

“Butterfly Wings of Pythagoras”

Joanna Hoffmann /text published in “Towards Third Culture”, CCA Laznia Gdansk, 2011/

One can say that reality is “everything”. No one possesses full access to it, yet each one of us has a feeling that he or she is allowed to approach one piece of it, predestined for that person exclusively. In this striving, we do not limit ourselves to a compact point of space-time continuum bending around us, but escape in mind and imagination towards horizons of past and future events. Looking through micro- and telescopes, or listening to radio noises, we believe to find “there” the missing piece of ourselves. Is there, really, anything existing “beyond” us, which could become our experience?

Millenium Simulation is the most ambitious ambitious endeavour to visualize the Universe. Developed by Virgo Consortium, it includes more than 10 billion points, each representing a group of galaxies. The scale is so enormous that it is impossible to spot our Milky Way there. If we put this impressive model next to a map of neural connections in human brain, we will be amazed by the striking resemblance of the two extremely complex systems.

Does this resemblance result from the kind of visualization and data rendering tools applied? Or is there more that connects than divides the macro- and microstructures of the Universe?

Pythagoras was first to take up the challenge of connecting human internal world with the cosmos. His *Harmonia Mundi*, including *Musicae Mundanae* (later known as the Music of the Spheres) and *Musicae Humanae* (music of the human body), was based on number and proportion. For him, a triangle drawn in sand, one marked by three distant stars, or a musical interval of a third was one and the same: it expressed the Logos – the invisible order of the world. Pythagoras’ mathematical-musical system combined philosophy, science and art, establishing directions of their development. This common model would later split and today, in spite of our endeavours, we still do not know how to unify single sounds and phrases of our cognition into an integrating whole: into an awareness which would be able to contain the abundance and diversity of reality as experienced by us.

Entering the field of interrelations between science and art, I return to the very roots of the marriage, posing the question of topicality of Pythagorean ideas in our times. I started my research with a series of multimedia works addressing musical relations in micro- and macroworlds. I employed the musical score of the *Music of the Spheres* by father of

contemporary astronomy, Johannes Kepler, as well as data acquired by radio telescopes and other devices used in contemporary space exploration. I combined this material with microsounds emitted by blood circulation and brain waves, discovering fascinating fractal structures whose resonance and harmonics reverberate in all octaves accessible to us. Not quite unexpectedly: for Pythagoras, the statement that the cosmos is music was *not* a metaphor but an answer to the search for *arche* – the principle of the Universe.

The series is concluded with the installation *Tones and Whispers*, presented at Science Museum's Dana Centre in London in 2005, as well as other venues. A visit at the Institute of Neuroscience of the University of London proved necessary while realizing the work; it is where the perception of sound is researched upon. I had my brain fMRI-ed, or scanned through a magnetic resonance machine while I was listening to Kepler's composition performed by Barbara Buchholz on theremin – an instrument whose source of sound are radio waves.

As a result, I have come up with an installation of three video films. In the first one, you can see rotating celestial bodies – Mercury, Venus, Earth, Moon, Mars, Jupiter and Saturn – included in Johannes Kepler's musical score. They are encircled by spheres relating to respective melodies, and animated by the musician's hands. In the second film, they rotate in a landscape composed of images of the interior of human brain and of remote galaxies. The third film presents my 3D-scanned head located in the centre of the system and thus replacing the Sun – the central position being the perspective assumed in the *Music of the Spheres*. Today we are aware that the Solar System is not the centre of the Universe; on the contrary – we revolve on our little planet around one out of millions of stars on the fringe of our galaxy, being one out of millions of galaxies rushing through space, or, to be precise, along with the space. Where do we find a point of reference, then? One of the answers could be: in our brain, whose function is the mind – the centre of individual feeling and perception of the world, and the source of all imagery and ideas concerning the Universe. Another answer could be abandoning the centre-oriented thinking and considering human brain-mind as a cognitive, evolving, participating and assessing system functioning within the space-time context and defined by the synergy of the information coming from the inside and outside of the system. Such approach, suggested by Tamar Levin¹, incorporates individual nervous system not only into biologic, genetic, historic and cultural experience, but, too, into the energy and information space of the cosmos. From this perspective, human consciousness is seen as a

¹ Tamar Levin: "Holographic trans-disciplinary framework of consciousness: An integrative perspective." In: *Toward a Science of Consciousness*, a conference. Stockholm 2011.

tiny fractal piece of a greater, undivided whole, hidden somewhere in pulsating nooks of the universe.

