CREATIVITY IN CONSCIENCE SOCIETY

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Abstract
Creativity is a result of brain activity which differentiates individuals and could ensure an important competitive advantage for persons, for companies, and for Society in general. Very innovative branches – like software industry, computer industry, car industry – consider creativity as the key of business success. Natural Intelligence Creativity can develop basic creative activities, but Artificial Intelligence Creativity, and, especially, Conscience Intelligence Creativity should be developed and they could be enhanced over the level of Natural Intelligence. Providing only neurological research still does not offer a scientific basis for understanding creativity but thousand years of creative natural intelligence behavior observations offer some algorithms, models, methods, guidelines and procedures which could be used successfully in Conscience Society Creativity. Present Essay discusses the evolution of the notion of Creativity (what it is, why it is important, where it is used), analyzes creativity from basic point of view (Creativity as a Brain Activity; Mastering Daily Life; Creativity and Profession; Piirto's six Steps; When and where Creativity Occurs; How Creative People are looked upon), and also manages Individual Creativity and Company Goals (Individual Creativity; Teams, Creativity and Product Development; Company's Product Development Goals; Entrepreneur's and Small Companies' Product Development).

Keywords: creativity, intuition, spirituality, conscience society, natural intelligence, artificial intelligence.

JEL classification: D83, Z13, A13, C87, D58, L86

Introduction

Conscience in Information Age represents individual spirit feelings, a set of conscientious actions of each individual member of Society. The Sum of Society's individual's conscientious actions forms Conscience Society of Information Age. Commonly used metaphors for conscience include the "voice within" and the "inner light". Conscience, as is detailed in Mihalcea, Rosca and Todoroi (2010), is usually seen as linked to a morality inherent in all humans, to a beneficent universe and/or to divinity, is

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increasingly conceived of as applying to the world as a whole and as a main feature of conscience society. It has motivated numerous models, characteristics and functions for creation of the Societal Intelligent Adaptable Information Systems in Conscience Society. The moral life is a vital part for the world to maintain a Conscience (civilized) Society, so always keep in mind to: accept differences in others; respond promptly to others; leave some "free" time; care about others as if they were you; treat everyone similarly; never engage in violent acts; have an inner sense of thankfulness; have a sense of commitment.

Academician Mihai Draganescu (2000) in community with such researchers as Moravec, Kurzweil, Buttuzzo, Broderick, and (Rosca, 2006; Mihalcea, Rosca and Todoroi, 2010; Todoroi, Todoroi and Micusa, 2010) analyzed the possibility to create the Conscience Society in the period from 2019 to 2035. In his essay he underlined: "… it is not possible for any kind of Artificial Intelligence (AI: electronic or in the future nano-electronic) to possess Intuition, Creativity and Spirituality without resort to other structural natural elements, which reality become more and more plausible. The equality of Artificial Intelligence with Structured Natural Intelligence (AI = NI Structured) will happen, after a set of opinions of Moravec, Kurzweil, Buttuzzo, Broderick and a., in the period of 2019-2035. Some researchers believe that in the moment when the equality AI = NI Structured will be obtained automatically such electronic brain will possess the phenomenological properties of Intuition, Creativity and Spirituality.

After AI > NI Structured it is obviously that a new stage will begin which will produce many consequences in society thanks to relations of humanity with such intelligences, some of which will be presented in the form of Software and other in the form of Intelligent Robots. It will be some intermediate stage between Knowledge Based Society and Conscience Society when the Artificial Intelligence with the Genuine Conscience will appear, that is Artificial Conscience (AC). In the moment when AC > NI this will be the enter in the zone of Conscience Society singing that the Society will be based on the relations between Natural Intelligence (which probably will be amplified through auto-transformations of genetic code and probably through coupling with Micro-electronic and Nano - electronic Information Systems, and even with Internet Networks) and Software or Robotic Artificial Conscience".

Let us discuss Creativity from the point of view of the development of the creation of Conscience Society in Information Era.

Information Society, Knowledge Society, and Conscience Society of Information Era

Since the 70s, Alvin Toffler was pointing in his work "Shock wave" the unprecedented acceleration of the transformation of the whole society. This transformation has been mainly generated by the informatics revolution. The annalists identified this new type of revolution in economy and society, next to the industrial revolution.

In "The fourth wave", Alvin Toffler's work published in 1993, he predicted the approach of a new wave of progress. This wave follows the post-industrial economies and is indebt to a revolution of knowledge, especially of the knowledge sprang from intuition, imagination and creative capacity of the human being. This stage, together with the previous ones, is represented in the Figure no. 1.
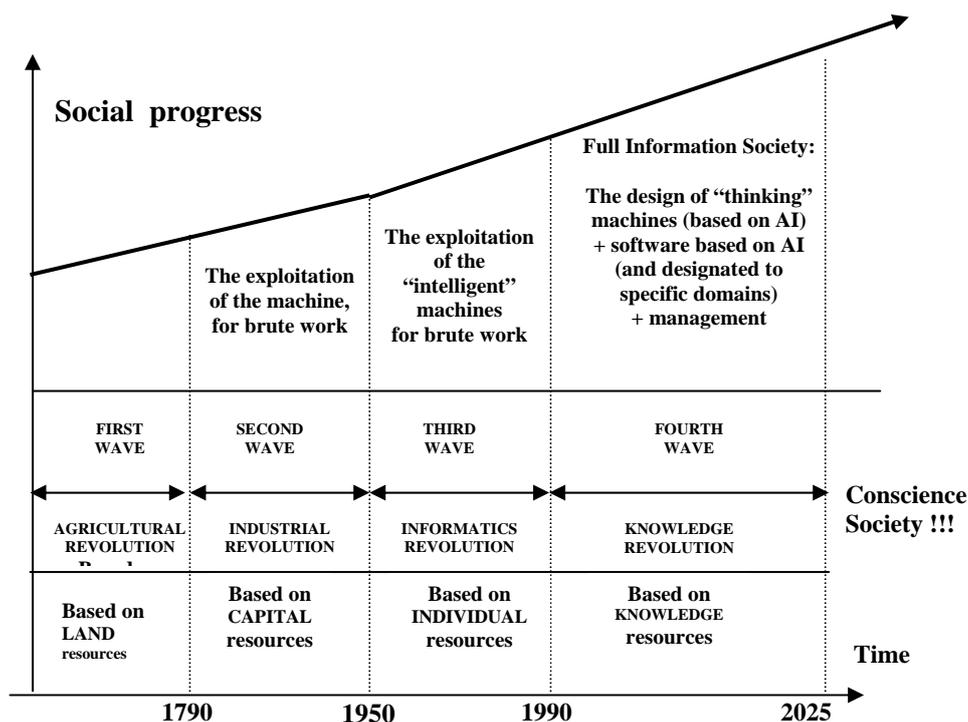
Social progress

