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Interaction – Science and Art: Divergence and Convergence

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Art and science are generally found to be the highest intellectual accomplishments. Creativeness, vision and abstraction are typical for both the artist and the scientist. Both of them are motivated by the desire for knowledge, so that they should belong to the same type.

Many consider that works of "art" (derives from the Latin word "to fit, to put together"), should be appreciated for their intrinsic value or their innovative vision of the world. In the past, art served religion, magnified the power of patrons, and reflected skills aimed at producing elegant objects. Nowadays it is used for self-expression, and even as therapy. When it comes to the word "science" (derives from Latin word for "to know"), most dictionaries offer a description which seems, at first glance, quite obvious. Science is the knowledge of the law of nature. In other words, it embodies all studies which carry a universal meaning and which are pursued by research methods based on objective and verifiable facts. Since science and art come from what are thought to be opposite ends of the spectrum of human understanding, there seems to be an added energy released when they embrace. Whatever the reason, it is temting to conclude that contemporary science and art have found gaps in each other that require filling.

The outcome of both science and art have then recently gained from the seemingly unlikely interaction of paintbrush and test-tube. The uses that arts have for science are possibly easier to identify. Any number of scientific tools has been employed as potentially rich new aesthetic techniques for the visualization of ideas and phenomena. Specific scientific findings have frequently thrown up challenging new ways of thinking about the world and our place in it, ripe for artistic interpretation. Now if some art can benefit from science might the opposite be true too? The world of science can gain in many different ways from the arts, bringing new

perspectives and insights. What science can learn from art is building a more engaged relationship with the public. Art can provide unique, and often unpredictable, viewpoints from which to marvel or decry, inspect or challenge scientific ideas and assumptions – in their words, a rather a different pair of glasses through which to undertand science. Scientists and artists are each trying to make maps of the world, and of our place in it. However, we should bear in mind that for centuries, metaphysics, theology and philosophy prevailed; science, too, was once nurtured by beliefs. Concepts such as "method and objective" have appeared only recently, and to some, science still remains a mystery.

The historical contexts.

Culture, part of which is art and science, is a specific type of human activity. It implies that there are essential similarities between art and science. The differences between the two branches are nevertheless equally implicit. Let us go on exploring the bridges over the differences between the two activities. Creativeness, vision and abstraction, as well as enthusiasm and astonishment, are typical for both the artist and the scientist. According to Plato and Aristotle, man is impelled to thinking by astonishment. "Somebody who asks a question in astonishment is aware of his or her ignorance". He or she starts philosophising to avoid the ignorance." The world "philosophising" could be replaced by the word "researching" in case of the contemporary scholar.

The real world of science and the spiritual sphere of art, predetermine different working processes. The scientists, who endeavour to discover new *laws* and causal nexus that shall gradually result in a universally valid *theory,* are trying to make us understand what is that what we have in common. The artist explores the abstract coherence of the changing action and the period specificities echoed in consciousness. The artistic type of creativity results in a spectrum of *convictions* and *expressions*, that is during the creative process transformed into personal and culturo-historical references and ideas, which may in the course of time *be mutated* in echoing the development of the artist´s personality and the historical changes he or she has experienced.

From the *historical* point of view, science and art had common roots and, regarding the early phase of both disciplines, the same representatives. Before a new way of thinking, later called philosophy, emerged in Greece around 600 BC, it had been various religions that had provided people with answers to the questions which they had been asking. The first Greek philosophers who started to explore natural processes were called "natural philosophers". I will make a reference first to Heracleitos from Efesos (today Turkey), and to three philosophers from Miletus, a Greek colony in Asia Minor. The first of them, Thales held the opinion that water was the basic stuff of the physical universe. He also asserted that the Gods were everywhere; nevertheless these

Gods differed from Homeric Gods. Anaximandros thought that our world was one of many worlds which had emerged from the “the indeterminate” or “the infinite”. Xenofanos was well-known thanks to the statement that the basic stuff was air or mist. These men endeavoured to understand natural processes by examining them. They differed crucially from the previous association of lightning, thunder, and the seasons with the events happened in the kingdom of gods. Thanks to it natural philosophers freed themselves of religion that explained similar phenomena as a manifestation of the gods´ grace or disgrace. Taking the first steps towards the *scientific* type of thinking they initiated the development of natural sciences.

