MATHEMATICAL EQUIVALENCE OF EVOLUTION AND DESIGN

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ABSTRACT

"Every one who is seriously involved in the pursuit of science becomes convinced that a spirit is manifest in the laws of the Universe." This Einsteinian statement remains outside of science. Our current understanding of the mind mechanisms have come close to explaining spirituality from the scientific point of view. In this paper a theory is presented which is a mathematical breakthrough, overcoming decades of limitations in AI, pattern recognition, neural networks, and other attempts to model the brain-mind. Solutions to engineering problems are presented that have overcome previous difficulties in terms of computational complexity. These solutions result in orders of magnitude improvement in detection, prediction, tracking, fusion, and learning situations. The theory is also extended to higher cognitive functions. It models the knowledge instinct operating in the hierarchy of the human brain-mind. At the top are concepts unifying our entire knowledge; we perceive them as concepts of the meaning and purpose of our existence. This theory is formulated mathematically as dynamic and equivalently as teleological. Experimental results supporting the theory are discussed. The theory overcomes various difficulties, including reductionism, which, in the past, interfered with the acceptance of scientific explanations of the spiritual.

1. CAUSAL DYNAMICS VS. TELEOLOGY IN PHYSICS

Teleology explains the universe in terms of purpose, usually a religious purpose, and it suggests an ultimate Designer must exist. Therefore, teleology is a hot point of debates between those believing in Design and evolutionists: Is there a purpose in the world? Evolutionists assume the only explanation is causal. Newton's laws give a perfect causal explanation for the motion of planets: A planet moves from moment to moment under the influence of a gravitational force. Similarly, today science explains the motions of all particles and quantum fields according to causal laws, and there are exact mathematical expressions for fields, forces and their motions. Causality explains what happens in the next moment as a result of forces acting in the previous moment. Science is associated with causal explanations, and it opposes teleological explanations in terms of purposes. The very basis of science, it seems, is on the side of causality, whereas religion is on the side of teleology.

However, the contradiction between causality and teleology does not exist at the very basic level of fundamental physics. The laws of physics, from classical Newtonian laws to quantum superstrings, can be formulated equally as causal (Hamiltonian formalism) or as teleological (Lagrangian). An example of a teleological principle in physics is energy minimization, which posits that particles in each moment "know" their purpose: to move so as to minimize energy. The most general physical laws, including those governing causal dynamics, motions of particles, quantum strings, and superstrings are formulated as minimization of a mathematical expression called the *Lagrangian* (Feynman and Hibbs 1965). A particle under force moves from point to point as if it knows its final purpose, to minimize the Lagrangian.

A general scientific assumption is that all biological laws are ultimately founded in physics. This, however, does not guarantee equivalency of causality and purpose. This equivalency exists in physics only for interactions of a few particles. For complex systems, *statistical* physics rules. It gives rise to the second law of thermodynamics, stating that less probable states evolve into more probable states; that is, entropy always increases. This defines the "arrow of time." Also entropy increase may sound like a teleological principle, but it is not; dynamic causal laws cannot be inferred from entropy increase. Entropy cannot lead to the evolution of complex systems. According to statistical physics and laws of entropy, the end state of the Universe is thermal equilibrium, i.e., "thermal death."

2. CAUSAL DYNAMICS VS. TELEOLOGY IN THE MIND

2.1. Crisp perception and vague imagination

Consider a seemingly simple experiment. Close your eyes and imagine an object in front of you. The imagined image is vague, not as crisp and clear as with opened eyes. As we open our eyes, the object becomes crisp and clear. It seems to occur momentarily, but actually it takes 1/6th of a second. This is a very long time for neural brain mechanisms – hundreds of thousands of neural interactions. Let us also note: with opened eyes we are not conscious about the initially vague imagination, we are not conscious of the entire 1/6th of a second, we are conscious only about the end of this process: a crisp, clear object in front of our eyes. The explanation of this experiment has become simple after many years of research, and we consider it in the next section. Recently, this experiment was conducted with much precision at the Harvard University neuro-imaging lab (Bar et al 2006). The resulting publication convincingly demonstrated that the initial mental imaginations are vague; they become crisp in the process of perception. Also, vague imaginations and the corresponding parts of the perception process are much less conscious than crisp representations at the end of the perception process.