	The exploitation of the machine, for brute work	The exploitation of the "intelligent" machines for brute work	**Full Information Society:** The design of "thinking" machines (based on AI) + software based on AI (and designated to specific domains) + management
FIRST WAVE	**SECOND WAVE**	**THIRD WAVE**	**FOURTH WAVE**
AGRICULTURAL REVOLUTION	**INDUSTRIAL REVOLUTION**	**INFORMATICS REVOLUTION**	**KNOWLEDGE REVOLUTION**
Based on LAND resources	**Based on CAPITAL** resources	**Based on INDIVIDUAL** resources	**Based on KNOWLEDGE** resources

Conscience Society !!!

Time

1790   1950   1990   2025

Figure no. 1: What comes after the Full Information Society?

As we already crossed the first years of the new millennium, one wonders how human life would be like… We have already seen much transformation in our lifestyle over the past several decades gradually leading us towards the so called "Information age".

While the Information Society (IS) is already taking into shape, its full impact is still a long way to be realized. The form of fully developed information society can only became a reality through an evolutionary process over the years.

It is, however, possible to conceptualize its basis, and, therefore, an assessment of specific issues in this process can be undertaken.

Modern society evolves under the sign of rapid changes. Change has become a reality at all levels (Todoroi, Micişa, Crişan and Nechita, 2008; Todoroi, Todoroi and Lobanoff, in press): (a) everyday-life of the individuals, (b) the life of the organizations, and (c) social systems. In our modern society, change equals to "a new way of life". Transformation of the whole society has been mainly generated by the informatics revolution. Modern society of Information Era evolves under the sign of rapid changes. Permanent innovation through the creative capacity of the individuals – in all domains of knowledge – is equivalent to a huge amount of information and an implicit step towards progress.

As a revolution in economy and society - next to the industrial revolution - the Post-industrial economy is supported by the knowledge revolution (Figure no. 1), especially of the knowledge sprang from Intuition, Imagination, and Creative capacity of the human being (Figure no. 2.).
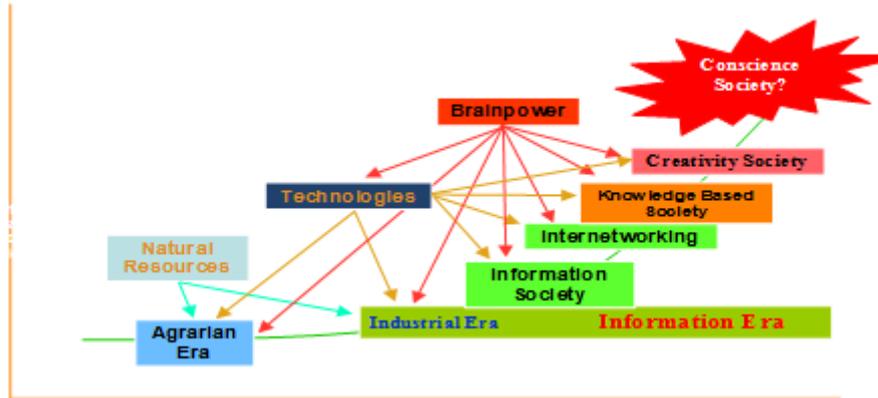
Figure no. 2: Information Society: 1970, Creativity Society: 2015, Conscience Society: 2019-2035

New orientations in informatics

In the last decade by collaboration of computer science with biology spectacular new orientations in informatics have arisen. Two landmark examples are:

- Ex.Nr.1: the completion of the genome project, a great success of bio-informatics (using computer science in biology) and

- Ex.Nr.2: Adleman's experiment (1994) of using DNA molecules as support for computing.

The latter example is illustrative for a new direction of research which is opposite to the traditional one, of using computers in biology: in Adleman's experiment, biological materials and techniques were used in order to solve a computational problem. This was the "official birth certificate" of what is now called DNA Computing, and this gave a decisive impulse to Natural Computing.

Actually, the whole history of computer science can be seen as the history of attempting to discover, study and, if possible, to implement computing ideas, models, and paradigms from the way nature – the humans included – "computes". This starts with Alan Turing himself who, in 1935 – 1936, defined the Turing machine, now the standard reference for what is "mechanically computable".

One decade later, McCullock, Pitts, Kleene founded the finite automata theory starting from modelling the neuron and the neural nets. Later, this lead to the area known now as Neural Computing.

A special mentioning deserve genetic algorithms and evolutionary computing/ programming, which are now well-established (and much applied practically) areas of computer science. This area is special because it perfectly illustrates the (unexpected) benefits for computer science to look and get inspired from biology.

The optimistic lesson – for other areas of natural computing - is that that nature has prepared for billions of years processes, operations, mechanisms having different goals from those of computer science, but which turned out to be very useful also to computer

science. The challenge is to discover the right processes, operations, mechanisms to abstract and implement them in silico in the right way.

The history making Adleman's experiment mentioned above has the merit of opening (actually, confirming, because speculations about using DNA as a support for computations were made since several decades, while theoretical computer models inspired from the DNA structure and operations were already proposed in the eighties) a completely new research vista: we can not only get inspired from biology for designing better algorithms for electronic computers, but we can also use a biological support (a bio-ware for computing). The objective was no longer to improve the use of standard electronic computers, as it was the goal of neural nets and evolutionary computing, but to have a new computer, based on bio-molecules used in a bio-chemical manner.

