Towards a Sustainable Mindset: Determinants of Change Learning

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1 Abstract

The author is a natural scientist and philosopher who has been successfully involved in the global experience industry for more than 25 years. During this period of time he has developed a coherent, interdisciplinary body of knowledge that appears to be of essential interest as related to the transition towards a sustainable society: the Experience Science (Frank, 2011, in print). Important scientific inputs come from underlying disciplines like cybernetics, system theory, psychology, and cognitive science. One of the key findings of the Experience Science is the innate structure of human experiencing. Any human experience includes 5 different experiential domains that influence and regulate each other. These five domains are: the emotional domain (feeling); the mental imagery domain (mental narrating); the sensorimotor domain (acting & perceiving); the rational domain (rational reasoning); the communicational domain (conversing). In the light of the Experience Science the dilemma of the current transition process towards a sustainable society becomes clearly visible. Any relevant (academic and / or technological) attempt reduces the existing problems to more or less exclusively the rational domain. Although ever evolving rational knowledge indeed is an indispensable prerequisite for a sustainable future this is utterly reductionist. Societal change towards a sustainable life-style can only happen if the whole experiential system gets a chance to reorganize itself. This among others leads to the following logical consequence. Any rational knowledge is embedded in a both emotional and narrative knowledge system that underlies and frames human reasoning. As long as human learning restricts itself to an exclusively rational attempt the underlying emotional and narrative program remains untouched. The learner hence continues orienting his / her attention into the direction determined by the underlying emotional and narrative paradigm.

The paper delineates the experiential determinants of change and analyses their specific, constitutive interrelations. From this a holistic choreography of change learning is outlined that pays tribute to the intrinsic transition principles represented by the human learner.

2 Introduction

Cultural sustainability is without any doubt a matter which roots in human experience and behavior. Humans either act in a sustainable way or they don't. Hence the question of global resource use cannot be exclusively reduced to technological solutions and their political constraints. It also has to take the human condition and its successful change towards an appropriately adjusted, green life style into account. Sustainability is a matter which has economic, political, technical and human implications. The paper deals with the human implications of responsible global resource consumption focusing on the following key problem: What are the main parameters of change seen from a human perspective of individual experience?

The traditional answer to this question says: Learning to act in a sustainable way is an educational issue. We have to educate ourselves towards a green attitude. But what does this actually mean? If education is the key to a sustainable life style, which type of education do we intend to establish? Modern education predominantly deals with rational understanding. To learn means to learn to do things in a logical way. Western school curricula emphasize on a scientific i.e. rational kind of knowledge. Is this type of rational education sufficient with respect to a global problem that has at least partly resulted from an ecologically inadequate life-style? Do not life style issues go far beyond the pure rational aspect of human life? And as a consequence of this, shouldn't we rather develop a

more holistic approach instead that includes additional human aspects such as our emotions for instance?

1.1 What do human experiences consist of? About the experiential parameters of human change

According to the scientific investigations of the author human experiences can be seen as self-organizing processes consisting of recursively interlinked process elements. These process elements will be outlined in the following, serving as the backbone of the paper. Frank's interdisciplinary investigations combine empiric data of his own professional work in the international attraction industry with data from different academic fields such as neurology, cognitive science, psychology and sociology. Eventually these data have been organized within a cybernetic and system theoretical framework, resulting in a coherent, holistic concept of the human experiential process. One of the main scientific sources referred to by the author is the cybernetic concept of living organisms developed by Humberto Maturana and Francisco Varela (1987). Due to their findings any human phenomenon has to necessarily correspond to the autopoietic, non-linear self-organization of living cells and organisms. This conceptual approach accords with the neuropsychological theory of D.O Hebb (2002) who introduced the cell-assembly as the key operational unit in his groundbreaking publication of *The Organization of Behavior* in 1949. Using these two pioneering concepts as main guidelines the author has developed his theory of human experiences aka the Science of Human Experiences. In the following I have outlined its key findings that define its main theoretical cornerstones:

