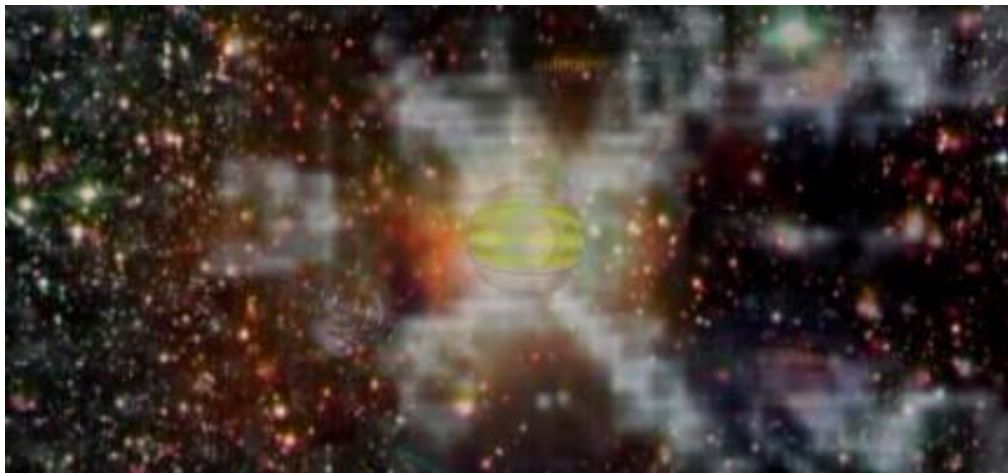


## BUTTERFLY WINGS OF PYTHAGORAS

JOANNA HOFFMANN

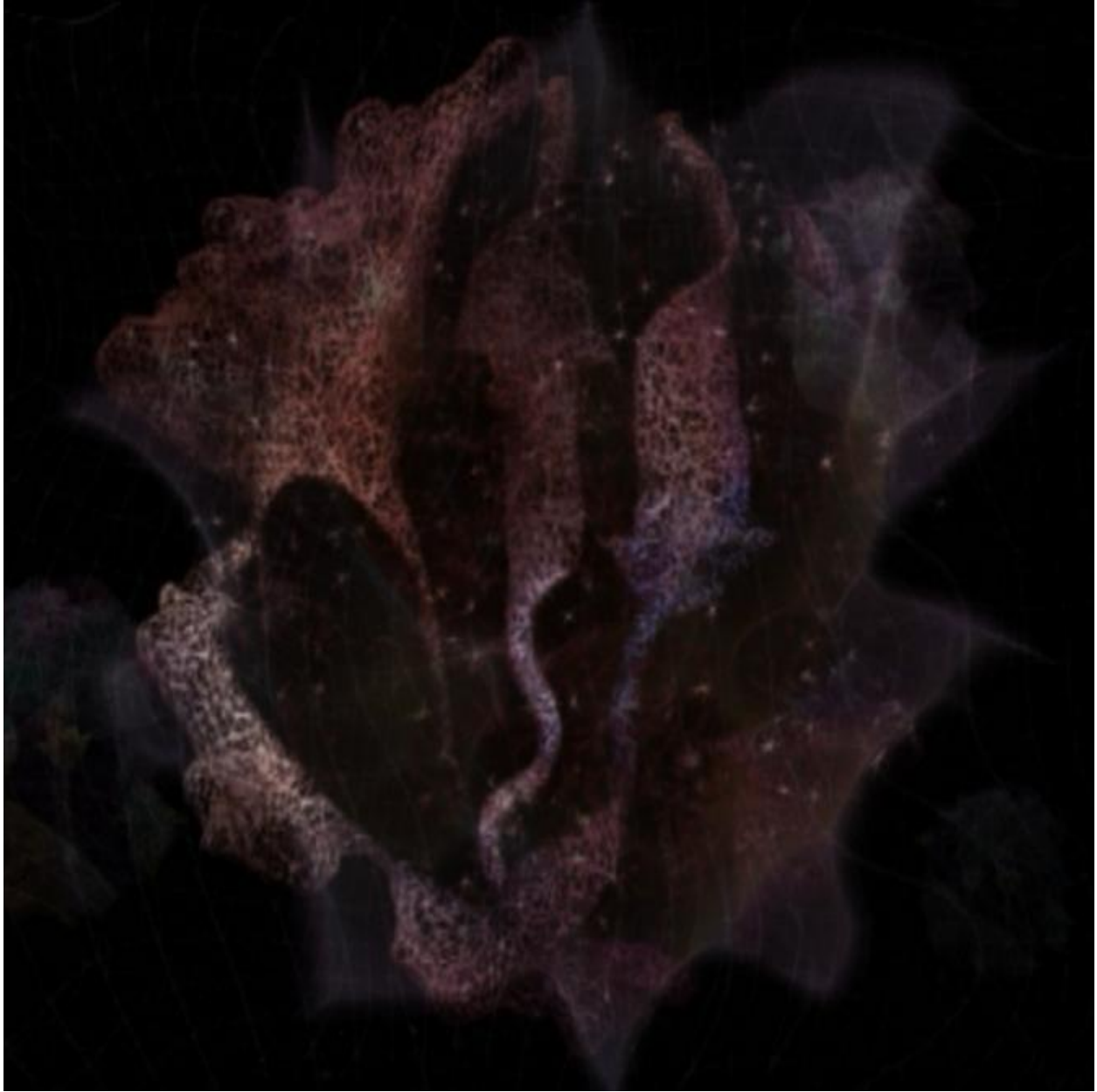
In my paper I recall Pythagorean idea of Universal Harmony, the first model that integrated the human inside with the rest of the world, questioning its validity in our times as well as its role in the process of redefining our humanity and relations with the nature treated no longer as the object of exploitation but as the subject of civilisational transgression.



