Anticipation, Meta-Morphology, and the Promethean Venture of Computing

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Abstract

Meta-Morphology is the *Systematics of Patterns that Connect*, or the *Systematics of Meta-Patterns*. Our familiar world of objects, phenomena, and qualia is, by current neurological knowledge, based on the electrical activation and connectivity patterns of our nervous system. Inside our brains, the neuronal "enchanted loom" weaves a complicated spatio-temporal meta-pattern structure from which derive our familiar world impressions. In abstract terms, the neuronal apparatus can be described as "Meta Pattern Machine" (MPM). The MPM is the ultimate parallel device, and its storage is an internal set of activation patterns, which form a fuzzy open set, and each new meta-pattern extends the set of existant patterns. Described from the temporal domain, the neuronal system forms an ensemble of *coupled oscillator fields with reciprocal stimulation*, and its operation mode is in the present context called *Neuronal Reverberation*. In music, the temporal succession and alternation of melodic themes forms meta-pattern structures which can also be understood as *reverberation systems*. *Reverberation* is, most abstractly formulated, the similar reproduction of a temporal pattern across a distance of time and space, and in the MPM description, it is analogous to *memory*, when viewed from $t_{(n)}$ *backward in time* towards $t_{(n-1)}$, and as *anticipation* when viewed from $t_{(n)}$ *forward* to $t_{(n+1)}$. In musical composing technique, we find an illustrating application: when an opening theme evokes in the listener a tension that is being filled in the consequent production of the piece. The Leitmotif of human temporal orientation is spelled out in the ancient Greek mythology of *Pro-Metheus* and his brother *Epi-Metheus*, who are both united in the Roman god *Janus*. How deeply these themes have influenced our occidental mindset, will be traced through various pieces of ancient literature, and their direct influence on the present-day venture of computing will be shown.

Keywords

Meta-Morphology, Meta-Pattern Machines, Neuronal Reverberation, General Theories of Patterns, General Neuronal Networks.

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1 Introduction to Meta-Morphology, Meta Pattern Machines, and Neuronal Reverberation

1.1 General Theories of Patterns: The Previous Literature

The present paper continues the contributions in Goppold (1999b-2000e). The series develops the concept of *Meta-Morphology: The Systematics of Patterns that Connect.* It is a *General Theory of Patterns* (GTP), which is based on a synthesis and continuation of the works of J.W. Goethe, G. Bateson, and Christopher Alexander, the latter being currently popular in some parts of the computer science community through the *Software Patterns* movement. (See also the specific literature: Salingaros (www), Appleton (www), Coplien (1995, 1998), Gabriel (1996), Gamma (1995)). *Pattern Theories* have a long history, many without knowledge of other, previous, and similar attempts. This is probably due to the protean character of patterns, they are a most general, most abstract concept, and so they re-appear in many sciences, and it is easy to understand that there exists as yet no coherent way of organizing and cross-referencing this thoroughly transdisciplinary topic. At the present level of research, the earliest attempts at constructing a *General Pattern Theory* date back to the ancient *Pythagorean thought system.* Although this heritage is heavily over-grown with folklore, magic, and mythology, their attempt at finding a unifying conceptual base for mathematics, music, and astronomy, can be classed as one of the earliest recorded attempts at GTP. (Bamford 1994, Bateson 1972: 449, Van_der_Waerden 1979). The ancient practice of mantics in all cultures has a common ground in discerning patterns in observed quasi-random events (e.g. the flight of birds, the pattern of clouds, livers of animals, hand lines, lead drops in water...), and deducing from these a general structure of fatual events that influence the course of human life. The German *morphology* tradition in Goethe's thought-tracks has been influential in the further development of GTP. Its main later exponents were Oswald Spengler (1980) and Leo Frobenius, in the field of *cultural morphology.* (Benedict 1934, Haberland 1973, Felken 1988: 53, Streck 1996a - 1999). The psychologist *Gestalt* school of Ehrenfels, Koehler, Koffka, and Wertheimer largely followed the tracks of Goethean *morphology.* (Köhler (1969), Luchins (1975), Rock (1991), Severi (1993: 309, 311-315), Strube (1974)). Their work influenced that of Bateson and many other workers in psychology. The social field theories of Kurt Lewin (1963) and Fischer (1965) can also be mentioned in this context.