- Human beings consist of approximately 10^{13} – 10^{14} cells (Lippert, 2006). These cells coordinate each other thus forming temporary patterns of interaction (Hebb, 2002). These metacellular patterns of interaction form the underlying operational matrix of human doing (action, perception, behavior, body functions etc.).
- 2 types of coordination between cells can be distinguished: neuro-humoral and neuronal coordination (Penzlin, 1977, Frank, 2002). Neuro-humoral coordination uses both the neuronal system and the body fluids as coordination pathway. Neuronal coordination is restricted to neuronal means of connecting body cells.
- These coordination events are non-linear processes thus generating operationally autonomous phenomena of human experience. The sensorimotor process for instance (see below) combines sensory and motor processes forming a continuous non-linear process entity: motor action leads to sensory feedback; sensory feedback shapes subsequent motor action.
- Five operationally autonomous domains of human experiences can be described: these are the emotional domain (feelings), the sensorimotor domain (perception), the communicational domain (communication), the mental imagery domain (mental images) and the linguistic domain (rational thinking). The emotional domain uses the neuro-humoral type of coordination. The remaining domains are purely neuronal events in coordination terms.
- The five domains exhibit two types of domain specific reciprocity: self-referential events connecting patterns within a singular domain and cross-referential events connecting patterns of and between different domains. Self-referential events lead to a contextual organization of repeatedly coinciding and / or succeeding individual metacellular patterns. This intra-domain reciprocity brings forth the human phenomenon of contextual i.e. meaningful knowledge. Individual experiences always refer or belong to overarching experiential contexts which provide the respectively specific meaning of the individual experience. E.g. the meaning of a spoon results from its functional role within the context of human ingestion; the meaning of protons and neutrons results from the contextual framework of the classical atom theory of modern physics.
- Cross referential events occur between individual domains thus leading to continuously reciprocal interactions. These inter-domain interactions have first been described by Luc Ciompi (1997a, b)

who specifically focused on deciphering the laws of interaction between feeling and thinking. His theory of affect-logic serves as a kind of scientific role model for the broader theory of Human Experiences.

- According to the above outlined cornerstones human experiences turn out to be self-ruled processes whose autonomy results from their unique structure i.e. a system of interlinked non-linear sub-processes (human emotions, human perception, human imagination, human reasoning, human communication). These sub-processes recursively interact thus regulating each other and forming a superordinate unity aka the experience process.

1.2 First consequences to be drawn: Preliminaries towards a Science of Human Change Experiences

Undeniably the above list of cornerstones has to necessarily be seen as a very rough and fragmentary outline, but nevertheless one that provides a coherent basis. This basis enables us to draw first logical consequences towards our honest goal. Neither in theoretical nor in practical terms can we reduce human experiences to one singular domain such as the rational domain for example. Human experiences are always multilayered, multidimensional events whose outcomes mainly result from the innate, self-organizational interdependencies of the human systems or human beings involved. To leave out these systemic interferences means to ignore the importance of the intrinsic, mutual interactions that both typify and specify human experiences. Whether we speak of an experiencing child, a juvenile, an adult or a senior member of our community; whether we have to deal with representatives of different cultures or those of different sexes; whether we relate to repeat experiences, learning experiences, or experiences that have been planned and directed in order to result in a specific habitual change; all this plays no role in structural terms. In any case, the experience process remains a deeply systemic event consisting of and resulting from the sub-processes outlined above. The five domains appear to be as indispensable as constituents as the organs of the human body. And like the organs of the human body that regulate each other, the five experiential domains mutually coordinate their processes thus forming an overarching totality as an indivisible process entity; the human experience.

We will therefore try to logically derive a generative matrix for a Science of Change Experiences from the preceding ideas in the following.

Before doing so we have to reach clarification in one important aspect. This will help us pursue our goal. From a contextual point of view we can distinguish between three different types of experiences: repeat experiences, learning experiences, change experiences (Frank, 2011). Repeat experiences occur when people experience something they are already familiar with. This, among others, is characteristic for theme parks, where guests normally enjoy doing things they already know (e.g. take a look at “The Wizarding World of Harry Potter” at the Universal’s Islands of Adventure in Orlando, Florida which has opened recently).

On the other hand, learning experiences add something new to an already existing context. E.g. students have already heard about basic chemical principles. Now they extend their knowledge by adding new information to this existing framework; they learn to understand the genetic mechanism of life inherent in the DNA complex (This mechanism roots in the basic chemical principles they have already become familiar with in their past).