Membrane Computing is a part of this general intellectual enterprise, in some sense extending the DNA computing (more generally – Molecular Computing), which starts from the observation that nature has created during billions of years of evolution, a marvellous tiny machinery, with a complex structure, an intricate inner activity and an exquisite relationship with the environment – the living cell. The challenging issue, suggested by this observation, is whether or not the structure and the functioning cell can provide any suggestions to computer science. Membrane computing emerged as an answer to this challenge, proposing a series of models inspired from the cell structure (a compartmentalized space, defined by a hierarchical arrangement of membranes) and functioning as well as the cell organization in tissue.

This field of research (founded in 1998) simply flourished at this level. The "strategic" similarities and differences between membrane computing and the other areas of natural computing are the following:

- these areas start from biological facts and abstract computing models;
- neural nets and evolutionary commuting are already implemented (rather successfully, especially in the care of evolutionary computing) on the usual computer;
- DNA computer has a bigger ambition, that of providing a new hardware, leading to bio-chips, to "wet computers";
- for membrane computing it is not yet clear which direction is the best (the most realistic): trying to get implemented in silico (this started already to be a trend and some successes are already reported) or in vitro (no attempt was made up to now). The following Figure no. 3 illustrates this dilemma, also summarizing the situation of the other branches of natural computing.

Academician Mihai Draganescu (2000) predicted that Conscience is the Science frontier, the Humanity frontier. The Information Systems of Knowledge Based Society as the successor of Information Society were analyzed by Rosca (2006). Guiding marks on Conscience Society's creation in Information Era, definition and characteristics, functions and models, and adaptability's features (Todoroi, Todoroi and Micusa, 2010) as well as motivation of its numerous models, characteristics and functions for creation of Societal Intelligent Adaptable Information Systems in Conscience Society were discussed in Mihalcea, Rosca and Todoroi (2010).
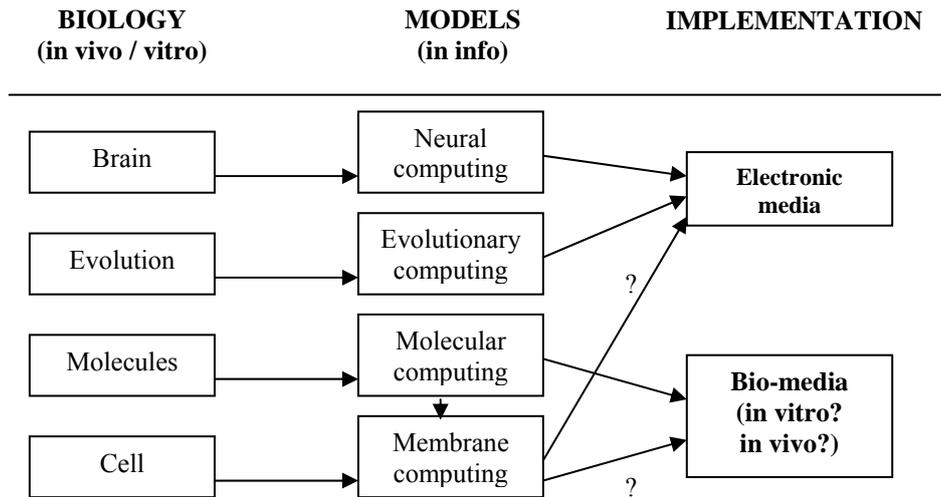
Figure no. 3: The four bio-domains of natural computing

Creativity in Conscience Society

The results presented discuss the evolution of the notion of Creativity (what It Is, why It Is Important, where It Is Used) in Conscience Society, analyze different approaches to achieve Creativity in Conscience Society (Creativity as a Brain Activity; Mastering Daily Life; Creativity and Profession; Piirto's six Steps; When and where Creativity Occurs; How Creative People are looked upon), and also manage Individual and Group Creativity in combination with Company Goals (Individual Creativity; Teams, Creativity and Product Development; Company's Product Development Goals; Entrepreneur's and Small Companies' Product Development).

1. What Is Creativity, why It Is Important, where It Is Used

There are two notions with similar meaning: Creativity and Ideation. Creativity has a more general meaning.

Creativity is man's (in our opinion not only man's Natural Intelligence but also and computer's Artificial Intelligence) capacity to produce insights, new ideas, inventions or artistic objects, which are accepted of being of social, spiritual, esthetic, or technological value (Harré and Lamb, 1986). Creativity is a mental process (Schepers & Peter T. van den Berg, 2007).

There are two parts in this definition:

• The first one considers a very large activity spectrum – starting from having insights and/or having new ideas – up to developing inventions and artistic objects. This opens the creativity door to every one: almost everyone has several new ideas daily. Therefore Creativity - in a larger sense - is a common activity of mankind (Natural Intelligence) and computer-kind (Artificial Intelligence); it belongs to the self Adapting Process to every day's life of natural and artificial intelligence. A given level of minimum creativity is

crucial to survive in the initial period of Conscience Society (Draganescu, 2000; Rosca, 2006; Mihalcea, Rosca and Todoroi, 2010). Jane Piirto said: "Creativity is the process of a life."

• The second part introduces a bottom limit in the very large creativity spectrum from insights to artistic objects: only these ideas, etc. which have intrinsic value – for others - are considered results of a Creative Process. All other, more personal results of a thinking process – necessary for individuals to cope with daily life - do not belong to creativity as this is defined through the quoted definition.

Creative results are normally related to profession results: when we speak about creativity we mean professional creativity (Draganescu, 2000; Rosca, 2006; Mihalcea, Rosca and Todoroi, 2010).

Unlike many phenomena in science, there is no single, authoritative definition of Creativity. It has been studied from the perspectives of behavioral psychology, social psychology, psychometrics, cognitive science, artificial intelligence, philosophy, history, economics, design research, business, and management, among others. Creativity has been attributed variously to divine intervention, cognitive processes, the social environment, personality traits, and chance ("accident", "serendipity"). It has been associated with Genius, Mental Illness and Humor. Some say it is a trait we are born with; others say it can be taught with simple creativity techniques. There is no standardized measurement technique (Todoroi, Todoroi and Micusa, 2010) to determine the creative degree of a person. Although creativity is regarded as a simple phenomenon, it is in fact quite complex.

