# A NOTE ON APPLICATION OF NATURAL PHENOMENA IN COMPUTER SCIENCE

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## ABSTRACT

This paper discusses some problems of modern computer science from point of philosophy and evolution theory. Main aim is to present natural way of research attitudes that is the research attitudes inspired by natural phenomena. Although these attitudes, ideas have wider connections, circumstances to other disciplines, fields of science, here we focus on problems that come with and from machine information processing. Beside the general problems more specific open problems are also mentioned. Further some relevant suggestions are denoted too.

## 1. INTRODUCTION

As the title PhD stands for „*Teacher of Philosophy*“ or „*Philosophiæ Doctor*“ in Latin, it is also important to understand philosophical background of science we study. As Holzbachova (see [4]) and others point out some problems of modern science, we need to think about our research approaches, attitudes before we choose select or decide. Especially, in computer science where changes come faster than we can imagine.

As each human kind is part of evolution process, our character and behavior have direct influence on evolution itself. Hence it is relevant what research attitude we serve, how our research and development power involve the environment and neighborhood. Since natural law holds the evolution has been enabled. More and more complicated structures were created until now and it still continues. By proper combinations of these laws evolution process was able to create many complex structures even without our interaction (e.g. in primeval ages). No matter how we believe or prove it, these laws hold even without our interest. But if we are able to understand the evolution process, we are able to under-stand our targets better.

By natural phenomena we understand such combination of natural laws that is the result of natural evolution process. For instance, a natural phenomenon is *flash in storm*, *growth of corn* or *human born*, etc. Then by application of natural phenomena we make of attitude that deals with philosophy, natural phenomena study, theoretical and practical problems of computer science. Main goal of this approach is to establish questions that come from problems of computer science, find proper solution inspired by natural phenomena and then apply it. There is still great deal we can learn, inspire from. In following section we

describe some preliminary applications of natural phenomena for common situations that we are affected every day. Goal of this premise is to point out often problems and offer some suggestions before we move further.

## 2. PREMISE

The mind, spirit and body are inextricably linked. So what one does, has a direct effect upon the other. Hence it is important to develop all of these three as one unit. Whatever research we do, we should not forget to support mind, spirit and body in balance. Otherwise some problems might appear. Our work, research is fingerprint of our character and vice versa our character is fingerprint of our work, past, history too. Therefore we should avoid of these problems to beware of imbalance and to be able to produce our effort correctly.

Now we subsequently give some examples, suggestions how we can support all three basic parts which create what we are. First let us start with the physical body.

### 2.1. PHYSICAL BODY

By the time the human reaches adult-hood, the body consists of close to 100 trillion cells, where each is part of an organ system designed to perform essential life functions. If any part of body is not used in the way that was designed it leads to its damage or atrophy. The most common is the muscle atrophy, which starts by muscle weakness. Together with abnormal weight gain or loss this may cause serious health problems (especially in case of older people).

Do not spend almost of your time sitting at the computer; find some daily activity where all your body is affected. It is not necessary to do some kind of top sport, martial art or to divide strictly your life into time of work and time of sport. Find some natural occasions to fill your body activity. For instance, to improve your physical condition, you can use bike instead of motorbike, use stairs instead of lift, park your car a few blocks from your destination and take a walk, go shopping instead of drive shopping etc. Seek tranquility in your motion.

### 2.2. MIND AND SPIRIT

Rather than discuss about support, development of our mind and spirit separately, we now give some suggestions (inspired by natural phenomena) simultaneously.

Although the term of mind is well known, the spirit is often omitted. By spirit we understand an expression of the thought, knowledge, feelings and intent of the mind (part of mental capability). A strong spirit makes for clear thought, enhanced perception, better intent which is assets to all situations. In abstract way the mind is the seat, house of the spirit.

To underline the natural phenomena application for mind and spirit, always be honest to yourself and humble to the others. Actions, changes we make come from our internal vital energy and this energy comes from our intention, mind. We should not base our intentions on physical goals only but on spiritual too. If our goals are spiritual, we will never have a failure. Spiritual intention is also important to prevent psychological *syndrome of burnout* (appears in many exacting professions including computer science). Intent brings about the physiological changes which allow application of energy on our focus. Where the power of our intentions depends on the focus too (all above three characteristics are dependent on the focus of the strength because it determines its efficiency).

Before the intent is focused on something, think about possible consequences. Do not study, focus on something by over-viewing the other important things, circumstances, see connections (avoid of blind aims, goals). Stop for a while and think about your goals, progress. Establish main questions. Answers should come naturally, do not force it. Answer is implication of question. If you are not able to see the answer, response directly, usually some kind of *wider perspective* is required.

Even failure means success. Let us imagine we are on the way to work, office. By every step we do, we get a bit closer. Then after the first step we made, we are not there, but it does not mean a failure. Even if the result is considered as failure, do not get from this failure to another without learning from previous failure.

Make a wish, give suggestions rather than give an order. What is the point to move with just a simple stone or do whatever else without being able to order ourselves, direct what our hands do, what we think about, what our mouth say.

Do not force any natural form to behave like another. Find its natural potential and support, motivate and stimulate it. The progress will naturally appear. Gather its potential together, do not use the force, force will cause the cease. Use brain rather than brawn. No matter how much we try to force the form to change, sooner or later its natural form will appear.

Remember natural form is like a piece of metal. We can use a force to band it. If force is low the deformation is not permanent, metal returns to origin form. If we use higher force, metal is bended permanently. If the force is too high the metal breaks permanently. Usage of brute force awakes force; usage of softness mind awakes softness. But note, even softness can overcome hardness. See how the form reacts and learn from it. Learn from history and present. Good points can be adopted and bad ones corrected.