Change experiences differ from both repeat and learning experiences; they differ in contextual terms. While both repeat and learning experiences remain within a pre-existing context (a storyline or a scientific model for instance), the contrary happens in the course of change experiences: the context itself changes.

Here is an example: An important change experience in the history of mankind was the transition from the ancient geocentric to the modern heliocentric world view. Apart from new discoveries due to better optical instruments the observed data remained pretty much the same over this transition period:

glittering stars in the nightly sky. But what changed was the explanatory context that was created in order to develop a meaningful astronomic and cosmological theory that organized the data in a coherent way. The cosmological paradigm changed (Kuhn, 1976). The consequences resulting from this transition belong to the cognitive legacy of mankind. Together with other coinciding intellectual and technological innovations it was the starting point of a decisive, collective change experience within the western hemisphere: the change that turned the medieval society into its modern follower. This societal change affected everything in human life; the way people felt about their place in the world (emotional domain); the way people thought about their being (rational domain); the way people perceived and interacted with nature (sensorimotor domain); the mental images that people used when they visualized their ideas, dreams and hopes (mental imagery domain); and last but not least the way people further developed their society by forming and institutionalizing specific conversation patterns (communicational domain).

20 years ago the Club of Rome (1991) stated that humanity is on the verge of a similar societal transition triggered by various challenging occurrences at the end of the millennium such as the irreversible decline of fossil resources, overpopulation and environmental pollution.

2 Human Change Experiences as a matter of science – steps to a new discipline under the roof of Sustainability Science

From our historical records we learned that the transition from the European dark ages into the European modern world was an unplanned event. No one was planning to deliberately transform the society s/he was part of in the way it was then transformed historically. It simply happened. It happened so to speak by trial and error and without any underlying bigger plan that the people affected by this change could have shared and used as a joint guide line and as a means of deliberately and jointly organizing their future.

Three important differences at least distinguish the pending transition from its medieval predecessor.

1. This time it will be a global affair.

2. It appears to be the first time in human history that we consciously experience and know about the change itself. Because of many different reasons people of the Middle Ages were not able to perceive or understand the societal circumstances or to anticipate their future in a way the modern human being can do in principal.

3. Highly sophisticated communication technologies have spread globally, enabling us humans to communicate ideas, concepts and information globally, effectively and immediately. Everyone can participate in a change process at any time.

The consequence I want to draw from these unprecedented differences appears to be conclusive: This time we humans have the ability to jointly and consciously choreograph the societal change that is about to happen. The technologies to coordinate this process globally do exist. The awareness regarding the process itself does exist. We literally have the obligation to intentionally take care of ourselves. There is no excuse if we do not proceed.

Taking care of ourselves in the proposed manner does not mean to impose solutions in an undemocratic way. On the contrary, a choreographed societal transition process could be based on a sound scientific methodology that everyone can understand and share globally. This could give humanity the opportunity to jointly participate in a democratic and historical movement. The danger of undemocratic occurrences lies in an approach that among others ignores the idiosyncrasies of the cultures, religions and cognitive styles of the communities involved. This can be avoided if the process is based on a holistic understanding of human experiencing that includes emotional, spiritual, social and other human aspects as well and does not reduce it to exclusively rational issues. What is urgently needed is a holistic knowledge base that enables us to flexibly and creatively deal with

cultural and personal differences and make use of these differences instead of ignoring or even misusing them.

2.1 The generative matrix of change experiences: two basic laws

I have outlined human experiences as deeply systemic events. Two intrinsic aspects appear to be of main importance in this respect:

A) Due to the systemic nature of experiences their individual constituents affect and influence each other. The individual human experience is a self-organizational entity and has to be dealt with as such. If we reduce our attempts to focusing on one domain exclusively, possibly negative side effects could and will necessarily result from the un-choreographed interplay and influences of the remaining domains.

