Theory and Applications of Mathematics & Computer Science

(ISSN 2067-2764)
http://www.uav.ro/applications/se/journal/index.php/tamcs

Theory and Applications of Mathematics & Computer Science 1 (2) (2011) 42–55

Symmetry, Hierarchy, Analogy Versus Embedded Systems

Tudor-Răzvan Niculiu[a,*], Anton Manolescu[a]

[a]*Politehnica University of Bucureşti, Faculty of Electronics, Telecommunications and Information Technology Faculty, Splaiul Independenţei 313, 060042 Bucureşti, Romania.*

Abstract

Intelligence = Consciousness × Adaptability × Intention and *Faith* = Intuition × Inspiration × Imagination, are the complementary parts of the human mind; the link between is *Conscience* = Consciousness × Inspiration. Simulation is the relation between function and structure. Conscience simulation demands transcending from computability to simulability, by an intensive effort on extensive research to integrate essential mathematical and physical knowledge guided by philosophical goals. A way to begin is hierarchical simulation. Coexistent interdependent hierarchical types structure the universe of models for complex systems. They belong to different types of hierarchy. Symmetry between simulation and theory can model the conscience (Fig. 1).

Keywords: Faith, Conscience, and Intelligence are ☯ in our Life.

1. Hierarchic approach

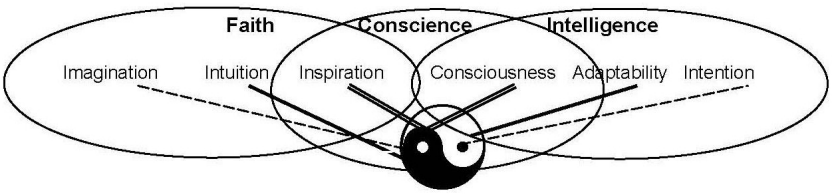

Figure 1. A possible model of the human mind.

The algorithmic approach is equivalent to the formal one. Algorithms, designs, artificial systems can be computer simulated so they represent computability, top-down (construction, design, plan) or bottom-up (understanding, verification, learning). Knowledge and construction hierarchies can cooperate to integrate design and verification into simulation: structural object-oriented concepts handle data and operations symbolically. Hierarchy types open the way to simulate intelligence as intentioned adaptable consciousness by extending the present limits of computability.

*Corresponding author
Email addresses: tudor-razvan@ieee.org (Tudor-Răzvan Niculiu), tony@golana.pub.ro (Anton Manolescu)

We enrich the template concept to structures and create a theoretical kernel, for self-organizing systems, based on a hierarchical formalism. This permits theoretical development as well as efficient application to different cosimulation types of reconfigurable systems. Coexistent interdependent hierarchies structure the universe of models for complex systems, e.g., hardware-software. They belong to different hierarchy types defined by modules, symbols, and classes. Hierarchy is the syntax of abstraction-simulation and knowledge abstraction:

- *Class* hierarchy: ↑concepts-virtual framework to represent any kind of hierarchy, based on form-contents, modularity, inheritance, polymorphism.
- *Symbol* hierarchy: ↑mathematics-stepwise formalism for all types, including hierarchy types.
- *Module* hierarchy: ↑managing-stepwise managing of all (other hierarchy) types on different levels by recursive autonomous block decomposition, following the principle *Divide et Impera et Intellige*.
- *Construction* hierarchy: ↑simulation-design/ verification/ optimization framework of autonomous levels for different abstraction grades.
- *Knowledge* hierarchy: ↑theories-reflexive abstraction, aiming that each level has knowledge of its inferior levels, including itself; this kind of abstraction enables consciousness.

Knowledge and construction have correspondent hierarchy types: their syntax relies on classes, their meaning on symbols and their use/ action on modules. Together with the construction hierarchy type, the knowledge hierarchy type hierarchically realizes the consciousness.

The hierarchy types can be formalized in the theory of categories (Ageron, 2001). Hierarchical types are objects of equivalent categories-functorial isomorphic-that formally represent hierarchy types. The consciousness hierarchy type communicates to the other hierarchy types by countervariant functors, while the others intercommunicate by covariant ones. Hierarchy consists of a net that can represent any type of mathematical structure-algebraic, topological, order-the first step to model the Conscience.

Constructive type theory permits formal simulation by generating an object satisfying the specification. Applying similar abstractions to hardware and software, representations and operations based on object-orientation, symbolization and structural abstraction can be extended from soft to hard (Keutzer *et al.*, 2000). A generic type (form of polymorphism) assures the ability to parameterize with types a hard/ soft element. Recurrence is confined to discrete worlds, while abstraction is not. This suggests searching for understanding mathematical structures that order algebra into topology.

