

ART AS RIGOROUS PHENOMENOLOGY

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*Between consciousness and reality there yawns
a veritable abyss of meaning.*¹

Ever since she began pursuing philosophy, Evelina was infected by Edmund Husserl's phenomenological upheaval. In the early 1990s when she was a philosophy student in Minsk, the only work of Husserl ever translated into Russian was his manifesto article from 1911, "Philosophy as Rigorous Science". Written at the time when science was becoming an accelerative and triumphant force of planetary transformation, Husserl was looking for an equally powerful approach to metaphysics and the study of consciousness. This new science "of whose extraordinary extent our contemporaries have as yet no concept; a science it is true, of consciousness that is not quite psychology; a phenomenology of consciousness as opposed to a natural science about consciousness"² would rigorously clarify the contents, structures and methods of our own perceptions wherefrom all "givenness of things" is made manifest.

Now, a century later, philosophy is moving ever further away from a realization of Husserl's phenomenological utopia. Transcendental idealism has fallen out of fashion as the reign of logical formalism, statistical analysis and artificial intelligence guides and solidifies the biological intelligence of humans. Despite the overwhelming triumph of such cerebral mechanization, it has utterly failed to unveil the nature of both physical and mental reality — as exemplified by the plight of John von Neumann's renown "proof" negating the presence of hidden variables within quantum physicality. Von Neumann was a pioneer

of computer science whose far reaching genius encompassed such distant domains as economics, geometry, nuclear arms, game theory, quantum physics and self-reproducing automata. The "success" of the atomic bomb came hand in hand with the nearly unanimous acceptance of his misconceived proof. (Do humans really need theory and philosophy, once a working a-bomb has been achieved?) The first one to disprove von Neumann's axiom was the philosopher, physicist, mathematician and anti-nazi activist, Grete Hermann. Her iconoclast article, "The Foundations of Quantum Mechanics in the Philosophy of Nature," was published in the highly prestigious *Die Naturwissenschaften* in 1935, but it went unnoticed until quantum master-mind, John Bell, stumbled upon the paper almost thirty years later. Thereafter, tremendous phenomenological insights have arisen from the depths of theoretical physics.

The artworks we create may be considered phenomenological investigations, clarifying not only the content of our perceptions, but also descending further into the non-rigid, morphing structures of consciousness itself. In this article, we will take a closer look at three of our endeavors which concurrently comprise novel multi-sensory performative environments, philosophical inquiries and scientific experiments, culminating in experiences that can equally exist outside the scope of science or phenomenology per se. We have selected artworks that are incited by acoustic phenomena, as Husserl himself considered the perception of music as one of the crucial means of time-consciousness and a superlative example of phenomenological elucidation.

According to Husserl, the content of perceptions and experiences is “objectified,” and the “object” is mentally constructed from sensorial impressions. Science involves precise measurements and gives meaning to these measurements by finding mathematical patterns in repeated measurements, disregarding the uniqueness of each concrete occurrence in favor of repeatability. In his last work “The Crisis of European Sciences and Transcendental Philosophy,” Husserl’s criticism does not undermine the triumph of science, but encourages a reexamination of the origins of the scientific mind, starting from ancient Greece. When he presented his critique in the mid and late 1930s, the incompleteness theorem of Goedel was already proven (1931) and Alan Turing’s non-computable functions were among the news (1936). It was clear that mathematics cannot be the ultimate language for endowing the universe with meaning, albeit among the most elegant and unequivocal. As the methods of natural philosophy have been slowly evolving during the last 2500 years, the intentions and concepts of its very few practitioners have changed dramatically. Of paramount importance to Husserl is the act of assigning meaning while deeply immersed within the flow of a uniquely emerging reality continuously addressed by consciousness. Hence, as our first step in preparing a phenomenological arena, we took a rather Husserlian stance by deliberately dismissing the utilization of recording and fixative media. Only the totality of an unfolding phenomenon, together with the observer in the act of perception, can provide the psycho-sensorial conditions for the emergence of meaning.