B) The emotional domain plays a predominant role within this concert of 5 domains. This predominance results from its physiological basis: neuro-humoral processes form the underlying operational matrix of human emotions (Frank, 1997). Humoral cell coordination is a considerably slower and prolonged process than neuronal cell coordination. It takes a certain time till specific molecules emitted into the body fluids reach their target cells. Neuronal signals are a much faster coordination means. Likewise neuro-humoral and neuronal processes are deeply affecting each other in general due to the neuro-humoral nature of the human brain. Hence any neuro-humoral or emotional wave influences its neuronal coordinated sister domains by having a long time and dominating effect on these coinciding processes. As a consequence human emotions direct and regulate its sister processes; they serve as an attractor in the chaos theoretic sense (Ciompi, 1997b).

These 2 intrinsic aspects represent so to speak the fundamental laws of a science of human change experiences. In a nutshell, these laws can be read as follows: Any human change experience includes 5 determinants that regulate each other; one determinant, namely the emotional domain thereby plays a dominating role. Due to its predominant role we will continue our discussion with briefly specifying the emotional domain.

2.2 The emotional determinant

It was Gregory Bateson who introduced the concept of cultural ethos (1958). According to this concept any culture is characterized by a specific affective undertone (Berman, 1985) or emotional identity that serves as invisible guideline for the community. It is interesting to listen in this respect to the late Marija Gimbutas, the Lithuanian-American archaeologist whose research into the Neolithic and Bronze Age cultures of “Old Europe”, although scientifically not unopposed, appears groundbreaking to me. She spoke of an important – Luc Ciompi would add: affect-logic - transition at the end of the Neolithic. It was triggered by the invasion of a warlike aggressor people that eventually supplanted the peaceful, preceding culture by imposing upon its natives the rules of warriors. In the course of these historical events the ethos of the people changed from a former unaggressive life-style to an aggressive successor.

As I said above, Gimbutas was not unopposed scientifically. But that’s not our issue at the moment. I mentioned her because she was archaeologically the first to shed light on something important that corresponds with Ciompi’s and Bateson’s view. Although she did not argue her findings affect-logically like Ciompi or ethically like Batson she emphasized the emotional matrix of culture. In accordance with affect-logic human aggression has to be seen as an emotional undertone that colors everything humans are doing. In the eyes of an aggressor any stranger is a potential adversary or enemy; and natural circumstances easily turn into something to be defeated or subjugated. We are entitled to conjecture a similar affect-logic context for the opposing case of a peace-loving, unaggressive people; its members assumedly perceive strangers as potential fellows and nature as a nourishing mother. Interestingly, this speculation corresponds with Gimbutas’ archaeological findings. In the course of major excavations of Neolithic sites in southeastern Europe she unearthed a great number of artifacts

of daily life and of religious cults. According to her interpretations these artifacts appear to give evidence of a peace loving people characterized by a life-style which was in sync with nature (Gimbutas, 1998).

When Bateson's concept of an underlying emotional attractor (Ciompi, 1997b) is correct – and I think it is since many findings from different disciplines point into his direction - we have to take it very seriously with regards to our attempts of intentionally orchestrating societal change processes. Among others, we have to consciously deal with questions such as: Which emotion do we have to trigger in order to make change happen as an event that organizes itself by addressing the right affect-logical interdependencies? Which emotion is the right one in order to approach nature not like a warrior but in the right mood to see her as a nourishing mother we are connected with by our metabolic ties, even if nature sometimes (re)acts in detrimental ways? Which emotion is the right one in order to connect people in a worldwide endeavor despite existing cultural differences and values?

The emotional determinant could be the main attractor of change. We have to learn to make use of the affect-logic principles of experiencing and include the insights resulting from this learning process in our change concepts accordingly.

2.3 The sensorimotor determinant

We should not forget that any perceptual event is organized by the perceiver. We should also not forget that any organizing process that directs the sensorimotor actions of the perceiver results from the internal interrelations between the domains. A perceiver who is driven by hatred organizes his perception differently from one who is driven by love. These are the affect logic constraints inherent in any human perception and acting. We have touched on it above.