The alternative ways followed to extension of the computability concept to concentrate respectively on the mental world of the good managed by engineering, the physical world of the truth researched by science, and Plato's world of the beautiful abstractions discovered by arts, as mathematics (Bacalu, 2004). We follow the mathematical paradigm of intelligent simulation by functionally modeling the self-aware adaptable behavior to simulate intelligence.

$$\text{Simulation} \in \text{Behavior} \times \text{Structure} \Leftarrow \text{Knowledge}$$
$$\text{Knowledge} \Leftarrow \text{Intelligence} :: \text{information}$$
$$\text{Imagination} \Leftarrow |\text{Intuition} - \text{Consciousness}|$$
$$\text{Intention} \Leftarrow \left|\text{Inspiration} - \text{Adaptability}\right|$$

Adaptability ⇐ simplifying _Abstraction (Imagination)
Consciousness ⇐ reflexive _Abstraction (Intention)

2. Symmetry. Hierarchy. Analogy

The integration between discrete and analog is needed for a softer adaptability and for consciousness simulation as analog reaction. Recurrence of structures and operations enables approximate self-knowledge, with more precision on the higher knowledge levels.

We oversimplify to move towards intelligent simulation: First, we neglect the essential but hard to understand intuition and inspiration, formalizing reflexive abstraction by knowledge hierarchy type and simplifying abstraction by construction hierarchy type:

$$\textit{Consciousness} = \textit{knowledge} \circ \textit{simulation (Consciousness)}$$

This fixed-point relation suggests modeling the consciousness by associating to any hierarchical level of the construction process a knowledge level. We need a metric space where knowledge construction is a contraction, i.e., elements implied in the construction get closer to one another in the formal understanding of the formal construct. General functional relations between the essential parts of the faith-assisted intelligence imply:

Consciousness = knowledge (intention (Inspiration, simulation (imagination (Intuition, Consciousness)))

A continuous model for superior hierarchy levels offers a better model for consciousness part of intelligence. Representation for design and verification is common, algebraic structures on which the different hierarchy types are based on are extended to topologic structures; the different simulation entities are symbolic (Hennig & Sommer, 2001).

$$\textit{Reality is beyond Nature } (\mathbb{N} \subset \mathbb{R})$$

The hierarchical principle is applied to the object of knowledge as to the knowledge structure itself: it mediates the action of a paradigm on an environment. An intelligent system is capable of reflexive abstraction, controlled by problem specification and solving strategies, derived from higher knowledge levels of approach principles that are structured by an even higher level containing abstract types.

Simulability is computability to the power of continuum

Applying the hierarchic principle both at environment and simulation level ensures flexibility of the framework, by defining it precisely only in the neighborhood of solved cases.

For representation, the hierarchic principle offers the advantage of open modeling, which enables reconfigurable realization. Formalizing hierarchical descriptions in continuous spaces we come closer to self-control, -organization, -awareness, i.e., (intention, adaptability, consciousness), hence to intelligence.

There are enough positive signs for this from analog electronics, control systems, mechatronics (Traub, 1999). Real progress towards real simulation instead of natural computation calls for unrestricted mathematics, integrated physics, and thinking by analogies. Knowledge is based on morphisms between the real

system and the simulator. An intelligent simulator learns generating and validating models.

Mathematics contains appropriate structures for self-referent models: the richest domain is functional analysis: it integrates algebra, topology and order, e.g., contractions and fixed points in metric spaces, reflexive normed vector spaces, self-adjoint operators of *Hilbert* spaces, inductive limits of locally convex spaces, reversible operators in *Banach* algebra.

God's ways are uncountable
His plans may be hierarchic

E.g., let U be a universe that is structured by different hierarchies. U is a category, e.g., containing *Hilbert* spaces with almost everywhere-continuous functions as morphisms, enabling different ways to simulate self-organizing, -control, and -awareness. A hierarchic formal system is defined by: hierarchic universe, functional objects (global functions, level structures, simplifying and knowledge abstractions), initial functions, and transformation rules. We consider the self-adjoint operators as objects on the higher levels of the knowledge hierarchy.

These levels strive then for self-knowledge, whose degree rises as the knowledge abstraction, in the context of the inferior level knowledge, and of superior level qualitative knowledge. Functorial morphisms on the functors of different hierarchy types solve the correspondence problem, i.e., the association of a knowledge hierarchy to the simulation one. Intention results by human-system dialog, completing the simulation of the intelligence.

Further than modeling consciousness to simulate intelligence is the search to comprehend inspiration. First we use *Lebesgue* measure on differentiable manifolds of (non)separable spaces. Even mathematics has to develop more philosophy-oriented to approach intuition. Evolution needs separation of faith and intelligence, understanding and using consciously more of faith's domain, and integrating them to human wisdom to be divided further to get more human. Metaphorically phrased: *Hierarchy* is a functional/ structural concept that fulfils mathematically/ physically the concept of abstraction. Symmetry is on the basic hierarchy level the complete correspondence among syntax, semantics, and pragmatics, i.e., among class, symbol, and structure hierarchies; Analogy is the correspondence among hierarchic levels.