1.2 General Neuronal Networks and a Universe of Patterns

The specific approach taken in the current project is to update the already ancient tradition of pattern theories with current neurological knowledge. The current approach of *Meta-Morphology* takes a *reformed* stance of the *reformed subjectivist principle* that was poignantly worded by Whitehead (1969: 194): *"Apart from the experience of subjects, there is nothing, nothing, nothing, bare nothingness."* The subtle difference is that "*experience of subjects*" is exchanged for "*process patterns of General Neuronal Networks* (GNN)". This will be expanded further down. In the neighborhood of this position, we find the well-known autopoiesis theories deriving from Maturana and

Varela's work (Maturana 1987, Varela 1991, Breidbach 1996). The term *pattern* is used here in a double role:

1) as a generic name to the *excitation configurations* of a GNN, and

2) for the "stuff" which a GNN can process.

Both are equivalent formulations of the operational closure of GNN. A GNN can "know" only its own excitation patterns, and nothing else. Thus, the aphorism of Whitehead is reworded as the *reformed GNN Universe of Metapatterns principle*:

"Apart from the process patterns of General Neuronal Networks, there is nothing, nothing, nothing, bare nothingness."

Goethe used *morphology* for the study of forms and their changes, and Bateson coined the expression of the "*patterns that connect*". Bateson (1979: 12, 18). Another important term is the Japanese *Kata*. (Goppold 1999d: 79, 221-222). The works of Christopher Alexander are devoted to discussions of the subtleties of patterns (1967, 1979), Salingaros (www).

1.4 The General Neuronal Net View of Patterns

In the view of *meta-morphology*, the only "things" that a GNN can process are *excitation patterns* of its neurons. Of course, some caveats against extending this working model to information processing by organisms in general should be mentioned: It may not be so simple to bunch together the brains of organisms and electronic NN implementations, since each organismic neuron is a living cell, and the bio-molecular complexity of its internal processes may not be so readily abstracted into the simple McCulloch/Pitts summing/switching element. But this argument can be turned around, since single cellular organisms, mainly the prokaryotic life forms, keep on existing and processing all sorts of information since about 3-4 billion years without a nervous system altogether, and the multi-cellular plants and fungi, as we all know, also do very well without it. This means that all living organismic cells and all their forms of aggregations can be fitted into the GNN abstraction.

Inside our brains, the neuronal "enchanted loom" (Sherrington) weaves a complicated spatio-temporal meta-pattern structure from which derive our familiar world impressions. When we observe the neuronal processing in our brains, we may (somewhat artificially) start with the constant flow of impulses of excitations coming from our exterior and interior sensory cells, in the order of several mega- and gigabytes per second. If, for example, something drastic changes in our environment, like when the lights are suddenly switched on in a dark room, then this constant flow is altered, and an orientation process sets in: after a few milliseconds of neuronal processing (and some giga- to teraflops in computing power spent), then arise the familiar object shapes, which are known in semiotics as "signs", and after still a few more milliseconds, arises the coherent field that we know as "consciousness", when the neuronal system has updated all the memory stores with the incoming sensory data. Of course we are not aware of all this before the neuronal processing has reached the consciousness level, and then

everything is ready-packed in the forms which we are used to, and only in exceptional situations, like an extremely alien environment, drugs, or emergency, do we experience that this process does not present us with the normal results.

