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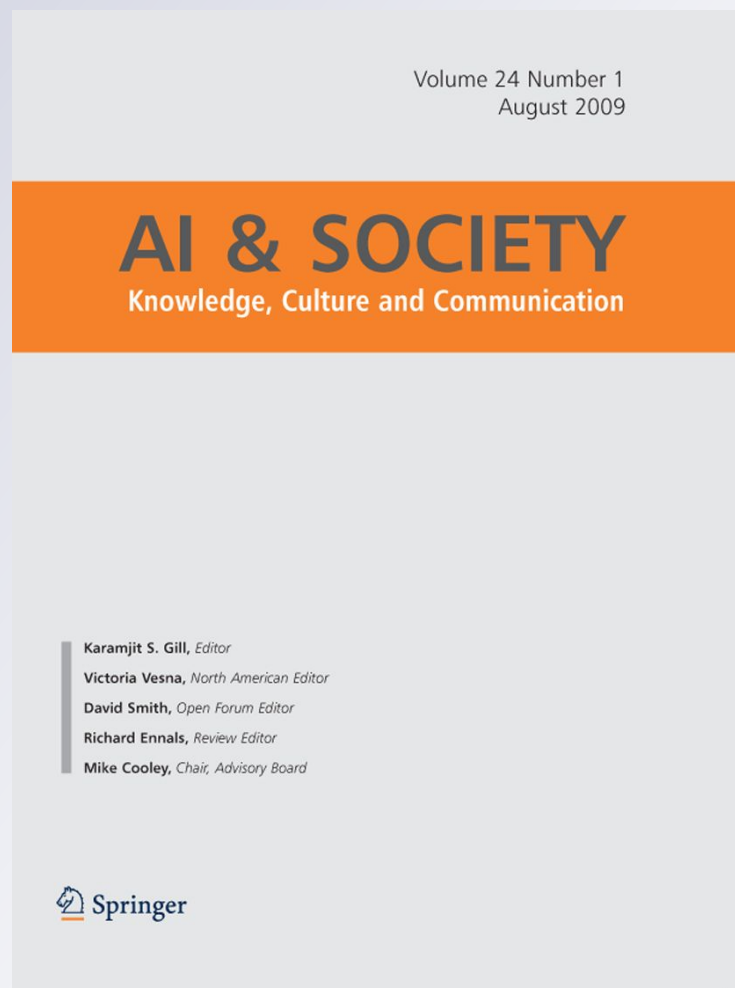
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Vibration matters: collective blue morph effect

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Abstract Once an artist takes on the challenge of making the invisible visible, or the inaudible audible, he/she is almost immediately thrown into the realm of energy at the edge of art and science. The established art world based on visual culture finds it difficult to place this kind of work. The scientific community, used to working in this realm in a reductionist way, finds it hard to comprehend. Yet, the public seems to be drawn to artwork residing “in between,” and there seems to be a universal need for a connection to the spiritual realm beyond what established religions offer. As many speculative ideas in the West circulate around ideas of energetic approach to matter in general, particularly the body and mind, alternative medicine and other Eastern philosophies are thriving. This essay will show how, in collaboration with nanoscientist James Gimzewski, we have investigated these ideas from the sounds of cells to the concept and realization of the Blue Morph installation at the Integratron [the Integratron is the creation of George Van Tassel and is based on the design of Moses’ Tabernacle, the writings of Nikola Tesla and telepathic directions from extraterrestrials. This one-of-a-kind building is a 38-foot-high, 55-foot-diameter, nonmetallic structure originally designed by Van Tassel as a rejuvenation and time machine (The Integratron 2009)].