Our physical experience aka the sensorimotor determinant hence is not independent from its sister domains. It is influenced by the permanent whispering of the emotional, the mental imagery, the linguistic and the communicational domain. We modern people for instance believe in a world in a physical sense that is independent from us and that waits to be explored and exploited by Homo Sapiens. According to modern conviction this world is shaped by immutable natural laws such as natural selection and the competition between species that is seen as the driving force of evolution. These beliefs are main cornerstones of the modern worldview. They are represented in mental images that reside as complex contexts of patterns in the neuronal archives of our mental imagery domains. Through the recursive feedback events between the mental imagery and the sensorimotor domain these beliefs become the sensorimotor cornerstones of our daily life.

We organize our daily sensorimotor activities in accordance to the key principles of these cornerstones. Therefore we mutually challenge ourselves to behave in a competitive way since we think that competition is a natural law that cannot be escaped. We transfer a scientific concept (competition is nothing else than a scientific concept; erroneously we treat it as a fact) into a societal one by shaping (both) our sensorimotor (and communicational) activities in a competitive way. Since we predominantly stick to this competitive sensorimotor behavior we earn nothing else than competitive feedback and competitive societal data. Again, erroneously we consider these daily feedbacks as proof of concept.

Interestingly, emerging disciplines and new theories within existing disciplines such as quantum physics, Lynn Margulis' new look on evolution based on symbiosis (1998), James Lovelock's Gaia theory (2000) and the theory of human cognition by Humberto Maturana and Francisco Varela (1992) draw a completely different picture. These concepts converge to a worldview that differs more or less fundamentally from its modern precursor briefly touched on above. Important cornerstones of this currently evolving, new paradigm that is about to supersede its modern predecessor are:

- Human Knowledge does not mirror the world as it is but represents a methodology enabling humans to jointly develop and agree upon viable life styles.

- Earth is a living system itself, constituted by complexly interwoven non-linear process systems (including us humans) that are mutually interdependent.
- Experiential categories like space and time are *projections from inside our minds, where experience begins* (Lanza, Berman 2009).

Imagine a daily sensorimotor practice that expresses this changed worldview and is guided by mental images that represent these new concepts in a narrative way. This mental imagery-sensorimotor interplay would literally change the world in a beneficial way; beneficial for us humans as well as beneficial for the world and nature which we are part of.

2.4 The mental imagery determinant

Important sensorimotor and communicational experiences leave their traces by being transformed into neuronal patterns of the mental imagery domain. The physiological mechanism underlying this mental transcription has been described by Frank (2011, in print). The mental imagery domain can be understood as a kind of neuronal archive that develops and holds the threads of our belief in the form of narrative contexts. These mental contexts and images have a powerful impact on our daily life. By constantly influencing our sensorimotor, communicational, rational and emotional decisions and activities they shape everything we do, our perception, our social events, our feelings and last but not least our rational thinking.

But in turn, our mental imagery sphere receives incessant input from its sister domains. Hence, the mental imagery domain and its sister domains shape each other thus creating a consistent whole, our personal worldview that we share with each other. In other words, the key to a viable worldview is the consistency of the constitutive domains.

Again, the transition that turned the medieval society into its modern follower can serve as an appropriate example in this respect. People involved in this historical transition literally changed their minds from a pre-scientific to a scientific worldview. In its theoretical framework this new worldview related itself to a mechanistic conception of the world by forming an overarching narrative that outlined the world as a huge machine. It tells us that the functions of this machine including both the inanimate and the animate world are ruled by unchangeable, eternal laws and forces like physical gravitation or the nuclear force that holds the atoms together. This narration resides within the neuronal archives of the mental imagery domain and forms the framework for our modern, scientific mind. Whenever we go ahead to gain a better understanding this framework starts resonating thus orienting our minds into a certain direction. It implicitly tells us what to do, how to gain a better understanding and which methods to choose. It guides our interests and attention towards phenomena and explanations that can be implemented consistently in the machine paradigm thus reconfirming this narration that constitutes the modern mind.

Since the five experiential domains recursively interact with each other every human discovery is based on and guided by this mental imagery narrative. We modern human beings therefore hardly can overcome our mechanistic bias. If we want to do this we have to change the underlying prerequisite of our knowledge correspondingly. In other words, the postulated change of our culture towards a sustainable life style requires an appropriate transformation of the underlying mental disposition. It requires an appropriate transformation of the mental narration that has created and still continues to create the modern, scientific worldview. The mental imagery domain creates the logical context within the rational mind or domain is operating. If change occurs it is literally this interdependency that makes it happen.