1.5 Neuronal Reverberation

Viewed from the temporal domain, the neuronal system forms an ensemble of *coupled oscillator fields with reciprocal stimulation*, and this aspect of neuronal operation is called here *Neuronal Reverberation*. In prior writings (Goppold (1999b-2000e)), the term *Neuronal Resonance* was used, but *Reverberation* carries a more active connotation trough the Latin root *verbero* (to beat). The conceptual difficulty is to adequately describe in the temporal domain a field view one would have if one could observe large and topically disjunct areas of the brain in their reciprocal stimulation in great detail. Current neurological measurement methods like neuron-needles, EEG, PET, and NMR impose their technical limitations on the visualizations we can make of the neuronal processes. Either we have only one or a few neurons that we can measure (needles), or we have a very diffuse electric potential reading through the skull (EEG), or localized, but with low resolution temporally and spatially (PET, NMR). Currently, it is not possible to measure with sufficiently fine detail temporally and spatially the excitational interdependence of whole neuron fields in different regions of the brain. In the present context, a preferred representation of the operation of the brain would be like a *complicated maze of reverberation patterns*, of *waves of excitation* (see the earlier Pribram holographic brain model). But this is actually more an *audialization*, than a *visualization*, because it emphasizes the *time domain* more than the *space domain*. Therefore a conceptual switch to a different domain of discourse is advised, to *music*. The issue of *discourse domains* is a critical one, since neuroscience discourse, like most of the rest of western thinking, is predominatly oriented along the visual domain (*visual space*, according to McLuhan&McLuhan (1988)), and thus employs *spatial metaphors*. In the present view, the only spatial aspect that matters is the connectivity patterns of a GNN and the requirement that the respective neurons must find a place somewhere in 3d-space, but it is quite uninteresting where, as long as the signal conduction delay and the necessary amount of "wiring" is somehow minimized. This is idential to the criteria of electronic circuitry layout.

Neuronal Reverberation is in the present context a technical term to describe in a *temporal discourse domain* not only what is happening *inside one* GNN (as in the brain of an organism), but also what happens *between several* GNNs. One has to account for the different pathways of coupling that are taken when the boundary between one GNN and the other is crossed. Here we find the already well known theories of Maturana & Varela (Maturana (1987), Varela (1991)) and followers like Luhmann (1993), who construct the emergence of social systems on this base. In the biological, medical and semiotic realm, we find the work of the Uexküll's (Uexküll 1997, 454) and *Biosemiotics*. (The *Semiosphere*: Hoffmeyer 1997, after Lotman 1990, *Endosemiotics*: Posner 1997: 464-487). It is trivially true that all interactions between innvervated organisms involve the mutual stimulation of (some parts of) their nervous systems. It is also trivially true

that these inter-organismic excitation sequences will display some semblance of the frequency distribution pattern (fourier transform) of the dampened oscillation that is commonly known as *resonance* or *reverberation*. In the present context, the usage of the term *Neuronal Reverberation* allows us to class the interaction of several GNNs as *just another (class of) metapattern(s)*.

There exist many different words from different spheres of behavior and communication studies describing this or that aspect of inter-organismic {communication / interaction / exchange} for which *Neuronal Reverberation* is used as class-descriptor. We find here: overt communication, like *spoken language*, *gestics*, and *mimics*; as well as automatic, involuntary communication, like *body language*, *emotive signals*. (Literature overview of semiotic studies, see: Noeth 1985). We also find there the effects of (longer or shorter) communicative sequences like: *empathy*, *sympathy*, *antipathy*, and *charisma*.

1.6 The Meta Pattern Machine

Bateson defined *Meta-Patterns* as *patterns of patterns*, and in technical terms, this indicates the familiar computer science concept of *recursion* for the pattern processing mechanism of the nervous system. Usually, the term "*meta*" implies a different *logical order* (or *logical type* in the terminology of Russell & Whitehead), but a *pattern of patterns* is just another pattern. Because an excitation pattern is always maintained by some finite GNN (-equivalent) system, there arise practical problems: In order that the *recursion* does not lead into the chaotic states and possibly self-destruction of a positive-feedback-coupled self-excitatory system (as it happens in epilepsy, for example), there must be a *dampening mechanism*, (neurologically: *inhibition*) present in the *recursion* process, and a mechanism for keeping track of the *recursion nesting levels*, in computer science terms, a *recursion hierarchy / nesting stack*. With this, a GNN constitutes a "Meta Pattern Machine" (MPM). This is contrasted against the familiar computer science model of the Turing Machine (TM). While a TM is the ultimate serial device, which uses an external storage tape and a clearly-defined character set, but knows no recursion nesting stack, the MPM is the ultimate parallel device, and its storage is an internal set of activation patterns, which form a fuzzy open set, and each new meta pattern extends the set of existant patterns. As pointed out above, a vital component of its operation is (an analogy of) a *recursion hierarchy stack*. There are definite practical limitations on the number and hierarchic stacking levels of metapatterns that brains can maintain, and human intelligence is, by conjecture, related to a greater flexibility and depth of these stacking mechanisms in comparison with animal brains.