3. Function. Structure. Architecture

To begin was the word. Words enable us to express ourselves, to be humans among humans. The expression is complex, so it has to be hierarchical in order to be comprehensible. Words are sequences of letters, sentences are sequences of words, and texts are sequences of sentences. Phrases, paragraphs, (sub)chapters, volumes, etc can enrich the levels of the textual hierarchy.

The basic hierarchical type is tree-like, to optimally represent the generic strategy of *Divide et Impera et Intellige*, or even graph-like, in order not to constrain the links between levels. Class, concept, term are aspects (syntax, semantics, pragmatics) of the expression.

Class is a primitive notion. Set is a class that belongs to another class. The set operations are paradigmatic: serial ($\cup$), parallel ($\times$), and hierarchic ($\wp$ -set of all parts). The possible expressions form a language. Syntax, semantics, and pragmatics define any language; the rules of each of the former defining components

refer, respectively, to correct construction, interpretation, and application.

The syntax is determined grammatically: grammars are of different types that can build a hierarchy that corresponds to the reciprocal inclusion of the defined languages. Grammar is a language that refers to the language that grammar defines, i.e., is beyond the defined language-a metalanguage. This is another hierarchy type than modularization (of a text) of inclusion (of the languages) due to the stronger rules of the defining grammar. Its definition is based upon the principle that each level is a metalevel of its inferior ones. This idea is realized symbolically.

Further, the language can be symbolic, and symbols can symbolize other symbols, what reveals another hierarchy type. We classified, we symbolized, we divided into modules, and we reflected an inferior level (language) on a higher one (grammar). Grammar is a language, so it has a grammar, which, if isomorphic to the initial grammar or to the language itself, would mean that we obtained a reflexive language, i.e., capable to express itself.

Classes, symbols, and modules permit the construction of a system that structurally implements a function expressed in a language, i.e., behavior. The same way, with classes, symbols, and modules, the behavior of a structurally described system can be determined.

Another hierarchy type, simulation hierarchy, orders the variety of languages that describe function and structure. It assists the passing from the goal function, constrained by functional parameters, to the structural form, and inversely, to determine the mathematical function/ physical behavior of a structurally defined system.

Architecture is the level on any hierarchy of any type that sees both ends.

Researching intelligence by simulating it, to enable intelligent simulation, demands the study of combined essential mathematical structures to understand the different hierarchy/ abstraction types. Being a hierarchical relation between static/ structural and dynamic/ functional structures simulation contributes essentially to understand the human mind. We model the consciousness for simulating the intelligence, then to reach for intelligent simulation.

A hierarchical type expressing reflexive abstraction can represent the conscious knowledge. The aspects of the Reality, and of the human mind reflecting it, have not to be neglected, although they are neither constructive nor intuitive. A way from Reason to Intelligence is to integrate Consciousness and Intention, then further to relate Intelligence and Faith to become Reality-aware.

We could consider just the simplifying types of hierarchy (classes, symbols, modules) and then express the construction, hoping to aim the absolute liberty, if we considered God as the simplest, totally unconstrained, essence of the Reality. However, we can simulate/ construct/ work/ live, associating knowledge hierarchies to all our activities, aiming to constructive understanding of the most complex absolute necessity, by this defining *God*.

Abstraction is the human gift for going beyond natural limits, meanwhile extending pure reason to real intelligence. Faith and intelligence can converge to integration, or destroy each other if not linked philo-

sophically by Conscience. The power to abstract is the crucial difference between human and other natural living beings.

Divide et Impera et Intellige applies the hierarchical expressed abstraction. *Intelligence* and *faith*, like any dichotomy, can converge to integration or can destroy one another if not associated by *Conscience*. Metaphor is a popular instance: we detail the metaphorical thesis:

God is the absolute abstraction,
the evolution goal for faith-assisted intelligence

Function is a transformation that can be mathematically formalized, or physically instantiated as temporal behavior. *Structure* is a set of properties that characterize a mathematical/ physical space. *Structured set* = (Set, structure). *Simulation* is the relation between function and structure.

Language/ system is a generic form of a mathematical/ physical *model* resulting of an inversion-able representation of the simulation object. *Abstraction* is a human defining capacity that enables him to think. Simplifying abstraction concentrates on a superior level the information that is considered essential for the current simulation approach. Reducing informational complexity has in view to clear the operation and to ease its formalism; it can be only quantitative, but also qualitative.

The reflexive abstraction-expressed as knowledge hierarchy type-tries to understand itself better at higher levels, understanding more of the inferior ones.

God is in us-faith belongs to our definition, with us-by the others, and for us-spiritual evolution, conditioned, then assisted, to be followed by the social one. Against the danger of dichotomy, we concentrate in three different ways on the unique Reality- *Plato*:

- Art for the art-to look for the essential Way,
- Science with God's fear-to search for the existential Truth,
- Engineering-to understand the Being and to concentrate more on the Spirit in our Life.