*Fig.1 "Tones & Whispers", 2005, Joanna Hoffmann, still from the video animation.*



*Fig.2 "Hidden topology of being" 2011, Joanna Hoffmann, still from the video animation*



*Fig.3 "Molecule", 2011 Joanna Hoffmann, still from the video animation.*

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## IN PYTAGOREAN UNIVERSE

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When we look at the "Millennium Simulation", the most ambitious visualization of our Universe made by Virgo Consortium, and we juxtapose this impressive model with the image of human neural connections, we immediately notice uncanny similarities between these two complex systems. Is it the result of tools used for these visualisations or maybe there are actually more similarities than differences between the macro and microstructure of our Universe?

It was Pythagoras who first connected the human inside with the cosmic space. His idea of the Universal

Harmony has been considered as the most important, influential and beautiful concept born by the human mind.

Pythagoras believed that the whole Universe was music. He divided it into *Musica Mundana* (later known as Music of Spheres) and *Musica Humana* (music of the human body). Pythagorean Harmony was based on numbers and proportions. For him a triangle connecting distant stars, drawn on sand or heard in a triad chord meant the same – they expressed Logos, the hidden order of the world.

His system united philosophy, science and art, influencing their development. With time, their paths separated and today, as Gyorgy Kepes noted, our understanding of the world is divided into the rational knowledge frozen in words and numbers, and emotional knowledge embedded in sensual images and feelings. To regain an integrated vision, a consciousness that could apprehend all the richness and diversity of our experiences of the world, we have to use all our abilities to “merge the scientist’s brain with the poet’s heart and the painter’s eye.” [1]

By entering (with my poetic heart and artistic eye) the sphere of mutual relations between science and art I recall the beginnings of this union and ask about the validity of the Pythagorean idea of Harmony in our times. I begun my investigations with a series of works devoted to relations between micro and macro scales, between *Musica Mundana* and *Musica Humana*, The series employs a musical adaptation of the Music of the Spheres by Johannes Kepler, the father of contemporary astronomy, as well as data obtained by means of radio telescopes and other devices used nowadays to explore the Outer Space.

I paired this material with microsounds of my cardiovascular system and later brainwaves, discovering in them fascinating musical structures, with resonances and aliquots reaching all accessible to us octaves. It is worth to underline that for Pythagoras identifying the world with music was not a metaphor but the answer to his search for arche, the essence of the universe.

The series ends with the multimedia installation “Tones & Whispers”, presented at the Dana Centre/Science Museum in London in 2005, and realized with the support of the Institute of Neuroscience at the University of London. In this piece cosmic and human soundscapes merge and images of my brain mix with those of distant stars and galaxies. In fact my brain replaces here the Sun: the centre of Kepler’s celestial composition and of the universe of his times.