Ideation is the mind process of forming and relating ideas, typically connected with new product development. The term ideation is often used interchangeably with "brainstorm", though brainstorm typically implies following a more specific group process while ideation is a more general term. Ideation is a concept utilized in the study of new product development, Creativity, Innovation, Design thinking, in concept development, and in marketing research, to describe sessions which are for "Idea-Generation" (Schepers & Peter T. van den Berg, 2007). Because Ideation is also a Creative Process, it could be regarded as a part of Creativity. A boundary between creativity and ideation cannot be defined, but we can consider that the creative processes are going much further and the results are more significant. Both could be considered also as a Psychological State of Mind in which an individual generates alternate scenarios or imagines things in a way that may contradict actual known and accepted reality (Standler, 1998).

The creativity's importance was best underwritten by Dr. Mohamad Mahathir, a former Prime Minister of Malaysia, one of outstanding personalities of the 20th century. He said: "The greatest asset of any nation is the creativity of its people." He championed in his underdeveloped country an unprecedented program - building schools, high schools and universities and offering development programs to open the young people's way to knowledge and to Personal Creativity.

Creativity manifests itself overall in everyday life: in business, in engineering, in medicine, in every intellectual activity. The USA was founded more then two centuries ago by very Creative People, who imagined a democratic government in a time when nobody knew exactly what democracy should be. Today all American companies demonstrate very high creativity in both new products and business practices. This allows them to stay ahead of

international competition. Hundreds of new products offered yearly in international markets testify for the high American and World Creativity.

Example. Actually, one of the most creative American companies is Apple Inc. It is successfully competing with much bigger conglomerates from different industries - for instance with Microsoft in Software industry, with HP in Computer industries, with Motorola in Cell Phone industry – offering new products with an advance of 1-2 years to its competitors. It is regarded as sure that this astonishing result is due to the Creativity of a highly gifted Person, his CEO and founder Steve Jobs: previously, when he wasn't working for Apple, the company was in big trouble. The question is: how is Steve Jobs' Creative Process?

There are some activities where Creativity is not accepted: one of them is Manufacturing Processes. The quality norms of International Standard Organization ask for exactly repeated operations for every manufactured piece: only in this way every piece is identical with the previously manufactured ones and the product quality remains constant for an entire lot. In such cases, no creativity – that means no unapproved process changes - is accepted.

Employees' creativity alone is very valuable asset of every company but it is not enough to ensure company's success: creativity should be directed to serve the company's goals. It should be managed. Because of that the module is about Discovering and Managing Creativity in Product Development.

2. Analyzing Creativity

Creativity manifests itself in all situations of daily life. It is interesting also to analyze Daily Creativity Aspects, which serve only a person and therefore are not considered as belonging to creativity (see above definition): their mechanism could be the same as for more important Discoveries.

2.1 Creativity is a Brain Activity

Creativity is the result of brain activity, but how the brain works, is not known: doing neurological researches on living brain is very difficult because this could be hurt. Researches on animals could be done but their brain activity differs immensely from the activity of a human being's brain.

External observations show that the Brain develops many kinds of Activities; two of them are:

- activities which are ordered by the human will. It allows to the human being to move, to learn and to communicate with other human beings. It is a Conscious Activity. The conscious activities could be improved, trained, developed, and modified.

- activities which are not consciously coordinated: body's growth and evolution, breathing and supplying cells with oxygen, eating and transforming food in energy, birth of a new life and probably…creating new ideas. It is a Subconscious and/or Unconscious Activity (Mihalcea, Rosca and Todoroi, 2010). These activities –

normally - cannot be influenced by the human will. They follow automatically, as if they were coordinated from a good programmed computer. The analogy with the processes of Artificial Intelligence adaptivity (Todoroi, Todoroi and Micusa, 2010) is often used to explain brain functions.

Consciousness (Figure no. 4) is subjective experience, awareness or wakefulness, the executive control system of the mind. It is an umbrella term that may refer to a variety of mental phenomena (Todoroi, Todoroi and Lobanoff, in press). Although humans realize what everyday experiences are, consciousness refuses to be defined, philosophers note: *"Anything that we are aware of at a given moment forms part of our consciousness, making conscious experience at once the most familiar and most mysterious aspect of our lives."*
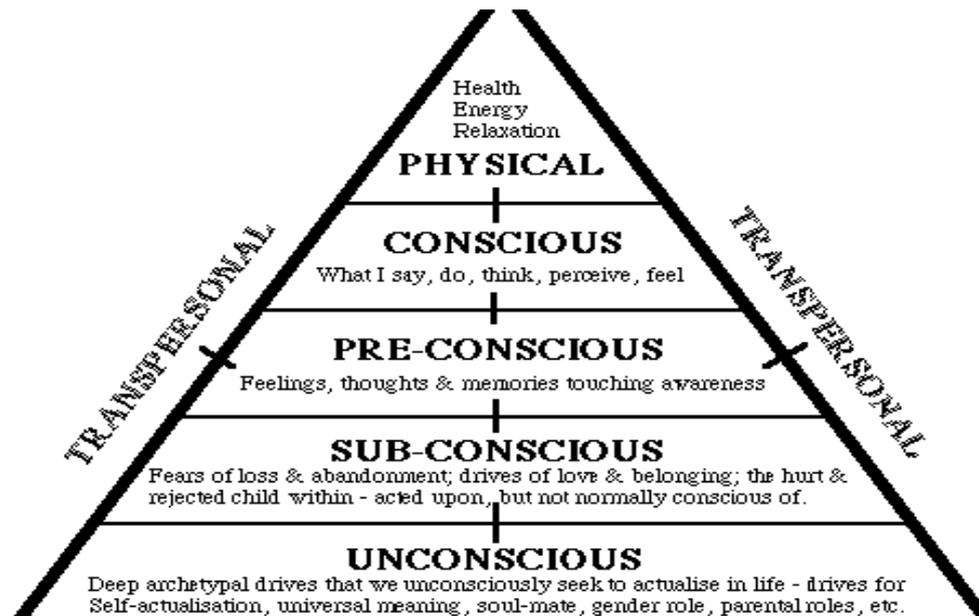

Figure no. 4: Conscience pyramid

Some Asian populations – especially Indians - developed procedures to influence not consciously coordinated body activities. For instance some special trained people could reduce their own heart frequency to values around 10 beats per minute which, from the point of view of scientific medicine, means almost dead: but they survive without damages. They could also reduce the breath frequency to values under one breathing per minute, they could renounce at food many days: they survive. They could "meditate": that means they could eliminate every thought from their brain. All this capabilities show that the "unconscious functions" could be consciously changed. A scientific explanation for this possibility is not available today.