Reason is an extension of the nature. Nature is not an ephemeral context, but the matter we are built of in order to develop spiritually. The integration experiments for the spirit-matter dichotomy failed because of their extremism. To go further, thinking while advancing, we divide twofold, as we cannot yet Intellige the dichotomies:

Spirit-Matter (force substrate, software-hardware) ⇒
real-natural (continuous-discrete, analog-digital),
form-contents (category-functor, representation-simulation, class/structure-function),
real-possible, perspective-profoundness,
beauty-truth (arts-science, mathematics-physics)
⇐ *Space-Time* (evolution)

Clearly, balance should not be in most dichotomies. Yin-Yang can represent any dichotomy, and its extension to a triad: *faith, conscience, intelligence*.

Society is only the memory of the past, manager of the present problems, assurance for a right future. We have to live together in respect of the others on the way to understand each other, in order to evolve toward essential beings for an integrated existence.

The present society is extremely materialistic, and tries to destroy every trace of ideal. The method is analog to *embedded systems*: adapt the human to the socialistic society-society is the master and human the slave.

We have to surpass the limits imposed by the essential dichotomy by a unique ideal, named God that should be constructive by continuous intelligent reconfiguration. Human among humans should reflect a strategic equilibrium, without hiding or even violating, as happens nowadays, the principle that the society has to assist unconditioned the individual, with correct continuous education, and assistance by an intelligent faith to search and research the *unknown*.

The unknown can be interpreted as a *unique God*: the absolute freedom by understanding all the necessities, and the absolute unity by closing all the *Divide et Impera et Intellige* necessary for the Way to look for the Truth along the Life. Extending reconfigurability to the simulation itself, by a self-aware simulation, we get self-control of the simulation process.

We build a knowledge hierarchy corresponding to the simulation hierarchy, and by expressing both hierarchy types in the reference system of the basic hierarchy types (classes, symbols, modules) we create the context for a self-organization of the simulation. The triad of the basic hierarchy types corresponds to the fundamental partition of the real life (beauty-arts, truth-science, good-engineering) that has to be continuously integrated by philosophy (essence, existence, being).

The absolute functionality is symbolized by yin-yang, while the waves suggest hierarchical levels that are increasingly structured for simulation and knowledge. Each of the nondeterministic separated complementary pairs of the *yin-yang* model is functionally structured like (interface, kernel, ambassador of the complement). The model was not randomly selected: it is formed of three tangent circles emphasizing the centers of the inner ones. It retains only the essence of a dichotomy symbol that suggests a complete integration of the parts without loss of autonomy, realized by vicinity and pointing one to another. The Chinese symbol reflects the importance of something else, reminding of creation as love for something else.

Three circles, each tangent to the others, models a partition of something to be understood in order to get further, say the center of Europe. Circle is *cerc* only in our mother tongue, a perfect expression: *Cer* (sky) is the infinite, *cerc* is the finite representation of the infinite, by the permanent link from the (never)begin to the (never)end. π is the most famous real number-*Pythagoras*. *Cerc* means perfection, which we permanently desire, therefore there exist integer numbers, having a perfect and beautiful theory, but not forgetting to continue the evolution searching and researching further-*cercetare*. The western Europeans attain research/ *rechercher* by recursive search/ *chercher*. The essential difference between analog and digital simulation paradigm is induced by that between the mathematical structures their models are based on algebraic-for digital, analytical-for analog. In view of intelligent simulation the whole intelligence has to be simulated, i.e., conscience and intention along with adaptability.

The discrete nature of simulation-design is a sequence of decisions and verification implies a sequence

of stimuli-does not easily match the continuity of analog properties or parameters. The difficulty of analog simulation is avoided by defining an auxiliary representation domain that intermediates between the behavior and the structure.

At this circuit level, the problem is decomposed into topology selection and dimension computation. The first process is discrete and the second one is continuous (Hofstadter, 2000) over a restricted problem space.

Object-oriented representation lends itself for this instance of complementary form-contents. However, topology selection is more systematic if continuous modifications of the form are possible, and dimension computing is more efficient when symbolic algebraic methods are used.

We searched for a compromise between simulation algebra and analog analysis on three ways: defining for the analog domain, upper abstraction levels that are governed by algebraic laws; modeling analog simulation for algebraic-analytical structures from the functional analysis, (Rudin, 1973) associating an analytical syntax to the analog simulation process.

$$\textit{Simulability is computability}^{\textit{continuum}}$$

Intelligence = Consciousness × Adaptability × Intention, and Faith = Inspiration × Intuition × Imagination, are complementary parts of the human mind, separated by the Conscience = Consciousness × Inspiration. Conscience demands continuous feedback.

Both intelligent simulation and simulation of intelligence demand transcending the present limits of computability toward simulability.

