Time, Anticipation, and Pattern Processors

Dr. Andreas Goppold
Postf. 2060, 89010 Ulm, Germany
Tel. ++49 +89 510 99 770; Fax: (Goppold:) ++49 +731 501-999
email: goppold@faw.uni-ulm.de
http://www.uni-ulm.de/uni/intgruppen/memosys/

Abstract

Recent advances in the neurosciences are leading to an understanding of the structures and processes in neural networks as electric activation patterns, consisting of oscillation fields and logical relation structures of neuronal assemblies, treated formally as coupled dynamic systems and neuronal attractors. These are specifically characterized by their space-time-dynamics. In the present context, these phenomena are also called *neuronal resonance patterns*, and as higher-order hierarchical aggregates, *patterns of patterns*: *metapatterns*, as Gregory Bateson would have termed it. The term *pattern* is suited equally well for the spatial as for the temporal domain, and thus allows to formulate an abstract conceptual system of the neuronal computation processes of organisms. In re-formulation of Goethe's original ideas, such a systematics of metapatterns is called *meta-morphology*, in an effort to account especially for their dynamic, time-relevant aspects. The fundamental properties of such a system display a strong resemblance to a very ancient thought system that was known as *Pythagoreanism* in the Western tradition. The present contribution will show some of the parallels between the ancient system and the *meta-morphology* as outlined here.

Keywords

Meta-Morphology, Pattern Transmission, Meta-Patterns, Neurosciences, Pythagoreanism

Introduction

In his *confessions*, St. Augustinus reflects on the question "what is time", and he realizes that although he believes he knows it, when nobody asks him, when he wants to explain it to someone, he curiously is not able to (Cramer 1993: 12). In the light of present discussions of time, this may be interpreted as an early indication that Augustinus hit on a barrier that separates different *kinds of time*, or *Zeitwelten* (Wiehl 1998), that cannot be brought into commensurability: In Augustinus' case, the properties of the subjective *Eigenzeit* of his consciousness, which cannot be transferred into the *communal time* of a linearly-ordered speech process, that humans have to adopt to when interacting with each other. (Wiehl 1998: 7-13). The life and work of Augustinus marks an epochal historical turnpoint in the ancient oikumene, since the sack of Rome was the final downfall of the Roman Empire, and the end of antiquity, likewise it marked the rise of

Christian Europe, and of Islamic culture, as the successors of ancient civilizations. There are many indications, that the present time also marks an epochal historical turnpoint, not only for the millennium change according to Christian reckoning, but also for many economic, ecological, medial, and political upheavals occurring now. *Anticipation* is a matter of being able to reach a perspective over the future, and that depends on our memory, how we rate, order, and weigh our experiences. For this, a perspective vision over the memory spaces of life on earth will be developed and displayed.

Meta-Morphology and Neuronal Pattern Processors

The present contribution will describe temporal orientation on the basis of a general theory of neuronal pattern processing, here called *Meta-Morphology*. The next section will give a short overview of this theory.

The Systematics of Patterns that Connect

Meta-Morphology is a technical term defined for *the systematic study of patterns that connect*. (Goppold 1999d: 40-63, 128-138). It is used here in two variants of meaning: 1) as short form for *morphology of metapatterns* as introduced by Gregory Bateson, and 2) as *morphology of metamorphoses*, as derived from Goethe's work (Goppold 1999d: 34-40, 236-246). The term *metapattern* is central to the work of Gregory Bateson, since it encapsulates his perspective and working method in one word, and Bateson describes this from many different angles and aspects in his works (Bateson 1972-1986). A short definition is given in "Mind and Nature":

Bateson (1979: 12): The pattern which connects is a metapattern. It is a pattern of patterns.

Bateson (1979: 18): We *could* have been told something about the pattern which connects: that all communication necessitates context, that without context, there is no meaning, and that contexts confer meaning because there is classification of contexts... So we come back to the patterns of connection and the more abstract, more general (and most empty) proposition that, indeed, there is a pattern of patterns of connection.

Stafford Beer describes the essence of pattern as a performance of the neuronal system:

(In Sieveking 1974, preface): A pattern is a pattern because some*one* declares a concatenation of items to be meaningful or cohesive. The onus for detecting systems, and for deciding how to describe them, is very much on ourselves... A viable system is something we detect and understand when it is mapped into our brains, and I suppose the inevitable result is that our brains themselves actually impose a structure on reality.

Pattern has recently gained prominence as key term for mathematics. In his work "Impossibility", John Barrow points out the universal importance of pattern perception and generation as the foundation of mathematics, which he identifies as central to the modern exact sciences. (Barrow 1998: 5-6, 57-58, 89, 190-193):

Barrow (1998: 192): The inevitability of pattern in any cognizable Universe means that there can exist descriptions of all these patterns. There can even be patterns in the collections of patterns, and so on. In order to describe these patterns, we need a catalogue of all possible patterns. And that catalogue we call *mathematics*. Its existence is not therefore a mystery: it is inevitable. In

any universe in which order of any sort exists, and hence in any life-supporting universe, there must be pattern, and so there must be mathematics.

A pattern definition of mathematics is quoted by (Allot (www)):

"A contemporary definition is that mathematics is the science of pattern and deductive structure (replacing an older definition of mathematics as the science of quantity and space)."

A very similar statement was already worded by the visionary Spengler:

Spengler (1980: 116): the idea of a general morphology of mathematical operations...

(p. 551): Mathematics ... as the quintessence of morphologically equivalent quantities, like the totality of quadratic numbers, or of all differential equation of a certain type, treated as a new entity, as a new number of higher order ... (transl. A.G.).