Some possibilities to enhance the personal creativity using procedures which are not cheked by modern science are shown were used intensively and successfully by some managers, secrets agents, and other persons who should keep a very high awareness level over long time under stress conditions.

The brain itself consists of some 100 billion neurons which are interconnected over 100.000 billion synapses. The number of synapses varies with the age and with the kind of intellectual activity: especially hearing regularly classical music contribute to an increase up to 30% of synapses' number (Morgan and Liker, 2006). Information is transmitted from a neuron to the next using chemical an electrical supports (Schepers & Peter T. van den Berg, 2007) every 0.005 seconds. Therefore the brain is the seat of a furious activity which occurs permanently. The advantage is that it allows a quick response to all excitements: a good trained and healthy person need only about 0.1 s to respond to a visual signal. But it has also a disadvantage: it hinders the brain's concentration on a subject. In order to do so, every person needs both special environment conditions and training.

Exercise. Please take a comfortable position in a chair in a dark room, close the eyes, remain quit and silent and concentrate yourself on your thoughts: do not follow any one of them! Let them pass through your brain and remain relaxed. Count the thoughts which you register. Don't follow them! Let them pass. You will find a number between 5 and 25 thoughts every minute. These are only the thoughts registered consciously: it is possible that some hundreds of other thoughts are circulating simultaneously in your brain but they don't came into your conscious. The conclusion could be that a chaos of thoughts reigns in the brain: this is probably his normal functional state. In order to create a new solution it is probably necessary to concentrate the brain activity only on a problem: creativity is the result of concentrate brain activity. All other thoughts should be blend out. Because the creativity process occurs in a particular brain, the result is attributed to an individual also in the case when a team contributed to realize favorable environmental conditions. "Team Creativity" means that such conditions were realized during team activity that one of the team members had a new idea.

2.2 Mastering the Daily Life

Daily personal activities happen following established routines; hence only changes in the environment could require a new solution. Small changes generate a spontaneous reaction: many of "new" situations occurred in the past, so the brain could review quickly one in its own "archive" and choose an already used solution. For instance: a person living alone would not think very long to prepare for breakfast the same what he prepared yesterday: a toast with spread and a coffee with milk and sugar. This solution is available in "archive" and was recently checked.

For a little bit more complicated situations a person would analyze consciously and very quickly some alternatives, in the same way like he did in the past. One can consider the alternatives as belonging to a "list" of preferred solutions, or actions, which is an individual characteristic. For instance: when mother is preparing the breakfast, she would ask the family members if they want to eat bread or cereal, juice or fruit, milk, tea or coffee. To prepare a breakfast is not a big deal, but the idea to use an object list – or an action list, or a parameter list – to define alternatives could be used to find solutions for a lot of much more complicated problems.

We should use the same process to analyze how a family would decide what to do on a Sunday morning. Every family member has his own idea – which is based on past preferences - but everyone would prefer to do something very original, what they didn't do recently.

O.K. But… what? They would read the Sunday's newspaper and would see what is offered. Or they would take the weekly publication "Where to go?" or another catalog to see what the offer is. To use a catalog of actions is a good idea also for more complicated activities: it could help find the best action for the existing problem, choosing this one from the past experience of others. The decision can be taken immediately and is taken consciously.

Solutions for many problems cannot be found immediately. There are too many alternatives, each with its advantages and disadvantages. Very often these cannot be compared each other and a hierarchy of interests cannot be found.

What happens? The decision is postponed. The person starts to do something else trying to buy time…Suddenly, after several hours or after several days, he *feels* that only one of the solutions could be the right one and he decides consciously to choose this. It was only a feeling, not an analytically found. But the person considers that the problem is solved.

O.K… But…Who found the solution, now considered being the right one? It is obvious that the problem was further analyzed in his brain until the best solution was selected. What is strange is that the person was not aware of this process: he was - Consciously - doing something different.

How did this analyze and selection happen? The modern science has no answer to this question: mankind doesn't know how the brain works. Some authors attribute this "Unconscious" brain activity (Todoroi, Todoroi and Lobanoff, in press) to a specific brain region, where also other "unconscious" functions – breathing, body evolution, chemical transformation of food in energy, and many others – may be located and accomplished. Brain researches using MRI do not confirm this hypothesis: every brain function activates more brain regions and those differ slightly from a person to another.

For the purpose of product development we don't need to know exactly how the brain works: we should only keep in mind that very often solutions for complicated problems cannot be found in the moment when we are looking for them. They appear later, very often unexpectedly, suddenly, and very often at night, when everyone sleeps.

2.3 Creativity and Profession

The thinking process of professionals is formed during their study time and completed during their professional practice. The profession specific thinking process influences decisively the creativity but this one is influenced also by other, non professional experiences, accomplishments or interests. Because of so many influences, the creativity of every person has specific characteristics and is unique. There are no two people with Identically Creativity.

Mechanical engineers are using daily notions like: performance, consumption, efficiency, specific weight, cost, optimization, and the like. When they are thinking about Creativity, they would consider all possibilities to improve these parameters. They would look for newest research result, invention or technological development which would help them to reach their goal.

Designers are using daily notions like: shape, color, nuances, comfort, customer feeling, and costs. When they are speaking about Creativity, they would modify some of these

parameters in order to enhance the customer's experience. To find ideas for their work, they would look in periodicals, would visit exposition, and would follow - or create - fashion trends.

