness and Higher consciousness evolve but a cogent consequence of the evolvement of life itself. Consciousness creates *mental based Semiotic* spheres as for example ideologies and religions. The model of (potentially pure) mental constructs is called Mento-Sphere. Mental constructs can ignore reality, twist or even contradict it. The impossible can as easily be imagined as the contra-real and made the base for action. The previous paragraph pointed out how with the loss of reality the faculty of anticipation is impaired; and which the damages can be for society as e.g. the reduction of societal rejuvenation by impaired learning.
The turn to basics comprises neither idleness nor escapism. Co-occurring sequences of crisises and diminishing option/action space signify worldwide fundamental limits and fish traps. More detailed knowledge into the base grids carrying life and human life need to further insight into the necessity to intervene, and how to do so effectively and efficiently. On an extended base of knowledge and *insight* humankind might be able to plan and act more sensibly and effective. Transdisciplinary research provides an approach to cope with the highly complex challenges for survival/ development under fast growing constraints.

Acknowledgement. Author's Note
The author is aware that concepts and hypotheses as addressed are controversially discussed and not unanimously agreed with. They need be further explicated and corroborated e.g. from logics an mathematics. The paper presents work in progress covering a wide field relating to many disciplines mainly from the social systems view. Connecting links are accounted for in the Selected References. I am gratefulness for encouragement when conceptualising the paper. - Hypotheses as grounded speculation are part of science. They are intended as here as a point of departure for discourse. Quicksand is seen a territory where to creatively learn to walk steadfast.

Selected References

Complexity

Cybernetics and Human Knowing (2009) Vol 16 No. 2-1. Directionality in Complex Systems. Imprint . Acad
Corning, P (3003) Nature's Magic. Synergy in evolution. Cambridge Univ. Cambridge.
Conway P. Heighfield R. (1992): Anti-Chaos. Rowohlt Hamburg

Gell-Mann M.(1994): Das Quark und der Jaguar). Piper München
Hofstadter, Douglas (1985) Gödel, Escher; Bach. Klett Kotta Stuttgart
Günther, Gotth. (1963) Das Bewusstsein der Maschinen. Agis Baden Baden
Mitchell, M. (2009) Complexity. A Guided Tour. Oxford University Press
Patton, M. Quinn [2010]: Developmental Evaluation: Applying Complexity ..to Enhance Innovation and Use.
Johnson, Neil (2007): Simply Complexity. Oneworld Book Oxford UK
Ragsdell, G.; Wilby J. ed. [2001] Understanding Complexity. Kluwer Ac New York
Schwaninger, M. (2000) Distributed control in social systems. In Parra Luna F. in: The performance of social systems. Kluwer, New York, pp 147 -173
Schwaninger, M. (2006) Theories of viability: a comparison. Systg Res Behv Sci 23; pp337 –347 Wiley New York
Syst. Res. and Behav. Science [2003] Vol 20 Number 5. Complexity. Wiley New York
Van Nieuwenhuijze Otto (1998). The Simplicity of Complexity. The Logic of Integration. Paper. World Congr. of Sociology. Montreal
Wolfram Stephen [2001],. A New Kind of Science. Wolfram Media Inc. New York