The cosmologist Tipler describes the importance of pattern continuity as criterium for identity (1994: 164, 282-284, 291-293).

Goethe, Morphology, and Metamorphosis

Morphology is derived from the Greek word *morphae*, which is translated as: Gestalt, form, gesture, position, pattern. (Rost 1862: II,98; Goppold 1999d: 128-129). The Greek *typos* word has nearly the same meaning field, which re-appears in *typology*. Goethe coined the term *morphology* for the study of forms and their changes, his perception of the "*patterns that connect*". Bateson (1979: 17) refers to Goethe as source of inspiration. Severi (1993: 309, 311-315) describes the essentially holistic and dynamic character of Goethe's conception of morphology: For Goethe, the living organism is an entity which cannot be reduced to the sum of its components. The change of forms (the metamorphosis) of organisms follows a logic which is different from the laws of physics, and it can only be described by a systematic morphology. The Goethean *morphology* is based on the *Gestalt* principle. (Strube 1974: 540, Britannica: Gestalt psychology, Ehrenfels, Köhler, Koffka, Wertheimer). It traces back to earlier work of Herder and Vico. (Straube 1990: 168; Herder 1975: XVI-XVII; Berg 1990: 61). The temporal and dynamic character of the *Gestalt* was the leading criterium for Goethe's concept, which is poignantly expressed by the term *Metamorphosis*. (Cassirer 1957: 146-147, 152 f., Cassirer 1922: 345-351, 362, 375 f., 386). This is derived from Aristoteles, and Ovid's famous poem: Metamorphoses (Cramer 1993: 23 ff.). The morphological principles of Goethe (or a derivation of them) were taken up in Germany by a school of *cultural morphology*, whose best known proponents were Frobenius (Haberland 1973), and Spengler (1980), (Felken 1988: 53). Also, the school of *Gestalt* psychology (above: Britannica: Gestalt psychology), followed the lead of Goethe's work. The liberal use of the term "*Seele*" (soul) by workers of the various *Gestalt* schools, which may seem offensive to present-day scientific standards, is best understood as direct application of the ancient nature philosophical concept of *soul* as the "essence of (e)motion" as expressed by Aristoteles in his work "on the soul" (Picht 1987). A serious methodological problem for the *Gestalt* workers was the lack of suitable conceptual tools with which to approach their subject of study. In Goethe's time, the calculus of Newton and Leibniz had just been invented (Goethe had probably never learned it, and his mathematical understanding was weak). Riedl (1995, 1996c) describes the obligation of modern biology to Goethe's work:

Riedl (1996c: 105): *Morphology*: since Goethe (1795), the methodology of comparing Gestalt and to generalize the Typus; the cognitive basis for comparative anatomy, taxonomy and phylogeny.
Riedl (1995: 114)...Goethe... tried to understand the principle underlying his ability to discern pattern.

A morphological influence leading to Bateson's concepts can be shown through Ruth Benedict, whose work "Patterns of Culture" had been influenced by Spengler (Benedict 1934: 49-56), and her work in turn influenced Bateson, via the other famous female disciple of Franz Boas: Margaret Mead, who was Bateson's wife and collaborator at the time of his fieldwork in New Guinea. (Bateson 1979: 211-212). Because the tenets of the German school of cultural morphology, mainly of Spengler and Frobenius, are nowadays considered out of date, the term *morphology* needs to be re-formulated for the present purposes. Also to reach a differentiation in terms, the word *Meta-Morphology* has been coined.

Morphology and the Controversy of Form vs. Substance

The term *Morphology* denotes a specific position in the old philosophical controversy of *form* and *substance*. (Hoffmeister 1955: 587, Goppold 1999d: 29, 128-129).[1] According to Bateson (1972: 449), the emphasis on *form* stands for a Pythagorean and Gnostic orientation, while the emphasis on *substance* (gr.: *hypokeimenon*) has been a majority opinion in Eropean intellectual history, as is exemplified in the important role of substance in christian dogma (the transsubstantiation of the Eucharist), and of the "substantial" role of matter-energy in contemporary physics (Lippe 1997: 126-163). The historical controversy over these viewpoints was not just intellectual, as is evidenced by tens of millions of victims of various intra-christian extermination campaigns against heretic sects like Gnostics, Cathars, or Bogomils, as well as the 30-year war, whose background theme was a conflict over the transsubstantiation. The (alleged) role of this issue in the trial of Galilei is argued by Redondi (1991)

As *epistemological* position, *morphology* denotes a preferred orientation towards *perception* in the study of *form* over and against {*substance / content / materia*} as most important issue. (Goppold 1998, Goppold 1999d: 135-136). It may be noted that the orientation towards *substance* combines more naturally with a preference for *being-things* (ie. the domain of *ontology*), and conversely, a preferred orientation towards *perception* treats the question of "what things are" (*ontology*), as secondary. In the history of Philosophy, the dictum of Berkeley had expressed this most succinctly: *Esse est percipi*: *to be is to be perceived.* As was pointed out above, a pattern can claim to no criterium of existence (ontology) other than being perceived. (Goppold 1999d: 41). The questions of time, change, endurance, timelessness, and eternity loom as background issues behind the issue of *form* vs. *substance*. Right from the very beginning of Greek philosophy, these questions were argued between different schools of thought. Two