Marketers are working with notions like: customer value, competitors' position, strategic positioning, price, and many others alike. For them, Creativity means to find a unique combination of product parameters, product price, and advertising actions which would ensure the highest possible revenue for his company in a specific market.

The Creativity worlds of these three professions couldn't be more different. It couldn't be a more difficult task than to balance them. But the company's success depends of a harmonious collaboration of these specialists and on synchronizing their Creative Efforts.

2.4 The Piirto's Six Steps

Creativity in the work place is connected with a special understanding for the working world, which isn't described sufficiently in the literature and wasn't discussed with young people. Only few of the young professionals know, share, and use it.

The activity in the work place is more than a job, a source of income, to pay living expenses, although many employees think this way. These employees are interested to keep their job, to do what they need to, and to go home as soon as possible: nothing less, nothing more.

But the work place is at the same time a permanent, very intensive, professional training place. If someone is interested and shows this interest to his employers, he would be assigned more and more complex tasks, with more and more responsibility. He would be encouraged to acquire deeper knowledge and experience, first in his own professional field and later in other, related fields. He would be asked to solve problems first related to new aspects of his profession, later to solve personnel management problems, accounting problems, marketing problems, and / or financing problems. The combination of specific techniques from every one of these fields offers the possibility to develop Unlimited Creativity. Successes in accomplishing such tasks bring not only a higher qualification, a higher income but also an important personality change: the personal attitude evolves from curiosity to professionalism. It brings also an incredible, incomparable fun in solving professional tasks.

Jane Piirto describes Six Steps to the Creativity top (Piirto, 2004) as follows:

- (acquire) Knowledge. This is the first step in today's very challenging professional life. But knowledge alone is not sufficient, because it is a static concept. Most knowledge could be found in a library but there it has a static existence: nothing happens!

- (develop) Curiosity. Knowledge become interesting when someone become curios: how can this knowledge be used? Why it is so, and how can it be modified? Curiosity brings life in a package of knowledge. But curiosity is still static; it means only accumulating more knowledge.

- (become) Interested. This means, a person starts to check what and how things can be done, how knowledge can be made useful for himself, for his company, for his country,

or for mankind. The first Creativity attempts are made in this phase. When the first results are obtained, the interest has the chance to transform itself in ...

- Passion. Man works intensively to develop knowledge, to create new devices, machines, or art works. The work brings satisfaction and this feeling makes work more interesting. The interest springs from special knowledge to the work place: man is passionately active and this gives him a sense of self accomplishment. His own Creativity level becomes higher.

- Dedication. Many years of passionate work achieves a blend between the person's own personality, knowledge, and the work field. Man is living to create values in his work place through knowledge. The person identifies himself with his work field and his knowledge. He starts to transfer his knowledge and personal passion to others, he creates a school which disseminates his own concept and knowledge. Creativity becomes permanent.

- Professionalism. This is the highest level of activity: man challenges himself and expects to deliver under every condition the highest quality of thoughts, products, or services. The person becomes a living example of perfection in his profession. His own Creativity is spread among his followers.

2.5 The Piirto's 7i

We already discussed the problem of Creativity differences between people. Jane Piirto identified the following features which characterize highly creative people (the 7i):

- Inspiration. It is defined as "…an infusion into the mind or soul of an exaltation." (Oxford English Dictionary). Inspiration is a result of brain activity and is perceived as a sudden established connection between disjoined facts or ideas, which brings solution to a problem. How it occurs, it is not known today.

- Imagery. "…is the ability to mentally represent imagined or previously perceived objects accurately and vividly".

- Imagination. "…is a mental faculty whereby one can create concepts or representations of objects not immediately present or seen".

- Intuition. It is the capacity to "feel" which one is the most promising solution, although a lot of important information is missing. It brings immense competitive advantages toward others, who are looking for scientifically or in other way defined "best solution". Creative people not only trust their intuition, they prefer to use it.

- Insights. It is "the ability to see and understand clearly the inner nature of things, especially by intuition." (Webster's New World College Dictionary)

- Improvisation. It means the replacement of necessary but not available best instruments, machines, devices, software, etc. through others, which are not so good, not so efficient, not so performing, but which are available. It means reaching results with improper tools. Improvisation itself is a highly Creative Activity.

- Incubation. Incubation is both a personal characteristic and a parameter (incubation time) of work planning. Above, in chapter "Mastering the Daily Life", we discussed about the fact that Creativity cannot offer an immediate solution: it needs time to find one. For easier problems, a time period of some several hours to one day could be sufficient. In order to find solution for more sophisticated problems, weeks, moths, or years are often necessary. "The mind is at rest. The body is at rest. You have gone to something else. The problem is percolating silently through mind and body. This is incubation."

The first six features listed in "7i" cannot be met very often in a given population. Only few people exhibit some of them. Only few exceptional personalities exhibit all features. Training methods are few and their results are not guaranteed but is very interesting to investigate them in the perspective to create The Artificial Conscience based on Piirto's Six Steps to the Creativity top (Table no. 1). That illustrate how seldom creative people can be encountered.

Table no. 1: Piirto's Six Steps to the Creativity top versus Piirto's 7i features which characterize highly creative people.

Creativity top versus Creative feature	Acquire Knowledge	Develop Curiosity	Become Interested	Passion	Dedication	Profes-sionalism
Inspiration						
Imagery						
Imagination						
Intuition						
Insights						
Improvisation						
Incubation						

In the process of creation of Conscience Society it will be very interesting to analyze many of the possibilities to achieve the performance in Natural Intelligence and Artificial Intelligence, and, especially, of Artificial Conscience using the table "Piirto's Six Steps to the Creativity top versus Piirto's 7i features which characterize highly creative people". What have to be introduced in the cells of this Table (for example in the cell: Passion / Incubation)?

2.6 When and where Creativity Occurs

Statistical studies made in Europe (Mihalcea, 2003) about creativity in technical and scientific field show that creative idea appear only seldom in the work place (24%), but much more during free time (76%) (Table no. 2).

That suggests a more complicated structure of the creative process, which could be characterized through the following:

- Most ideas do not appear during the intensive, concentrated, conscious effort to solve the problem. A new idea is "born" later, at a time when the person relaxes. Relaxing eases idea finding.

