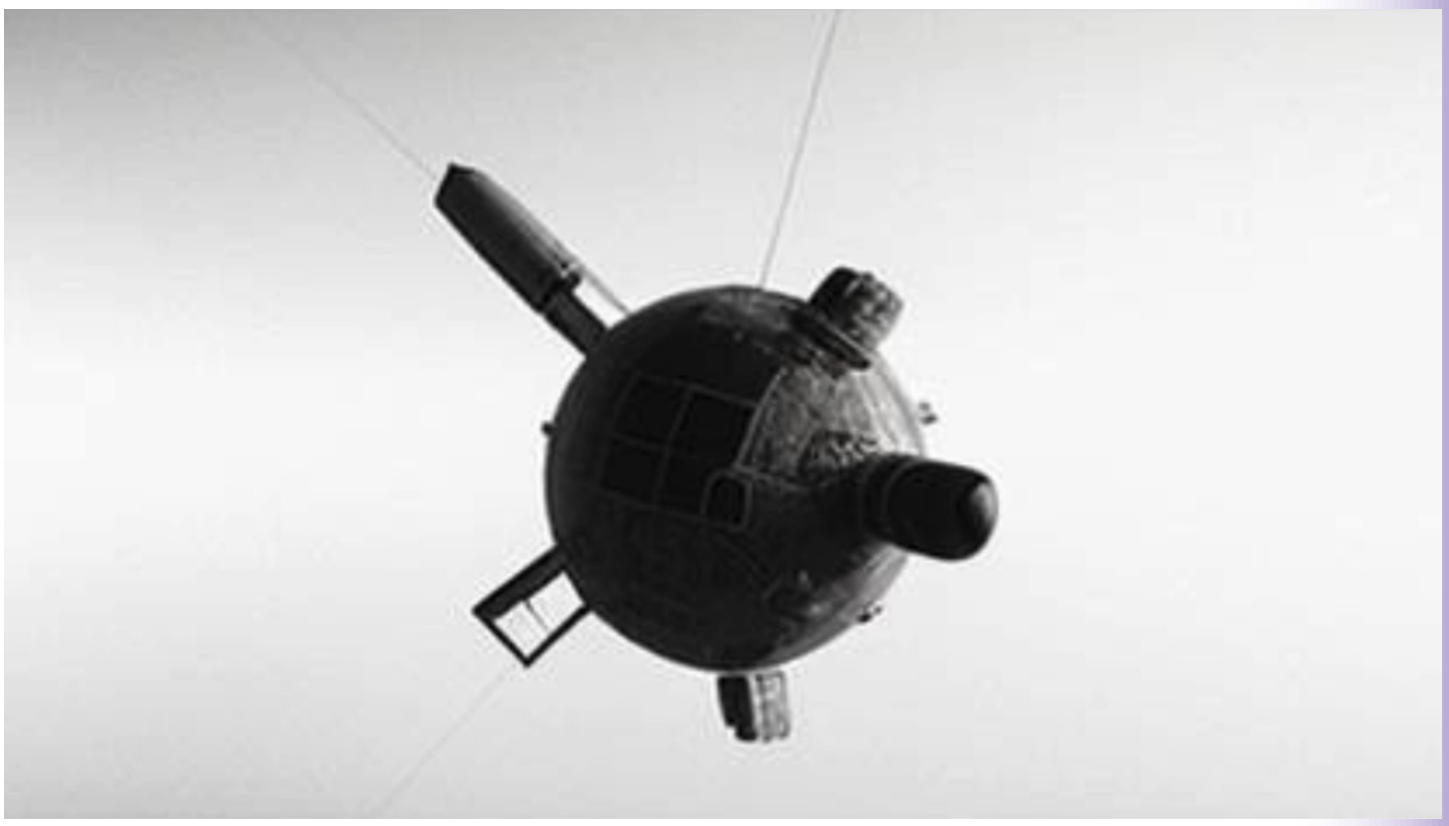
Evolution of nSpace (2004–2024)



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The Evolution of nSpace is an experiment in 'pataphysical filmmaking. The film is generated in real-time through custom-made optical/sound apparatus (see Fig. 1) calibrated to the music of the Opalio brothers, and with the participation of the audience. The format, style, and process draws on 'film d'art' or Art Cinema motifs and practice. Until the moment it is observed by the musicians and other participants during the performance, the film exists only in a 'quantum cloud.' [1] At run-time, the film's superposed elements are procedurally edited and sequenced; collapsing the quantum cloud of the film into the resulting (observed) timeline. In the 'pataphysical tradition, the film is presented as a factual embodiment of inventions which presently, from the perspective of generalised science, remain impossible. The film/performance becomes contemporaneously evidence and artifice, *both* science and fiction. Will the growing use of (super) intelligent systems lead to an understanding of the universe as infinitely *knowable*? If any question can be computationally resolved through the statistical inference of probabilistic models based on the constant and indiscriminate accumulation and control of data, what, if anything, remains unknowable?