[1] http://www.uni-ulm.de/uni/intgruppen/memosys/desn07.htm#Heading16

camps can be identified: the school of *being*, *eternity*, *stability* and *endurance*, with Parmenides, the Eleatic school, and Platon as proponents, and the school of *becoming*, *process* and *change*, with Anaximandros, Heraklit, and Aristoteles as proponents (Goppold 1999d: 22, 25-29, 39). Western European societies have in the last 2300 years after Platon tended to emphasize the issue of *being*, *eternity*, and *stability*, as is exemplified by the preferred orientation of the underlying socio-ideological fabric of these societies in the last 2000 years, *Christianity*, which is based on the idea of an eternal heavenly kingdom of God and a corresponding hierarchy of worldly powers, the feudalistic "ancien régime" that largely governed the fates of western Eurasia until 1918 (Goppold 1999d: 7-10, 18-19, Lippe 1997). In the last 200 years, the issue of *process* became a foreground theme on the socio-political agendas, with the French and communist revolutions marking historical political turnpoints, and the emergence of thermodynamics, entropy, open systems, and the chaos paradigm marking scientific "revolutions" with re-orientation toward process issues (Goppold 1999d: 8-9, 18, 34-39). Nietzsche and Whitehead brought the theme of process back into the philosophical discussion, with Whitehead's "Process and Reality" (1969) serving here as the main philosophical point of departure (Goppold 1999d: 112-116). With "Zeitwelten", Wiehl (1998: 13, 25-27, 29-128) delivers a recent philosophical statement and further temporal classifications basing on Whitehead's work.

Meta-Morphology: the Patterns of Change

"Our virtues lie in the interpretation of the time."
(Shakespeare, Coriolanus, IV, 7.)

The temporal aspects of patterns concern their stability and their changes, and what makes a neuronal system mark two patterns at different "points in time" as identical, similar, or entirely non-identical. On closer examination, we discover that *change* is a *class of meta-patterns* for itself, and has to be treated as such. On even deeper examination, it becomes apparent that the apparently obvious stability of any pattern, say, the perception of a tree in the countryside, or the letter "A" on a page, is the result of extremely complex neuronal pattern processes that yield as final end result an apparent constancy of a form that our consciousness then labels with a word, like "tree" or "A". Especially, the expression above: "points in time" needs to be carefully re-examined since this performs already an implicit binding of our conceptualization towards a certain Newtonian-Leibnizian, linear-time concept that must be brought before the inquisition (in Baconian manner). Thus, the very oldest and venerable philosophical questions and answers need to be re-examined afresh for a more general theory of *morphology* that takes the recent neurological findings into account. We come to realize that neuronal *pattern perception* and *-processing* are the key ingredient in mankind's quest to make the universe intelligible, to fashion a *Cosmos* from the pure *Chaos* of the undiscriminate swarm of photons, air pressure changes, and chemical and physical stimulants, that organisms are exposed to every instant of their living existence. On this facility are based not only the sciences, but also human society, and in the wider

sense, life, and the lawfulness of the universe. (Goppold (1999d); Schunk (1996); Spengler: Morphologie der Wissenschaften (1980: 549-553)). While the phenomenon of change has taken a back seat in the history of European philosophy, it had always kept a prominent position in the cultural awareness of China, with the classic *I Ching*. (Govinda 1983; Sung 1971; Wilhelm 1939).

Goethe's emphasis was on the permanence of *change* of all forms, the *metamorphosis*. Spengler (1980: 9) defines the emphasis of his *morphology* as the "logics of time" in differentiation from the "logics of space". In the light of present scientific usage, it is necessary to further differentiate between the reversible time of Newtonian/Einsteinian physics (or the space/time continuum), and the irreversible time of organisms and history, under the laws of thermodynamics. (Cramer 1993: 61 f., 80 f.). Spengler's "logics of time" can be brought to coincidence with Cramer's concept of organic time, the *Zeitbaum* (the tree of time) (Cramer 1993: 116-122), with its primary attributes of "Synchonicity, Convergence, and Resonance" (Cramer 1993: 159-264). The tree structure of organic time reflects the nested hierarchies which the sciences of the organic are accustomed to deal with, as expressed by Salthe: hierarchies of scale, and hierarchies of specification (Salthe 1985). The hierarchies of scale correspond to hierarchies of time in the "*Zeitbaum*", a factor whose vital importance becomes apparent when current technological computer driven applications of concurrent processes need to implement local times and trans-hierarchical coordination for process control, a task which the present VonNeumann derived computer architectures are not well suited for. Wiehl (1998) gives a contemporary philosophical rendering of these finer perspectives over local and global times, under the title "Zeitwelten" (time worlds), where a further differentiation is introduced between *subjective*, *communal*, and *historical* time (Wiehl 1998: 7-13). His work relates to Whitehead's *metaphysics of process* as precursor. Wiehl (1998: 13, 25-27, 29-128), Goppold (1999d: 112-116), Whitehead (1969).