- A new idea appears after a period of time: an "incubation" time – see Piirto - is required.

- It seems that in the time period from formulating a problem to the time when the solution is found, the brain is further working at the problem, even during the time when the person is not thinking or is not aware of it. It happens in the same way as other brain functions – breathing, digesting the food, growing tissue, etc.: unconsciously and automatically.

Table no. 2: When do creative ideas appear?

New idea appeared during working time	%	New idea appeared during free time	%
Brainstorming and similar activities	1	During meals	3
During breaks	3	During sport activities	4
At work	4	While watching TV	6
During tiring meetings	6	During business trips	11
During boring meetings	10	During holidays	13
Total	**24**	Walking alone	28
		During other activities	11
		Total	**76**

In some works (Standler, 1998) the end of incubation is described as an "intuitive flash of insights" which appears suddenly, very often during the sleep. Following examples are given:

- Ex.1. Friederik A. Kekule found the shape of benzol molecule during sleep. He became awake and recognized that this should be the solution of his problem.

- Ex.2. Albert Einstein had a vision of traveling with light speed when he developed his relativity theory.

- Ex.3. Paul McCartney was dreaming the melody of "Yesterday" during sleep. He woke up and wrote the music down.

2.7 How Creative People are Looked upon

What seems to be sure is the perception that creativity cannot be planed. To be creative takes time, the result cannot be foreseen and it comes unexpectedly. Creativity needs conditions which do not match well with planned activities- used extensively in management. Therefore it is difficult to integrate creative people in a team: they are considered – very often – as arrogant, stubborn, uncompromising, tenacious, and persistent. All these are qualities which allow them to follow their own pathway and to create a new idea, very often against an important resistance and against generally accepted opinions. But these qualities are very different from the qualities which are asked for in a harmonious team. One needs a total team dedication to the final goal in order to integrate and support Creative People. When the Creativity is working, the individuals, the team and the company hit success!

3. Managing Individual Creativity and Company Goals

3.1 Individual Creativity

The creative capacity differs much from a person to another. The causes could be found both in the differences of individual genetic material and in the influence of Education, Training and Experience. The latest three elements could only enhance an existing creative predisposition: the reverse attempt, to develop creative capacity of people without any inclination to it, brings only modest results.

Individual creativity could be enhanced:

- When individual knowledge is increased (#1 from the Piirto's six steps). During graduating, every student accumulates only a minimum of knowledge in different technical, design or marketing fields. The real knowledge volume is much greater and the individual has to continue to accumulate it and to understand the outer edge of human knowledge. Creativity can start only from this edge further. Another increase in knowledge can happen in the professional field related to the individual's activity: looking over the fence, analyzing how other professionals think and act, learning from others, brings a substantial opportunity to enhance individual creativity.

- When the qualities shown in "7i" are improved. Besides permanent and goal directed training, besides creativity related professional activity, hearing classical music could contribute substantially to creativity enhancement: the synapses number in the brain could grow up to 130% (Cempbell, 1997): this has an important effect on the first four qualities shown in "7i". Metal music and other similar music have the opposite effect.

- When professional attitude evolves corresponding to the six Piirto – steps. Dedication and passion help increase harmonically both the time spent for professional activities and the intensity of unconscious activity, which contribute to solving problems.

- When problems outsides the professional field are solved and / or blended.

- When a relaxed attitude in the work place is possible. Because of this, most research and development departments are located in parks, far away from noisy streets or polluting manufacturing units.

- When the mind is free from permanent excitations: background noise or music, TV or radio news reports, and the like.

- When the body is healthy: sports contribute to mind relaxation and increase the creative capability.

Companies promote the creativity enhancement of some people, already recognized as being very creative: the number of creative tasks in a company is limited. Too many creative people could create trouble through their mutual rivalry. The greatest interest in enhancing personal creativity should focus on individuals which exhibit the traits shown before.

The Solution people Inc., a creativity consulting company based in Chicago, considers the following four personal predispositions regarding Creativity (those are also activity types):

- create ideas; these are the creative people;

- investigate needs; these are people who are researching the causes of everything;

- evaluating solutions; these are people who compare solutions, their costs, and their promotion;

- activating plans; these are the managers, the people who achieve the project.

Creativity is needed in all the above activities, but in different levels. Creating new ideas requires a very high level of creativity; evaluating solutions needs a smaller amount of creativity, necessary to accommodate project data to prepared calculating algorithms or software. Therefore to every activity one can find a corresponding amount of creativity.

3.2 Teams, Creativity and Product Development

The ultimate goal of a product development team is to create a new product idea. The main important goal is to achieve the product. Without realizing it, a product idea remains only a representation without any value. Value is created by transforming ideas in products.

In order to do so, people with different predispositions – see before – are needed to work together in a product development team. They have to accomplish different tasks necessary first to formulate and second to realize the documentation for a new idea. Normally, a product development team consists of some, few, very creative people and many others who help fix and analyze many ideas and choose the best one.

On a personal scale, people use skills and knowledge to specialize themselves in different professions; therefore, in a product development team, one could / should involve people with different qualifications – engineers, designers, marketers, production specialists, and many others – who bring in original points of view characteristic to their profession.

In a product development team the required skills change over time because the tasks change also continuously. One can differentiate Five Time Periods - or steps, or tasks – before the product can be sold: everyone is related to a specific activity and everyone needs a special type of creativity. There are:

- Market and technical development evaluation. Only some top engineers, some top marketers, and very few clerks belong permanently or only temporary to team. Their creativity is directed to identify the actual market situation and to formulate visionary ideas regarding customers' possible future needs. The team manager is the person who should coordinate the team activity and should ensure the continuity of concepts until the project ends.

- Formulating the development goal. This is the task of upper management and of team leader. Their creativity must consider both the visionary and the feasibility aspects of the new product idea.

- Developing and designing the product. The team consists of engineers with different specialties: designers, drafters, analysts, testing personnel, technicians, accountants and

clerical support. Marketing specialists, production planning specialists, quality assurance specialists, and others are consulted from time to time. A great amount of detail creativity is necessary to develop product parts and subassemblies, to determine the form, color, packing and advertising of the new product. Every professional group gets involved in specific types of creativity.