The historical experiment of the pure reason should have ended long time ago. Human thoughts cannot be explained or handled by our adaptability-based reason, even if non-deterministic or parallel. Therefore, reason has to extend to intelligence in the context of faith. An obvious way is to integrate consciousness, then intention and imagination to intelligence, then to extend this to inspiration and intuition.

4. Discrete to continuous

Mathematics develops the countable natural numbers to the uncountable real numbers closing to the inverse, on its three integrated ways: algebra, order, and analysis. Physics uses particles or fields in various chapters. All other sciences are chapters of physics, inheriting and developing the inheritance. At the limits of reasonable understanding, quantum physics tries to balance the knowledge and the unknown, without success. Engineers have always considered digital a mere ingenious abstraction of analog. Presently, we talk about electronic computers, but the nowadays trend is to copy from the living Nature, i.e., the emulation of the advantages the living beings show to achieve unconsciously complex duties.

Vanguard domains are biotechnology and computational intelligence. Neither intelligence nor life is well understood; remember *Goethe's Zauberlehrling*. More important is that emulation is less human than simulation-they should always develop in parallel, permanently exchanging experience. Reality does not reduce to Nature, as cardinal ($\mathbb{N}$) is strictly inferior to cardinal ($\mathbb{R}$)-*Georg Cantor*. Reason is the closure of the Nature relative to the primary operations, as $\mathbb{Q}$ results from the closure of $\mathbb{N}$ to the inverse operations of

addition and multiplication. However, the Reason is dense in Reality-as the real numbers are the analytical closure of the rational numbers, $\mathbb{R} = \left\{ \lim_{n\to\infty}(q_n) \,|(q_n) \in \mathbb{N} \to \mathbb{Q} \right\}$.

Reality extends beyond Nature and Reason, not just for the quality of the quantity, but also regarding the power of transforming operations. $\mathbb{R}$ closes $\mathbb{Q}$ to the inverse of exponent-the last arithmetic operation resulted by recurrence of the prior one, which can be pursued by Reason, e.g., algorithmically.

Reason closes Nature 2 the inverse of natural functions.

Further, closing to the inclusion order, the set of all subsets of countable sets is the uncountable IR, the power of continuum. To get to complex numbers is a matter of imagination.

Example: *Transfer Function Singularities:*
We presented a related work that compared two methods to determine the poles and zeros of a transfer function, based on state-equations, respectively on node-equations (Mărculescu & Niculiu, 1987). Complexity of the set-up actions of the first was balanced by weak convergence of the second. This is a typical case to try heuristics together with expert systems; hence we presented (Niculiu & Manolescu, 2009) a knowledge-based object-oriented analog simulation system. The Newton-Raphson method was used in circuit simulation for 40 years, and the interest for its optimization has not decreased (Zhu *et al.*, 2007).

The graphical or numerical results of a circuit simulator are the primary information that has to be sampled with a variable rate appropriate to the simulator output variation. Knowing the dominant singularities is decisive for simulation, as they reflect the stability of the circuit, (Niculiu *et al.*, 2008) or can represent primary data in formal simulation, e.g., root locus method. The transfer function of a linear-linearized around a static operation point-circuit is a ratio between real coefficient polynoms with complex roots, functionally describing the frequency behavior.

A pattern-matching search decides which rule applies, and at the end, the transfer function results as a two polynoms ratio (Manolescu *et al.*, 2009). The search is bottom-up while determining the singularities, and top-down to find recursively the dominant ones. The function of our program is threefold:

- *classification* - to recognize the type of singularity from the transfer function or Nyquist diagram;
- *control* - for stability;
- *anticipation* - to link the results to possible alternatives for improved behavior.

The is object-oriented, and written in Java. The main classes are *Element, Rule, Match,* and *Act*. The input is a circuit simulator .AC result-numerical or graphic, the output a rational function representing the approximate transfer function that describes the essential behavior.

5. Revolution by opening to evolution

The human has to enlarge, not to tear, the bands of the Reason, and to apply them to the society. The Reason has to transform into the consciously recognized limits of the Intelligence in front of the Faith that offers to the human the way to evolve beyond any limits.

A reasonable society is hierarchical. Its essential architecture contains three tree-like structures for the same set of humans, therefore, interdependent: arts, science, and engineering-technology.

The social hierarchies reflect only a temporary order, generated by humans, to help them concentrate on the spiritual evolution, without neglecting the material problems. The hierarchical social structure can assure an optimal organization of humans among humans. The interdependence of the three social classes is assured functional, not only structural. Without giving up anything essentially human: different cultures and social or natural togetherness, humans among humans have a lot in common: philosophic desire, comprehension of the own hierarchy in the context of the other two, free life based on understanding the necessities, constructive fear of the unknown, and especially love for creation/ discovery. Except the three cultural ways, that permanently *Divide et Impera et Intellige*, there is no other.