Due to the conquests of Alexander the Great, Egypt and the Orient as far as to India were connected with Greek civilisation. This era is called Hellenism. Philosophy was oriented towards the salvation and the consolation of the human soul. It endeavoured to answer the questions of what life and death were like. It was ethics that was brought into prominence. The gradual departure of philosophy from science was echoed also geographically: Athens stayed the centre of philosophy, the cradle of the Platonic and Aristotelian Schools; But a new centre of science emerged in Alexandria; a city with a famous library where mathematics, astronomy, biology and medicine flourished.

Leonardo da Vinci, painter and draftsman of the High Renaissance, is best known as an artist whose works were informed by scientific investigation. Leonardo observed the world closely, studying physiology and anatomy in order to create convincing images of the human form. He believed that the moral and ethical meanings of his narrative paintings would emerge only through the accurate representation of human gesture and expression. For this Christian artist, science and art were different paths that led to the same destination—a higher spiritual truth. His *Sketch of Uterus with Foetus* (1511–1513) is one of several thousand drawings he produced in his lifetime in which artistic and scientific investigation are bound together. These extraordinary drawings are revered as examples of the Renaissance concept of the integration of all disciplines of Science and Art. ”Science and art naturally overlap. Both are a means of investigation. Both involve ideas, theories, and hypotheses that are tested in places where mind and hand come together—the laboratory and studio. Artists, like scientists, study—materials, people, culture, history, religion, mythology— and learn to transform information into something else. In ancient Greece, the word for art was *techne*, from which *technique* and *technology* are derived—terms that are applied to both scientific and artistic practices.

The Astronomer (1668) by Dutch painter Johannes Vermeer is another example of the profound connection between science and art. The people of 17th-century The Netherlands had an exploratory spirit. Equally interested in this world and the larger universe, the familiar and the exotic, they were intent on looking and

investigating. It was here in the early 17th century that the microscope and telescope were first developed. Vermeer's painting celebrates an astronomer. Yet it equally celebrates the work of artists and the materials of this world. The painting hanging on the back wall was created by a local artist; the Middle Eastern carpet on the table was crafted by a foreign artist; Vermeer's own paints (ground mineral pigments mixed with linseed oil) and brushes were produced by local artisans. The globe at which the astronomer gazes, is evidence of the link between science and art; most pointedly, for it demonstrates this astronomer's—and his culture's—combined interest in finely crafted objects and scientific systems, such as cartography and astronomy.

In the late-19th and early-20th centuries, the physiological, psychological, and phenomenal effects of color and light were of primary concern to Impressionist and Post-Impressionist artists such as Edgar Degas (1834–1917), Vincent van Gogh (1853–1890), Auguste Renoir (1841–1919), Paul Gauguin (1843–1903), and Claude Monet (1840–1926). Considered by many to be the greatest nature painter in modern-art history, Monet suggested that our sense of our physical environment changes continuously with our shifting perceptions of light and color. In *On the Bank of the Seine, Bennecourt* (1868), a painting of his wife-to-be, Monet captures a fleeting "impression" of the landscape through loose brushwork and composition. His impression is pre-cognitive—before the mind labels, identifies, and converts what it sees into memory. Tellingly, the woman in the painting looks not at the house and trees across the river, but down at their wavering, upside-down reflections in the river, a perspective that echoes the process of perception itself. Images in the form of light enter the eye, an orb with a nerve-sensitive background. As light penetrates, it is inverted and projected onto the back of that light-sensitive orb, where the brain processes the information. Monet's painting captures the vibration between impression and perception—the contingent moment. It conveys a sense of trembling as the light and color of the landscape shift as time passes.

A number of years after Monet's *Bennecourt*, Georges Seurat began painting *A Sunday on La Grande Jatte—1884* (1884–1886). As an art student at the Academy of Fine Arts in Paris, he studied the physics of color, and this enormous painting is an exercise in color theory. Unlike Renaissance and Dutch artists, Seurat and Monet did not mix their own paint. They benefited from breakthroughs by French chemists in the early 19th century who had invented both premixed paints packaged in tubes and synthetic pigments, such as ultramarine blue, which previously had been made from ground lapis lazuli and was, therefore, the most expensive pigment. Neither Seurat nor Monet, with little money in their pockets, could have created their blue-filled, experimental works without the scientific breakthroughs earlier that century. Using these new paints, Seurat invented a technique called Pointillism to investigate how adjacent colors blend when taken in by the eye. Up close, the

surface of his painting contains thousands of painted dots and dashes, discrete areas of color. But Seurat placed these dots of complementary colors next to each other—purple and yellow, orange and blue, green and red—so that at a distance they interact to create vibrant blended colors and larger, whole forms. Carrying his scientific approach tools color theory to the edges of the image, Seurat represented the range of the visible spectrum in the painting's border which is dominated by red and blue.