In Pythagorean analogy, a musical representation may offer an intuitive way to understand the temporal aspects of GNN systems, and seen this way, the MPM is a musical machine. In music, the temporal succession and alternation of melodic themes forms meta pattern structures which can also be understood as *reverberation systems*. This *reverberation* is of course not passive (like in simple physical arrangements), but active, based on the positive feedback system of the GNN. In more abstract terms, *it is*

the similar reproduction of a temporal pattern across a distance of time and space. For the MPM description, *reverberation* is analogous to *memory*, when viewed from $t_{(n)}$ *backwards in time* towards $t_{(n-1)}$, and to *anticipation* when viewed from $t_{(n)}$ *forwards* to $t_{(n+1)}$. (See also the description of "three types of memory" and the example: "Hyperincursive Discrete Harmonic Oscillator" in Dubois 1998). In musical composing technique, we find an illustrating application: when an opening theme evokes in the listener a tension that is being filled in the consequent production of the piece. (Schmidt-Garre 1992: 52).

1.7 Meta-Morphosis: The Dynamic Aspects of Meta-Patterns

The Goethean side of the *meta*-aspect derives from his usage of *Meta-Morphosis*, emphasizing the *temporal* and *dynamic* aspects, ie. *the forms of changes of patterns*. A common term for the class of *dynamic patterns* is *process*. Since *dynamics* is that part of the Aristotelian heritage which remains up to this day largely unknown and undervalued, the current development of *Meta-Morphology* may also contribute to extending a line of work that western philosophy had discarded in favor of static-state ways of thinking in the wake of Parmenides and Platon. This line of thought, of "*dynamics per dynamics*" was first known from the *dark dicta* of Heraklit, from some main themes in the works of Aristoteles, the Buddhist and Chinese philosophy (Paticca Samuppada, I Ching (Govinda 1983; Sung 1971; Wilhelm 1939)), and in recent times, F. Nietzsche (1969), and A.N. Whitehead, mainly his ground breaking work "Process and Reality" (1969). Another, more maverick philosopher dealing explicitly with the *forms of changes of patterns* is Arthur Young, with his *theory of process* (Young 1976, 1977, www). In reformulation of Nietzsche's paradigmatic dictum, the *systematology of the ever-changing* could be reworded as: "The Infinite Return of the Eternally Unequal". (Goppold 1999i). The delicate balance between stasis and dynamis is evident in the life process itself. Life may be understood as *the endeavor of keeping a continuous stable molecular and energetic pattern in an ever-changing current of thermodynamic entropy* (Goppold 1999d: 25, 49-50). But this pattern of life also presents constant change. Life also means the "*perpetually perishing*" (Whitehead 1969: 34). Goethe vividly described the futile human game to achieve ever-secure stability and its inevitable failure in his *Faust*. (Goppold 1999d: 25, 34-39, 236-255). *Mephistopheles*, the name of the antagonist of Dr. Faustus, can be interpreted as word-play in allusion to the age-old mythological background of the permanent struggle of the forces of *Chaos* against the forces of (Law-and-) *Order*, which, in our western cultural heritage is preserved in the *Theogony* of *Hesiodos*. (But it faithfully reappears in many mythologies and religions of humanity. Campbell 1996).

2 Anticipatory Computing and the Prometheus Mythology

As Dubois (1998) points out (quoting Robert Rosen), *anticipation* re-introduces the *final causation* of Aristoteles. This is a "why" theme, and an area of philosophy, and not of science, which deals with "how" questions and *efficient causes*. The next paragraphs seek to explore the fine dividing line between the present and the

past, by following some ancient thought tracks of humanity. *Anticipation* is a form of memory, since it involves the production and detection of patterns across a distance of time. The discussion in Dubois (1998) states this indirectly with the three types of memory: An anticipated event can only be represented as (a variation of) some past pattern that was detected / produced in the GNN. Also stated above, the detection and production of an excitation pattern is equivalent for a GNN. Pure and unmitigated novelty is unimaginable, it is pure chaos.

