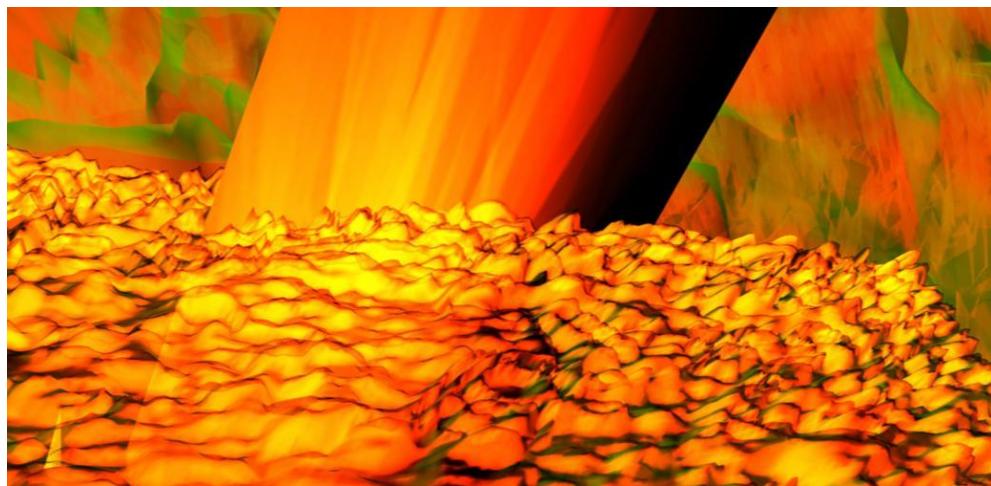


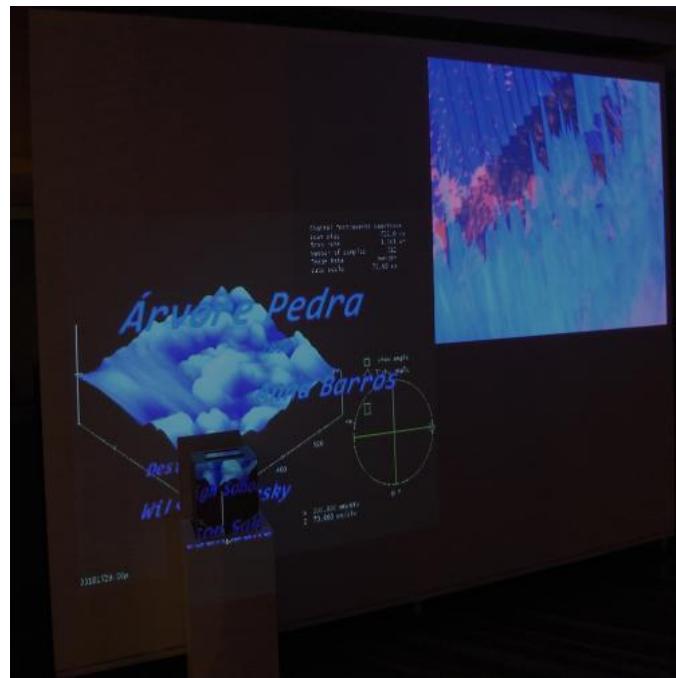
## NANOART- SCIENCE AND MAGIC

### ANNA BARROS

In the nano world the transmutation of elements by manipulation of its molecules, the superstar of nanotechnology, introduces an almost magical connotation. The condition of invisibility and the presentation of its images provided by the electron microscopes increase the sense of touch to the first magnitude. This text discuss ways that have been updating Nanoart. The emphasis is on the presentation of works and research by the author.



*Fig 1. 200 Million Years - Durée, 2010, Anna Barros. Still frame of digital animation.*



*Fig 2. Petrified Tree, 2010, installation, Anna Barros. Photo Carlos Donaduzzi.*

The integrated circuits and optoelectronic devices that enabled the first steps on the path of nanoscience and nanotechnology – molecular technology – were invented in the last century, in the 1960's. Art and science together aimed at researching and presenting nanometric particles (a nm designates a billionth fraction of a meter), which are placed beyond human perception, in a horizon where the material and the immaterial are perambulating a space dominated by quantum functions, under a never experienced behavioral way. With this, a hybrid discipline was created, where two knowledge categories start to be experienced in mutual transformation, able to amplify the perceptive qualities of humans.