Keywords Pataphysics, Speculative Design, Science Fiction, Cybernetics, Quantum Theory.
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Project, process and operation

> *'Pataphysics will be, above all, the science of the particular, despite the common opinion that the only science is that of the general. 'Pataphysics will examine the laws governing exceptions, and will explain the universe supplementary to this one.*[2] *—Alfred Jarry*

At the heart of the project, *The Evolution of nSpace*, is an automated-art-system consisting of custom-made equipment (see Fig. 1) which uses computer vision and sound analysis to generate images which are computationally arranged into film sequences in real-time. This apparatus and its custom-coded software, is calibrated to be used with either an amplified phonograph record, or the live performance, of sound-art by Maurizio and Roberto Opalio (aka My Cat Is An Alien) in order to generate a parallel live-video feed of a unique science-fiction film.

The film, although completely generated frame-by-frame in real-time, is designed to proceed through three distinct parts or acts. Each act is narrated through subtitles generated with custom-coded scripts for synthetic language which stems from, and contributes to, the ongoing creation of the film.

Fig. 1. Custom-made apparatus, vinyl phonograph disc and player for calculating Tonalytic Trajectories for the *Evolution of nSpace*, Donnachie & Simionato, with Maurizio and Roberto Opalio, 2024

ACT I: Phonon Conversion

The first act introduces the 'pataphysical invention of 'phonon conversion,' the principle underpinning the generation of 'Tonalytic Trajectories', converts phonons (quantum units of sound) into photons (quantum units of light).[3]

The synthetically generated narrative describes how, before the invention of the Phonon Converter, there was no known way to directly convert phonons, or the lattice vibrations in solids into photons. Additionally, the synthetic narrator describes how computational sound

1. The automated-art-system which generates the film, here envisioned through the metaphor of a 'quantum cloud' references the principles of superposition of quantum mechanics, where a particle doesn't have a definite position until it's measured; Superposition in quantum mechanics refers to the ability of a quantum system to exist in multiple states at once. The principle of superposition, as described by Paul Dirac, suggests that a quantum system can be in a combination of states, each with its own probability. This means that a quantum system can be considered as being partially in several states at once, without these states interfering with each other; "The intermediate character of the state formed by superposition thus expresses itself through the probability of a particular result for an observation being intermediate between the corresponding probabilities for the original states, not through the result itself being intermediate between the corresponding results for the original states" P.A.M. Dirac. 1947. *The Principles of Quantum Mechanics* (2nd ed.). Clarendon Press, 12.

2. 'Pataphysics, as established by Alfred Jarry, is an artistic practice that challenges the determinism of classical Newtonian physics.; Alfred Jarry, 1996. Exploits & Opinions of Doctor Faustroll, Pataphysician: A Neo-scientific Novel. Boston: Exact Change, 21; Christian Bök explains Jarry's 'pataphysics prefers to

analysis and Cross-Modal Encoding, permits a quantum superposition that allows data (generated as sound) to be transmitted via photonic spectra. In other words, with phonon conversion, lattice vibrations in solids can now be harnessed to produce a photon beam capable of propelling and steering a spacecraft, by converting sound to photon-encoded data suitable for transmission via a synchronised audio-to-optical interface.[4]

ACT II: Tonalytic Trajectories

In the second act of the film a Tonalytic Trajectory system which controls the movement of spacecraft based on photon beams produced by focused tones or music, is described. Intentional music compositions are crafted, or, in the case of skilled musicians improvised, to direct a spacecraft along desired orbital paths. Different tones, rhythms, and chords produce different wave shapes, to sculpt the trajectory.[5] For example, music produced in a major key can send the spacecraft outward on escape trajectories; dramatic diminuendos may be used to slowly spiral inward; and complex polyrhythms used to enable intricate course adjustments.

ACT III: Experiencing nSpace

In the final act, the viewer is invited to directly experience travelling through nSpace through these new inventions under the "controlled conditions designed for safety and comfort". As the viewer begins to move through various iterations of nSpace they may experience feelings of disorientation and other somatic sensations. These are expected.

You are now entering nSpace. Welcome.

Notes

The title of this project is taken from a series of photographs and related works Donnachie and Simionato began making and publishing in the early 2000s. For these projects, small objects (representing platonic shapes such as cubes, cones and spheres) were photographed on existing printed publications in ways intended to problematise the viewer's perspective, either collapsing the illusion of depth, or otherwise disrupting our perceptual resolution, of the original, underlying image. We even created a series of anaglyph images of these same objects for a small exhibition in Paris, inviting the viewer to see the (2-dimensional) images of the (3-dimensional) objects through red/blue glasses.[6]

explore the "surrational potentials of such physics… what is random and absurd"; "'Pataphysics is speculative, waiting for its chance to happen, as if by accident, in a theme park of scientific conception."; Bök reminds us that "Science suggests that what is probable coincides with what is most provable[…] not because they can be proven but because they can be probed. There are "probeable" systems."; Christian Bök, 2002. 'Pataphysics: The Poetics of an Imaginary Science Northwestern University Press, 29; Andrew Hugill and James Hendler in "'Pataphysics and Computing" also trace an entanglement between artistic research and quantum computing through the lens of 'pataphysics.