Keywords Art and science · Metamorphosis · Vibration · Bio-mimetics

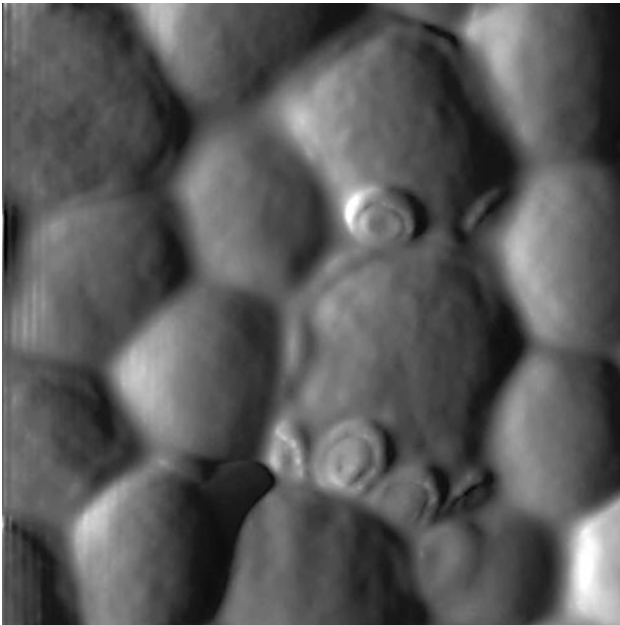
Does the flap of a butterfly's wings in Brazil set off a tornado in Texas? —Edward Lorenz in a talk at the 139th meeting of the American Association for the Advancement of Science in 1972 (Lorenz 1993).

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1 Cell sounds: art and science

While in the midst of collaborating on a series of media arts/sci projects, Gimzewski and then PhD student Andrew Pelling first made the discovery in 2002 at the Pico lab in UCLA that yeast cells oscillate at the nanoscale. Excited by the initial results, he was eager to share the data but knew that I would not be able to understand the importance by simply looking at the graph. Knowing that Pelling was also interested in music, he asked him to output the data into sound files instead and sent me the audio file of live cell vibrations. This was definitely exciting, and through this sound, I could instantly see the importance of this finding. Soon after I asked whether he would “compose” sounds from the yeast cells, and Gimzewski experimented as Pollock would, by throwing scotch on the yeast cells and recording the sound of cell death. I used these sounds in a piece that I called “Cell Ghosts” (Vesna 2004) and Pelling collaborated with Anne Niemetz on a piece called “Dark Side of the Cell” (Niemetz and Pelling 2004), also inspired by these sounds. Not only art was created from this event, but an article on “screaming cells” came out in journal *Nature* (Zandonella 2003), and a scientific paper was produced in which Gimzewski coined a new word for this kind of data amplification of vibrations within a human audible range for research and analysis: “Sonocytology” (Pelling et al. 2004).

The tool with which the cell sounds are extracted, the atomic force microscope (AFM), could be regarded as a new type of musical instrument. Indeed, it is easy to compare the AFM to a record and a needle that moves across the surface grooves to produce sound—the AFM “touches” a cell with its small tip. With this interface, the AFM “feels” oscillations taking place at the membrane of a cell and these electrical signals can then be converted, amplified and distributed by speakers.



2 From yeast cells to butterfly chrysalis

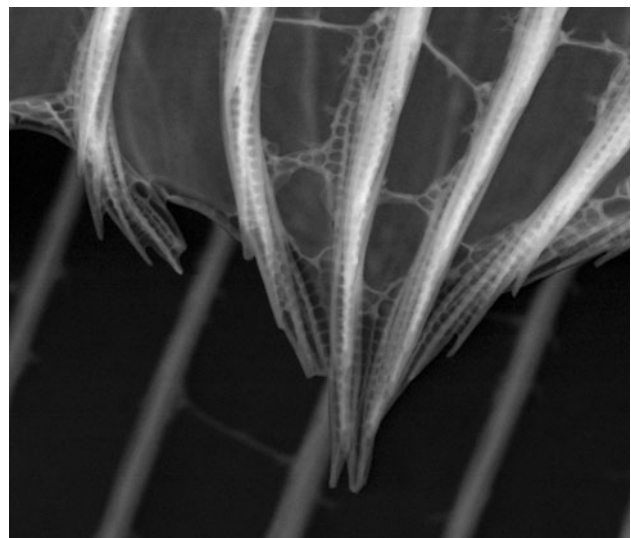
The press on sonification of yeast cells generated much interest across the disciplinary spectrum—scientists in nano- and bioresearch, the medical community, the experimental artists and musicians, as well as the fringe spiritual healers and gurus all demonstrated an interest. This diverse scope of attention eventually led to the butterflies appearing onto the scene of the research laboratory with a phone call from a woman by the name of Anna Costello who called Gimzewski after reading about his research with sonification of yeast cells. She was in contact with biology professor at the Lancaster campus of Harrisburg Area Community College, Richard Stringer, who studies butterflies and suggested, with enthusiasm, that Gimzewski tries to record the metamorphosis to see what kind of sound would emerge. He reluctantly agreed, and within a week, a package of chrysalis arrived to his laboratory.

