

CONSCIOUSNESS FOR MODELING INTELLIGENCE

Simulating the Evolution by Closure to the Inverse

Tudor Niculiu

University POLITEHNICA Bucuresti, Dept. Electronics, Telecommunications, and IT

Cristian Lupu

Romanian Academy, Center of New Electronic Architectures

Sorin Cotofana

TU Delft, Electrical Engineering, Mathematics, and Computer Science

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Abstract: *Intelligence* = Consciousness \times Adaptability \times Intention and *Faith* = Intuition \times Inspiration \times Imagination, are the complementary parts of human mind. *Conscience* = Consciousness \times Inspiration is the link between. The subtitle refers to an interpretation of *Way, Truth, and Life*. It is a strategy of development. 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 hierarchies structure the universe of models for complex systems, e.g., hardware - software ones. They belong to different hierarchy types, defined by simulation abstraction levels, autonomous modules, classes, symbols, and knowledge abstractions. Applying *Divide et Impera et Intellige* to hierarchy types reveals their importance for intelligent simulation. The power of abstraction is the real measure for the human mind. Turning the abstraction into comprehensive construction could be the aim of humanity, the *unique God* for different cultures of free humans. The way to freedom is by understanding necessity. We have to recall our conscience, to reintegrate our mind, and to remember that society has to assist humans to live among humans, not to consider that they only have to work for it. An operating system serves the autonomous programs, both for the function of the hard and for development of the soft. The society has to be reasonable, to assure health and education for every human, and to encourage search and research for every conscient human.

1 FUNCTION STRUCTURE

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. The hierarchy is not necessary linear. 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. The sequence is an ordered set, i.e., a function that applies the first n natural numbers on the set M :

$\text{seq} \in \mathbb{N}_n \rightarrow M$, $\mathbb{N}_n = \{i \in \mathbb{N} : 1 \leq i \leq n\}$. If n is finite, it is the number of sequence elements. Not. $\text{card } M = n$.

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), hierarchical (\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) or 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. 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 (Niculiu, 2002). In 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 system (characterized by structural properties).

Simulation is the relationship between function and structure. Researching intelligence by simulating it, to enable intelligent simulation, demands the study of combined essential mathematical structures (algebra, order, topology), to understand the different hierarchy/ abstraction types. Because it is a hierarchical relation between static and dynamic structures, and even between structural and functional, the simulation can contribute essentially to understand the human mind. A multihierarchical representation for complex systems can be formalized in the theory of categories, object-oriented expressed, symbolically interpreted, and structurally approached.

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 or physical space. The properties can be constant or variable in time, reflecting static or dynamic

structures. Simulation is the relation between function and structure. Structured set = (Set, structure). Language/ system is a generic form of a mathematical/ physical model. Model results of an inversion-able representation of the simulation object. Abstraction is a human defining capacity that enables him to think. Hierarchy is a functional/ structural concept that fulfils mathematically/ physically the concept of abstraction. Hierarchy is syntax of abstraction. Intelligence and faith, like any dichotomy, can converge to integration or can destroy one another if not associated by Conscience.

God is in us - as the faith is part of our definition, with us - by the others, and for us – by the spiritual evolution, that is first conditioned, then assisted, to be followed by the social one. To prevent 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 the existential Truth; Engineering-technology - to understand the Being and to concentrate more on the Spirit in our Life.

The power to abstract is the crucial difference between human and any other natural being. *Divide et Impera et Intellige* applies the hierarchical expressed abstraction. The abstraction can be simplifying or reflexive. Intelligent simulation results by integration in the hierarchical simulation of the associated knowledge hierarchy, which represents a reflexive abstraction that converges to self-awareness of the adaptable intentional simulation.

2 HIERARCHY TYPES

By a self-aware simulation, we get self-control of the simulation process. Therefore, we build a knowledge hierarchy corresponding to the simulation hierarchy. Then, by expressing both simulation and knowledge hierarchies in the reference system of the basic hierarchy types (classes, symbols, modules), we create the context for a self-organization of the simulation (Figure 1). 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.

Hierarchy consists of a net that can represent any type of mathematical structure (algebraic, topological, order). The different hierarchy types correspond to the kind of abstraction they reflect:

- Class hierarchy (\uparrow concepts) // \uparrow abstraction goal
- Symbol hierarchy (\uparrow metaphors)
- Module hierarchy (\uparrow strategies)
- Construction hierarchy (\uparrow simulation)
- Knowledge/ consciousness hierarchy (\uparrow theory)
 \leftrightarrow reflexive abstraction, each level aiming to know all inferior levels, including itself; it is the first step to model the Conscience.

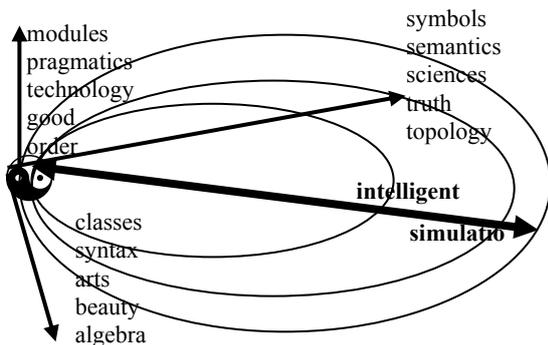


Figure 1: Extended H-diagram.