2.1 Mythology: What is it Good For ?

If the *anticipatory computing* community were to look for a mythological *tutelary deity* or *daimonos*, *Pro-Metheus* would be the ideal candidate to fill the position. It might be questioned of what usage would mythology be in the context of *Anticipatory Computing*. In the natural science and engineering community, mythology is usually not a theme at all, and if it is, then it is quoted to remind the rest of the world of how far humanity has progressed out of an archaic, backward frame of mind and thinking. In the current context, *mythology* is a technical term for a certain class of cultural transmission patterns that extends through the history (and into the future) of humanity, and thus relates directly to the focus theme of what are the most general kinds of patterns that humans are able to formulate/discern. The mythological mind experienced the world as a system of pattern *correspondences*, or in the present diction: as pattern *resonances* and *-reverberations*. The well-known dictum "as above so below" exemplifies this. In the Neo-Jungian formulation of Joseph Campbell (1996), one could state: "*Mythologies are the invisible threads out of which the fate-fabrics of entire cultures are woven*". Of course this motto will have to be modified somewhat for the present purpose and context, and instead of the rather mystical *archetypes* of Jung, and the equally mystical "fate-fabrics of cultures" that Spengler talks of, we are today in the better position to be able to identify mythologies as *entities residing in the Semiosphere*, the *cultural-pattern* transmission envelope of the human world, in analogy to the *Biosphere*, which is the molecular *(phylo-)genetic-pattern* transmission envelope of the planet Earth. (Goppold 2000a: 2.8, 2.9, 7.4; Goppold 1999d: 49-52, 64-79, 116-119, 132-190).

2.2 The Prometheus Mythology as the *Leitmotiv* of Anticipation

The mythology which is chosen as the *Leitmotiv* for the present contribution is that of *Prometheus*, or rather, the quadruple brotherhood of *Atlas*, *Meno-Etios*, *Epi-Metheus*, and *Pro-Metheus*, who are the sons of the Titan *Iapetos*. The following is a quote from the Encyclopaedia Britannica:

(Britannica: Prometheus): in Greek religion, one of the Titans, the supreme trickster, and a god of fire. His intellectual side was emphasized by the apparent meaning of his name, Forethinker. In common belief he developed into a master craftsman, and in this connection he was associated with fire and the creation of man.

2.3 Jean Gebser and the Mental Structure

Pro-Metheus means: the *Forethinker*. *Epi-Metheus* means: the *Afterthinker*. Taken together, they are the *tutelary daimonoi* of *human temporal orientation*, of

{memory/reminiscence} and {expectation/anticipation}. They are both united in the bi-faced Roman god *Janus* (Goppold 2000a, 4.1). The role of *Meno-Etios* will become more clear from the following discussion. He is the *daimonos* of the balance, and that aspect of the consciousness which brings memory and anticipation into balance in the moment, the *now*. Atlas is the *daimonos* of the tension under which this balance stands.

Jean Gebser (1973: 125-164) enlarges on the theme with etymological material in his chapter on "the mental structure" which is rendered in condensed version here. (125-127): Around the year 1500 A.D., a crucial development unfolded in Europe, when the perspectivic world experience mutated out of the medieval aperspectivic world experience. The medieval aperspectivic world was only a part of the mythical structure, actually only its European part. The perspectivic breakthrough merely repeated something that had happened already around 500 B.C. in Greece, and it was re-enacted around 1250 A.D. by the European humanity. But a new integration was reached by the European process because it involved three great achievements that had already contained in nuce the perspectivic world experience: the Greek doctrine of *Knowing* [the *mathesis*, A.G.], the Jewish doctrine of *Salvation*, and the Roman doctrine of *Law and the State*. Commonly, we associate the word *mental* with *mentality*, with various different shades of meaning for the different European languages. But *mentality* covers a wider meaning field than just its moral components. The original root of *mental* comes from the Sanskrit *ma*, and secondary roots like *man-*, *mat-*, *me-*, and *men-*, which re-appear in an extraordinate richness of connections and associations in the indo-european language family. All these words provide us with decisive characteristics of the mental structure. Moreover, this word is the primal expression [the *Leitmotiv*, A.G.] of our occidental culture:

It is the first word of the first line of the first song of the first utterance of the occidental mind. This is the "menin aeide thea", the opening line of the Iliad.