Today we know that our Solar System is not the heart of the Universe. Quite the opposite, we rotate on our small planet around one of a billion of stars on the outskirts of our galaxy, one of millions of galaxies racing through the Space, or, strictly speaking, together with the Space. Where should we look for a point of reference, then? One possibility is to focus on the brain and mind as its function; the nexus of individual sensations and perception of the world as well as the source of all ideas and concepts including the idea of the Harmony of the World. We can go even further and stop thinking in categories of centres (and peripheries). Then we may recognize the brain-mind unit as a “knowing-becoming-participating-valuing system functioning within a 'spacetime' context described by the synergetic collaboration between information within a system and information from outside systems”. This approach suggested by Tamar Levin [2] links the individual nervous system not only to biological/genetic, historical and cultural experiences but to a greater undivided whole: to the information space and energy of the universe. Looking again at the Millennium Simulation, one can imagine that somewhere in pulsating nooks of its vast volume, there is a fractal mote (his/her brain) that manifests the deepest creativity of matter: the intelligence of life.

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## LIFE MATTERS

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During the last century, our knowledge of the world and of ourselves has expanded tremendously. Today we know that we are made of the same components as the rest of the Universe. Thus, it is optimistic to think that at the atomic level, as part of the universal recycling, we are practically immortal. Nevertheless the question: "what makes us alive?" remains unanswered. Today we acknowledged that Aristotelian definition of life, based on the notion of a living organism, is no more valid because life "happens" on the molecular level. Biological sciences claim that only DNA is alive, making the rest of the organism merely a part of its much larger habitat. What is confusing however, is the fact that no inherent quality has been found in a replicating gene that would differentiate it from the inanimate matter. The phenomenon of life turns out to be very context-dependent.

The shared genetic heritage of the animated matter makes us realise the biological unity of all life on the Earth. The harmony of nature however conceals a ruthless struggle of genes for survival and does not favour its components. Considering the ease with which our cells start to reproduce foreign genetic sequences, it might be concluded that if mankind is ever wiped off the surface of the earth, it might be the result of the lost "gene war". Moreover, just like the extinction of dinosaurs, it would not disrupt the phenomenon of life and its further evolution. I referred to questions about the substance and meaning of life in my multimedia project "Life matters" realised during my residency at the International Centre for Genetic Engineering and Biology in New Delhi in India where I was working with research material on malaria, SARS and AIDS. I continued my investigations in the project "Proteios" developed at CEMA Centre for Experimental Media Art / Srishti College of Art, Design and Technology and the National Centre for Biological Sciences, Bangalore, India in 2009.

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## HIDDEN TOPOLOGY OF BEING

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We usually identify life with the processes of maintaining and transmitting information and knowledge both at the biological and the cultural levels. Obviously, it is not the only interpretation. Life is also, to quote S. Symotiuk, "the way in which space exists, and vice versa; space might be treated as the way in which life exists." [3] This tautological sentence has its consequences. In our common perception our reality is made of four dimensions but according to the superstring theory it contains additional dimensions compacted to the subatomic level and hidden from our limited perception. All dimensions are liquid in their interconnectivity, and the space-time is no more defined by "specified points" or "corpuscle" but by minute strings which vibrations secure diversity of matter. Our anew musical universe coupled again science with aesthetical desires. "If guitar strings can create the splendid music in the three-dimensional space - writes the physicist Saul-Paul Sirag - think how exquisite must be the music in the nine-dimensional space!" [4]

We assume that we are connected with ourselves and environment in much more subtle ways than told by our senses, but we have to wait a long time before the evolution of our brain will overpass its current limitations and allow us to fully experience our multi dimensional existence.

Meanwhile we have to rely on our imagination and use available keys for its stimulation and for representation of our assumptions. In my artwork "Hidden topology of being" I use a model of a protein molecule as a space-time unit of my "liquid universe". Its folded globular form brings to mind Calabi-Yau manifolds, geometric formations containing contracted dimensions, whilst exposed to X-rays it shows an

arrangement of atoms that might serve as a map of the starry Sky. Bridging micro and macro scales, scientific imagery with daily recordings and poetry, I translate scientific ideas into the area of art as a source of personal and collective consciousness inviting intuitive examination of the unfathomable nature of our reality.