Epistemology Anticipation Systems

Beer, S. (1981) The brain of the Firm 2nd ed. Wiley Chichester
Churchman C. West (1971) The design of inquiry systems. NY Basic Book New York
Dubois, D. M. (1988). Introd. to Comput. Anticipatory Systems. Intern Journal. of Computing Anticipatory. Systems *2.* Ed Daniel M. Dubois, pp. 3-14.
Kineman, J.J. (2007) Fundament. of Relational Complexity. john.kineman@colorado.eu
Löckenhoff, H. (2004). Innovation for Creative Control by Basyesian Syllogism. In: Cyb. A. Syst.. R. Trappl ed. Austrian Soc for Cybern Studies, Vienna. Vol 1+2
Löckenhoff, H. (2007a). Nano Science - Science in Transition. A Borderline Case. Proceedings CASYS 2007 Liège Belgium
Nalimov Vassilij V. (1985) Space, Time and Life. ISI Press. Pittsburgh.
Pierce (1993) C.S. Phänomen und Logik der Zeichen. Ed. H. Pape. Suhrkamp Frankfurt
Rapoport Diego L. (2009) Surmounting the Cartesian Cut through Philosophy, Physics, Logic, Cybernetics and Geometry….. Foundations of Physics, Vol 39
Rössler, Otto E. (1998) Endophysics. World Scientific. Singapore
Rowlands, Peter (2007) Zero to Infinity. World Scientific New Jersey etc.
Rosen, Robert (1985) Anticipatory Systems. Pergamon Press (1985)
Rosen Robert. (1991) Life itself: A Comprehensive Inquiry into the Nature, Origin and Fabrication of Life. Columbia University Press, New York (1991)
Rosen Robert (2012) Anticipatory systems. Sec. ed.. Ed. Judith Rosen. NY Springer
Rosen Judith, Kineman John J (2005).: Anticipatory Systems and Time: A New Look at Rosennean Complexity. In: Syst Res and Behav Science. Syst. Res. 22 399-412
Vrobel S. (2009) The Extended Mind: Coupling Environment and Brain. Paper, CASYS'09 Conference Liège ed. D. Dubois
Vrobel S. (2011) Fractal Time. London, World Scientific

Bio-Semiotics

Barbieri, Marcello, editor (2007). Introduction to Biosemiotics.. Springer Intern.
Brier, Soeren (2010) Cybernetics and Human Knowing. Transdiscipl Cybernetics and Cybersemiotics. Imprint Academic.
Cybernetics & Human Knowing, (2003- 2012). A Journal on Second Order Cybernetics, Autopoiesis and Cybernetics vol *2007 – 2012 ed. Soeren Brier*
Corning, Peter (2003): Nature's Magic... Cambridge U. Press. Cambridge.
Bateson Gregory (1979). Mind and Nature. Wildwood House, London
Hoffmeyer Jesper (2008): Biosemiotics.. Univ. of Scranton Scranton Press
Kull K. (2012) Advancements in Biosemiotics. In : Rattasepp et al. 2012 pp 11-24
Peirce Ch.(1911-1935). Ed (1969) Collect Papers of Ch S. Pierce. Harv. U.. Press, Cambridge Mass.
Rattasepp S. Bennett T. ed.(2012) Gath in Biosemiotics. Univ. Tartu Press Estonia

Living Systems, Social Systems

Bergson H. (1998) Creative Evolution Dover New York
Miller J.G. (1978) Living Systems. McGraw Hill, University Press
Maturana H., Varela Francisco (1987). Der Baum der Erkenntnis. Scherz, München
Morris, I. (2011) Why the West rules – for now. London Profile Books
Sedlacek, T (2011) Economics of good and Evil. Oxford Univ
Von Uexküll Jakob; Kriszat G. (1956). Streifzüge durch die Umwelt... Rowohlt Hambg

Transdisciplinarity

Löckenhoff, H. (2006). Grounding Transdisciplinarity for an Innovative Science. *In*: Cybernetics and Systems. ed R. Trappl. Vienna
Löckenhoff, Helmut (2007b) Intent, Future, Anticipation. A Semiotic Transdisciplinary Approach. Proceedings CASYS ed D. Dubois. Liège Belgium
Löckenhoff, Helmut (2010) On Sustainability and Sustainable Learning. Note in preparation for ISA . IFSR Conversations Pernegg, not published
Schwaninger M (2001) System theory and cybernetics. A solid basis for transdisciplinarity...Kybernetes 30(9/10) pp1209 – 1222
Spencer-Brown, G. (1969) Laws of Form. The Julian Press New York