Neuro-Aesthetics, Neuro-Semiotics, and Patterns

The recent advances in the neuro-sciences, and neuro-computing provide the reason and the means to re-examine the millennia-old philosophical paradigms (according to Kuhn 1962) of the perceptive, cognitive, mnemonic, and mental performances of the human being under a more general principle of *pattern processing and transmission*. In the present context, this is introduced with the terms *Neuro-Aesthetics*, and *Neuro-Semiotics*. (Breidbach 1993-1997; Brock 1994; Clausberg 1999; Goppold 1999d: 41-42, 122-124). According to this recent work, cognitive orientation and action of innervated organisms is effected by neuronal activation patterns, consisting of oscillation fields and logical relation structures of neuronal assemblies, treated formally as coupled dynamic systems and neuronal attractors. These are specifically characterized by their space-time-dynamics. In the present context, these phenomena are also called *neuronal resonance patterns*, and as higher-order hierarchical aggregates, *patterns of patterns*: *metapatterns*. Viewed in this way, *pattern* is the "infrastructure" of neuronal processing happening in our brains, *below*, and a few miliseconds *before* our working

consciousness experiences the "*phainomena*" and "*noumena*", the *Gestalten* of discernible impressions and thoughts. (Goppold 1999d: 42; Klages 1981, I: 57-60). The present working focus is on neuronal processes, but this is for purely practical reasons. Organisms do not need a nervous system for perceptive and cognitive performance, as single-cellulars and plants attest. But the (possible) role of the cytosceleton for intracellular information processing (Penrose 1994: 348-392), or of symbiotic organisms like fungi, whose mycelium may provide nerve-like services in a biotope of trees (Goodwin 1998), are outside the scope of the present contribution.

Morphology and Cosmic Pattern Transmission

The ultimate goal of a morphological cosmology has been expressed in the grandiose eschatological "*Endzeit*"-vision of Spengler's "*Untergang*" (1980: 553, transl. A.G.):
... the dissolution of the totality of knowledge into an immense system of morphological affinities and relationships [in Bateson's diction: *the patterns that connect.* A.G.] ... the unification of all singular scientific aspects into a whole will have all traits of the great art of counterpoint. The infinitesimal music of the limitless cosmos... the testament for the spirit of the cultures yet-to-come - a legacy of forms of monumental transcendence, which may never be revealed. With this, the occidental science may one day, tired of forever striving, return to its spiritual cradle.

Twenty-five years after Spengler, in 1943, Hermann Hesse formulated another vision of a universal system of "morphological affinities and relationships" with his "Glasperlenspiel" (Hesse 1971). Both visions shared a common musico-cosmological Pythagorean theme (Hesse 1971; Neubäcker 1994, 1995). Other indications of an "*Endzeit*"-drive in Western science are expressed in John Horgan's "The End of Science" (Sentker 1997) and Mittelstraß (1989: 43-44), or in the scientific quest towards the "ultimate questions" (eschatology), which were up to now in the domain of theology, like the "Physics of Immortality" (Tipler 1994). For all their differences in outlook and method, Tipler's work can be directly compared with Spengler's on the central theme of pattern identity (Tipler 1994: 164, 282-284, 291-293). With present and future computerized multimedia systems, the technological basis for practical implementations of a unified knowledge space of humanity is coming closer to realization (Veltman 1997-1999).

The present contribution outlines a morphological cosmology on the basis of patterns and metapatterns. Continuity and change are expressed as interplay of patterns and tension fields (Goppold 1999d: 20-30). This was already voiced in the most ancient Greek philosophy, and reoccurs in recent cosmological descriptions, like the catastrophe theory of René Thom.
Thom (1975: 323): "Our models attribute all morphogenesis to conflict, a struggle between two or more attractors. This ist the 2,500 year old idea of the first pre-Socratic philosophers, Anaximander and Heraclitus... they had the following fundamentally valid intuition: *the dynamical situations governing the evolution of natural phenomena are basically the same as those governing the evolution of man and societies*, profoundly justifying the use of anthropomorphic words in physics."

Vice versa, the phenomena that had previously been reserved for the anthropic domain, like mental facilities, are increasingly being treated in the same context as the more general organic processes that take place in the biosphere. These processes are again being treated as patterns under more general paradigms like *thermodynamic open systems* (Prigogine 1984, Schrödinger 1946, Straub 1990, Vernadsky 1930, 1997). In this view, the cosmos is interpreted as a system of *pattern transmission classes*, which are hierarchically ordered in epochs with respect to pattern persistence and speed of pattern change. At the base are the atomic and physical pattern transmissions of inanimate matter whose persistence is marked by the age of the universe: about 15 to 20,000,000,000 years. The next great class are the chemical- biological pattern transmissions of organic forms on planet Earth, the *biosphere*, whose persistence is about 4 to 5,000,000,000 years. (Hofkirchner 1997, Vernadsky 1930, 1997). Further up on the scale are various pattern transmission classes within the biosphere. The following diagram will present the hierarchy of these pattern transmission classes in a finer grading from a temporal perspective view.

Temporal Perspectives: The Ordering of Pattern Transmission Classes

In a temporal perspective view, looking back into the past, we can discern the following order of pattern transmission classes that can be arranged, *cum grano salis*, in a logarithmic scale of factor-ten steps (except the last one):

