



**HAL**  
open science

## Quantum Dream

Virgile Novarina, Walid Breidi, Jean-Marc Chomaz, Laurent Karst

► **To cite this version:**

Virgile Novarina, Walid Breidi, Jean-Marc Chomaz, Laurent Karst. Quantum Dream: the day I imagined the ocean. *able*, 2023. hal-04303676

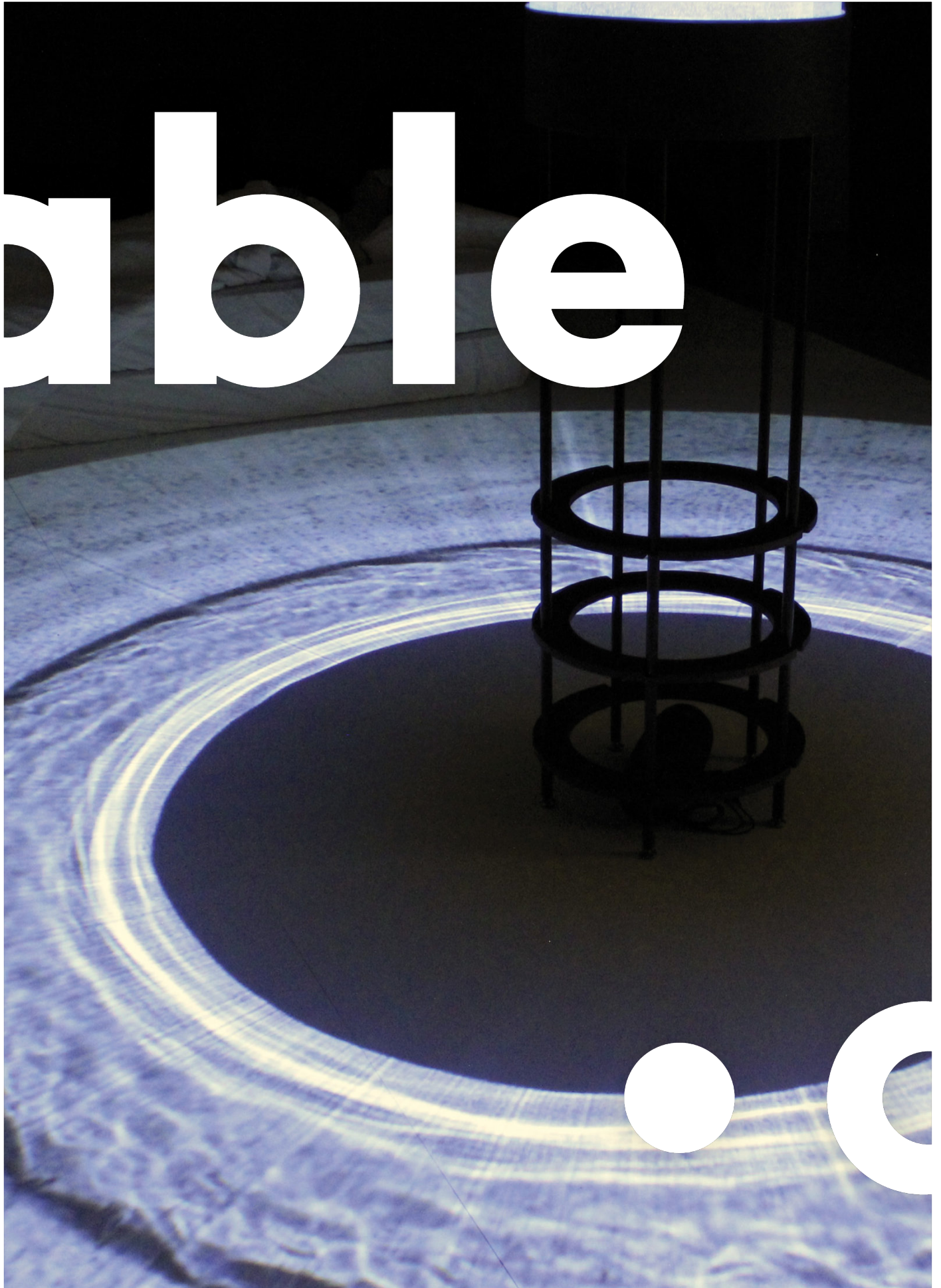
**HAL Id: hal-04303676**

**<https://hal.science/hal-04303676>**

Submitted on 15 May 2024

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



[www.able-journal.org](http://www.able-journal.org)