In the following sections we consider neural and mathematical theories of this process of perception, and describe a theory leading to equivalence of dynamics and teleology in the mind.

2.2. Instincts, emotions, concept

Explaining this experiment and understanding perception requires consideration for the mechanisms of concepts, instincts, and emotions. We perceive and understand the world around us due to the mechanism of concepts or mental representation. Concepts-representations are like mental models of objects and situations: during the visual perception of an object, a mental model of the object, stored in memory, projects an image (top-down signals) onto the visual cortex, which is matched there to an image projected from retina, bottom-up signals (Grossberg 1988; Kosslyn 1980, 1994). When top-down signals match bottom-up signals, conscious perception occurs.

The mechanism of concepts evolved for instinct satisfaction. According to a theory of instincts and emotions (Grossberg and Levine 1987), instinct is a simple inborn, non-adaptive mechanism, similar to an internal “sensor,” which measures vital body parameters, such as blood pressure, and indicate to the brain when these parameters are out of safe range. This simplified description will be sufficient for our purposes. We have dozens of such sensors, measuring sugar level in blood, body temperature, pressure at various organs, etc.

According to the instinctual-emotional theory, satisfaction or dissatisfaction of instinctual needs is communicated from instinctual parts of the brain to decision making parts of the brain by emotional neural signals. The word emotion refers to several mechanisms in the brain (Cabanac 2002; Juslin and Västfjäll 2008); in this paper we always refer to the neural mechanism connecting conceptual and instinctual brain regions. Perception and understanding of the concept-models, corresponding to objects or situations that potentially can satisfy an instinctual need, receive preferential attention and processing resources in the brain-mind.

Projection of top-down signals from a model to the visual cortex “primes” visual neurons or makes them to be more receptive to matching bottom-up signals. This projection produces the imagination that we perceive with closed eyes, as in the closed-opened eye experiment. Crisp, conscious perception occurs, as mentioned, after top-down and bottom-up signals match.

2.3. The knowledge instinct

The process of matching mental models-representations in memory to bottom-up signals coming from sensory organs is necessary for perception; otherwise an organism will not be able to perceive the surroundings and will not be able to survive. Therefore humans and high animals have an inborn drive to fit top-down and bottom-up signals. We call this mechanism the instinct for knowledge (Perlovsky 2001a,b, 2006a; Perlovsky & McManus 1991). This mechanism is similar to other instincts in that our mind has a sensor-like mechanism that measures a similarity between top-down and bottom-up signals, between mental models and sensory signals. Brain areas participating in the knowledge instinct were discussed in (Levine and Perlovsky 2008a,b). As discussed in those publications, biologists considered similar mechanisms since the 1950s; without a mathematical formulation, however, its fundamental role in cognition was difficult to discern. All learning algorithms have some models of this instinct, maximizing correspondence between sensory input and an algorithm internal structure (knowledge in a wide sense). According to Grossberg and Levine (1987) instinct-emotion theory, satisfaction or dissatisfaction of every instinct is communicated to other brain areas by emotional neural signals. We feel these emotional signals as harmony or disharmony between our knowledge-models and the world. At lower levels of everyday object recognition these emotions are usually below the threshold of consciousness; at higher levels of abstract and general concepts this feel of harmony or disharmony could be strong, as discussed in (Perlovsky 2006a,b, 2010a) it is a foundation of our higher mental abilities. Experimental demonstration of this instinct and corresponding emotions has been presented in Perlovsky, Bonniot-Cabanac, & Cabanac (2010). The next few sections discuss that the knowledge instinct turns out to be the teleological principle of the mind operation.