Pablo Picasso's (1881–1973) portrait of art dealer *Daniel-Henry Kahnweiler* (1910) combines Monet's ideas about the contingency of time and Seurat's theory about the perception of discrete elements. Here, Picasso breaks up the figure and objects in his composition in the style known as Cubism. Instead of rendering his subjects as distinctly recognizable forms, he paints them from several points of view. Kahnweiler's head, suit, fob watch, and hands, as well as the still life to the left and the decorated wall behind, remain identifiable, but these elements have been broken up into flattened planes and rearranged across the picture surface. Painted just a few years after Albert Einstein put forth his theory of relativity, which asserts the contingent nature of observing reality, Picasso's work similarly illustrates the elusive presence of his subject—Mr. Kahnweiler. Picasso's Cubist painting style, like studying Einstein's scientific theory, requires careful analysis, but it rewards the viewer's effort with perception and understanding.

The invention of photography in the middle of the 19th century was a technological wonder—artistically and scientifically. The practice of oxidizing and fixing images on light-sensitive paper or a metal plate posed a great challenge to painters, who had historically been charged with the task of providing their culture with images of itself and the world around them. People believed this new medium could represent the world accurately and more quickly. Ansel Adams (1902–1984) one of the most extraordinary photographers of the North American landscape, used his camera to capture the spirit and beauty of the American West. His majestic vistas of mountains and rivers, such as *The Tetons and the Snake River, Grand Teton National Park, Wyoming* (1942), embraced the bond between man and nature while recording with astonishing technical accuracy the phenomenal effects of light and atmosphere.

Today, light-and-space artist James Turrell seeks to link the terrestrial and celestial realms in his work at Roden Crater, a natural cinder volcano situated on the southwestern edge of the Painted Desert in northern Arizona. Since 1972, Turrell has been transforming the crater into a large-scale artwork by subtly manipulating and reshaping its form. Like Renaissance artist Leonardo da Vinci did, Turrell uses his knowledge of engineering, and, like Seurat and Monet, he employs his knowledge of the effects of light and space. When Turrell completes

his gigantic project, visitors standing in the middle of the crater on the reflective material with which the artist has lined it will feel suspended between the sky and earth.

There has long been a connection between art and science, one that can be traced back to the Egyptian pyramids. History proves that the two disciplines cannot exist without each other, enduring in constantly changing and evolving relationships.

The impact of the separation of art from science, that resulted in the creation of the two parallel worlds of art and science, has been sensible up to the present. British scholar, writer and celebrity C. P. Snow identified the existence of "men of letters" in the book entitled "The Two Cultures". The absence of the mutual intermingling of the two world results in mutual misunderstanding. Recently artists and philosophers have denounced science and scientists as the originator of the tragedies of the world. "The belief in the objectivity of scientists-experts is a generally accepted superstition of the epoch of science and technology. It was the mother of all extremes, the only reason why the 20th century was the century of totalitarianism, wrote philosopher Václav Bělohradský. He went on: "If 'objective facts' are speaking all protesting voices shall be silent. In another case they will be labelled mad or extremist." The philosopher was oblivious of the role which art and philosophy played in totalitarianism (for example fascist poets), and the abuse of art for fostering particular and / or corporate interests in social and political spheres. Political power is able to mauld these disciplines into obedient puppets in service of particular ideologies.

If intellectuals, especially men of letters and philosophers, are not be able to understand the emerging "science culture" they will be hardly able to understand the current technological revolution. They may go to the extent of tilting at windmills, similarly to the *Luddites*, who destroyed machines in England in the early era of industrial revolution.