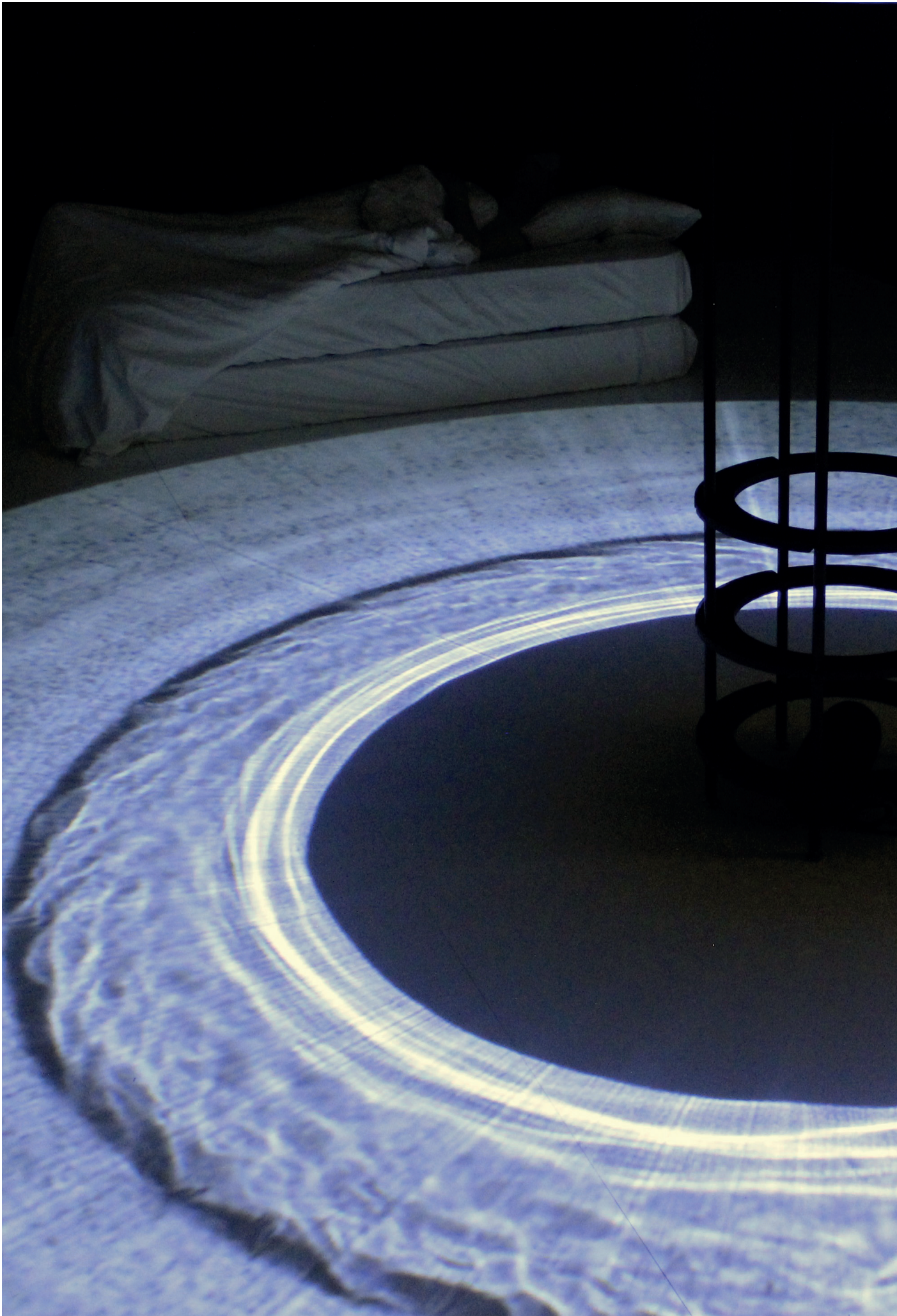
e-ISSN: 2802-7590

ISSN: 2993-7825

*.able* is a project initiated by the “Chaire arts & sciences” of École Polytechnique, École des Arts Décoratifs – Université Paris Sciences & Lettres (PSL) and the Fondation Daniel et Nina Carasso, in partnership with more than 30 international institutions, all represented within the *.able* board. It is developed by the Reflective Interaction Research Group of EnsadLab (research laboratory of École des Arts Décoratifs).



*.able* is published by Actar Publishers.



# rêve quantique

## *the day I imagined the ocean*

Virgine Novarina, Walid Breidi & LABOFACTORY (Jean-Marc Chomaz, Laurent Karst) – March 23, 2023

• sleep • dream • quantic • brainwaves • ocean • fluids • shadowgraphy • invisibility • imaginary

While a sleeper may seem inert, their brain is going through subconscious creative states. Nonrapid eye movement sleep in particular is associated with a lesser perception of their self and their environment. During this stage, intense exchanges occur between brain regions.

The brain is a fathomless entity involving billions of interconnected neurons exchanging electrical, chemical, and physical signals. The electronic activity is described by the Schrodinger equation of quantum mechanics for the wave function associated with the electrons shared between all the cells. The wave-particle duality applies and, depending on the measurement apparatus, electrons may be observed as a coherent wave pattern covering large regions of the brain or as particles localized on individual