Menin is the accusative flection of *menis*. The Greek word *menis* means *anger, courage*, and it is related to *menos*, which means *intention, power, anger, courage*. It is closely related to the Latin *mens*, which on its own turn has a complex semantic field very much the same as *menos*, but with many connotations of *thinking, thought, mind, presentation*. The *man- men-* root contains the fundamental seed of *oriented thinking*. The rise of the mental structure was an extraordinary event that literally shook the world in its foundations. The myth of the birth of Athena paints a vivid picture of this eruption: Zeus had had an affair with *Metis*, who was the tutelary deity of reason and intelligence, and she had the *protean* ability of the water-gods of being able to change forms. Zeus feared that *Metis* would give birth to a son, and he feared that this son would repeat the drama that he himself had played with his father *Kronos*, whom he had deposed as the celestial *hieron archon*. Therefore he devoured Metis, who was already pregnant with a daughter, *Athene*. By this, Zeus had involuntarily implanted the divine fetus of *Athene* into his own body. The fetus grew and grew, and was ready to be born, but the natural way of delivery was blocked, of course. In his desperation, Zeus called to *Hae-Phaistos* (in other versions: *Pro-Metheus*) for help, who used his special methods to open the

blockade. With his hammer, and a mighty blow, he split open the forehead of Zeus, and with a terrific crash, that shook all the earth, the seas, and the sky, *Athene* sprang from the gap, fully clad in shining armor. The Roman name of *Athene* is *Minerva*, and her Etruscan correspondence: *Menerfa*. Gebser goes on for a few more pages of family relations around the *man-*, *mat-*, *me-*, and *men-*, root words, and he mentions the name *Minos* (see the connection with *Daidalos*), who re-appears in other cultures as *Menes*, *Manu*, and *Mani*, and finally *man*, and *Mensch*, as indicators for the emerging mental structure of a *weighing*, *ordering*, and *measuring mind* (p. 129-130). The revolution that the mythology refers to is related to cosmic upheavals around the time of which the Ilias recounts, sometime around 1250 B.C., with similar cataclysms occurring everywhere in the ancient world: the Jewish Moses and the Seven Plagues mythologies, and the birth of Jewish monotheism. So much for Jean Gebser's account. Other sources recount in the same context the Thera explosion, the Egyptian Hyksos invasion, and the demise of the Kretan empire. More data in: Assmann (1998), Dechend (1977, 1993, 1997), Zangger (1995).

Pro-Metheus as fire god emphasizes his {relation to / identity with} *Hae-Phaistos*, the Greek smith god of metal-and-fire-works, and supreme mechanic genius of the pantheon. Against the orders of Zeus, *Pro-Metheus* brought the fire to humanity, and for this and other misdeeds he was cruelly punished. The mythological patterns reappear in similar constellation in different ancient plots, and the *Daidalos* mythology plays upon the same theme. There, the role of *Meno-Etios* is played by *Minos*. The Sanskrit word for *fire drill* and *buttering rod* is *pramantha* (Dechend 1993: 128, 291), which gives the word play around *Pro-Metheus* some more interesting twists-and-turns. This *pramantha-ProMetheus* vexing image (Gestalt picture) is the central *corpus delicti* in Dechend's monumental work. So it is for the present contribution, since it is the cosmic axle of time, of the *Keraunos*, which "*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*." (Goppold 2000a: 4.1). V. Dechend provides another Sanskrit connection through the word *manthano*, meaning: *mens provida* or *providentia*, which is again none else than a Latin rendering of the *Pro-Methe-* theme. (Dechend 1993: 368).

3 The Proimion of Parmenides and the Axle / Axis of Time

(The following excerpts are from: Parmenides 1974,B1: p. 8-11, transl. & comment, A.G.). Parmenides is situated right at the epicenter of the 500 B.C. Greek mental mutation that Jean Gebser speaks of. Parmenides was the founder of the so-called Eleatic school and the primal proponent of the "it is real only when it is permanent" party, and directly opposed to Heraklit's views. Thus he offers two interesting aspects for the current theme: For one, his work is the first in the European intellectual history to clearly spell out the precedence of *ontology* over *epistemology*, of *being* over *becoming*, and of *rationalism* over *empirism* which had influenced much of its later course. This is the content of the main body of his treatise. But the *proimion* (verses 1-21) has an entirely different theme: Here he brings up an interesting variation of the Titan-firedrill-

time-axle theme (known from Goppold (2000a: 4.1)). The proimion is framed by a repetition of the words *hippo-*, Greek for *horse* in lines (1) and (21):

(1) hippoi tai me pherousin, hodon t' epi thymos hikanoi (horses that carry me hurriedly, as far as the will will carry)

(21) ithys echon kourai kat' amaxiton harma kai hippous. (right through, in the straight way, the Sun-daughters guided the chariot and the horses).