2.4. Combinatorial complexity, logic, and dynamic logic (DL)

The process of matching bottom-up and top-down signals has presented difficulties in mathematical modeling for decades. The perception and cognition abilities of computers still cannot compete with those of children and animals. Since the 1950s, algorithms and neural networks used for modeling perception and cognition have faced the difficulty of combinatorial complexity (CC), , as discussed in (Perlovsky 2001, 2006a, Perlovsky & McManus 1991). All algorithms and neural networks capable of adaptation and learning have to be trained to understand not only individual objects along with their variabilities, but also in combinations with other objects. This leads to CC: combinations among only 100 objects is a huge number 100^{100}, exceeding all elementary interactions in the entire life of the Universe. Clearly, no algorithm can perform that many computations and mathematical modeling of the mind processes requires new type of mathematical principles.

These difficulties of CC turned out related to Gödelian limitations of logic, a most fundamental mathematical result of the 20^{th} c. CC is a manifestations of logic incompleteness in finite systems (Perlovsky 2001). Even approaches designed specifically to overcome logic limitations, such as fuzzy logic and neural networks, encountered logical steps in their operations: neural networks and fuzzy systems, as well as all algorithms capable of learning are trained using logical procedures (e.g. "this is a chair").

To overcome limitations of logic, dynamic logic (DL) was developed (Perlovsky 2001, 2006a, Perlovsky & McManus 1991). In the next section we summarize the mathematical description of DL, here we describe it conceptually. Whereas logic works with static statements (e.g. "this is a chair"), DL is a dynamic process from vague to crisp, from a vague representation, statement, decision, plan, to crisp ones. It could be viewed as fuzzy logic that automatically sets a degree of fuzziness corresponding to the accuracy of mental models, while this accuracy improves.

DL corresponds to the open-close eye experiment: initial states of the models are vague. A similar, more detailed experiment, as mentioned, was performed measuring brain operation details using brain neuro-imaging by Bar et al (2006). These authors identified brain regions facilitating perception. This facilitation was unconscious. In addition they demonstrated that the initial imagined perception generated by the top-down signals is *vague*, similar to the close-open-eye experiment. Conscious perception of an object occurs when vague projections become crisp and match a crisp image from the retina; only then an object recognition area of the brain is activated.

2.5. The knowledge instinct and neural modeling field theory

We summarize now a mathematical theory of the knowledge instinct and DL combining the discussed mechanisms of cognition as interaction between top-down and bottom-up signals at a single level in multi-level hierarchical system following (Perlovsky 2006a).

Neurons are enumerated by index n = 1,... N. These neurons receive bottom-up input signals, $\mathbf{X}(n)$, from lower levels in the processing heterarchy. $\mathbf{X}(n)$ is a field of bottom-up neuronal synapse activations, coming from neurons at a lower level. Top-down, or priming signals to these neurons are sent by mental concept-models, $\mathbf{M}_h(\mathbf{S}_h,n)$; we enumerate these models by index h = 1,... H. Each model is characterized by its parameters, $\mathbf{S}_h$. The models *represent* signals in the following sense. Say, signal $\mathbf{X}(n)$, is coming from sensory neurons activated by object *h*, characterized by parameters $\mathbf{S}_h$. These parameters may include position, orientation, or lighting of an object *h*. Model $\mathbf{M}_h(\mathbf{S}_h,n)$ predicts a value $\mathbf{X}(n)$ of a signal at neuron *n*. For example, during visual perception, a neuron *n* in the visual cortex receives a signal $\mathbf{X}(n)$ from the retina and a priming signal $\mathbf{M}_h(\mathbf{S}_h,n)$ from an object-representation-model *h*. A neuron *n* is activated if both a bottom-up signal from lower-level-input and a top-down priming signal are strong. Various models compete for evidence in the bottom-up signals, while adapting their parameters for better match as described below. This is a simplified description of perception. Models $\mathbf{M}_h$ specify a field of primed neurons {n}, hence the name for this modeling architecture, *neural modeling fields (NMF)*.

The knowledge instinct maximizes a similarity measure between top-down and bottom-up signals,

$$L = \prod_{n\in N}\sum_{h\in H} r(h)\, l(n|h).$$

Here l(n|h) is a partial similarity of a bottom-up signal in pixel n given that it originated from concept-model h; the functional shape of l(n|h) often can be taken as a Gaussian function of $\mathbf{X}(n)$ with the mean $\mathbf{M}_h(\mathbf{S}_h,n)$. Partial similarities are normalized on objects (or concepts) h being definitely present, and coefficients r(h) estimate probabilities of objects actually being present. Similarity L accounts for all combinations of signals n coming from any model h, hence the huge number of items H^N in expression (1); this is a basic reason for CC of algorithms.