2.5 The linguistic determinant

Reasoning appears to be a specific human feature. Our reasoning is subject to our linguistic abilities and the rules created by this domain. According to latest scientific findings these rules result from learning processes that each individual undergoes by speaking to others and by identifying recurring

patterns of communication (Tomasello, 2003). Historically human reasoning became a dominating factor of experiencing in the course of the disputes between the ancient Greek philosophers. Since these ancient times humans try to gain understanding by creating linguistic explanations that correspond with the logical rules initially defined by Aristotle (Russel, 2005). In the meantime modern logic has made many amendments to these historical rules but independent from this, the average western mind still sticks to the Aristotelian logic of creating knowledge and consent among human beings. Whereas the mental imagery domain with its overarching narrative outlines the big picture, the logical operations of the linguistic domain intend to decipher the detailed mechanisms inherent in the world machine. The mental operations of both domains recursively interact and reinforce each other thus trying to form a consistent representation of the world machine.

It appears to be evident that under the circumstance of a changing culture these intellectual interdependencies play a crucial developmental role. By transforming the underlying narrative from a mechanistic to a post-mechanistic context the rational data within this mental framework necessarily get reorganized. This change of the underlying concept does not exterminate the huge amount of scientific data that the western mind has created in the course of the last centuries; it reorganizes these data by melding them with new scientific ideas and insights thus regimenting them in a new system. The post-mechanistic worldview will continue to talk about gravitation, forces and other elements of the outdated mechanistic precursor, but the meaning of these logical items will change.

2.6 The communicational determinant

By communicating with others we express our emotions, our mental images and thoughts and we comment on our perceptual processes. Due to the recursive interrelations between the five domains any significant change occurring in one of them spreads over the whole system and eventually affects each one of the interacting sister domains. The mental imagery narrative underlying the mechanistic world view hence results in specific communicational patterns that turn this element in a jointly shared vision. The communicational patterns of this vision form the keywords for an invisible chorus that incessantly repeats the cognitive cornerstones of the tribe. This invisible chorus is constituted by the means of modern communication including press, media, entertainment and other technologies that feed our personal dialogues. And although these means appear to deliver a never ending series of latest information and news the underlying message remains the same. It is the recurring message of a world that we modern humans have conceptualized as a (complex) machine that is ruled of attracting and repulsive forces.

The societal choreography of communicational exchange results in a mantra-like, suggestive ritualization that again and again “evangelizes” the rules of this machine. These ritualized exchanges normally do not include physical explanations in the proper sense. To a great extent they relate to human affairs since this is the main point of human interest: the other human being(s). But due to the prevailing mechanistic conviction these human affairs appear to be ruled similarly by natural forces like the inanimate physical world. Modern people hence speak of the competitive forces between human beings that decide upon the fate of societal entities, be these nations, ethnic groups, corporate entities or individuals. Conceptually these competitive forces seem to result from nothing else than a mental transformation of the repulsive forces of the physical world. The daily reports about antagonistic societal occurrences including the ever changing versions of the daily struggle for life therefore constantly reinforce our bias of a world ruled by mechanistic laws.

The main message of the daily chorus is readable between the lines. This is the challenge of the communicational determinant. Its messages are implicit. It is this implicit knowledge inherent in our recurring communications that we are talking about when change choreographers reason about the role the communicational domain plays in the transition process.

3. Conclusions

Despite their exemplary nature the preceding lines shed light on the cornerstones of a science of human change experiences. Human experiences have to be treated in accordance to their inherent generative structure. This structure includes five non-linear sub-processes that bring forth the key phenomena of human life: emotion, action and perception, mental imagery, rational thinking and communication. These domains recursively regulate each other, thus forming the human experience process as a self-organizing entity. The main criterion of viable human experience and behavior thereby is experiential consistency.

In other words the scientific key to a human change process towards sustainable behavior points to a five-fold choreography that addresses the human experiential process in a consistent way.