The mythological *hippoi-* theme of the first line is completed with the corresponding *harma-* leitmotif of line 5:

(5,1) harma titainousai; kourai d' hodon haegemoneoun. (they tearingly pulled forth the chariot; Sun-daughters guided the way).

In the epic context, the *hippoi-harma* dyad carries a special meaning, and still reappears in many later imageries, like Platon's parable of "the chariot of the soul" that is being drawn by two horses, one white, and one black. *Harma* is the two-wheeled war chariot of homeric origin. Its root means also: to yoke, to unite, to bring in *harmony*. The journey described by Parmenides is a quote from the familiar *Phaeton* mythology that everyone reading these lines knew back then. The full story might be like this: Parmenides has somehow managed to borrow the sun chariot and has enlisted the help of the Sun-daughters to take him to *the realm of everlasting truth* (*alaetheia*), that is separated from the terrestrial sphere through "a gate separating the ways of night and day" (ln 11). There he meets the presiding tutelary deity and she congratulates him on his achievement and proceeds to give him a lecture on the evident truth of being, which is the main body of the treatise.

For further connection with our *Pro-Methean* theme we will analyse the imagery of the text. His journey is a dangerous one, and we have a *titanic* effort descripted here, *all forces are bent under the will-power up to the point of breaking. titaino-* connects us to the archaic word of *titanic energies*. The meaning is connected to an ultimately extended or intended bow, reappearing in modern language as the *in-tension*, or *in-tention*. The mental imagery gives us the figure of a *Titan* who is stretched bent between heaven and earth, and thus stands for *Atlas*, the brother of *Pro-Metheus*. We are being led into the deeper and deeper reaches of the archaic mind, the *titanic mind*, of the first generation of creation, before the emergence of the *mental structure* (in the version of Jean Gebser), that Hesiod tells us about in his *Theogony*.

(2) pempon, epei m' es hodon beaesan polyphemon agousai daimonos. (they pulled me forth, having brought me onto the renowned path of the goddess)

(6-7,1) axin d' en chnoiaesin hiei syringos autaen aithomenos. (the axle in the wheel hubs screetched the shrill sound of a reed whistle, red hot was it.)

The imagery of the *titanic* effort is empathically underlined through the intense description of the glowing heat and screeching sound of the axle. We can imagine that in the next moment, the wheels might be flying off, or the chariot catch fire because of the intense heat. *aithos* or *aitops* is the semantic field of fire, burning, heat, glowing red with heat, also the red hot iron, the realm of *Prometheus*, or *Hephaistos*. We are lead back to

the dyad semantic fields *phos* and *phonae*, giving us the root connection of the *light* and the *sound*, when we substitute *aithomenos* with its synonym *phoinos*, both meaning purple red. We also get the connection mentioned in the sound field of *chnon*, *axon*, *pramantha* or *prometheus*, the fire drill, leading us into the deep abysses of archaic cosmology that H.v.Dechend speaks about. (Goppold 2000a: 4.1).

(7,2-8,1) doiois gar epeigeto dinotoisin kyklois amphoterothen (driven was it by two whirling wheels on both sides)

In the normal order of things, the *axle* is that which remains *static*, and *unmoving*, while the *wheels* are *turning*. This peculiar formulation that the axle was "driven by the two whirling wheels", gives reason to assume that it is not just epic freedom why Parmenides choose that particular form but that he intended to indicate also the *dynamic* (*dinotoisin*) aspect of the axle. In the next verses (11) up to (21), Parmenides brings up yet another variation of the time {axis / axle} theme, with the "great gate separating the ways of Night and Day" (ln 11), that is "turning on bronze axles and posts" (ln 18-20). This indicates an inverted mirror image of the *Keraunos* (Goppold 2000a: 4.1), the image of the double bladed axe is exchanged for the dual wings of the gate, which perform the primordial time separation of "Night and Day". While the *Keraunos* (and the Roman god Janus) cuts/looks in both directions simultaneously, into the past and the future, the gate with its exclusive-or functionality clearly separates the two realms in a dichotomic manner.