This research was not immediately of particular interest to Gimzewski. He pursued it only because of his involvement in the arts and would frequently send me results asking whether I had any ideas of how we may create a piece out of these data. I have to admit that I resisted for quite awhile and found it quite difficult to imagine what to do with such an overused image/symbol/metaphor of the butterfly. But, occasionally, I would notice the creature, and I started to pay more attention to it when I read somewhere that the ancient Greek word for “butterfly” is *ψυχή* (*psūchē*), which primarily means “soul” and/or “mind.” It is true that butterflies have, for centuries and in many cultures, signified the elusive quality of beauty and have brought many to ponder the wonder of change and the power of nature. Poets and artists in the past and present have been inspired, philosophers used

them as metaphors, and scientists studied their properties. As far as 3,500 years ago, Egyptians have portrayed this creature in ancient hieroglyphs. History clearly shows the existence of an innate human interest in the nature of the butterfly. And it is the archetypal instinct that moved us to consider both this ephemeral and beautiful insect.

3 Sounds of metamorphosis

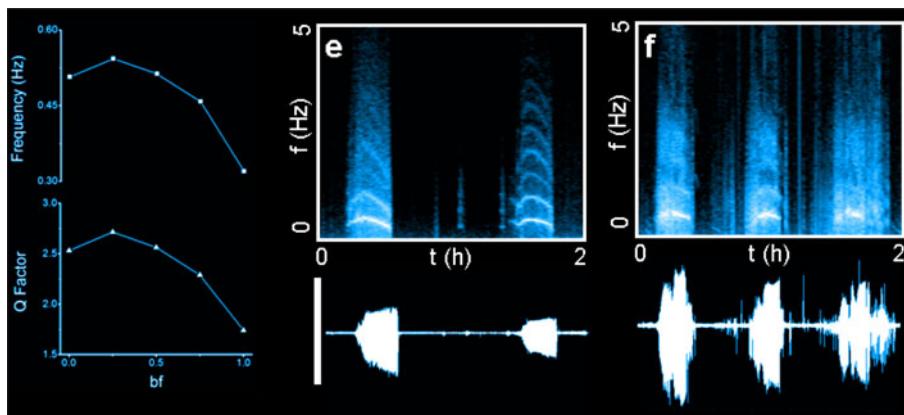
It was the experience of listening to the sounds of the metamorphosis—excruciatingly difficult to capture—that finally got me very excited about doing something with the results. Gimzewski and his research team examined the mechano-structural properties of the *Morpho Peleides* butterfly to provide insight into the developmental process and intrinsic optical properties. The sounds were acquired and recorded by detecting nanoscale motions of the pupa surface using the AFM and optical beam deflection during the developmental stages of metamorphosis. Raw data files of the caterpillar membrane “sound” vibrations were sped up and amplified by arbitrary amounts depending on the individual sample. Imaging of wings was an individual effort by Gimzewski who made a trip to the FEI company in Oregon and, through his close relationship with the CEO Don Kenia, got access to the most cutting edge scanning electron microscope (SEM) and obtained one of the best operators in the field to work with. Use of highly sensitive instrumentation provided images of both the surface and internal wing structure that is mostly black space. The nanoscale architecture inherent to the butterfly wing produces its brilliant color through photonic crystalline effects. The images produced are of the highest resolution and detail that I have ever seen and I started thinking of how to connect the sounds to the optics to produce a meditative space for an audience. The goal became to create a space that would introduce a contemporary metaphor of this ephemeral creature.



4 Butterfly effect: symbolic of our times

4.1 Collective butterflies in our stomachs

Seeing and hearing the images of the metamorphosis were what created a breakthrough in the creative block around working with the butterfly. The sudden realization that change does not happen gradually, as is assumed, but is in fact a series of intense bursts of energy with a rest period that vibrates in anticipation is an important discovery. (Pelling et al. 2009) The sounds were what we would interpret as pain, which is counter to the idea of the gentle, beautiful creature we have previously perceived as the butterfly. Indeed, I was not able to find any reference to anxiety and pain when researching metaphors and ideas around the butterfly. I did, however, discover that nature's nanophotonics used in the blue color of the wing was used in anti-counterfeiting technology. The link to the financial crisis that was starting to happen at the time and continues to surface—in bursts—was not only with optics but with sound as well. The financial markets patterns, drastically moving up and down, are almost identical to the graphs of the metamorphosis of the butterfly. Could it be that we are having a collective metamorphosis and the markets are our mirror?