### 2.3. SUMMARY

If our body, mind or spirit is deformed (imbalanced), information we accept as knowledge can be deformed too. This may lead to misunderstanding, wrong decisions. Remember, our character is imprinted in everything we do (including research and development). By supporting all of these three linked components we obtain progress for our body, health condition, our work, research. This progress is then retroactively imprinted to our character and thus we do next step forward in our evolution.

Across many different cultures there exist some exercises which were developed, discovered to support, train our mind, spirit and body as one unit, to keep it in balance, to discover ourselves better. Some of these exercises have further applications. For instance, applications are in medicine or in combat. Combat, self-defense applications are also known as martial arts. But this topic is not the main focus of this paper (see [1] for details).

## 3. APPLICATIONS IN COMPUTER SCIENCE

Nothing happens incidentally. Every event, which happens, is caused by configuration of certain conditions. This event then creates, represents next condition for another events. See how it works in deterministic way based on natural laws. Even chaos has an order. Notice the nature of elementary particles, natural constants and laws with respect to evolution process, which began from origin chaos and led to more and more complex structures. These constants, laws allow our evolution, hence it have the form we can see. Also notice

how simple these laws may be and how deep changes, complex structures are able to create, generate (see [2], [6]).

### 3.1. HISTORICAL CONNECTIONS

Every form, phenomena has its duality. See how computer science is based on duality with respect to binary representation of information.

*Fibonacci series* is one of the keys for other natural phenomenon. In field of botany the structure of flowers is based on Fibonacci numbers. *Golden spiral*, known as a growth determination of many natural forms like sea shells, can be approximated by Fibonacci spiral (inscribed into rectangle, tiling with squares whose sides are successive Fibonacci numbers in length). Detail connections to *golden spiral* are justified in Thompson research (see [2]). By division of two successive Fibonacci numbers we obtain ratio which approaches but never reaches the divine proportion also known as *golden mean*.

Beside the biological circumstances also human creativity was inspired by study of *golden mean*. For instance the Parthenon consists of proportions approximating the *golden ratio*. The proportions of Cheops pyramid were also designed with respect to *golden mean*.

From point of growth and evolution of form we can underline the Thompson study. He pointed out example after example of correlations between biological forms and mechanical phenomena. In study of comparison of related forms he explored the degree to which differences in the forms of related animals could be described by means of relatively simple mathematical transformations. See [2] for details.

Similarly to Thompson study, later biologist Lindemayer (see [6]) pointed out other important natural laws. He observed natural laws for generating, modeling the behavior of cells of plants. System based on this observation is called *L-system* (Lindenmayer system). These systems were later studied from point of theoretical computer science because it generates new class of formal languages too (differs from Chomsky hierarchy of languages).

### 3.2. SPECIFIC APPLICATIONS

If we put the studies, ideas, mentioned above, together we can observe many applications in computer science.

Beside the biological aspects we focus on applications in information technology. Form modeling, growth simulation, form generation, forms transformations can be used in field of biometry systems (e.g. application in facial or ear recognition where identification is based on human biometry structure, form). Notice the application of *L-system* in computer graphics to design environmental scenes (including 3D computer games and simulators), computer art (fractal images). Many variants of these systems were developed to be able to reflect context of environmental conditions which influence the plant, image growth. For instance, there exist *parametric L-systems*, *stochastic L-systems* or *context L-systems*. In my master thesis I also studied these systems and designed another variant called *selective L-systems*.

Further we can mention methods of *soft-computing* as other computational techniques inspired by natural phenomena, evolution process. Soft-computing is referred in artificial intelligence, machine learning and other engineering sub-disciplines, which attempt to study, model, and analyze very complex phenomena originally developed in artificial intelligence. Key areas of soft-computing are *evolutionary computation*, *neural networks*, *fuzzy logic* (see [3] for application examples).

Well known are *evolution algorithms* and their applications. Recently, there were published papers about evolvable hardware design (each circuit is assigned a fitness, which indicates how well a candidate circuit satisfies the design specification). But beside the hardware design we can think about evolvable *software architectures* or *design patterns*.

Another kind of natural phenomena is expressed by *neural networks*. These networks are composed of artificial neurons or nodes to simulate biological neural networks or to solve artificial intelligence problems. Main applications are in classification, including pattern and sequence recognition (e.g. letter recognition, spam filter) or data processing.

Recently, there were also published papers about usage of neural networks in natural language processing. Although some remarkable and interesting work had been done, deeper sentence context is still lacking. It seems like these artificial neurons model the neural network but not the mind. It is similar to brain but not approaching mind. Hence there is still much to improve too. Consider problems from wider perspective to hit new inspiration.

## 4. CONCLUSION

Many town dwellers, owing to the pressures of work, traffic congestion and other factors do not properly balance the mind, spirit and body. As a result, we can become victims of mental strain, nervous tension and other maladies which detract from our efficiency in our daily research.

In premise we gave some suggestions, advices how to practice regularly to develop a healthy body and an alert mind. The improvement in our health will better enable us to concentrate on our routine tasks and to make effective decisions, all of which leads in turn to a greater success in research and development area too.

Rather than study evolution algorithms, neural networks, L-systems or other methodology inspired by natural phenomena separately we should see connections and understand it as complex system as the unit theory of evolution based on natural laws. As the *water flows* as the *rain falls*, nothing happens without connections to other circumstances. There is no evolvable hardware without evolution. There is no evolution without natural laws that enable it. This kind of research approach provides the deeper understanding and thus we are able to observe progress. Do not waste time by solving effects without solving the causers.

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