The knowledge instinct demands maximizing the similarity L over the model parameters $\mathbf{S}$. DL maximizes similarity L while matching vagueness or fuzziness of similarity measures to the uncertainty of the models. It starts with any unknown values of parameters $\mathbf{S}$ and defines association variables f(h|n),

$$f(h|n) = r(h)\, l(n|h) \,/ \sum_{h'\in H} r(h')\, l(n|h').$$

DL determining the Neural Modeling Fields (NMF) dynamics is given by

$$d\mathbf{S}_h/dt = \sum_{n\in N} f(h|n)[\partial \ln l(n|h)/\partial \mathbf{M}_h]\partial \mathbf{M}_h/\partial \mathbf{S}_h.$$

These equations describe the DL process "from vague to crisp" (Perlovsky 2009c). Initially, parameter values are not known, and the uncertainty of partial similarities are high (e.g., if l(n|h) are modeled by Gaussian functions, variances are high). So the fuzziness of the association variables f(h|n) is high. In the process of adaptation-learning, models become more accurate, and association variables more crisp, the value of the similarity increases. The initial vagueness of mental representations is fundamental to overcoming CC. No combinations need to be considered in processes of perception and cognition: due to initial vagueness of mental representations-models, initially any pattern in the bottom-up signal fits every vague model. As models improve, specific patterns are associated with specific models, as in Fig. 1, below without combinatorial searches.

2.6. Engineering example of perception-detection

In the following example, NMF-DL is looking for 'smile' and 'frowns patterns in noise shown in Fig.1a without clutter, and in Fig.1b with clutter, as actually measured. This example is beyond capabilities of previously existing techniques. Using standard logical matching techniques, solving this problem will take about $M^N = 10^{6,000}$ operations—completely unsolvable problem. The DL complexity is 10^8, so that a problem previously unsolvable due to CC have been solved using NMF-DL.

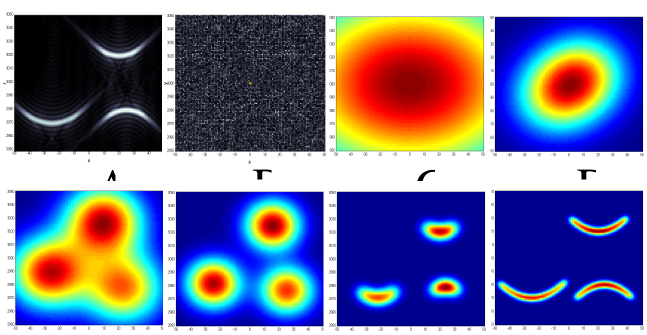

Fig.1. An example of NMF-DL perception of 'smile' and 'frown' objects in clutter in 2-dimensions of X and Y: (a) true 'smile' and 'frown' patterns are shown without clutter; (b) actual image available for recognition (signal is below clutter, S/C ~ 0.5); (c) an initial fuzzy blob-model, the fuzziness corresponds to uncertainty of knowledge; (d) through (h) show improved models at various iteration stages (total of 22 iterations). The improvement over the previous state of the art is 7,000% in S/C; this example is discussed in more details in (Perlovsky 2006a).

2.7. The knowledge instinct and dynamic logic: teleology and dynamics of the mind

The knowledge instinct is a teleological principle of the brain-mind. The brain-mind evolves toward an increase in knowledge. At the moment of perception as well as over millennia of cultural evolution, the brain-mind evolves as if it knows its final aim: maximizing knowledge, given by expression (1) (knowledge is a correspondence of mental models to the world, or more accurately, a similarity between top-down and bottom-up signals). This teleological principle is equivalent to dynamic logic, given by the process (2, 3). For the first time, very complex systems, the human brain-mind as well as the entire culture, are described by the pair of mathematically equivalent principles, one teleological and one dynamic. In other words research, exemplified by dynamic logic aimed at differentiating knowledge and deriving more and more exact characterization of events, is equivalent to research guided by the design principle, the design maximizing knowledge. Of course, there is no surprise that the human mind has an ability to discover minute details of events as well as grand theories, such as theory of relativity. Here we obtained a mathematical theory establishing equivalence of both principles of the mind operations.