The sensation of feeling “butterflies in the stomach” is most often experienced prior to important events, related to nervousness and can be experienced in situations of impending danger. It is possible that the condition, frequently felt by an oncoming new experience or relationship, is caused by a surge of adrenaline. One could look at the current condition of humanity as a collective state of nervousness, especially in relation to the current economic ecological crisis that is global. The “butterfly effect” has been very much in the public imagination in the last two decades with numerous movies, Sci-Fi novels and even

games, center plots around the idea that one butterfly could have a far-reaching ripple effect in the subsequent historic events. This idea was first proposed by science fiction writer Ray Bradbury in his short story about time travel, “A Sound of Thunder,” which incidentally is the most republished science fiction story of all time (Bradbury 1952).

Almost a decade later, Edward Lorenz was using a numerical computer model to rerun a weather prediction when, as a shortcut on a number in the sequence, he entered the decimal .506 instead of entering the full .506127 the computer would hold. The result was a completely different weather scenario. Another decade would pass before he used the now famed title “Does the flap of a butterfly’s wings in Brazil set off a tornado in Texas?” in a talk at the 139th meeting of the American Association for the Advancement of Science in 1972 (Lorenz 1993).

5 The Integratron

Throughout and in parallel with working on our various collaborative projects, I was fascinated by a structure in Landers, a small town in the California desert, about 2 h

away from Los Angeles called The Integratron. It is a 38-foot-high, 50-foot-diameter, nonmetallic structure designed by the engineer George Van Tassel as a rejuvenation and time machine. It emerged at a time when much speculation and inspiration around idea of vibrations, electromagnetic fields and the invisible realm was circulating, no doubt influenced by discoveries of Einstein and Nikola Tesla as well as the theosophists who started introducing spiritual teachings from India and Tibet to the West. An abbreviated eccentric history, very much relevant to this project, follows.



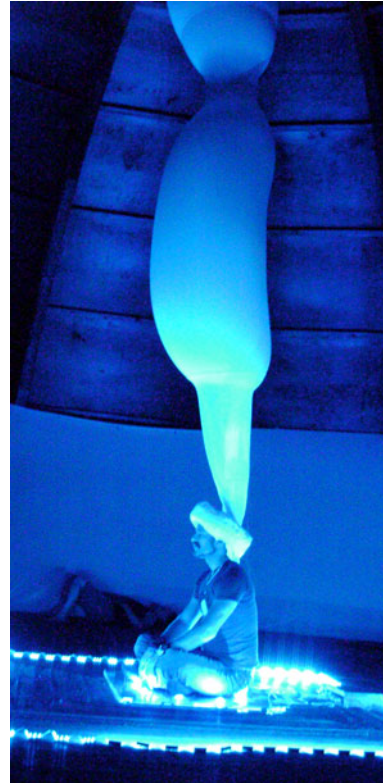
In the 1930s, Frank Critzer, a middle-aged German immigrant prospector with an interest in shortwave radio, arrived to Landers, CA, and staked a claim at the “Giant Rock,” reputed to be one of the world’s largest free-standing boulders. He excavated about 400 square feet of space under the rock into a one-room subterranean home with the door facing west, and a storage room toward the east with a radio antenna to the top. Critzer’s eccentricity was suspected by nearby residents who left him alone, but during World War II, he became under suspicion as a German spy because of his radio hobby and was killed in a botched law enforcement raid in 1942. The burned out room under the rock was closed and locked for years. But, before his unfortunate end, he met George Van Tassel, a former test pilot for Howard Hughes and Douglas Aircraft, who later took over his “apartment” under the Giant Rock and operated an airport at the site.

Van Tassel believed the rock’s crystalline structure possessed great channeling power by virtue of its piezoelectric characteristics. He led weekly meditations in the excavated room under the rock from the 1950s to the 1970s, which he claimed led to UFO contacts. Van Tassel claims that UFO channelings and ideas from scientists such as Nikola Tesla led to the unique architecture of the Integratron. He spent 18 years constructing the building.