As far as content is concerned this choreography will benefit from scientific heralds like Gregory Bateson (1979), Humberto Maturana and Francisco Varela (1992), Lynn Margulies (1998), James Lovelock (2000) and others whose pioneering conceptions point into the direction of a non-mechanistic mental narrative. Important cornerstones of this narrative already exist. It is now the task of a non-mechanistic meta-discipline to integrate these cornerstones in a consistent way thus forming the underlying narrative context of a sustainable culture.

This content related meta-discipline scientifically complements the Science of Change Experiences or briefly Change Science outlined in this article. Change Science teaches us how to proceed, how to jointly design, choreograph and eventually perform the imminent societal change towards a sustainable life-style. It's complementary sister discipline that we refer to as the Science of Sustainability or briefly Sustainability Science teaches us where to go by forming a new, post-mechanistic paradigm that supersedes its mechanistic precursor.

These two meta-disciplines could serve as attractors in the sense of chaos theory by reorganising the traditional knowledge creating disciplines (scientific and non-scientific ones) under their unifying umbrella. Sustainability Science and the Change Science can be regarded as twin disciplines that necessarily complement each other. Sustainability Science alone is headless; a lonesome Science of Change Experiences similarly is blind.

References

Bateson, Gregory. *Naven*. *The culture of the Iatmul people of New Guinea as revealed through a study of the "naven" ceremonia*l. Stanford University Press, 1958.

Bateson, Gregory. *Mind and Nature. A necessary unit.* New York: Hampton Press, 1979.

Berman, Morris. *Wiederverzauberung der Welt. Am Ende des Newtonschen Zeitalters*. Hamburg: rororo, 1985.

Ciompi, L.: *The concept of affect logic. An integrative psycho-socio-biological approach to understanding and treatment of schizophrenia*. Psychiatry 60: 158-170, 1997a.

Ciompi, Luc*. Die emotionalen Grundlagen des Denkens. Entwurf einer fraktalen Affektlogik*. Göttingen: Sammlung Vandenhoeck & Ruprecht, 1997b.

Club of Rome. *Die Globale Revolution*. In: Spiegel Verlag Rudolf Augstein, Spiegel Spezial 2 / 1991, S.9.

Frank, Gerhard. *Konstruktivismus und Vermittlung: Interaktion als museologisches Paradigma*. In: Museum im Kopf. Hrsg. Muttenthaler, Posch, Sturm. Wien: Turia + Kant, 1997.

Frank, Gerhard. *Zoodramaturgie.* In: Zoopädagogik. Hrsg. Udo Gansloßer. Fürth: Filander Verlag, 2002, S.229-248.

Frank, Gerhard. *Erlebniswissenschaft. Über die Kunst Menschen zu begeistern*. LIT Verlag: Münster, London, 2011.

Frank, Gerhard*. The Experience Science. A New Discipline on the Rise. LIT:* In print.

Gimbutas, Marija. *Die Zivilisation der Göttin. Die Welt des Alten Europa*. Frankfurt am Main: Zweitausendeins,1998.

Hebb, D.O. *The Organization of Behavior. A Neuropsychological Theory*. London, New Jersey: Lawrence Erlbaum Associates, 2002.

Kuhn, Thomas. *Die Struktur wissenschaftlicher Revolutionen*. Frankfurt am Main: Suhrkamp, 1976.

Lanza Robert, Bob Berman. *Biocentrism. How Life and Consciousness are the Keys to Understanding the True Nature of the Universe*. Dallas: Benbella Books, 2009.

Lippert, Herbert. *Lehrbuch Anatomie*. München, Jena: Urban & Fischer, 2006

Lovelock, James. *GAIA. A New Look on Life on Earth*. Oxford University Press, 2000.

Margulis Lynn. *Symbiotic Planet. A New Look at Evolution*. Massachusetts: Basic Books, 1998.

Maturana, Humberta, Francisco Varela: *The Tree of Knowledge. The Biological Roots of Human Understanding*. Boston & London: Shambala, 1992.

Penzlin, Heinz. *Lehrbuch der Tierphysiologie*. Stuttgart, New York: Gustav Fischer Verlag. 1977.

Russel, Bertrand. A *History of Western Philosophy*. London: Routledge Classics, 2005.

Tomasello, Michael. *Constructing a Language. A Usage-Based Theory of Language Acquisition*. Cambride, Massachusetts, Harvard University Press, 2003.