The morphological totality of acoustic phenomena, lying far beyond the aural horizon, led us to the integration of other sensory faculties for sonic observation. In order to accommodate a non-virtual, three-dimensional, multi-sensory experience of sound, we set out on an enduring, tenebrous pursuit of an exotic phenomenon known as sonoluminescence: coherently repeating picosecond flashes

of light emitted from sonically imploded gas bubbles in liquid. Deep within a liquid, such as water, float microbubbles far too small to see with the naked eye. Only high frequency acoustic vibrations are tiny enough to penetrate these bubbles, causing them to viciously collapse at over four times the speed of sound. Teaming with shock waves and jet formations, a *cavitation* bubble (containing a sonically injected cavity) shrinks into a dense plasma core that reaches temperatures as high as are found on the Sun. At this scorching stage, clouds of collapsing bubbles emit light which traces the intricate behavior of acoustic propagation. The extraordinarily high temperatures incited certain physicists to hypothesize that nuclear fusion might arise during sonoluminescence, prompting a great deal of research in the 1990s and early 2000s. However, the theory of “bubble fusion” was eventually dismissed, the squeezed plasma core has yet to be directly observed, and the main energy focusing mechanism remains unknown. Consequentially, various theoretical processes are still being formulated to explain this mysterious transformation of sound into light — ranging from quantum tunneling and collision-based radiation to quantum optical heating.

Amidst the vast body of research conducted thus far, it turns out that we have been the only ones pursuing sonoluminescence as a perceptual tool. It is not surprising, since it is quite difficult to procure sonoluminescence on a scale suitable for human perception. Laboratory experiments are usually performed in a little cuvette, smaller than a glass of water, with single bubble sonoluminescence that is hardly visible to human eye. Also, the sonication frequency is beyond the human hearing spectrum (although the synchronous bubble implosions are slightly audible). Over the course of five years, in collaboration with the Institute of Advanced Science and Technology (Japan), The Physics Institute of Goettingen University (Germany) and St. Petersburg-based acoustic physicist Alexander



Fig 1. Sonoluminescent standing wave in *Camera Lucida: Sonochemical Observatory*; image and © E. Domnitch and D. Gelfand

Miltsen, we created five different versions of *Camera Lucida: Sonochemical Observatory*. They constitute the largest displays of sonoluminescence to ever have been created, vigorously cavitating 60 to 90 liters of water.

When *Camera Lucida* is presented to the public, all of the research in no way frames the experience. It begins with a guided descent into pitch black darkness with a small group of spectators who are asked to sit quietly until their eyes slowly switch to night vision. This is also a moment of inward concentration during which the absence of the ever-dominant visual field and resultant self-invisibility become the premise for a new kind of lucidity. When the preparatory adaptation phase is over, visitors are guided to a 60-liter glass sphere positioned at eye level. After they form a circle around it, the performance commences. From an immeasurable distance dim nebulae start to appear, refusing to come into focus. Gradually, as one's pupils maximally open, the light

grows brighter and brighter until one is able to perceive the fleeting configurations of glowing sound fields. As larger patterns come into focus, one gains enough confidence to place one's head right in front of the chamber. An immense liquid lens, the chamber strongly magnifies its radiant contents.

Though such faint light is supposed to be devoid of any discernible hue, different observers claim to have seen different dominant tonalities, such as yellow, pink, blue or green. The predominant emission wavelength is in the invisible ultraviolet spectrum, which is why sonoluminescence was once labelled "star in a jar": very high energies and temperatures are necessary to create ultraviolet emissions. "Acoustic cavitation results in an enormous concentration of energy. If the energy density in an acoustic field that produces cavitation is compared with that in the collapsed cavitation bubble, there is an amplification of almost one trillion. The enormous local

temperatures and pressures of cavitation result in sonochemistry and sonoluminescence. Cavitation produces an unusual method for fundamental studies of chemistry and physics under extreme conditions, and sonochemistry provides a unique interaction of energy and matter.”³ Some of those who have perceived this tremendous energy transfer in the *Camera Lucida* installation have shared their experiences with us: from vivid evocations of neural activity to out-of-body wanderings and visions of Earth from space. There is also a scale chasm that is difficult to surpass. The spatio-temporal scale of sonoluminescent events reaching our senses from such minute quadrants conjures a sense of looking deep into the starry sky.