Van Tassel’s meditation sessions led him to develop the building with direct input from his alien designers who gave him instructions for a machine that could rejuvenate human cells using the natural energy found in the atmosphere. He called the device *The Integratron*.

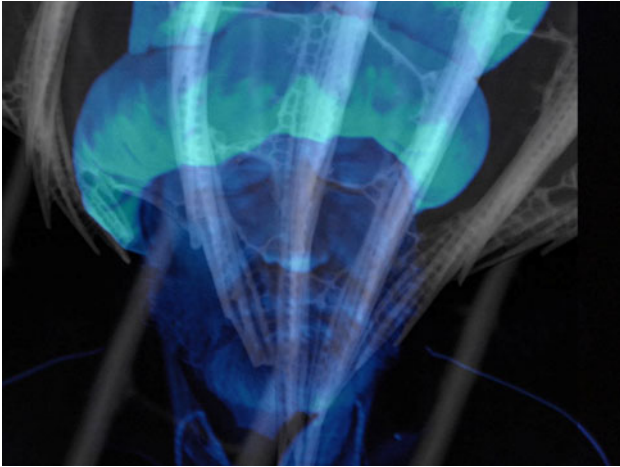
The 16-sided dome was built of wood and concrete and held together by glue and gravity-electrically neutral materials. The generating core was made of copper wire. Had it been placed into operation, candidates would have walked through the building, essentially a huge air capacitor, while wearing white outfits. The charges, distributed over a wide range of frequencies, would affect every cell.

6 Blue morph at the Integratron



There is little need to elaborate on Nikola Tesla’s extraordinary contributions to humanity that basically changed the way we live on Earth. Much has been written about him, yet many aspects of him remain shrouded in mystery, especially his eccentric statements about receiving information from extraterrestrial sources. His work on the ionosphere is also surrounded and largely informed by conspiracy theories. We were quite inspired to do our first interactive version of the Blue Morph on this site, as we feel its history is a perfect context for the essence of the piece.

As we both practice Kundalini yoga, Gimzewski and I discussed the idea of creating an environment where people experience the interactivity by keeping still and/or moving from their center. Gimzewski suggested that we use the meteorological balloons and I looked for ways to enclose and design the hanging. While showing him the long tube I got manufactured in the Los Angeles fashion district, he jokingly rolled up the end into what looked like a turban and placed it on his head. The jest became inspiration as we decided that this is exactly what needs to happen and integrated the idea of a “mad hatter” into the project. Alice in the Wonderland so naturally fits into the complexity and absurdity of our projections and realities.



The Integratron turned out to be the ideal location for the development of this project as the audience brought their interpretations and guided us to how we may continue to interact. What we did not anticipate is the ritualistic nature that emerged with people seeing the installation as a place to release, albeit publically, their inner urge toward transformation and metamorphosis. The audience becomes the performer when in the center and the witness when observing others in the center and the artist and scientist are on the sidelines—giving up the limelight. It is neither art nor science, neither theater nor reality, but a scene that is open to interpretation and allows for an individualized ritual to take place. Nonsensical to a large degree, what emerged is possibly the closest to dada in the arts.

7 Sounds of thinking

Just as much of new technology is repurposed by the public for something quite different than what it was originally intended for, the Blue Morph was developed by the interaction and feedback from the audience. It also pointed to us the direction to take in our next work that emerged out of this experience, which will take a deeper look at the interface of our neuronal vibrations with our environment.

We are interested in exploring rhythm of electrical oscillations in the brain that give rise to consciousness, and

how failures in this rhythm can lead to a variety of brain disorders. That the vibrations influence and create our reality can best be surmised by a statement made during an interview with neuroscientist Rodolfo Llinás of the New York University School of Medicine: “Neurons have an intrinsic rhythm, a bit like a hum. They generate this electrical dance at a given frequency because they have similar rhythms—they hum in unison. But as in the case of choirs and dancing, you can have two groups doing different things at the same time. Now imagine that each group doing something represents an aspect of an external event, like a color (Nova Online 2001)”.

Perhaps, we are experiencing a collective, entangled and unpredictable electrical dance with extreme ups and downs that point to a major shift in consciousness that is unpredictable while in the midst of the metamorphosis. The chrysalis has no idea what it is becoming, and once a butterfly, how much it influences another part of the world with the flap of its wings.

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