3. HIERARCHY OF THE MIND

3.1. The knowledge instinct in the hierarchy of the mind: beautiful and sublime

The NMF-DL theory has been extended to higher cognitive functions (Perlovsky 2002, 2006a,b,c, 2007a,b,c, 2009a,b, 2010a,b; Perlovsky & Kozma 2006a; Mayorga & Perlovsky 2007). It models the knowledge instinct operating in the hierarchy of the human brain-mind. At the bottom of the hierarchy are simple objects, higher up are situations, general and abstract concepts; their purpose is to unify contents of lower levels. At the top are concepts unifying our entire knowledge; we perceive them as concepts of the meaning and purpose of our existence. DL explains why these concepts are inherently vague and unconscious: they are built on the hierarchy of vaguer and less conscious mental representations-concepts. Therefore, our consciousness is in great doubt about their very existence. When we feel that we are understanding them a bit better or our belief in their existence is becoming a bit firmer, we feel emotions of the beautiful. In parallel with the concepts of understanding the meaning and purpose, there are concepts of behavior needed to realize the beauty in our life. When we feel that we are understanding them a bit better or our belief in their existence is becoming a bit firmer, we feel emotions of the spiritually sublime.

3.2. Language and cognitive representations

Sometimes we feel we know exactly what the highest concepts are, and this can make it difficult to accept the above explanation about the vagueness of the highest mental experiences. Leonardo da Vinci and Vincent Van Gogh, or the Ten Commandments—don't we know exactly the contents of these and other examples of the beautiful and sublime? Answering this question requires an understanding of similarities and differences between cognitive and language model-representations, analyzing the interaction between language and cognition (Perlovsky 2009a,b, Perlovsky & Ilin 2010a). Mechanisms of their interaction explain why language is acquired in childhood, whereas cognition requires much longer. How are correct connections learned between words and objects, among the multitude of incorrect ones (no amount of experience would be sufficient to overcome CC of learning these connections)? Why does human-level cognition not evolve in animals without language? What, exactly, are the similarities and differences between language and cognition?

According to the given references, these and other properties of cognition-language interaction are explained due to the mechanism of the dual model (Fig. 2). This model suggests that a newborn brain contains separate place-holders for future representations of language and cognitive contents. Initial contents are vague and non-specific. Yet connections between placeholders for future cognitive and language representations are inborn. Due to these inborn connections, word and object representations are acquired correctly connected: as one part of the dual model (a word or object representation) is learned, becomes crisper and more specific, the other part of the dual model is learned in correspondence with the first one. Objects that are directly observed can be learned without language (like in animals). However, abstract ideas cannot be directly observed; they cannot be learned from experience as useful combinations of objects, because of CC of such learning. Therefore, cognitive representations of abstract ideas can only be learned guided by language. This is the reason language is acquired in childhood, whereas learning corresponding cognitive representations requires much experience. Learning language can proceed fast, because it is grounded in surrounding language at all hierarchical levels. But cognition is grounded in direct experience only at the bottom levels. At higher levels of abstract ideas, learning cognitive representations from experience is guided by already learned language representations. Abstract ideas that do not exist in language (in culture or in personal language) usually cannot be perceived or cognized and their existence is not noticed, until first they are learned in language.