This doubling raises suspicion regarding the two different fields of thinking such as art and science. Doubly-gifted men and women are found strange, incompatible transplants by the members of both communities, labelled often as "the best painter of all physicists" or "the best physicists of all painters" - these euphemisms describe someone who is familiar with neither art nor science. Regardless of the fact that literature is also an artistic discipline, it is noteworthy that writers usually accept this type of such endowed persons. Visual artists are particularly jealous of their exceptionality. They are unable to admit that the ability to express something through "non-conceptual language", (as corresponds to the definition of art by Rudolf Fila), could be cultivated outside the sphere of art school. Fila hold the opinion that the antagonism between the artistic and scientific types of thinking is cardinal. He evidences his thesis by an example of the role of intuition thanks to which a

scientific discovery could be similar to an experience of art. It is the role of the subconscious that makes the difference: while the subconscious turns undesirable in the case of science, it embodies the materialized irrationality in the case of art. This understanding of the difference between art and science results often in the artist's self-importance, a "self-identification with a creator, endowed with a great exceptionality and uniqueness". This is the cause of the empty vessel of the bohemian that is found so disgusting by the sober scientist.

The gradual convergence of art and science will result in the asking of non-traditional questions which will naturally bring about non-traditional answers and the discovery of new horizons. This type of relationship between art and science, resulting in creativity, has its importance also in the field of natural sciences as a phenomenon that emerges in periodical cycles in mediating incidentally the information about moral values.

There are few examples of the evolution of art and / or the understanding of art. The sphere of art has also been influenced by evolutionary processes. It is valid to say the evolution of art has has not resulted from the nature of art. It has been mediated by the artist echoing the metamorphoses of the artist's memetic portfolio. What is meme? It is the basic component of the human mind structure. Its importance corresponds to the generally accepted role of gene regarding the biological forms. Corresponding to the evolution of new forms of life starting with the gradual transformation of genetic portfolio caused by mutation, the evolution of culture (including art) is based on replacing the old memes by new ideas and thoughts. The fact that they are disseminated among posterity does not result from the "good" nature of these ideas. It results from the fact that the "good memes" such as safety, food and reproduction have been included within them. It influences the evolution of human behaviour, forcing people to respect them. (Naturally, it does not eliminate the importance of free will). In the early history of humankind - Homo Sapiens - the human consciousness was focused on survival and reproduction. The character of knowledge was simple and purposeful: the knowledge of the field, the knowledge of the season, the way of hunting etc. The originally unspecified, universal knowledge gradually became specialized, due to the emotional influences and the evolutional selection, corresponding to the metamorphosis by man. It was

a memetic revolution. Memes influenced cardinally the selective forces which had an impact on the genetic portfolio of preferring the group of genes that were able also to satisfy the aesthetic libido (for example the ideal of beauty). French anthropologist Levi-Strauss formulated a thesis about the birth of human thinking. According to Levi-Strauss the use of language resulted in the transformation of the natural being into the cultural breed of men. Human culture emerged, i. e. the state of mind enabling the dissemination of information vertically (from

the parents to the offspring) as well as horizontally (among non-relative individuals). Creativeness, associated with satisfying needs other than simple survival, emerged from the depth of the awakening consciousness. *Homo habilis* started to experience emotions, so he created art to satisfy them. Successful art was based on a combination of many elements regarding the human instinctive experience of values that contributed to the satisfaction of emotional needs.

Contemporary society is so complex that the simple, practical type of knowledge, which was purposeful in the stone-age, is not able to compete with the new memes. It is expected that further developments in cognitive abilities will evidence that the evolution of human consciousness and culture has been formed by particular memes capable of leading men to perfection. The empirical evidences differ from this thesis. Concerning tests, students' results have worsened. It is evident that the identical memes have been being disseminated globally thanks to the inventions of writing, letter-print, communication nets and information technology, which has resulted in the planet turning into a global village. "The globalization of thoughts" has been evidenced by the identical moral standards, norms of behaviour, ethics, fashion, and the desire for a free society. The systems, which are not strictly rigid, i. e. are able to reconsider their memes and / or tolerate the coexistence of various memes (science, democracy and liberalism), have a better chance of survival. An increasing number of people like to overcome the limits of established concepts. The aesthetics have been confronted with new images. The sources of inspiration have been searched in the nontraditional spheres of the mind; the mystery of science is a thought-provoking, seething source of new stimuli. It is like integrating the two spheres - science and art - that were splintered hundreds of years ago. The questions are: Do different artistic forms express identical emotions? Are the emotions being changed in correlation to the development of culture, so that the artistic form echoes the spirit of a particular period?

The Venetian Biennial evidenced the leading role of science, followed by art. Which of the classical media of painting, printmaking and drawing have remained in force? None of them! The theorists have been challenged to redefine art. How should one classify the items which were on show in the Venetian Biennial? Of course, they must be called art: Conceptual, post-Modern, Theatrical, Visualization and Utopia , nevertheless it hardly could be described as fine art. All of the aforementioned types of art represent more or less mastered shaping ideas through technical means. Creativeness has been limited by the technical skill of the creator.