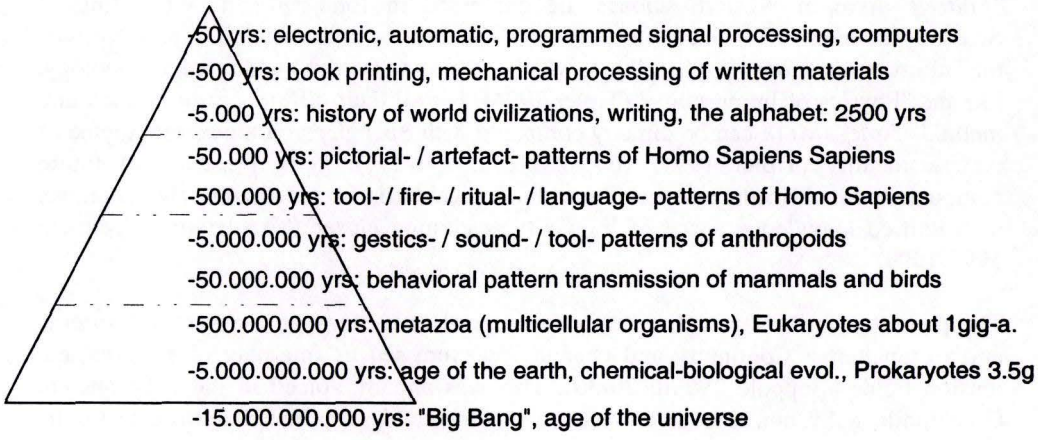

Fig. 1: A temporal perspective view of Pattern Transmission Classes

Pattern Transmission Classes in the Biosphere: Phylogenetic and Ontogenetic

Viewed from a general thermodynamic perspective, the main characteristic of life is: **the activity of self-replicating dissipative structures, to maintain their patterns against the entropic force of dissolution, to propagate them, and to evolve them to greater**

complexity. This formulation derives from statements of various workers: Prigogine (1984); Salthe (1985, 1993); Straub (1990); Schrödinger (1946: 68-75) ch. VI: "Order, disorder and entropy"; Frei Otto (1985: 30): "Jede lebende Ordnung ist der Tendenz zur Destruktion abgewonnen" (every living order represents a victory over the tendency of destruction). It has in an earlier version already been formulated by Spinoza (Hoffmeyer 1996: 138). Conjuring the ancient Greek and Hindu primordial creation mythologies, Lev Gumilev gives a dramatic account of the anti-entropic drive of life:

Gumilev (1990: 198): ... "lightning is energy, in my language anti-entropic impulses that with their rise disrupt the processes of death, the entropy of the Universe. Force, the cause provoking acceleration, saves Cosmos from conversion into Chaos, and the name of this force is Life. But in the eternal war of the protogenic elements, the servants of Kronos, the hundred-handed giants or asura (Sanskrit), lose nothing because they have nothing to lose. Kronos changed their appearance every second, and so deprived them of personal qualities and properties."

The genetic material transmitted via DNA and RNA through the generational succession of organisms in the biosphere can be abstracted as a *Pattern Transmission Class* defined by the laws of the *phylogenetic transmission* as spelled out in *molecular genetics*. Life is an instance of *pattern transmission* on the face of an ever-changing, ever-flowing, and ever-disintegrating material substrate, and beyond the imminent death of the individual gene carriers. In other words, genetic patterns form *immortality complexes* (Goppold 1999d: 137). The genes are an instance of *pattern identity* in the language of molecular genetics:

(Wright 1994: 157): The only potentially immortal inorganic entity is a gene (or, strictly speaking, the pattern of information encoded in the gene, since the physical gene itself will pass away after conveying the pattern through replication).

The genetic trans-generational pattern transmission of organisms has been understood by humans in at least some measure since the early neolithic, as the success with domestication and breeding of animals and plants shows. The recent success history of molecular genetics which is now leading to genetic engineering needs not to be re-told here.

An area of which there is considerably less secure knowledge, and which is consequently under hot scientific debate, is that of behavioral, *ontogenetic* pattern transmission (Goppold 1999d: 48-52, 84-85). It has been found that higher animals, especially birds and mammals, transmit a wide range of behavior patterns across the generations, for which there is no genetic base. If such a transmission chain is broken, like young animals early on being separated from their mothers or the herd, then that behavior pattern is lost for them. *Ontogenetic* pattern transmission is currently being dealt with in very different manner by diverse scientific camps: Approaches deriving their methodology from neo-darwinist evolutionary and genetics sources, which could be comprehensively labeled as *evolutionary* (Koch 1986-1991) or *sociobiology* (Dawkins 1976, 1986; Goppold 1999d: 84-85, 113; Lumsden 1981; E.O. Wilson 1975, 1978), a related camp of *memetics* (Dennett 1990, 1991, 1995; Goppold 1999d: 248-

255), *information theory* (FIS94, FIS96; Stonier 1992, 1994), and *(bio-)semiotics* (Portis 1979; Posner 1989, 1997; Sharov (www)). Dennett sums up the similarity and the difference between *phylogenetic* and *ontogenetic* pattern transmission:

Dennett (1990): Memes, like genes, are potentially immortal, but, like genes, they depend on the existence of a continuous chain of physical vehicles, persisting in the face of the Second Law of Thermodynamics. [material carriers]... tend to dissolve in time. As with genes, immortality is more a matter of replication than of the longevity of individual vehicles... Brute physical replication of vehicles is not enough to ensure meme longevity... for the time being, memes still depend at least indirectly on one or more of their vehicles... a human mind.

Semiotics interprets the pattern transmissions in the biosphere under the aspect of sign exchanges between organisms (called the *Semiosphere*: Hoffmeyer 1997, after Lotman 1990) and within their bodies (Endosemiotics, Posner 1997: 464-487). In his overview article on biosemiotics, Thure v. Uexküll describes the health of an organism with the fluent and efficient integration and functioning of all the multitudinous communication activities of all its subsystems on and across all hierarchical levels, and he defines illness as deviation from this communicative "communion" (Uexküll 1997, 454). In the diction of Maturana (1987) and Luhmann (1993), social systems and proto-social systems arise in the behavioral coupling of organisms, which is another way of looking at the *Semiosphere*. The Semiosphere is the comprehensive concept for all *ontogenetic pattern transmissions in the biosphere*. In the case of organisms with higher neuronal systems, like mammals and birds, the behavioral coupling is effected by *Neuronal Resonance*. (Goppold 1999d: 41-42).