Relative roles of language and cognition can be compared to the roles of bottom-up and top-down signals in the open-close eye experiment. Language serves as inner mental eyes for abstract ideas. It grounds and supports learning of the corresponding cognitive representations. The fundamental difference, however, is that these eyes cannot be closed. The crisp and conscious language "eye" masks vague and barely conscious cognitive representations. Therefore we cannot perceive them. If we do not have necessary experience, our cognitive representations are vague and unconscious and language model-representations are taken for this abstract knowledge. Because language contains wealth of cultural information, we are capable of reasonable judgments, even without direct life experience. Such is the case (most of the time) with perceiving the beautiful in Leonardo Da Vinci and other generally accepted examples of the beautiful and sublime. These examples might be very good, but they do not necessarily correspond to one's personal life experience and personal needs and feelings. This discussion is directly relevant to the difference between much discussed "irrational" heuristic decision-making discovered by Tversky & Kahneman (1974) and decision-making based on personal experience and thinking, grounded in learning and driven by the knowledge instinct (Levine & Perlovsky, 2008).

Emotions of the beautiful and sublime are not necessarily experienced in museums and temples, they might be experienced anywhere at any moment.

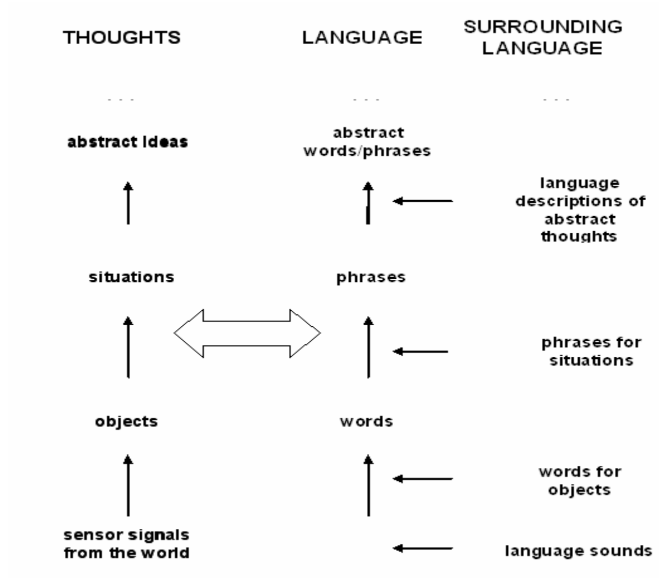

Fig.2. Parallel hierarchies of cognition and language. Language learning is grounded in surrounding language at all hierarchical levels "ready-made." Learning abstract cognitive models requires experience and guidance from language.

3.3. Science is not reductive

Reductionism is a logical and philosophical difficulty which has for centuries been standing in the way of scientific analysis of spiritual abilities and values. If a spiritual ability could be reduced to a scientific explanation, then all human abilities, artistic and spiritual values, could be reduced to biology, then to chemistry, to physics, and a human would be no different than a piece of rock. This argument is called reductionism. Most people cannot accept such a conclusion. Yet accepting that there is no difference in substance between spiritual and material, seemingly lead to no choice. Never any philosopher or theologian has been able to offer a resolution of this conundrum. I. Kant suggested that such are the inborn properties of the judgment ability (1790), but he could not identify the appropriate mechanism.

Because of the fundamental importance of the principle of reductionism, let me add few details. The essence of science is that spiritual and material are of one substance. Otherwise a "free spiritual will" could interfere any moment, and a possibility of any scientific law is questioned. The unity of spiritual and material substance is also the essence of monotheism, a theological doctrine that over the last 4000 years became the essence of all major religions. To discard 4000 years of spiritual development of cultures around the world along with science might seem flippant. Therefore the brightest scientists, including Newton and Einstein, accepted the contradiction of reductionism in one way or another. For some people, however, believing in the power of human mind to resolve all contradictions has been a sufficient argument to reject the unity of the material and spiritual. Therefore some people have rejected monotheism and chosen dualism, a belief that spiritual is in principle different from material, and cannot be explained by material laws. Among people choosing dualism have been great philosophers, B. Spinoza (2005), R. Descartes (1646), as well as a contemporary philosopher D. Chalmers (1997).