The structure of a protein is used also in my interactive installation “Molecule”. Here the 3D model of its atomic arrangement merges with ever-changing sequences of video-animations referring to basic elements and states of matter. The installation creates a dynamic and contemplative landscape, a kind of atomic puzzle, underlining the fundamental homogeneity, instability and interdependence of components of our world. The interactive aspect of the installation enhances the experience of belonging to some dynamic system of interconnections.

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## FROM HARMONY TO SPECTRUM OF POSSIBILITIES

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Pythagorean idea of the universal harmony has not gone stale but evolved together with changes in our knowledge of the world. In the 19th century, theories of evolution and thermodynamics introduced motion and variability to the otherwise stable cosmic composition, while non-Euclidean geometries opened the way for new space-time theories and interpretations. At the threshold of the 20th century, quantum physics confirmed Pythagoras’s intuition, igniting our modern imagination with vibrations of micro-strings of the matter in eleven dimensions. Greek Tetractys was replaced by physical constants describing the Universe in which the biological life evolved. Seen in a new light, the oneness of nature finally rebutted our long-built illusion of our privileged position in it. The proud Renaissance monument of the human being as a measure of the Universe cracked and old Pythagorean attitude emanated through its crevices.

Born out of the observation of the chaos of the world, Pythagorean Harmony searched for interconnections not for hierarchies. Today we learnt that synchronization, adaptation and interaction are at heart of deterministic chaos that rules natural phenomena. Its notorious “butterfly effect”, in which the slightest perturbation of the system leads to unpredictable but expected and unavoidable changes, proves the fragility and dynamics of relations between animated and non-animated, micro and macro environments. By all means, it concerns also the human being from his genetic code, social behaviour to mental processes.

We learn to accept that nothing in our world is for granted and there is no defined future only the spectrum of possibilities.

Paradoxically the progress in science and technologies together with the crises of humanistic ideologies give us an opportunity for re-questioning and redefining our humanity and for a renewed approach to nature treated no longer as an object of exploitation but as a subject of civilisational transgression.

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## BACK TO THE UNIVERSE

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Our spiritual, intellectual and physical environment is changing rapidly. We cannot foresee how quantum, biogenetic and computer revolutions will transform our lives and ways of our thinking. Nevertheless using the very poor knowledge we have today we can make some random predictions and direct our endeavours.

Inspired by scientific breakthroughs in search for water in the Universe, I visited La Reunion, a tiny island

on the Indian Ocean, a home of SALM – Moon/Mars Analogue Site, serving the research towards our future colonisation of the Space.

According to scientists it will take us at least 300 years to make Mars habitable and considering all our earthly dangers as well as the development of our civilisation we should start the process of adaptation now. Yet, turning our eyes and minds towards unknown places, it is worth to recall words of one of the heroes (Snaut) in “Solaris” by St.Lem: “We leave for the Space, ready for everything that means for loneliness, martyrdom and death. Through modesty we don’t say it aloud, but we think sometimes how splendid we are. Meanwhile, meanwhile we don’t want to gain the Space, we want only do extend the Earth to its limits.(...) We don’t know what to do with other worlds. One is enough and we already choke with it.” [5] In other words, for the human consciousness there is no difference between apprehension and appropriation. The strong anthropocentric tradition (reflected in the anthropic principle) reveals a deeper problem of the human condition: inability to go beyond our common human subjectivity. Nevertheless by acknowledging and understanding our boundaries we can extend our conceptual reach and “not choke” with our own world. If we manage to mature our humanity and thus our sustainability, we may succeed, despite the threat of a nuclear war, deadly pandemic and environmental collapse, in creating a truly planetary civilization [6] able to manage and share resources of its own planet; the civilization based on advanced cooperation and cultural convergence. That would be our first step towards stars. Then in thousands of years, as a stellar or even galaxy civilisation we may come across the Golden Record, our today’s message to distant civilisations, carried aboard Voyagers through the cosmic space and again listen to its immersive invocation: vibrating tones of J. Kepler’s Music of Spheres, the testimony of power of human creativity, imagination and visions.

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6. I am referring here to the classification of civilizations introduced by Nikolai Kardashev and Freeman Dyson based on the ways their utilize energy: 1. Planetary civilization, 2. stellar civilization and 3. galaxy civilization. Freeman Dyson, *Disturbing the Universe* (New York: Harper & Row, 1972).