The creativeness of the matter gives birth to the intelligence of life.

Johannes Kepler believed that the Music of the Universe reverberated only once, in the very moment of Creation, filling the space with eternal resonance of cosmic polyphony. Relatively recently (3.7 billion years ago), it was joined by the melody written in the score of the ACGT code, shared by all life on the Earth such as we know it.

The discovery of the DNA particle and the decoding of the human genome shed new light on fundamental human questions: Where do we come from? Who are we? Where are we heading? Also, the very meaning of the word “life” has altered.

Aristotle’s definition of life, based on the notion of a living organism, which laid a fundament for European humanism, does not apply anymore. Life namely develops on the molecular level. As a matter of fact, only the DNA is “alive”; while the rest of the organism makes but for a part of the environment of the replicating gene, exceeding it in size. The function of the genes is to contain information about the habitat and to preserve and transmit the data. Consequently, we can assume that information is the matter of life. On the biological level, it is encoded in the genes, while on the psychological, or cultural level – in the so-called memes.

During the last 100 years our knowledge about the world and ourselves extremely widened. Today, we know that we consist of the same components as the rest of the Universe. There is an optimism in the fact that on the atomic level, we are practically immortal – included in the cosmic recycling system. Confusion arises, though, when we are reminded that no inherent feature of the replicating gene has been found which would anyhow differ from the non-living matter. Life turns out to be extremely contextual.

There is either no proof that our own lives are special in the evolution of life, or that our position is anyhow privileged in the process.

The title of art project *Life Matters* completed during a residency at the International Centre for Genetic Engineering and Biotechnology ICGEB in New Delhi, India, relates to the double meaning of the English word “matter”, standing both for ‘material’ and ‘importance’. In this work, I have employed results of lab research on malaria, SARS and AIDS.

The question about harmony has gained a new dimension. The genetic unity of living matter makes us aware of the biologic oneness of life. The harmony of nature does not favour its components, though, covering ruthless war the genes have to wage in order to survive. Considering the ease with which our own cells start to reproduce foreign genetic sequences,

we can assume that one of the causes why humankind might evaporate from the Earth could be the loss in the “war of the genes”. We can also suppose that – just as in case of the extinction of the dinosaurs – it would not destabilize the phenomenon of life, or its evolution. *Life Matters* turned out a starting point for a long-term project continued at CEMA Centre for Experimental Media Art at Srishti School of Art, Design and Technology and at the National Centre for Biological Sciences in Bangalore, India, in summer 2009. It includes interactive installations and video-animations, among them: *Proteios* and *Secret Life* – whose soundtrack by Dave Lawrence was based on the material collected at the Neutrino Mediterranean Observatory and at the Grand Manan Whale and Seabird Research Station in New Brunswick, Canada.

As I have mentioned above, life could be identified with behaviour and processes of knowledge transfer, both on the biological and cultural level. Obviously, it is not an exclusive interpretation. According to Professor Stefan Symotiuk², life is, too, a way in which space exists, and vice versa: space could be considered as a way in which life exists. This idea has inspired my fascination with the protein particle. Its dynamic, diverse structure consists of amino acid sequences, quite widespread in the Universe. When X-rayed, it reveals its atomic arrangement, which could serve as a map of a starry sky. Its folding topology, on the other hand, reminds me of mysterious geometric formations called “Calabi-Yau manifolds” in which, according to string theory, successive dimensions of our world are “curled up” on a subatomic scale. In the realm of elementary particles “all the movements, the vibrations, rotations, joinings and breakings are extremely complicated and rich in harmonics. If guitar strings can make wonderful music in 3D space, how awesome must be the ‘string music’ of 9D space!” – writes physicist Saul-Paul Sirag.³

In the field of string theory, the M-theory assumes fluctuation of dimensions within their connections and a unity of all uni- and multiverses. One day, maybe, we will be able to comprehend *how* we exist in the multidimensional Universe, and reach it with our minds, “narrowed down” to 4D.

The piece *Hidden Dimension* inspired by protein topology reminds us that we ourselves are involved in the obscure matter of the Universe and contain dimensions unavailable to our perception, while our relationship with the reality remains much more subtle than what our senses offer us to believe. *Hidden Dimension* is a seed of an expanding

² Stefan Symotiuk: “Filozoficzne aspekty problemu przestrzeni.” [‘Philosophical aspects of the problem of space.’] In: *Przestrzeń w nauce współczesnej*. Lublin: UMCS 1998.