We need Consciousness to return intelligently to Faith.

People of one choice exist, in all senses of the word. They either comprehend all the alternative ways and their convergence, or, in the context of natural love for philosophy and interest for the other selectable directions, put more passion in one direction. Of the first category are temporary elected, in different convergent hierarchical modes, the social leaders, of the second, the institutional directors. Both kinds of leaders are more philosophical than their cohabitants, even if the ones master the strategic perspective given by an attained peak, while the others have the joy of the courage to climb into profoundness. The elected artists permanently reconfigure a system of laws, to be beautiful by intelligibility, true by consistence, and good by human understanding. The elected physicists, pure or of different correlated scientific domains all collaborating with mathematics and engineering, govern by research strategies with Gods Fear. The elected engineers critically construct and criticize constructively. For any social role, the elected concentrate, respectively, on Faith-mathematicians, Intelligence- physicists, and Conscience-engineers. There always exists a human, called No.1 or the Philosopher, depending on the stability of the times, cloudy or clear Sky. He will always lead directly the elected or the philosophers, who will know to educate and optimally learn the humans of all ages, including themselves. We have to start. Otherwise, it is no hurry (Penrose, 1996).

Intellige is to link, to understand, and to be aware. In Latin: *intellego* = to understand, to feel, to master, to gather in mind. Artificial has a derogatory sense; however, the root of the word is art. Arts remind of liberty, as *Arts for arts*. Artificial is at first sight the complement of natural. Our ideas transfer us to places that are neither natural nor artificial. Maybe artificial means something natural created by the human being and Nature is an extension of our body.

However, we feel to be superior to Nature, as to our body: we can think. Why are only humans creating arts, why do they need to know more, and why do they construct other and other natural things they have not found in the Nature? We learned the arts have to discover the Beauty that science looks for the Truth, and that engineering invents things to help us, caring for the Good. *Goethe* wrote on the theatre in Frankfurt:

Das schöne wahre Gute

because the three wonderful scopes have to be always together. He stretched the Good that is important to all natural beings, whereby for beautiful or true cares only the human being. Arts and science demand a distinct power for both development as understanding, and possibly for usefulness. The power of abstraction distinguishes us among the natural beings. Engineering is to be ingenious, not only to design engines. Any human choice to surpass the Nature by arts, to know it better by science, or to enrich it by ingenious

construction, is as noble and legitimate, because to follow any selected way demands intelligence and faith.

Artificial intelligence has an initial sense of enriching natural domains by natural extensions. Reason is an extension of the Nature. The natural language whispers to us: as the rationales are a straight extension of the naturals, if we neglect the integers, however, you remain in a countable world as the Nature initially is. We should not be ashamed if someone that we only understand by proper preparation and that is at least so powerful as the Nature; let's remember the beautiful mother language. *Cer* (sky) suggests the infinite, and we desire to see it and to link the its begin to its end, or better the never begin to the never end, and we find the *cerc* (circle). The language whispers to us again: is not rational, it is more than this, and it is as if we listen to a symphony by *Beethoven*. We understand that the Reality of our Existence is more than the Nature of our Being, therefore, we should know them better, because only Nature can open us the way to Reality. We wonder whether any of the alternative ways demands the same kind of intelligence, and if not, which of them should we first research (*cerceta*) in order to simulate.

- Arts are free, and even when they return to Reason, as mathematics, they bring results, that could before just be seen by Intuition, to be sent by Inspiration and Imagination to Intelligence;
- Physics reaches and gets conscious of Reasons limits, both by the quantum theory and by the too complex phenomena, e.g., society and human;
- No difference seems to be for the intelligence that is useful to one of the ways. An example, that confirms that they simply represent different approaches to understand and develop the-presently natural-Reality, is *architecture* that we cite for each of them.

Therefore, there is something else in the Intelligence, which allows us to consider ourselves humans, human groups, peoples, beings on the Earth, or conscious beings in the physical Universe. We also feel that there is something essential beyond the physical-the metaphysical-*Plato*. More, there is something exterior to the human intelligence, without that we could not fight the Time to evolve. We have to feel complete, even if we need education and permanent work in communication with the other humans, of the past, the present, and the future.

We need Conscience to link Faith to Intelligence

You see now why we neglected the integers when we showed that the rational numbers are countable, i.e., they are as much as the naturals. This way, we divided the problem into two others that we do not forget to reintegrate after we have solved them - *Divide et Impera et Intellige*. We count the positive rational numbers x/y along the secondary diagonals in an odd quadrant of the coordinate system - $x0y$. Then we repeat this counting for the negative ones in an even quadrant. Finally, we count them together by jumping between quadrants for every current number. We come to the idea how to count the $\mathbb{IQ}$ is without using *Divide et Impera et Intellige*, that we have to keep in mind for harder problems, as Life, Truth, and Way.