4 Computing as Anticipatory Venture

Daniel Dubois (1998) states: "With computing power, systems are able to anticipate". But the statement can also be turned around: that computing is in itself and by its intrinsic nature a anticipatory, *pro-methean* venture. This may not be so apparent at first glance, and some discussion will be devoted to the point. Computation is a Janus-faced phenomenon, with its symbol manipulation aspect on one side, and its technical aspect on the other (Janich 1993, 1998). Both coincide only by our societal decision to make them coincide: For a computing machine there exist no symbols, and as implemented in the current technology, a computer processes just packets of electrons that are driven through connection lines and their flow shut off or opened by transistors. Behind this, formulated more abstractly, is the TM model, or the *algorithm*. This is a step-wise procedure, proceeding linearly by one operation at a time, until the computation is finished. The matter of anticipation appears only in the form that the algorithm is expected to finish in some practical time to be useful. (Halang (1992) even speaks of an underdeveloped awareness of time in the computer sciences). The crucial question is whether a TM is able to anticipate anything at all, beyond that class of patterns to which it was programmed by a human to react to. Here, we find a recurrence of the TM vs. MPM discussion above, to the effect that a TM needs a technically (and humanly) pre-defined set of internal states relating to threshold values of its input sensors to operate on. (This is e.g. the character set by which to mark its storage tape and its internal states.) In the GNN case, with a MPM as technical implementation, on the other

hand, there is no such defined character set. A GNN pattern is by its very definition, fuzzy, and in a natural system, it is defined through "autopoiesis" (the term being used in a rather loose sense, not literally Maturana's definition.)

As viewed from the societal side, computing is anticipatory because of the *pro-gramma*, the script that the machine is given to make it react to future events. Computers are, like all technical devices created by humans, trivially a materialized form of anticipation, since they are based on the anticipation of future labor-saving usage of the device. This anticipation justifies the additional physical and mental effort to invest the time to fabricate the device in the first place, and to keep it around for the intended future use. While all other machines have the patterns of their intended usage physically fixed in their material design (form follows function), computers provide for an unprecedented level of indirection. An exchange of programs makes possible a change to a different class of usage. An anecdote may serve to illustrate this: a scene in the movie "Tron" of (about) 1984 depicts two personified motorcycle racing programs talking to each other, and one of the programs says: "I used to be a humble financial accounting package, but then some hacker converted me into this motorcycle racer that I am now". (Quoted from memory). Although we are used to consider that box that sits on our desks, as a PC and as "a machine", it is actually the physical placeholder for *a whole class of machines*, and each program that we run on it, converts it into a *different machine*.

4.1 The Pro-Methean Venture of the Pro-Gramma

A suitable Greek generic name for the scientific branch to which the fields of computing and anticipatory computing belong, would be *pro-mathesis*. The *pro-gramma* (*grammata*: gr. the written letters) is a central term in computer science. In the last 5000 years since its invention, the character of writing was predominanthly *epi-methean*, since writing is a memory substitute, or -prosthesis (see Platon's (1988) Phaidros (274c-275) passage for this) and as such is mainly geared to the things of the past, for the preserving of personal and cultural memory. (With some exceptions like science fiction and utopian literature). The *pro-gramma* aspect of computing is a major revolution in the history of thought as it represents a systematic and organized endeavor to incorporate future events into the technology of writing, a thoroughly *Pro-Methean* venture. In the last 50 years, a sizable portion of the total creative energy of humanity was channeled into this venture, and today, computerized multimedia and telecommunications are becoming a pervasive societal infrastructure without which our civilization would soon grind to a halt.

5 Conclusion

The point made in the preceeding discussion is that computing is an expression of life's inherent (and distinctive) capacity to anticipate. To illustrate this, the concepts of General Neuronal Networks and Meta Pattern Machines served as an abstract formulation of that substrate which underlies as foundation any higher-order symbolization: Pattern Processing. The connection with ancient mythology served to recall an earlier cultural phase of humanity, when symbolization had not yet reached its

present form of standardization (and ossification) that was mainly an effect of alphabetization. The material presented may lead to a new appreciation of Hertha v. Dechend's (1993) claim that ancient mythology contains not just old and discarded folklore, but rather, that it contained a sophisticated kind of computational- / time machine device. In present diction, the old mythologies may present us with clues to some as-yet hidden operation modes that the human brain can be programmed into for presently unanticipated levels of operation.

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