³ Saul-Paul Sirag: “Hyperspace Crystallography.” In: Bob McGown: *Music of Spheres: Astronomical Connections*. Rose City Astronomers 2004.

interactive network of video-animations growing from individual studies, discoveries and uncertainties.

Another installation, *Molecule*, enables the public to explore the atomic structure of protein composed mainly of carbon, oxygen, hydrogen and nitrogen – elementary components of cosmic matter. However, the composition is never allowed to be seen as a whole, or from the outside, instead evoking a feeling of being inside an undefined yet all-embracing structure. The chaotic arrangement of atoms is involved in the changing video sequences relating to four elements and physical states of the matter. A landscape emerges, both dynamic and contemplative, a kind of atomic puzzle, thus emphasizing the fundamental homogeneity, instability and co-dependency of the components of our world. The interactive aspect of the installation enhances the experience of space as a dynamic and complex system of mutual relations.

A delicate, intimate relationship ties together life and space. The smallest perturbation of the system can trigger entirely unexpected changes. This is exactly what the theory of dynamics of complex structures teaches us, to cite (after E. Lorenz) the famous example of the tornado in Texas caused by a flap of butterfly's wings in Brasil. It is yet another example of a relation between micro- and macroscales. The phenomenon is characteristic for the entire nature, including humans, beginning with human genetic code, through social behaviour up to mental processes, where the tiniest impulse may inspire new creative ideas.

The contemporary notion of harmony takes on new faces, so often escaping aesthetic and ethical schemes worked out in preceding centuries. As far back as in the 19th century, the theory of evolution and thermodynamics shook the traditional order of the world, and non-Euclidian geometries opened the door for new space-time interpretations. The stormy 1960. introduced yet another explanation. The aforementioned theory of non-linear dynamics of complex systems, which underlies the contemporary interpretation of natural phenomena, has reduced the eternal Harmony to an instant of synchrony, a momentary adjustment and cooperation of diverse systems. We can see here one of the paradigms of interactivity so characteristic for our contemporary culture, expressed best in the catchphrase “interact or die”.

Adaptation – the ceaseless fitting in with dynamically changing conditions – is the basis for survival and evolution of species as well as ideas.

Recently, I have returned from Réunion, a small volcanic island on the Indian Ocean. SALM Moon Mars Analogue Site is located in Sainte-Rose. They pursue research upon our future colonization of the space. According to the scientists, we need another 300 years to

make Mars habitable and we should start as soon as possible. Directing our eyes and minds towards unknown worlds, we ought to keep in mind the words of Snaut from Stanislaw Lem's novel *Solaris*: "We head into space prepared for everything, that is: loneliness, martyrdom, death. Our modesty prevents us from mentioning it aloud, but sometimes we get to think that we are great. But we aren't really willing to conquer space; all we want is to expand the Earth to the boundaries of space. (...) We don't need other worlds. We need mirrors. We don't know what to do with other worlds. We've had enough of this one, and we are already choking."⁴ From the past experience we know that human mind finds no difference between understanding and possessing. Proud Renaissance motto making humans the measure of the Universe conceals not only an ethical ambiguity, but also a profounder issue of human condition. Since the transcendent idealism of Kant, we no longer unshakably believe in our abilities of discovering what is real and constructing the vision of reality like it is, beyond our common subjectivity. According to Joel Parthemore,⁵ the notions we create are naturally a kind of necessary fiction, simplifying and deforming the world in order to make it more comprehensive. Only the recognition and comprehension of our limitations could help us expand our conceptual framework and prevent us from "choking" with our world. Human communication (interaction), nowadays developing on an unprecedented level in human history due to the digital revolution, serves this aim exactly. Thanks to it, one day we may be able to manage – in spite of the threat of nuclear war, lethal pandemia and ecological collapse – to create a true planetary civilization, or even go further.

It may be that in hundreds of thousands of years we will find the lost and floating Voyager Golden Record, our contemporary message to the civilizations distant in space and time. And again, we will listen to the opening vibrating tones of Kepler's *Music of the Spheres*, the embodiment of the idea which has laid ground to our imagination, vision and creation. Then, from the perspective of the solar civilization, or perhaps even galactic civilization, we will give the present-day homo sapiens an understanding look, seeing their imperfections, downfalls and limitations, in spite of all, as a significant link of humanity.

⁴ Stanislaw Lem: *Solaris*. Unpublished translation.

⁵ Joel Parthemore: "The limits of concepts and conceptual abilities." In: *Toward a Science of Consciousness*, a conference. Stockholm 2011.