Time, Memory, Anticipation, and Pattern Transmission

Pattern Transmissions always happen through time (*vertical*) and sometimes through space (*horizontal*). In ethnology and cultural anthropology, the term *diachronic* is equivalent with *vertical* transmission, while the term *synchronic* means *horizontal* transmission but this is actually a misnomer since any transmission needs time to happen. (Goppold 1999d: 103-104, 132-135, 139). By applying a perceptive Gestalt flip switch pattern transmissions can be viewed as *memory*, in other words, *memory* is a function of *recurrence* of (similar) patterns. (Goppold 1999d: 23-24, 123). Such had already been formulated in the treatise of Aristoteles "On Memory and Reminiscence" (1924). A memory recall leads in the neuronal system to an activation pattern that has a similarity with the activation pattern that occurred at the original event. (Goppold 1999d: 43-44, 139). Correspondingly, life can be viewed in terms of *memory*. Cassirer (1960: 68-69) cites Hering: "Memory is to be considered a general function of all organic matter." Bateson thematizes this in his *metalogue on instinct* (1972: 38-58).

There is an ancient symbol which appears on every US One-Dollar bill: **The Eye on the Pyramid**. For the present purpose, the motives of the Freemason influenced US founding fathers, who installed this symbol, are irrelevant. It is interpreted here to visualize the distinctive phases of human temporal orientation:

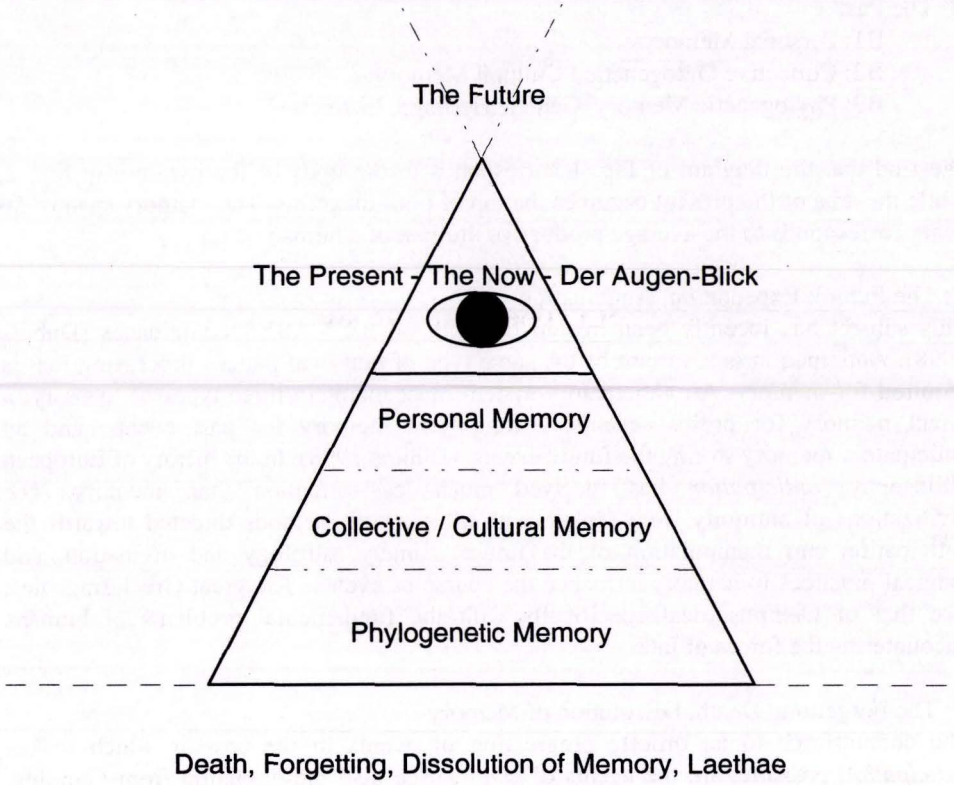

Fig. 2: The Eye on the Pyramid as Symbol of Temporal Orientation

The interpretation of the symbol gives three main phases: A: The Present, B: The Past, C: The Future. These can be differentiated further.

A: The Present - The "Now"

The *Present* is the focus of all existence. We cannot act and think but in the *Now*, and also *Memory*, the mental projections of a *Past*, and *Expectation* or *Anticipation*, the projections of a *Future*, can only happen in the present moment. In German, the *Now* is called "der *Augen-Blick*", which again leads us back to the symbolism of the pyramid. In neurological terms, the *Now* is governed by a temporal coherence function spanning about three seconds: "the three second consciousness" (Pöppel 1978-1995). In a more general perspective of hierarchical systems, it is called the *cogent moment* (Salthe 1985: 75, 121, 171, 192; 1993: 46, 144, 186).

B: The Past

B1: Personal Memory

B2: Collective Ontogenetic / Cultural Memory

B3: Phylogenetic Memory, Genetic Heritage, Instincts

We find that the diagram of Fig. 1 corresponds to the body of the pyramid in Fig. 2, while the area of the present occupies the top of both diagrams. The memory span of 50 years corresponds to the average productive lifetime of a human being.