Problems, which are more important than technical mastery, concern the idea, inspiration, message. Only a few of the displayed works evoked the feeling of beauty. The majority of items on display represented the desperate cries of disgust, hopelessness and fear. Why? Who is decadent? Art? The world? Artists? The Viewer?

Why do artists try to get the audience involved in the cheerless states of their minds? Why do they disturb the viewer by the sour atmosphere of purposeless philosophizing, and idle ambitions of being the leaders of nations. What are the sources of their elixirs of life like? Do they still live within the real world? Have they lost the ability to understand it due to its dynamic transformation? Do they mediate their depression, caused by the frustration resulting from their incapacity for understanding the world, the public ? Who is the dictator? The viewer? Do artists transmit their disorientation to the audience, making the viewer co-responsible for their false view of the world?

In contrast to the theory of art, the aesthetics deal with categories of beauty, attractiveness and ugliness within complex contexts, including non-artistic issues such as the behaviour of animals, particularly associated with the sexual affinity (the law of the preservation of species is one of the dominant natural laws). The aesthetic norms, used from the animal kingdom to beauty contests, differ from the aesthetic standards of men, so that they are hardly identifiable. The majority of conclusions are empirical, based on observations in the open air. In the mating season male birds get their proper coat and / or try to woo female birds with beautiful songs. Due to our experiences we are able to imagine the feelings of a young female bird listening to the grooms' warbling but we are hardly able to imagine her criteria concerning the selection of future father, the donor of sparrow's genes. And what about fathers? British and Swedish scientists discovered that the role of fathers is not as passive as we have come to expect. They studied the quality of the ejaculation on cocks according to the following criteria: (1) The frequent mating with promiscuous hens. (2) mating with a new hen for the first time. (3) mating with a hen with nice "sexy" ornaments, signalizing dominant maternal standing. The scientists discovered an increase in ejaculation from 1 to 3! The category of beauty served both as the aesthetic criterion as the biological criterion regarding the quality of offspring.

The philosophy of aesthetics could be applied to both the artificial (artistic) objects and the natural structures and forms. In accordance to the Kant's statement the perception of beauty is subjective. It depends on one's taste and is always associated with feelings of pleasure and delight. According to George Santayane, beauty can be found equal to pleasure. No surprise that many people can derive the aesthetic pleasures from the harmony of nature. Geologist Václav Cílek meditates about the male and female elements of landscape. He speaks about human characters influenced by the Earth. A German molecular biologist Andreas Ruppel explored the concept of natural beauty. He arrived at a conclusion that the link connecting biological function with beauty, echoed in the mysteries of the evolution of biological systems. He compares the *metamern* order of particular organs, such as the articulated body of the centipede and the earthworm, and the human ribs and vertebrae, to the rhythm of

music and rhymes of a poem. He derives the rhythm from the heartbeat. The emotions of verses have been formed by the rhythm of the words. The veneration for the metamorphosis of dropping into the beautiful bug scarab by the ancient Egyptians, and the veneration for the mystic metamorphosis of the malodorous swamp into the beautiful lotus in bloom by the Buddhists, endows beauty with a spiritual dimension.

Categories such as aesthetics, beauty, harmony and art are hardly ever associated with science. The rational, analytic and emotionless nature of science is often found contrasting with the subjective, sensual, emotional and unique nature of art. This strictly antagonistic understanding of art and science, representing the common opinion, has resulted from insufficient information about the world of science, scholars, and particularly the function of emotions regarding the selection of scientific discipline and the process of research. According to the common opinion a scholar is an uncommunicative, who is almost antisocial and absolutely unsocialized. Jacobus H. van't Hoff, the first Nobel Prize-winner for chemistry (1901), said in his speech delivered on the occasion of the Nobel award that great scientific discoveries were unthinkable without the scientist's great imagination. He gave an example of the outstanding chemist Sir Humprey Davy, who was a poet and visionary. Physical chemist Wilhelm Ostwald, the Nobel Prize-winner for chemistry in 1909, was a zealous amateur painter. His research in the field of theory of colours resulted in his collaboration with the Bauhaus School in Weimar (1920). Paul Klee and Wassily Kandinsky were teaching there. Ostwald's theory of colours influenced Kandinsky, who believed that the specific selection of colours could intentionally touch the right chord of human emotions similarly to the strings of a piano. According to Suzanne Anker, the New York based artist and co-author of the book *"The molecular gaze. Art in genetic age" (2003),* Kandinsky's artistic style was also influenced by the discovery of atomic fission and the endeavour to visualize this discovery. Duchamp, Picabia and Kupka were influenced by the invisible world that emerged after the discovery of X-rays. Russian Avant-Garde artist Pavel Filonov propagated a scientific, analytical, intuitive type of naturalism. He suggested to analyze the purpose of the whole object, the real substance of the whole world based on the processes observable and unobservable with the naked eye. Thanks to the shift of the genesis of thinking a new source of artistic inspiration emerged from the invisible world of scientific and technological inventions.