The techniques that opened up the mysteries of nanoscience may be classified in the general category of Scanning Probe Microscopy. The Scanning Tunneling Microscope have a tiny tip made of conducting material with one or a few atoms at the top, controlled by a mechanical arm that executes a tridimensional movement scanning the sample. The laws of quantum mechanics permit the electrons to move (tunnel) between the tip and the sample. The images are in 3D and have a virtual character, what you see on the screen is their transcoding by a computer program. The same for the Atomic Force Microscope images.

The domination of seeing was altered by the entry of these three-dimensional topographic images, closer to tactile sense. The existential condition of nanoscience lies between matter and energy, a world unseen but felt, here it is possible to blur the boundaries of mind, and dream of the creation of new materials, even artificial life, throughout a new disposition of the atoms organization.

A new world is the dream of all creators; in nanoscience this is taken to a higher level raised by the possibility of the human being to recreate himself, which can be a marvel or a damnation. At the nanoscale, matter has different properties. A new cultural paradigm is formed by the convergence of several disciplines: nanotechnology, biotechnology and biomedicine, information technology, cognitive science, together under the acronym NBIC that refers to nano-bio-info-cognito.

These conditions generate a feeling of magic, of presence of an occult science, a source of power beyond that provided by the perceptive experience, already settled in knowledge and recorded by culture.

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### SCIENCE AND MAGIC, SCIENCE FICTION

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The importance of science fiction in the course of researches in nanotechnology strengthens this enchantment, while science still searches for a narrative to describe what happens in this world by the difficulty to understand its properties. The science fiction narrative is more intuitive and fantastic, contributing for an opening to new scientific perceptions.

In literature, Suzan Lewak presents nanotechnology and nanoscience focusing on an analysis between her enchantment and that found in Alice in Wonderland, by Lewis Carroll. She shows Alice's journey as a useful metaphor to nanotechnology, which "is a magic that is predicted to become a valid part of human experience." [1]

In Carroll's book, it is not the tiny scale of the environment where the story takes place that enchants, but the enchantment presented and validated by itself. The child's imagination is set free, with no moral messages. What Alice must realize to experience this new world is that "there is a 'logic' to Wonderland,

she must... learn to accept Wonderland's microscale logic as a separate entity which operates according to its own set of principles." [2]

In a similar way, we realize as magical the properties and the matter behavior in nanoscience, but they are ruled by the laws of quantum mechanics. Used to perceive the world as a set of things, more or less solid, how do we react to this set of molecules swirling in a frenetic dance of electrons?

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### THE SENSES AND THE POETIC IMAGINATION

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Let's bring back the question of the predominance of sensing over seeing in the nanoscience and nanoart world. William J. T. Mitchell claims the nonexistence of a sense, in a pure state, as to the specificity of media to organize them: "there are no visual media." [3]

Since the avant-garde movements, art seeks the integration of all senses: in nanoart, this has to start from scratch because one can not physically touch the matter; there lies a perceptive ambivalence, between the microscope and human.

In the mean while seems to be a clear consensus about the classification of first-order senses: sight and hearing have been dominating our occidental culture and art. Some current thinkers as Roy Ascott, in digital art, and Madalina Diaconu, in aesthetics, follow this classification.

Diaconu says that touch would be among the secondary senses – touch, smell and taste (according to phenomenologists), which in principle could not produce art because "they deal with ephemeral stimuli and consume their objects." [4] Diaconu gives careful considerations to the exceptions in arts that are transitory, such as dance, theater and music, where the touch prevails, to what we add digital animations.

The properties of digital animations are introduced at the beginning of the new Technologies of Communication when Mario Costa places the Aesthetics of Communication in Cyberspace as an aesthetics of events that are not reduced to a form; they present themselves as a space-time flow, an interactive living process. They are a mobilization of the energy that replaces form and object.

This energy mobilization in digital art is updated by bits, in nano, is present in atoms and molecules allowing us to speak of a quantum event.

Roy Ascott identifies "digital, somatic, and pharmaceutical" [5] as second-order senses. Within the first order, he includes further senses according to neuroscience: "pain, balance, proprioception, kinesthesia, sense of time and of temperature", similarly so with the ranking of secondary perceptive senses by Diaconu.