We have to remember the abstractions that assisted us to go further. We said complete human to someone complete in a context, what implicitly supposes the power to go beyond the context. This is the story of the integers-*integer* = perfect, complete-they have a beautiful complete theory, however, do not forget to build the rational numbers to feel as close as needed to any real number. Nevertheless, they realize this is not enough, rewarded by the conscience of the continuous Reality-infinitely more powerful than the discrete/ countable one.

To $\mathbb{IR}$, we get by the perfect circle that is beyond the power of Reason. Another way to the same scope is by the boring perfection of the square, when computing its diagonal ($\sqrt{2}$). Again and not fortuitous this alternative is due to Pythagoras, the godfather of π . The beautiful natural induction tells us that the equilateral triangle and the square are but the pioneers of the regular polygon sequence that converges to the circle. Encouraged, we turn an equilateral Δ or a square about itself, obtaining the area of the circumscribed circle when the number of sides $n \to \infty$, from the areas of the n-sided polygons. However ... we wanted to approach π by a sequence of rational numbers, but the example is wrong. Again, we hear like a sweet wind from the sea: *Alle guten Dinge sind drei* and intuitively sense that we have to know how mathematics masters the infinite.

For long time, we knew nothing of sets, but we knew too well to play the role of a calculator. We should not forget what Intuition said to Intelligence, by Imagination: we just had imagined a sequence of *algebraic irrational numbers* converging to the *transcendent* number π.

We scare to be further taught rather what a discrete computer, instead of what an intelligent human, has to know. For example, we plan to realize artificial intelligence, to have a friend that is conscious of the problems to solve together. For the moment, there is no artificial intelligence. However, we learn to be conscious of the computer limit to process only rational numbers. This means it uses a sequence $(x_n)\, n \in \mathbb{Q}$ that converges to $\sqrt[n]{a}$ (Newton), what reminds us of the density of $\mathbb{Q}$ in $\mathbb{R}$.

Perhaps not practice has to push us into evolution, but Gods fear, i.e., the scientific desire for further ascending encountered on any reached level of knowledge. Conscience attaches us to science and unfastens us of the false eternity, arrogated by some level of the evolution to freedom. To be free we have to understand all the necessities in the Reality, or metaphorically: to escape God of any fear. Intelligent systems need a cosimulation of the parts that belong to different domains, e.g., hardware + software, in the context of representation unifying for simulation-design/ verification/ optimization.

Unified simulation of the hardware-software systems is imposed by the incompatibility or the lack of optimality that results of the initial partition of the system. The design-verification cycle is not efficiently processed for a fixed partition. This disadvantage is eliminated when the simulation methodologies are unified, e.g., by categorical strategies, what implies planning and learning, i.e., the possibility for interlevel communication in the knowledge hierarchy. An intelligent simulator learns by recursive generation and validation-possibly interactive-of models. The objective of human-machine dialog is to advance toward simulated intelligence by knowledge communication in a common language between human and his mental/ physical extensions.

We pleaded that abstraction is the handiest tool for the human among other beings. Let us use it to simulate the present situation. Neglecting the conscience, let us see what remains of the human.

What should I do? *What you want*. *What do I want*?

What you like. *What do I like*? *What you should do*.

This is a cyclic definition only at first sight, because most probably that what he should do has changed while crossing the cycle by what he wants or likes. We sketched a minimal intelligent system: it has to be adaptable, self- and context-aware, and to communicate with the exterior by signals and actions. It is most disputable that Consciousness can be extracted from Conscience. However, we try that the system is fashionable. Consequently, we also abstract from the fact that a discrete processing is not capable of

self-consciousness- *Gödel*. To avoid any discussions we abstain from any hypothesis on the class of the processor, discrete or continuous.

What is the Conscience: it is the link, in our mind, between what we are conscious of and what we are not. Presently, only the extended to Reason adaptability, and the unjustified Intention, are conscious. We can imagine an intelligent machine that looks like a human-robot is labor, Slavonic. It accumulates knowledge and behavior rules by preprocessing the senses, and it can change the interior defining rules (reconfigurable) corresponding to the behavioral (professional, ethical) knowledge that is considered most important, e.g., most recent or most decent.

Therefore, it can consciously filter the actions that determine a new state of the context, what also means new knowledge to accumulate and to be conscious of (adaptability). It means, the dialog with the external environment determines the intentions. If the system had conscience, the external dialog would be more complex and interesting. Consciousness only makes the adaptability more efficient, what, among others, transforms the human into the most powerful animal.

Why do we compare the system without conscience with an animal, not to a human? It is true that we could compare it to an animal, if we had attributed intuition to it. However, what for should we do this, when the human just adapted to a consumption society? The built artificial objects and the socially useful natural objects send him the necessary messages to adapt consciously at the rising efficiency of the society. He neglects both the warnings from the superfluous Conscience and the unnecessary Intuition. If sometimes the two beasts shout too loudly, it is just unpleasant. To be useful Intuition should be linked by Conscience to Intelligence, and intelligently bridled by Imagination.