C: The Future: Expectation, Anticipation

This subject has recently been treated in depth on the CASYS conferences (Dubois 1998). Anticipation is a variant of the same type of neuronal pattern processing that is required for memory. An anticipatory system must maintain three types of memory: a direct memory for present events, a long term memory for past events, and an anticipatory memory storing the future events. (Dubois 1998). In the history of European philosophy, *anticipation* has received much less attention than memory. The civilizations of antiquity were replete with all sorts of methods directed towards the anticipation and manipulation of the future, namely astrology and divination, and magical practices to actually influence the course of events. The great Greek tragedies, like that of Oedipus, deal specifically with the fundamental problems of humans encountering the forces of fate.

D: The Forgetting, Death, Dissolution of Memory

The counterforce to an orderly progression of events in the *cosmos* which makes *anticipation* possible, are the agents of *chaos*. (See also the quotation from Gumilev, above). Greek mythology had a detailed picture of these dark forces, that weave and cut the fates of the mortals, and they personified them in a dark pantheon that stood on equal footing with the Olympic gods. (Goppold 1999d: 35-39, 55-56, 240-243). As given in the *Theogony* of Hesiodos (1978), they were the direct descendants of the *chaos*, the children of *Nyx*, the *mother night*. (Kaiser 1980). Sleep, Death, Nemesis, the Dreams, and the Moirae: *Klotho*, *Lachesis*, and *Atropos*.

Hamilton (1942: 43): Klotho, the Spinner, who spun the thread of life, Lachesis, the Disposer of Lots, who assigned to each man his destiny; Atropos, she who could not be turned, who carried "the abhorred shears" and cut the thread at death.

The Dissolution of Memory was personified by *Laethae*, a river and a goddess who washed away the memories of the departed souls. (Goppold 1999d: 240).

Metapatterns of Recurrence: Pythagoreanism and the Spindle of Time

As was said above, *memory* can be viewed as a function of *recurrence* of (similar) patterns. If we form a more general classification of metapatterns of recurrence, we enter the field of *rhythm* and *music*. (Goppold 1999d: 43; Klages 1981, III, 499-551). The human ability to perceive and appreciate music depends on a vast neuronal computing facility to distinguish temporal metapatterns. In the field of natural phenomena, the

celestial movements form another metapattern of recurrences. In the ancient European world, and in many cultures world wide, the domains of rhythm, music and celestial movements were unified in the world view of *Pythagoreanism*. (Behrendt 1992; Dechend 1993; Godwin 1989; Haase 1989, 1998; James 1993; Kayser 1930-1950; Kepler 1982; McClain 1978; Pyta-www; Rudhyar 1988; Schneider 1951-1990; Thimus 1868-1876).

The imagery of ancient mythological descriptions of *metapatterns of recurrence* used the cultural implements that were common to their times. A good example is the description given in Platon's highly ominous note of the *spindle of necessity* in his *Republic* (617 B) (Schneider 1990: 30). Here the *music of the spheres* is brought in connection with the *spindle of necessity* which is being activated by the three *Moirae* (see quotation of Hamilton, above). The spindle was located in the center of eight concentrically moving circles, each of which was occupied by a siren, which made a specific sound, and the eight sirens together produced a harmonious sound (*the music of the spheres*). And together with the sirens the *Moirae* were singing the past, the present, and the future. This is even described in more detail: *Klotho* (the present) moved the outer circle with her right hand, *Atropos* (the future) moved the inner circles with her left hand, and *Lachesis* (the past) moved with both hands successively the inner and the outer circles.

Peri Peirasis. The Journey into, and Beyond, the Boundaries of the Time

The following will give a short condensation of ancient mythological views of time machinery as they can be found in the Odyssey and presocratic thought. (Diels 1954; Gadamer 1989; Gebser 1973; Goppold 1999d: 207-218, 1999h; Heuser 1992; Hölscher 1989; Pleger 1991).

Please allow me to introduce myself, I am a man of *mnaemae* and *phrenae*, *Mnaemo* is my name, and *peirasis* is my game.

(*Perasis*: the going through, the going beyond, the transcending; *mnaemae*: memory; *phrenae*: brain). The word *mnaemo-* connects us to *Maemosynae*, the ancient Greek "mother of the muses", the numinous personification of *memory*, and of *poetic inspiration* of the *Aoidoi*, the bards, epic singers, and prophets, of antiquity. It also reminds us of the captain *Nemo* in Jules Verne's novel. *Nemo* in Greek means: *outis*, *maedeis*, *oudeis*, and this is the name that *Odysseus* called himself in the land of the *Kyklops*. (Od. 9,366). From the word sounds, we can get a possibly interesting "pattern that connects" *oudeis* and *Odysseus*. As the captain, and seafarer, he is a *gubernator* or *kybernaetaes*. In his fragment B 64, Heraklit alludes to this: *ta de panta oiakizei Keraunos*: The Universe is steered by the *Keraunos*, the *thunderbolt*, or the *Vajra*. Odysseus had to endure seven years of captivity, on the island of *Ogygia*, the *Omphalos* of the *Thalassaean* sea (Od. 1,50; Dechend 1993: 183-185, 193, 269, 324). There is a deep cave, the hiding place of the *God of Time*: *Kronos*, in Plutarch's account (Dechend 1993: 121). *Kronos* is the original owner of the *Keraunos*, before his son *Zeus*, or