Although visitors are asked not to touch anything in the dark for reasons of safety and social complacency, touching the vibrating walls of the chamber, especially with one’s forehead or fingertips, provides a hair-raising tactile odyssey. In fact, we still contemplate creating an installation shaped so that the audience could place their hands inside. Through one’s hands, invisible under swarms of luminescing bubble clouds, one would touch the implosive power of cavitation.

Sonolevitation is another performance that simultaneously explores the auditory, visual, tactile and kinaesthetic repercussions of acoustic propagation. The title is a literal description of the performance itself, meaning sonically actuated levitation. Even such an unequivocal title rarely prevents the unversed from misinterpreting the phenomenon as magnetic, the type of levitation with which many are familiar both theoretically and empirically. The audience begins to reconsider this interpretation while gradually becoming aware of the continuous presence of a 15 kHz tone modulated by floating slivers of gold. The sound, emanating from an upwardly directed transducer, is bounced back by a reflector, creating alternating areas of strong acoustic pressure and vacuous pockets.

Suspended within these low-pressure voids, the gold slivers spin and vibrate with infinitesimally discernible aural consequences. Their each and every motion transforms the standing wave that levitates them and synchronously interlocks with the motion of their hovering neighbors. During the course of the performance, the observer gains spatio-temporal insight into an emergent feedback system in which each part evolves from the whole, and the whole from each part.

Similar to *Camera Lucida*’s visual entry into the non-linearity and complexity of sound, Sonolevitation prompts the extension of the auditory perceptual horizon by constructing a mental framework fusing hearing with other senses. Though the tactile dimension can only be physically experienced by the performer while positioning the gold within the sound field, the spectator can both see and hear the suction force of the vacuum. The resulting apprehension of sound can transcend the initial sensory experience, however, such synthesis is not guaranteed and may require strenuous mental efforts and even restructuring of habitual modes of perception. “The object appearing constantly new, constantly different, is constituted as the same in these exceedingly intricate wondrous systems of intention and fulfillment that make up the appearances. But the object is never finished, never fixed completely.”⁴

Husserl likes to stress the implicit incompleteness of sensory perception by referring to the fact that no object can be seen from all sides at once, and that it is the mind that objectifies into a unified whole the multifarious content of sensory perceptions, of lived experiences. The vigorously spinning and fluttering gold leaf in *Sonolevitation* reveals all of its appearances in rapid succession, nearly blending them into one image. By trusting and carefully synthesizing one’s senses, as any phenomenologist would do, one may altogether restructure one’s pre-linguistic spatio-temporal perception and reach unprecedented