Ascott identifies four forms of sensibility, among which we travel freely in our current experience: physical presence in eospace, apparitional presence in spiritual space, the telepresence in cyberspace and the vibrational presence in nanospace", what makes us return to the domination of the tactile and haptic system in nanoscience and technology.

The philosopher Gaston Bachelard assumes the universe of imagination and poetry where senses are never seen as isolated or working separately. According to Bachelard the poetic image does not germinate from a perception of the senses, but comes from a “poetic reverie as a phenomenology of the soul.” [6] This classification echoes in Ascott’s “second order senses. Technoetic senses.” [7]

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#### ART BEING GENERATED IN NANOART

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The presence of atoms and molecules energy, decoded in images, is something quite new to us, artists, and the way we display it in artworks is still in its earliest stage.

Having no history, it asserts itself by the search of artistic techniques for its own achievement and, at the same time, aims at breaking them. If Art History depicts the struggle of artists to destroy parameters and evolve in the interstices of accepted knowledge, nano art performs in a space without boundaries, where the constitution of the artwork-subject conflicts with the continuous flow of energy, in a cosmic dance of molecules, which becomes visible in this field where the real and the virtual, the potential and the actual still flirt, things that we are just starting to perceive. To us, artists, it offers the opportunity to penetrate our creative interiority, a magical space where the act of creating explores the possibility to experience wonder for wonder, and deliver it to the community in a new perception.

Among the means used to creating in nanoart, we define:

First - The use of images generated by research lab microscopes, on which artist and scientist work together. Several artistic techniques are used. Cris Orfescu was the first artist to create a group to work under these conditions: NanoArt 21.

Second - Artworks that use a metaphor to translate the perceptive conditions themselves into a nano environment. Some outstanding artists: Christa Sommerer and Laurent Mignonneau, and Victoria Vesna who worked together with scientist James Gimzewski.

Christa Sommerer and Laurent Mignonneau, *Nano-Scape*, 2003, is an artwork with little visual information, where the sensing perception prevails. According to the artist, it is an invisible sculpture, like the nano world. She wants to reach this world throughout intuition; she uses a wireless magnetic force interface so that the visitor can create an invisible sculpture by touching with a ring, a table prepared to this experience.

Victoria Vesna's and James Giimzewski lead us to the experimentation of philosophy issues on the impact of this emerging science over culture in general, in interactive installations.

Maybe Blue Morph is the most paradigmatic artwork of these two; it uses images and sounds obtained by an Atomic Force Microscope from different phases of the metamorphosis of a caterpillar into a blue butterfly in a sound process called sonocytology. The poetics of the artwork is built to generate a poetic and mysterious environment where the scientific information is invested with a sense of magic.

There is the suggestion to transform the visitor and here Vesna meets Ascott's ambition of a codependency between the observer and the observed object in “technoetic systems (digital, somatic, pharmaceutical) designed to enable us to traverse further states of consciousness, to access psychic states, and extend our spiritual awareness.” [8]

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## 200 MILLION YEARS - DURÉE, 2010

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As an active artist, my research is always combining theory and creative practice and ponder over it. This installation is part of a trilogy: *200 Million years – Petrified tree*, 2010, *200 Million years - DURÉE*, 2010 and *DURÉE*, 2011. For its accomplishment, I faced lacunas in the traditional art education, where there is no priority development of the sensorial systems, tactile and haptic; I sought for perceptive experiences arising from body contact, during my training in Laban movement for enhancing my sensibility; in the extension of conscious while penetrating the unconsciousness, in active imaginations in Jungian analysis, where the boundaries of reality are broken similarly to the experience in nanotechnology and nanoscience.

In *Petrified Tree*, only the imaginary information of the petrified tree was activated. For the first animations, images derived from the Scanning Tunneling Microscope were used, seeking to give movement to geometric forms suggested by those images. There are archetypal forms found in drawings since the beginning of time, and also in nature formations: in the Ypê tree bark images, an hexagon; in the petrified tree, a sphere. A dominant color to each instance was assigned to those images.

The installation has a little box, with mirrored sides, containing a digital picture frame that displays images of the first JPG animations, combining in sequence the sound created by Wilson Sukorski, a musician and special sounds and instruments inventor who has helped me in my research. By the side of the box, in a large scale, two animations are projected: one is the same in the box, in which the viewer is also included; and next to it, another one in 3D displaying poetic images scanned by the Scanning Tunneling Microscope.