3. Phonons represent the quantum basis of acoustic propagation through solids. On a quantum level, the vibrational motions caused by the music involve discrete quantized excitations of the vibrational states of the crystal lattice— and these quantum mechanical vibrational quanta are called phonons. Through careful tuning of the system (in a probabilistic combination of spatially separated vibration states), applying a phonon at a certain frequency stimulates the emission of a photon in a predictable way while preserving the superposition. Detecting the output photon 'collapses' the superposition (into either one vibrational state or the other). In the interim, there is a direct linkage between the phonon input and photon output at a quantum correlational level through the shared phononic superposition. In other words, phonon conversion effectively translates between macro-scale sound wave vibrations and light emission events tied to underlying molecular phonon and photon dynamics.

Fig. 2&3. Early photographic studies of the *Evolution of nSpace* published in *This is a magazine*, 2009.

After twenty years, these same small objects have found their way into a new iteration of the project. They represent an evolving system for articulating, understanding, and moving in, through and beyond generalised space with the help of computational systems. They offer opportunities to explore the science of the exceptional.

Acknowledgments: This artwork uses a number of open-source libraries, software and tools— Quantum Fourier Transform and Fourier Transform tools for acoustic analysis and conversion; NASA's open-source GMAT system for space trajectory optimisation, navigation, and flight analysis (see https://gmatcentral.org); Arduino and Adafruit libraries to drive the kinetic Phonon Converter; and Python, OpenCV, Blender, WebGL, Javascript (p5.org, threejs.org), with Stable Diffusion (Stability.ai), for the procedurally generated film.

Evolution of nSpace Video presentation https://vimeo.com/912892331

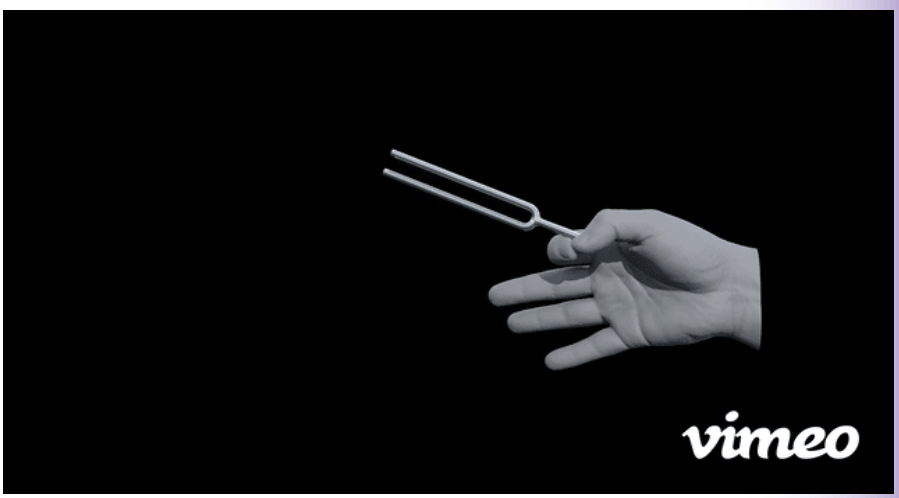

Fig. 4. *Evolution of nSpace*, [presentation video] 2024 (https://vimeo.com/912892331)

4. "Photonics Reshapes the Future of Computing" in Photonics Spectra Feb 2024. https://www.photonicsspectra-digital.com/photonicsspectra/february_2024?folio=36; See also Programmable photonic integrated circuits (PPICs) which process light waves for computation, sensing, and signaling, in https://phys.org/news/2024-02-key-photonic-components-supercomputing-technology.html.

5. Similar to the subjective experience of superposed acoustic phenomena such as Shepard's tone, superposed light waves may conjure unique visions in viewers. These waves may be perceived by the audience as images, although studies in Quantum dream state visualisation reveal that due to the subjective influence photon wavefunctions have on human consciousness, each participant may experience unique perceptions of images and environments (in other words, results may vary); Traditional visualisation shows photon waves move linear forward, while they wobble and pulse in planes perpendicular to their direction of motion. Visually the wave shape oscillates up and down sinusoidally and cycles in intensity over space and time.

6. "Evolution of nSpace." in *Archistorm*, Paris, France, 2010, curated by Catherine Geel; in *Activities in Space and Time*, Warm Grey Gallery, Paris, 2010; in "Pink Laser Beam," *This is a Magazine*: Compendium #6, 2009.

References

Bök, Christian.
2002. *'Pataphysics: The Poetics of an Imaginary Science*. Evanston, IL:Northwestern University Press.

Dirac, P.A.M.
1947. *The Principles of Quantum Mechanics* (2nd ed.). Clarendon Press

Hugill, Andrew and James Hendler.
2022. "'Pataphysics and Computing" in *'Pataphysics Unrolled*. DeGruyter. https://doi.org/10.1515/9780271091853-020

Jarry, Alfred.
1996. *Exploits & Opinions of Doctor Faustroll, Pataphysician: A Neo-scientific Novel*. Boston: Exact Change.