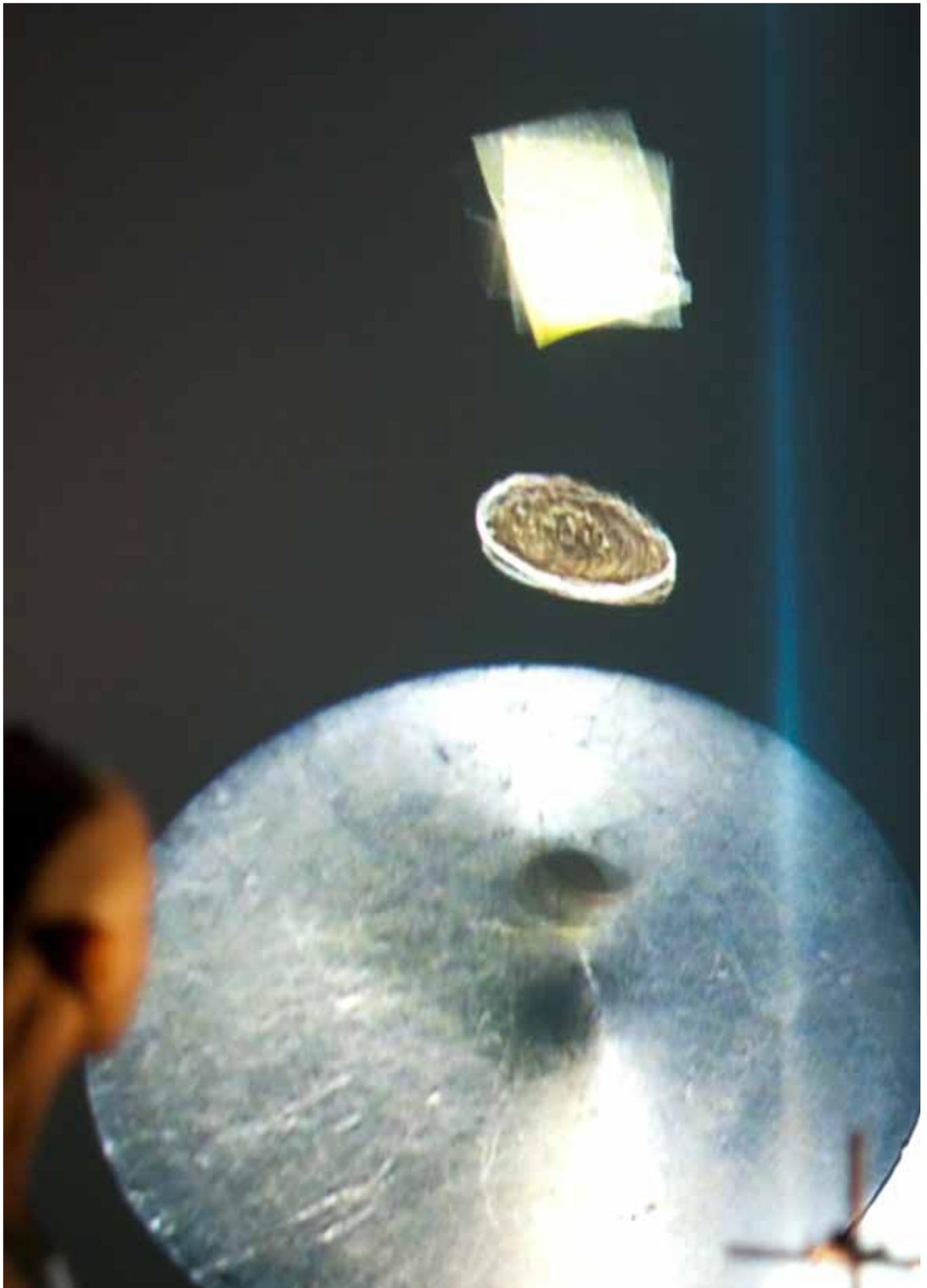


Fig 2. *Sonolevitation* performance in Krakov, 2010; image and © A. Dera

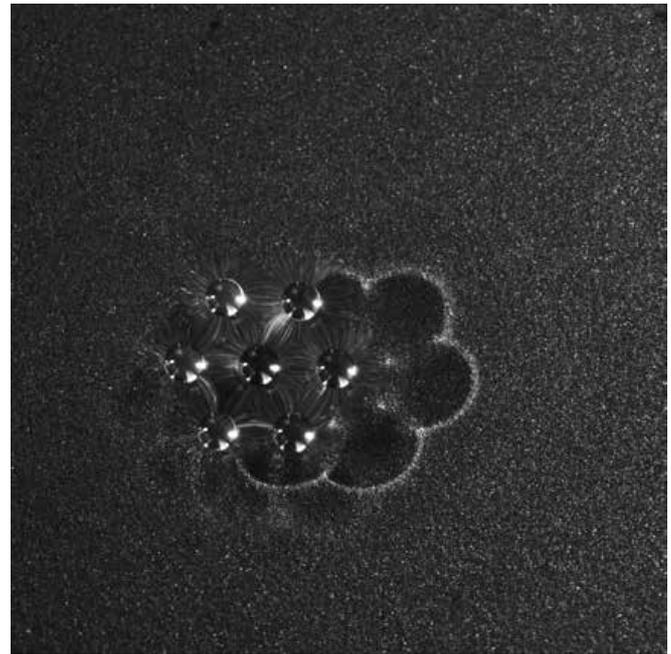
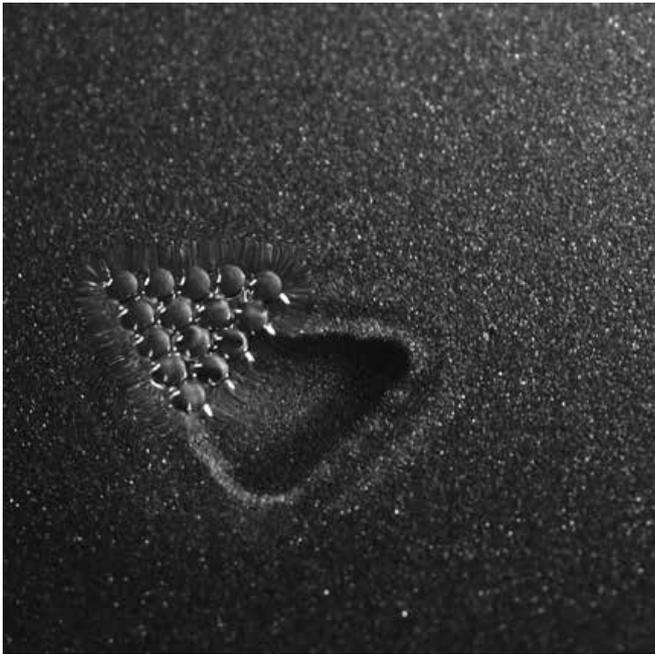


Fig 3 and 4. Acoustically levitated droplet-lattices in *Mucilaginous Omniverse*; image and © E. Domnitch and D.Gelfand

sensibilities and transcendental elevations. “...in order to be able to emanate from actual evidence every theory that refers to nature presupposes natural experience — what we call outer experience. In this way, all theoretical knowledge in general ultimately leads back to an experience. We see upon closer inspection that already under this rubric, “experience,” sense-giving accomplishment, is carried out, indeed, a highly ramified, intricate one...”⁵

Sonolevitation is also a suprematist tribute to Kazimir Malevich who postulated that the goal of humanity “consists of distributing weight in systems of weightlessness.”⁶ Guided by his obsession with levitation, in the 1920s he taught his UNOVIS students in Vitebsk courses on the scientific research of Tsiolkovski and Chizhevski, both pioneers of space exploration. The value of such knowledge for artists was motivated by Malevich’s insight into microgravity’s transformation of customary modes of perception, especially the kinaesthetic coordination of spatial sensations. Eventually, after hundreds of people having lived in microgravity, it has been acknowledged that even color vision is affected by free-fall, due to the eyeball’s change in pressure.