3 DIVIDE. IMPERA. INTELLIGE

Philosophy is not a specialty but a human right. There have to be schools to prepare the teachers of philosophy for the other humans. These schools have to develop also respect for those that look for the Way on one of the three alternative paths that correspond to the fundamental partition (arts, science, engineering). Because recently the essential *Divide et Impera* do not *Intellige*, the only philosophers are the masters in:

- Arts – especially great mathematicians, and those, aware or not, compose mathematically
- Science – physicists, and those that do not forget their science is a chapter of physics
- Engineering – mostly those working in domains that attain the limits of the pure Reason.

Each of the nondeterministic separated complementary pairs is functionally structured like (interface, kernel, ambassador of the complement). The *yin-yang* 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, says 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 (*Pitagora*), followed by *e* (existence). And research is *cercetare*.

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 ourselves, 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. Mathematics develops by 3 basic structure types, integrating them. We divide our Universe in 3 worlds: essence, existence, and being. We divide our existence in three interdependent components: arts, science, and engineering, corresponding to our beauty-loving ideas, our truth-searching efforts, and our good-oriented constructions - presently exaggerated to exclusivity. As the Reality contains abstract ideas, even if physics could explain everything as being discrete, the power of continuum can not be forgotten. (Marcus, 2000) Consequently, the analog engineering has not to be neglected in modeling and simulation. Physics permanently uses as dichotomy the discrete-continuous, while the engineering just adapts intuitively (as a primitive life form) to the requests of a consumption-oriented society (characteristic for primitive life). The reason is that presently the engineering escaped of the control of the inspiring arts, as of the consciousness for the science that conditions its existence.

For physical or philosophical orientation, we need *cardinal* points. To inspire ourselves of the most pure of the arts, we learn about cardinal numbers (although, being sincere, mathematics leads the way to show that nothing is pure, so without leaving anything behind the Way has to be followed further). Cardinal numbers are just numbers of elements in a set, but also for infinite sets. The Nature demands the least infinity and is defined by

(0, successor, induction). Adding is in Nature's definition. However, the inverse operation, subtraction, needs negative numbers. We close mathematically the Nature to an Integer that opens the physics for recognizing the limits of Reason (electrons), in the meanwhile, attracting marvelous engineering solutions for different technologies. Electronics is among the most advanced engineering sciences (Lupu, 2004); therefore, it has to be practiced by the most conscient human beings.

Recurrent addition is multiplication, a most important parameter for the Nature. Mathematics closes the integers to the multiplication inverse, defining the rational numbers. These are not more than the naturals, but we can do many useful things with the Reason, from strategy to computer. So "what else do we need?" say too many, forgetting that the limits of the, so-called, pure Reason are caused by the fact that it bounds itself to close the Adaptability to (discrete) sequential operations. Thanks God, neither the mathematicians, nor the physicists do accept the all-happiness. They discover in three ways (order, algebra, analysis), which assisted all of them together to think, the power of continuum and that of the patience.

The Reality does not reduce to Nature, as card IN is strictly inferior to card IR. The Reason is the closure of the Nature relative to the primary operations, as \mathbb{Q} is the closure of IN to the inverse operations of addition and multiplication. However, the Reason is dense in Reality – as the reals are the analytical closure of the rationals, $\mathbb{R} = \{\lim_{n \rightarrow \infty} (q_n) : (q_n) \in \mathbb{IN} \rightarrow \mathbb{Q}\}$. The Reality extends beyond Nature and Reason, not just for the quality of the quantity, but also regarding the power of transforming operations. IR closes \mathbb{Q} to the inverse of power rising – the last arithmetic operation resulted by recurrence of the prior one, which can be pursued by Reason. Further, closing to the inclusion order, the set of all subsets of IN, \mathbb{Z} , \mathbb{Q} , or in general, of countable sets, is the uncountable IR, the power of continuum. To get to complex numbers is a matter of Imagination. Reason closes the Nature to the inverse of natural operations. Reality is the closure of the Reason to the inverse of artificial operations, or to the reasonably deducted infinite, or to an order over the Being itself. We know that if there were no cardinal number between the natural/ integer/ rational discrete and that of the real continuum, then the logic would include the principle of the excluded tierce. This, pure and simple, hurts the Human, who is fond of nuances. Therefore, we can prove that there is an intermediary level between Reason and

Reality (*nonconstructive*). There are angels between Human and God, said the wise.

The density of Reason into Reality means that every real is the limit of a sequence of rationales. Therefore, we hear nowadays that if we master the Reason, Reality becomes a complexity problem, i.e., speed of convergence. The density of \mathbb{Q} in IR shows that between any two real there is a rational numbers one. Therefore, Reality is much more than Reason can even imagine but something reasonable exists between any two real objects (*nonintuitive*).

Neither Intuition nor Reason arrives to something that mathematics proves elementary. As any true art or beautiful Science of the ideas or the phenomena, mathematics does not limit itself to either Intuition or Reason, allowing them to collaborate by Conscience.

4 CONCLUSIONS

Conscience = closure to (knowledge o simulation)⁻¹ of Conscience

Note: initially Conscience = Consciousness
 The essential limit of discrete computability, inherited by the computational intelligence, is generated by the necessity for self-reference to integrate the level knowledge with metalevel knowledge in Conscience modeling. A hierarchical type expressing reflexive abstraction can represent the conscient 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 to integrate Intelligence and Faith to Reality-awareness.

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

REFERENCES

- Lupu, C., 2004. *Interconnection. Locality and Symmetry in Orthogonal Computer Nets*, Technical Publ. Bucuresti.
- Marcus, S., 2000. From Real Analysis to Discrete Mathematics and Back, *Real Analysis Exchange*. 25, 2.
- Niculiu, T., 2002. *Hierarchical Intelligent Simulation*, Matrix Publ. Bucuresti.