- Developing and designing the production facility. Architects, production planers, specialists in manufacturing technologies, personnel department representatives, logistics specialists, quality assurance specialists, representatives of purchasing department and of finance / investment departments - they all collaborate in solving this assignment. Because their task differs substantially, they could be organized in a different team, with another team manager, or in a sub-team, managed by the same project manager; it all depends on the complexity of the production facility, on company organization complexity, and on the team manager's qualification and self assertion. In order to reduce time to market, both teams must work very closely together and could work – more or less - in the same time (simultaneous engineering). Requirements flow normally from product design to production facility design, but very often also the other way: not all product designers ideas could be manufactured economically so that some details of the product should and would be changed. This activity includes also highly creative individual tasks, but again the creativity type is different.

- Developing marketing strategy. Marketers, sales persons, advertising specialists have to accomplish this task. It includes cost calculation and price determination. This sub-team could also start working from the project beginning, but the most important activities and the greatest working volume will be done just before product introduction on the market. Every one of participants develops a specific kind of creativity: this is directed to customer's perception issues.

3.3 Company's Product Development Goals

Every company has two fundamental goals:

- To satisfy customers' requirements in its own activity field;

- To earn dividends for its invested capital.

Every company defines its activity following strategic goals, valid for a long period of time and approved by the board. The main task of product development department is to develop such products which satisfy the fundamental goals within the approved strategy. Therefore, every proposal for a new product is analyzed from this point of view: if and how much it can contribute to reach the fundamental goals. If this is not the case or is not in a sufficient manner, the product development work is not started.

Companies are acting on markets, where customer requirements, technical knowledge, competitors' offer, and many other parameters evolve permanently. In order to be successful – that means in order to sell large quantities of its own products for a good price - the company should develop products which satisfy future customer's needs. The time interval from the first product idea until sales time varies between several months (for apparel) and a decade or more (for airplanes).

Because other companies bring steadily new products on markets, every company is forced to spend substantially and continuously in developing new products. Their quality must be better than the competitors', so that the company can earn enough to finance his activity and to satisfy shareholders' expectations. Successful product development becomes crucial in fulfilling these goals, such that – in between - companies compete less on the markets that through the results of their product development departments; the companies compete with each other through the creativity of their employees. Companies compete with each other also:

- In the personnel market, to attract the best qualified product development people.

- In the training market, ensuring the best training for their employees. The UIC-offer is highly welcome.

- On facility market, ensuring the best working conditions for product development employees.

- Through financing research and development work outsides the company.

Experience shows that employees' intrinsic motivation brings the best results in product development departments. This one could be significantly enhanced when companies create a unique culture of performance using methods analyzed in subchapter Motivation in module "Teams and Team Management in Product Development":

- Highly motivating project goals;

- High and recognized product quality;

- Motivating company vision.

Good results are brought about also by extrinsic motivation like:

- Rewards (money, gifts, awards, medals);

- The power of decision. Especially team managers are highly motivated through it;

- Self fulfillment. It represents the highest possible motivation for many individuals.

3.4 Entrepreneur's and Small Companies' Product Development

The business environment of an entrepreneur or of a small company is totally different from the one of a multinational company. Normally an entrepreneur offers his products on local markets, his competitors are acting also locally and his customers are interested in products - and very often also in services - which satisfy their immediate needs. Both, a professional contact and a competition between entrepreneurs and big companies exist, but this is solved in one of the three following ways:

- The entrepreneur avoids the competition because he sees no chance to compete successfully;

- The entrepreneur collaborates with big companies completing their offer and adapting it to the requirements of local markets;

- The entrepreneur studies the offer on market and develops his own range of products in such market spots, which are too small to be supplied by a big company. Such opportunities are widely available.

Therefore, an entrepreneur understands by "product development" something totally different from a big company. For him, "product development" means to develop an offer:

- Which can be sold in (small) markets where he participates;

- Which can be realized with his own means and specialized knowledge.

Of course this "product development" involves a certain quantity of creativity but – in most cases – an entrepreneur doesn't care about fundamental or applicative research and only in very few cases he realizes a "new product" which did not exist on the market before. In most cases the product existed already, but it is "new" because he never offered it, or because this product was never offered in the local market. Very often the product is only one variant of an existing product adapted to the local requirements. Of course the adaption requires some creativity, but it is a totally different kind of creativity – much smaller – than that necessary for new products. Sometimes it might be a change in color, or shape, or improvement in quality to be considered as the creation of a new product. Market studies, the voice of customers, fundamental research and other methods are replaced in this situation by the entrepreneur's personal contact with the individual customer.

Small companies follow the same path as individual entrepreneurs, but because their market is larger, they have to go further in adapting methods and procedures used by larger companies. Because there is an infinite variation of company's purpose and size, there is a broad diversity in the meaning of product development and how it can be accomplished.

An Idea Festival for small enterprises is organized every year in September in Louisville, Kentucky (Standler, 1998). This year recommendations in pursuing big ideas are:

- Think when you are not thinking, for example, on a run or on a walk;

- Listen to classical music, go to a concert or a play, or sit quietly in a park to daydream;

- Read periodicals you would not typically read: a scientific magazine, for example, if you are more interested in business. Same with books outside your typical genre;

- Surround yourself with creative thinkers;

- Attend a conference outside your field;

- Immerse yourself in a problem; ask questions, investigate possible outcomes;

- Keep an idea journal;

- Take a course to learn a new language or some other skill outside your expertise;

- Be curios and experiment;

- Articulate your idea, seek feedback, put structure on it, harvest it.

In conclusion, some future steps to be considered in the research processes aiming at developing the concept of Creativity in Conscience Society should be: Working Methods in

Creative Activities (What Hinders Creativity? Whatever you think, think the opposite! Creativity of Innocence. Use the Former Experience! Analyzing the Market Structure. Ideation Techniques etc.), the methodology of Artificial Conscience's Creativity evolution (adaptable system, procedures, algorithms, models), and Artificial Creativity creation as Computer Based Information System. These will be future announced and developed.

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