Regarding Czech chemists, Emil Votoček is a paragon. He was the leading Czechoslovak chemist in the mid-war era. He contributed to university textbooks, musical compositions and an encyclopaedia of music. Great ideas emerge during the quick, spontaneous gleam of spirituality. It is like poetry illuminating the scientist's mind in revealing the truth without warning. Everybody, who experienced the beauty of science and research, is aware of the role of illumination in the birth of a great scientific idea. Henri Poincaré (1854) , who inspired both Albert

Einstein and Pablo Picasso, declared that all discoveries, including the scientific inventions, had to exceed the limits of pure logic. He found logic a „sterile science“, useful in recognizing the correct way, nevertheless inapplicable in showing the way to unknown spheres of knowledge. The artificial barriers between cogency and enthusiasm, appreciation and sensitivity, and the senses and intuition have a detrimental influence on scholars. The suppression of passion for science, sensibility and intuition from the scholar's daily activities does not make science. It is the elimination of the subjective, emotional stimuli from the origins and conclusions of scientific discoveries that is fundamental. "The concentrated mind and blurred feelings". Is it really true that science mortifies the sense of aesthetics, artistic sensitivity and creativity, and the intellectual and spiritual potentialities? Does science impair human abilities of profound experiences and sensibility? Here are examples:
Roald Hoffmann, born in 1937 in Zloczow, Poland, Nobel Prize winner in Chemistry (shared with Kenichi Fukui), writes essays and poems. Two of his poetry collections, "*The Metamict State*" (1987) and "*Gaps and Verges"* (1990), have been published by the University Presses of Florida. In 1993 the Smithsonian Institution Press published "*Chemistry Imagined*". A unique art/science/literature collaboration of Roald Hoffmann with artist Vivian Torrence, "Chemistry Imagined" reveals the creative and humanistic sparks of molecular science. Miroslav Holub, poet and physician, brought new themes into Czech poetry, those of people working in research laboratories (he knew this environment from his own personal experience). The doctors, the researchers and other main characters of these poems are non-heroic, selfless and mostly anonymous enthusiasts, who move humankind forward. Become acquainted with the painting of pathologist Jiři Špacek from the Fingerland Institute of Pathology in Hradec Králové, read philosophical books about science written by mathematician Petr Vopěnka, and with the work of geneticist Vladimír Vondrejs, who contributed by engaging "pictures made of water" and spatial constructions of tensegrity to be assured about the contrary conclusions.

The perfect shapes in nature have attracted the attention of people from time immemorial. Why does a tree have a spacious top? Why are its roots divergent? It is because the tree needs to obtain the maximum nutritive matter from the earth and simultaneously expose its body to the sunshine as much as possible. The flow of nutritive matter in a tree is influenced by friction and gravity, similar to the circulation of blood in the human body. The ramifications are typical of wood, vascular system and human lungs. The latter is comparable to the ramiform shape of coral – the maximum volume is crucial for both a coral and human lungs, evidencing the highly professional constructive potentialities of nature. This opinion was expressed by American scientist Adrian Bejan in his book *Shape and Structure. From Technology to Nature.* Bejan used the term *constructal theory.* It represents a scientific and philosophical attitude thanks to which people are able to approach new

biological and lifeless forms of nature. Where did the shapes in nature originate from? Scientists, artists and philosophers keep asking this question.