The project for the installation *200 Million years - DURÉE* was presented at FILE 2010, São Paulo; 9º International Meeting of Art and Technology, UnB Brasília, 2010 and the art work exhibited at the international exhibition EmMeio#2, in the National Museum of the Republic, Brasília, November 2010. It features a digital animation and a vibrating chair. Sound was created by Sukorski and is presented in a hybrid form with the image in order to emphasize the tactile and haptic perception, generating a vibration that is felt by the body.

The scientific images derive from samples of a petrified tree that grew 200 million years ago in a paleontological reserve of Mata, in Rio Grande do Sul; seeds of Ypê and Reseda trees; a branch of a Reseda tree and the bark of an Ypê tree scanned by the Scanning Electron Microscope and the Scanning Force Microscope (Instituto de Física da Universidade de São Paulo, São Carlos; Laboratório de Filmes Finos, Instituto de Física, Universidade de São Paulo, São Paulo; Centro de Nanociência e Nanobiotecnologia, Universidade de Brasília).

Animations of poetic nature were created from these topographic images in 3D computer programs. The still images generated by the computer program connected with the microscope are in tiff format, and even if they are seen in the third dimension with topographic quality, they do not show the necessary technical characteristics to create 3D animations. An independent object that can be animated is required. To this purpose, I worked with the program, Blender, in order to obtain a bitmap of the image, which was then transferred in sequence to 3D format, where I created the animations.

While science and media try to capture images from these tiny particles to understand their properties, DURÉE tries to make them accessible, poetically and intuitively, according to the felicitous space of Bachelard, a space that "... has been lived with all the partiality of the imagination." [9]

My digital animations, despite being usually abstract, have their origin in tales and mythologies, as seen in Saci, Tiamati, Mahamaha. This magical atmosphere beyond the daily reality, was activated in the poetic narrative of DURÉE, where 200 million years are placed in that same quantum of the nano scale.

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### THE CREATIVE PROCESS

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My body is connected to the universe through nature in a growing complexity; in a process of bottom-up as scientists call the path that arise from the possibility to rearrange one by one the molecules position. Not only the biological body, but my whole being.

While walking in a nanoart installation, we carry the experimental and conceptual burden of culture, and we have to acquire new perceptive experiences to fully enjoy the experience in nanotechnology and nanoscience.

In *200 million years – DURÈE*, imagination irrupts and uses intuition to find something that can unveil the invisible in a nano scale during all this period of time; a possibility arises: to think life as a duration – Bergsonian durée. Bergson establishes that "the essence of duration is to flow ... the flow is the continuance of transition, is the change itself;" [10] to the work under examination, its updating vehicle is the digital animation, what integrates the idea of flow, of a continuous happening, of an event, not matter but energy.

Since the world of nanoscience and nanotechnology floats between matter and energy, all microscopes offer to our eyes can be seen as magic representing something that can not be represented and that constitutes simultaneously the basic stuff of the universe.

The memory, the durée, has to promote changes for new associations that exceed the boundaries of the time spent and include the future. "The real duration means simultaneously indivisible continuity and creation." [11]

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### THE VIBRATING CHAIR

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In order to experience the dominant condition of the nano environment, that of the energy in the boundaries of matter, using a perception relating to the tactile sense, a chair equipped with a vibration engine modified by a device that operates according to the rhythm of the sound of the animation was created. Since the beginning of my research, I considered the effect of vibration as a possibility to include the haptic system in the artwork. When seated, the visitor experiences the matter, seen as compact and still by Newtonian physics, in its energetic quality of atoms and molecules, and experiences the animation in a sensorial perceptive set that spreads throughout the body. I looked for generating a dramatic tension on the visitor that exceeds the daily experience of reality. The intention is to be a participant not a voyeur. One must seat to watch the video.

The images perception is altered when we sit on the chair because the vibration leads to a state of half trance, while liberating the ego to new perceptive apprehensions (when one remains seated for a long time). The sound, the music, is intended to open the soul to new sensitive experiences.

The installation includes the vibrating chair and a video projection on the front wall.

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## DURÉE

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It is the second version of the approached installation. There is a modification including three projections of the same animation, which circle the chair activating all vision fields and creating an immersive environment that emphasizes the ambience magic.

The artwork is not the vibrating chair, but the concept of vibration as an haptic perception which drives to the origin of energy in a field where the connectedness is both macro and nano. The experience includes an inner space and an outer space.

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