More, Intuition should also know to bridle by Intention the Adaptability. Whether he is human or animal, the human is anyway a machine, a social machine. His use is to contribute at the eternity, on an arbitrary level of evolution, of a materialistic consumption society. The evolution is for the human among humans, assisted by a reasonably organized society developing by the human, for the human towards the Human. We said arbitrary level as, if the educated and encouraged consumption were not strictly materialistic, the human himself would escape from the vicious circle together with the others. And more, the present level is artificial in the human evolution. The essential limit of discrete computability, inherited by the computational intelligence, is the necessity of self-reference to integrate the knowledge of the levels to that of the metalevels for modeling the Conscience.

A hierarchical type representing reflexive abstraction can model the conscious knowledge and the knowing Consciousness, if it categorically collaborates with a simulation hierarchical type. We have to search and research for the aspects of the Reality, and of the human mind that reflects it, even if they are neither constructively nor intuitively expressible.

The humans that have consciously chosen the eternity have transformed into dolphins. This also taught the English how to conserve a stabile existence. The desire to stop the human evolution on arbitrary stages has no real argument.

To conclude: Intelligence is more than Reason, to make us feel as beings superior to Nature, what also means that we have to respect Nature more:

Spiritus Sanus in Mens sana in corpore sano

For the present, the evolution is forced to halt on an inhuman level, a consumption society transforming the society into a beehive without interest for Conscience and Faith, which most probably has been realized by destabilization of all revolutionary forms.

We need intelligent Faith to develop to freedom as humans among humans

6. Conclusion

The religion had to learn us about God's existence in our being. The philosophy has to learn us about essence, existence, and being. Our conscience is our representation of the essence of our existence as being, i.e., God is in us, for ourselves, and among ourselves.

We have to be to search our essence researching our existence. *Divide et Impera et Intellige* has three parts as *alle guten Dinge sind drei* of the most philosophic European people.

Neither intelligence nor life is well understood, remember *Goethe's Zauberlehrling*. More important is that emulation is less human than simulation, remember *Mozart's Zauberflöte*; they should always develop in parallel, permanently exchanging, remember *Thomas Mann's Zauberberg*.

References

Ageron, P. (2001). Limites inductives point par point dans les categories accessibles. *Theory and Applications of Categories* **8**(11), 313–323.

Bacalu, I. (2004). *Differential Equations. Stability*. Matrix Publishers, Bucureşti.

Hennig, E. and R. Sommer (2001). A reliable iterative error tracking method for approximate symbolic pole/zero analysis. In: *Proceedings of ECCTD'01 - European Conference on Circuit Theory and Design, August 28-31, 2001, Espoo, Finland*. pp. I.193 – I.196.

Hofstadter, D.R. (2000). *Godel, Escher, Bach: An Eternal Golden Braid*. Penguin; 20-th Anniversary edition. 20-th anniversary edition with a new preface by the author.

Keutzer, Kurt, Sharad Malik, A. Richard Newton, Jan M. Rabaey and Alberto Sangiovanni-Vincentelli (2000). System-level design: Orthogonalization of concerns and platform-based design. *IEEE Transactions on Computer-Aided Design of Integrated Circuits & Systems* **19**(12), 1523–43.

Manolescu, A., A-M. Manolescu and T. Niculiu (2009). A simple algorithm for approximating the transfer function of analog integrated circuits and systems. In: *Proceedings of the 32nd IEEE International Semiconductor Conference, Sinaia, Oct. 12-14, 2009*. pp. 503 – 506.

Mărculescu, R. and T. Niculiu (1987). Transfer function singularities determination. In: *Proceedings of the IEEE International Semiconductors Conference, Sinaia, 1987*. pp. 61 – 64.

Niculiu, T., A. Copilău, C. Lupu and A. Manolescu (2008). Hierarchical intelligent analog simulation. In: *Proceedings of the I3M European Modeling and Simulation Symposium, Campora San Giovanni, 2008*. pp. 323 – 332.

Niculiu, T. and A. Manolescu (2009). Symmetry for intelligent analog simulation. *Romanian Academy Noema J.* **VIII**, 230–250.

Penrose, R. (1996). *Shadows of the Mind: A Search for the Missing Science of Consciousness*. Oxford University Press, USA.

Rudin, W. (1973). *Functional Analysis*. McGraw-Hill. 1st edition, McGraw-Hill Series in Higher Mathematics.

Traub, J.F. (1999). A continuous model of computation. *Physics Today* **52**(5), 39–43.

Zhu, Zhenyong, He Peng, Chung-Kuan Cheng, Khosro Rouz, Manjit Borah and Ernest S. Kuh (2007). Two-stage Newton-Raphson method for transistor-level simulation. *IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems* **26**(5), 881–895.