neurons. Thus, thoughts and dreams belong to the wave functions space, neither undulatory nor corpuscular, and any measurement corresponds to an arbitrary projection. Alpha, beta... delta waves are such observables, traditionally used to project quantic states of mind onto a predetermined representation. But what is lost or gained in such a simple abecedary?

To explore the richness of brain activity during sleep, sleep artist Virgile Novarina, in collaboration with digital artist Walid Breid, has teamed up with physicist-artist Jean-Marc Chomaz and architect-designer Laurent Karst of LABOFACTORY, who produce art installations to question our relationships with wind, waves, clouds, and oceans.

“Full fathom five thy father lies,”<sup>1</sup> the ocean, origin and close, limbo and shroud. The ocean transmits electromagnetic signals only a few meters down. Deeper data may only be collected through sound scattering or water-born measurements from ships, buoys, or gliders. The ocean is animated by streams, vortices, and waves at all scales. Water masses retain the elusive memory of the Earth’s climate at the time they left the surface and sunk deep. The associated vertical circulation is slow, one thousand years to close the loop. It is called Thermohaline Circulation, driven by heat and salt density variations.

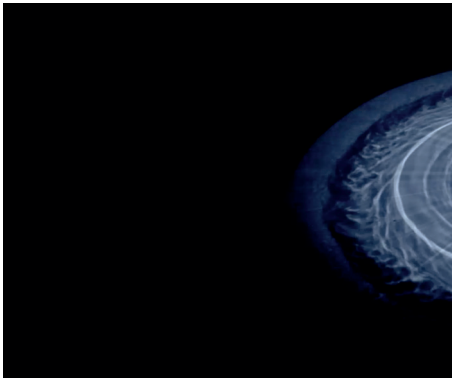
Presently, it is tempering global warming, returning the heat of the past. But its fate in the changing world is unknown. Could the oceanic circulation stops leading to the next anoxic event as in previous geological periods?