Resembling scintillating transparent cells or cyclically flickering eyeballs hovering in microgravity, laser-scanned droplets of silicone oil are acoustically airborne in *Mucilaginous Omniverse*. From underneath a bath of silicone oil low-frequency sound waves propel a pillow of air just above the bath’s surface, preventing falling droplets from coalescing with the bath. Once released from a syringe the droplets assemble into a floating latticework, the nodes of which correspond to the sonic wavelength. Certain frequencies may entrain droplet pairs and larger ensembles into quantized orbits analogous to the bound states of electrons around atomic nuclei.

Discovered only a decade ago, this means of sonically levitating droplets has lately attracted much attention after Yves Couder’s conceptual breakthrough: the experiment macroscopically mimics several quintessential quantum phenomena, such as single particle diffraction, tunneling, quantized orbital motion and most recently the Zeeman effect. Though not immediately perceivable, the droplets continuously experience a bouncing motion that is phase-locked to the sonication frequency. While bouncing on the air-oil

interface, they create surface waves with which they are symbiotically linked, in the manner of wave-piloted particles. Posited by Louis de Broglie in 1927 and enriched by David Bohm in the 1950's, the pilot wave theory is an alternative to the Copenhagen interpretation (also published in 1927) which precludes the simultaneous observation of a particle and its associated wave state. Permitting awareness of only one state at a time, depending on the protocol of the measuring apparatus, this still dominant interpretation, formulated by Neils Bohr and Werner Heisenberg, blocks any route towards the visualization of wave-particle duality.