DL has resolved this great contradiction. Abstract mental representations-ideas, according to DL, are vague and barely conscious. They cannot be reduced to lower level ideas, and further to even more lower levels. Of course, nobody was able to reduce the highest level spiritual ideas to laws of chemistry or physics. The inevitability of reductionist arguments has been a fiction of logic. Reductionism seemed inevitable in logic, and this problem only exists in logic. DL explained for the first time that science is irreducible, not just because scientists have not learned yet how to reduce the highest ideas to the lower ones, but mechanisms of the mind are irreducible in principle. Even if one accepts that spiritual laws and material laws are of the common origin, still the highest ideas of human mind are not reducible to physical laws governing interactions among few particles. And we know, they are governed by the knowledge instinct.

4. CONCLUSION

C. Jung wrote that schism between science and religion points to a psychosis of contemporary collective psyche; survival of culture demands repairing this schism (1934). Many outstanding scientists are trying to mend it. Many books are written arguing that scientific discoveries do not contradict the main tenets of the world's religions. Yet, there has been no unifying approach, science and religion remained in two separate parts of the mind. There has been no bridge between the two; no scientific approach to spiritual dimensions of the mind-brain. With the knowledge instinct and DL science can approach mechanisms of human spiritual abilities and make scientific sense of the Einsteinian statement: *"Every one who is seriously involved in the pursuit of science becomes convinced that a spirit is manifest in the laws of the Universe."*

DL and the knowledge instinct are mathematically similar to Hamiltonian and Lagrangian formulations of general physical laws: evolution of the mind is guided by causal dynamics, which is equivalent to maximization of knowledge. In this regards the KI is a revolutionary principle. For the first time it states that for a very complex system, the human mind, causality and purpose are equivalent. Instead of rule of entropy and thermal death, the human destiny is ruled by increase of knowledge. The knowledge instinct defines a new "arrow of time". One does not have to choose between scientific explanation and teleological purpose: Causal scientific dynamics and purpose-driven dynamics (teleology) are mathematically equivalent.

Scientific understanding of the beautiful and sublime corresponds to artistic and teleological ones: these are not final notions that could be formulated axiomatically. It follows from Gödel theory, that mechanisms of the highest aspirations of human spirit are not logically reducible to finite statements. Attempts to compute them logically exceed in complexity all elementary interactions in the Universe in its entire lifetime and therefore logical choices of beautiful and sublime involve more information than is available in the Universe. A possibility of these choices is called a miracle in traditional language. DL gives a computational theory of these choices without reducibility.

We have significant power over conscious linguistic contents of our highest models, but most of the cognitive contents are unconscious and determined by evolution. (Is there one model or several models at the top of the mind hierarchy cannot be meaningfully questioned because of the profound vagueness of the top model(s)). Unconscious contents are outside of the conscious "I." Even as the neural brain substrates of these models are within one's brain, a conscious self does not command it, does not "own" it; rather, the opposite relations take place: these models owns and commands one's self at its highest levels. This explains a seeming paradox that a non-religious person, a scientist with materialistic views, would not accept that principally he is no different than a rock or a leaf in the wind. The unconscious cognitive model at the top of the hierarchy is significantly independent from consciousness and guides consciousness in many ways, in particularly toward feeling its highest purposiveness. This model therefore has the property of an *agent,* independent from one's consciousness, but in control of it. In traditional societies as well as among religious peoples everywhere this agency is called God.

In our culture, since the ascendance of science, many people consider themselves non-religious. But it is not in one's power to change the unconscious structure of the mind. The model of our highest purposiveness is outside of our conscious control. The scientific analysis in this paper leads to a conclusion that it is not in our power to be "religious" or "irreligious." One could participate in an organized religion or refuse to do so. One could consider himself or herself a non-religious person. Or one could choose to study what is known about the contents of the highest models from accumulated wisdom of theologists and philosophers, or by combining this wisdom with the scientific method, as the science-and-religion community does. One can choose to refer to the agency property of the unconscious model at the top of the mind hierarchy, and yet refuse or accept to use the word God.

Understanding of the mind mechanisms today came close to bridging spirituality and science. Religious principles can be understood scientifically, by understanding human mind. Contents of models of beautiful and sublime are unconscious; they do not belong to our consciousness. They are "collective," outside of consciousness. Consciousness does not control them, *they* control individual consciousness. Therefore, we feel them as a source of agency outside of ourselves. In recent arguments it is called Designer.

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