Jupiter, had wrenched it from his fist, to govern the universe himself as usurpator. This island is guarded by the nymph *Kalypso*, whose name means "the Veiled One" (*kalyptron*, Od. 5.232), she is the personified numinous power of veiling, obscuring, and occulting, in the ancient Greek Homeric mythology. Her name also connects to the flower- *kalyx*, and the seed husk, thus symbolizing the encapsulation of future potential. She shares her occulting power with *Laethae*, the numinous force of *death-forgetting*. (Illich 1988: 13); Hesiodos (1978: verse 211 ff.)). When Odysseus was finally allowed to leave his place of banishment, *Kalypso* gave him two special tools to cut the trees and fashion his raft: two double axes, the *pelekys megas*, and the *skeparnon*, both being variants of the original *Keraunos*. (Od. 5.234-237; Dechend 1977). Now, as Dechend tells us, the *Keraunos* is the *tool of the time*, belonging to the *god of the time*: *Kronos*. (One could say: nomen est omen, because *Kronos* - *Chronos* and *Keraunos* are deeply related through their sound). And by its use, *Time*, the *present*, the *past*, and the *future*, is initially created, *en archae*, as is related in the mythic account of Hesiodos (1978). Its most common symbol in many cultures world wide is the double axe, the *Pelekys*, *Thor's Hammer*, or the *Labrys*, as it was called in Minoan Crete. (Marija Gimbutas sees a butterfly image in its symbolism, which has its own reasoning, via the temporal stages of metamorphosis, and their initiatic associations: caterpillar / chrysalis / butterfly (Gimbutas 1974: 185-190)). The *Keraunos cuts both ways*: into the past, and into the future. Its *axis / axle / hub* is the *Kairos*, the *present*, the decisive *moment*, the instant of creation, the *Now*. In the grand gory finale of the Odyssee, Homer describes down to the minutest detail the feat how Odysseus shoots his arrow through the hubs of twelve aligned double axes, the abovementioned *pelekon*. (Od. 21.75-21.421). Let is be said that the *Omphalos* is a *navel* as well as a *hub* (*gomphos*, Parmenides 1974: B1,17-20), and how else could the *Keraunos* steer the Universe than *through the hub*? (German: *Nabe* -> *Nabel*). In Roman mythology, the *threshold* of the past and the future is guarded by the god Janus, the *Double-Faced One*, who looks into the past, as well as into the future. He ist the guardian of the *limen*, the *threshold*, called *peras*, in Greek. (See also, the *liminal*, in Gennep 1960). His name re-appears in the month *Janu*ary. A lesser known aspect of the *mythological chronology* of January was that after the winter solstice on Dec. 21 (and the official end of the year), the following week was considered "*outside of the time*", that is, in the *liminal*, or *limbo*, and also *in the hub of the time*, until the new year began. Not without good reason, the celebration of the *birth of the Christ* was placed right in the middle of this period, to Dec. 24. The captain *Nemo* in Jules Verne's Novel makes his journeys in the *Nautilus*, or *nao-telos*, the *naos*, a *submerged*, or *sub-liminal*, ship. According to Vedic mythology, the *Vajra* was hidden on the ground of the ocean. (Dechend 1977: 99). But *naos* also evokes our association to *noos*, and *nous*, the thoughts, the stuff out of which our *memories*, *imaginations*, and *anticipations*, are fashioned. The connection of *nous* and *telos* (aim, goal, finish, completion, success, death, limit -> peras) leads us into the association field of *anticipation*, and *planning*, in the ancient mythologies personified by *Pro-metheus*, the before-thinker. This was also a characteristic of Odysseus the *poly-maechanaes*, the *crafty*, *cunning*, *ruseful*. Our mental imagery consists of things perceived as *phai-*

nomena, as impressions derived from sensory inputs, and as *nou-mena*, the impressions derived from mental, *noetic*, or *noietic*, sources. The *Mnaemo-synae* is the ancient nouminous personification of those *forces*, *patterns*, and *processes* which do their work under the surface of the visible and intelligible, in the *mae-phainon*, the realm *below*, and *before* they turn into the *phai-nomena*, and the *nou-mena*. These are, in scientific terminology, the workings of *neuronal activation patterns*, of *oscillation fields* and *logical relation structures* of *neuronal assemblies*, of the *coupled dynamic systems* of *neuronal attractors*, of our brains: the *phrenae*. The *mnaemo-synae* reminds us of this still quite mysterious working of the *neuronal sym-plexis*, and *syn-apsis*, by which our *sym-ballein*, the concept formation is effected. When the subliminal workings of the neuronal webworks of our *phrenae* then weave (*histon*, *historia*) together into the appearances of the intellegible and discernible, they become *ho phainon*, that which finds its appearance through *phos*, the light, and *phonae*, the sound, as *appearance*, and *apparition*, *phaino-menon* (in German: *Auf-Scheinendes*), with form: *mor-phae*, and *Gestalt*. This, *ho phainon*, the *Brilliant*, the *Shining One* (in German: *Er-scheinung*), is also the name of the god *Hae-phaistos*, the one who works the brilliant and shining metals, while they are red and glowing: *phoibos*, and *phoinos*, *phos-phoros* (*lucifer*). With his hammer and anvil, and with his mighty blows, he forges them into their forms, the *mor-phae*. And with his hammering, the metallic sounds of *phonae* and *phthongos* ring out to make themselves heard awide and afar.

Conclusion

Behind a shroud of mythology, we may find in the ancient *Pythagoreanism* a core of knowledge which may provide us with new mental tools to come to grips with a "time that has gone out of joint" (Hamlet, I,5,188-190; Cramer 1993: 11-12) and gain new perspectives over the grand totality of cosmic processes as they are being revealed to us with our latest technical instruments, so that our mental and cognitive facilities will have a chance to re-integrate the floods of scientific data, and the torrents of socio-political and ecological change on planet Earth. This is the aim of the *Meta-Morphology*, as outlined in the present contribution.

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