Unconvinced by the notion that the very nature of physical reality cannot be envisioned, Albert Einstein strongly encouraged the development of the pilot wave interpretation, closely entwining it with his theory of relativity. "Physical objects are not in space, but these objects are spatially extended (as fields)... Since the theory of general relativity implies the representation of physical reality by a continuous field, the concept of particles or material points cannot play a fundamental part, nor can the concept of motion. The particle can only appear as a limited region in space in which the field strength or the energy density are particularly high."⁷

In *Mucilaginous Omniverse*, one may simultaneously observe with the naked eye the oscillating corporeality of a droplet-particle along side its disembodied pilot wave. The perceptual mapping of this quantum analogy also greatly enhances the observer's awareness of non-local mental phenomena. Husserl's elucidation of these "transcendental" structures of perception deeply converges with our mesoscopic artistic pursuit and with the scientific revolutions sparked by relativity and quantum theory. The psychophysics originated by his predecessors, the legendary likes of Thomas Young, Hermann Helmholtz and Ernst Mach, elaborately evolved into Husserl's

kinaesthetics of global "perceptual fields," as fundamentally indivisible from one another as from their infinite surroundings.

"The appearances form dependent systems. Only as dependent upon kinaestheses can they continually pass into one another and constitute a unity of one sense. Only by running their course in these ways do they unfold their intentional indicators. Only through this interplay of independent and dependent variables is what appears constituted as a transcendental perceptual, precisely as an object that is more than what we directly perceive, as an object that can completely vanish from my perception and yet persist."⁸

Since the fuzziness or non-locality introduced by quantum theory, and relativity's erasure of the frozen Euclidian/Newtonian backdrop, the perceptual construction of space-time can only be an idealized synthesis (eidetic or numeric) of co-dependent, semi-hidden phenomena. Evocative of Einstein's imminent thought experiment leading to the discovery of quantum entanglement in the 1930s, Husserl's phenomenology would eventually emerge into the meta-kinematic framework for the slippery abyss of high-energy physics. Though hastily mummified by philosophical circles, phenomenology has been gradually reborn in the subterranean tunnels of CERN, at the "open horizon" beyond the Standard Model. "...an intending beyond the thing itself with all its anticipated possibilities of subsequent determinations, i.e., an intending-beyond to other objects of which we are aware at the same time, although at first they are merely in the background. This means that everything given in experience has not only an internal horizon but also an infinite, open external *horizon of objects cogiven*..."⁹

The new phenomenology is an indispensable conceptual bridge between experimental and theoretical physics, painstakingly achieved after a long, meandering path of tumultuous debates between empiricists and transcendental

idealists, between particle prophets and particle poppers. Ascending from CERN's subatomic debris, John Bell started drawing physicists' attention to the uncanny phenomenon of an entangled pair of particles (akin to Husserl's "cogiven objects" or "dependent variables") behaving as a single global wave system ("a unity of one sense"), regardless of the distance between the particles. No longer a thought experiment, by the early 1960s, Bell devised a fool-proof means to empirically scrutinize entanglement and verify the vibrating presence of non-local hidden variables. Finally, von Neumann's fossilized conviction of their absence was indubitably refuted, but the ultimate question still remains as to where and if there lies a horizon between our massive, misleadingly rigid macro-reality and its underlying wavy world of telekinetic quantum behavior.

Though Husserl constrained himself from using scientific language and terminology borrowed from physics and neuroscience, choosing instead a critical re-examination of the language of transcendental idealism, our text does not shy away from scientific terms or concepts. It also does not represent an example of exclusively phenomenological investigation. Rather, it is the experience of an artwork described in this text, coupled with the intention of an observer, that can become an experience of phenomenological immersion, a co-emergent performative experiment. The intention of this article is to prepare and incite the potential spectator to attempt such an experiment or even go beyond it.

Notes

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