Robert Root-Bernstein, the physiologist from the Michigan University (2003), expressed in his essay entitled *"Esthetics as a motivation for research"* an opinion that, concerning the Nobel Prize-winners for chemistry, the strong aesthetically emotional relation between the scientist and the field of his research was evident. He paralleled the truths of natural sciences with the refinements of art. The understanding of the scientific truth is as simple as perceiving the beauty. The genius of Newton, Shakespeare, Michelangelo and Händel were basically similar. The taste and refinement, which are so important regarding the research in the fields of natural sciences, are simply other expressions of knowledge; the love for nature is a passion similar to the love for the perfection of an artwork. The article by James Watson and Francis Crick describing the structure of deoxyribonucleic acid (DNA), published in the British journal Nature on April 20, 1953, was accompanied by a simple drawing by Odile Crick, Francis Crick's wife. The Crics were so enchanted by "their" molecule that they said that it was so beautiful that it had to exist. The double helix of DNA turned the icon of modern science. Serving as the visual and verbal types of inspiration for novels, films and computer games it turned a trendy cultural phenomenon. Salvator Dali was the first artists who used it (see the catalogue accompanying the Dali exhibition held at Egon Schiele Centre from 23. 11. 2003 to 14. 9. 2003, p. 114). Since Dali's times DNA has been the subject of many artworks. Brazilian artist Eduardo Kac transliterated biblical sentences first with the Morse code, than with the DNA code transmitting it to the genetic portfolio of a bacteria. Some artists, biologists and computer scientists endeavoured to set DNA to music, declaring the newly generated music to represent the "voice of the 21st century". The aforementioned artist Suzanne Anker approached the theme of DNA as "the genetic imagination". Her paintings have echoed the artist's searching for beauty coded in genes and biological structures. Oscar Wilde pointed out the artist's role in creating beautiful things. He found the purpose of artmaking in revealing art and veiling the artist.

Within the contexts of Oriental cultures products of nature are not distinguished from artifacts. The explanation for this fact is simple: the concept of statutory difference is unknown in Oriental cultures. The Occidental type of thinking takes for granted that a thing can have fundamentally different statutes, for example the "denoting" and the "denoted". In contrast to it the cognizance of unity and universal continuity is typical of Oriental cultures. From the Oriental point of view the "denoting" is a concentrated form of the "denoted" within the continuum. If we keep pulling at an end of a rope we can expect that something from the other end will fall down on our heads soon. We could be crushed under it.

Art and literature are searching and concerning cardinally for and gaining freedom. Thanks to it, difficult traumas, scandals of instincts and desires, passions, encounters with death, and elements of chaos have been integrated in the articulated world of forms. The continuity of culture, civilization, history and psychology have resulted in a state of lawfulness which is the background for order, and the cosmos, and therefore the awful dread of being hurled down the abyss by the forces of the hurting edges of traumas and the never-ending questions have been weakened.

The idea of a loose interpretation of art and aesthetics emerges thanks to the social processes of liberalization and democratization. This idea is absolutely unthinkable within the contexts of dictatorial and /or fundamentalist régimes that keep controlling and correcting the deviations from the strictly defined categories of arts and aesthetics.

The searching for the new aesthetic stimuli and experience beyond the traditional bounds will neither inflict damage upon us nor deprive us of something desirable. We could only be enriched by it. Since its origins science has stimulated art. On the other hand, art has influenced thinking applicable to science.

The last words.

The oldest human documents go back a few thousand years, originally written in pictures. Alphabets seem to have been invented about 35 centuries ago in the Middle East, and they've changed and spawned numerous varieties of alphabet since then. We are performing based on the instruction of 64 basic DNA words that arose at least 35 million centuries ago. Since that time, it hasn't changed one jot. Not just the alphabet, the dictionary of 64 basic words and their meanings is the same in modern bacteria and in us. Yet the common ancestor from whom we both inherited this precise and accurate dictionary lived at least 35 million centuries ago.

What has changed is the long programs that natural selection has written using those 64 basic words. The messages that have come down to us are the ones that have survived millions, and in some cases hundreds of millions, of generations. For every successful message that has reached the present, countless failures have fallen away like the chippings on a sculptor's floor. Our DNA has proved itself successful, because it is here. Geological time has carved and sculpted our DNA to survive down to the present.

The DNA in you is a coded description of ancient worlds in which your ancestors lived. DNA is the wisdom of the old days, and I mean very old days indeed. There are perhaps 30 million distinct species in the world today. So, there are 30 million distinct ways of making a living, ways of working to pass DNA on to the future. All

these different ways of making a living are just different tactics for passing on DNA. The differences are in the details.