*Rêve quantique: The Day I Imagined the Ocean* is conceived as an immersive installation that creates connections between the brain and the ocean, both unfathomable. An installation that keeps the quantum idea of projection onto observables that define a system of states, similar in their semantics for ocean and brain: waves, vortexes, streams, and pulsations. What would happen if the semantics of one universe is translated into the other, in a kind of inside out automatic writing? Would the visitor entering the transcoded world feel themselves diving into the dream or falling into the ocean or would reality itself be subdued, the visitor drowned in their own unconscious?

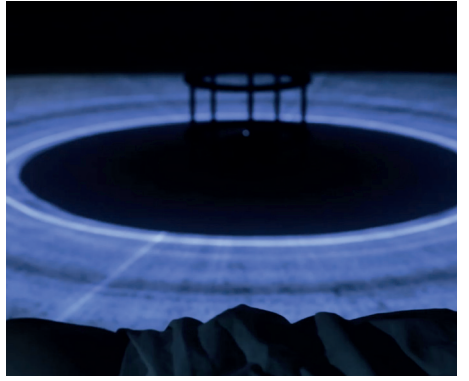
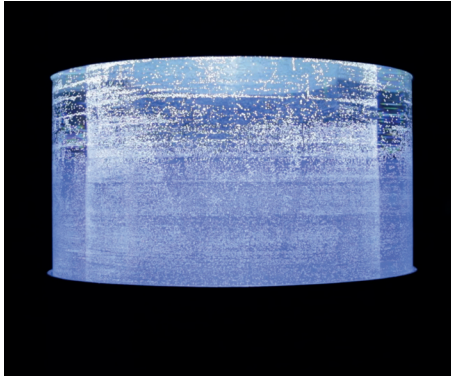
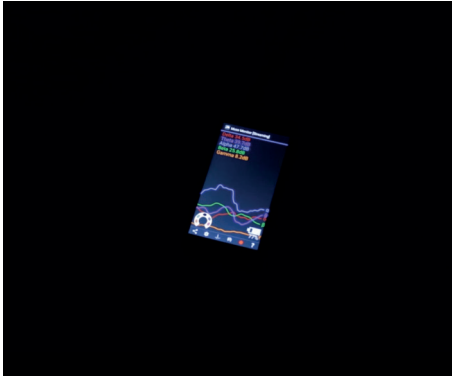
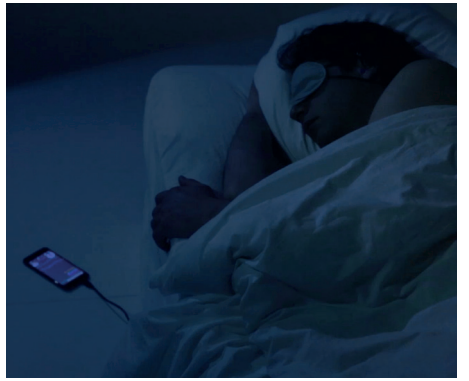
The documentary film traces the project’s genesis and the research involved. The film brings together the two unfathomable worlds, sleep and the ocean. It constitutes a visual exploration of the space opened up by the imbalance between the poetic dimensions of the project, the scientific facts and knowledge, and the human experience of shared research.

The documentary also interrogates the experience of a visitor entering the intimate space with the sleeper in his bed, close to a sort of a lighthouse that contains a miniature ocean. Getting closer, she notices the headband, the cellphone monitoring the brain waves. On the floor she observes the shadowgraphic projection of the internal oceanic movements making a bright changing circle 4 meters in diameter. What is the connection? The artists have patiently built an abecedary of delta wave states from measurements. The time series of different states forms a never-ending phrase transcoded live into a second abecedary to control a motorized device at the surface of the ocean mimicking the wind-driven entrainment. Could the visitor perceive that? Or be lost in the translation, dreaming with the ocean, flowing with the sleeper?

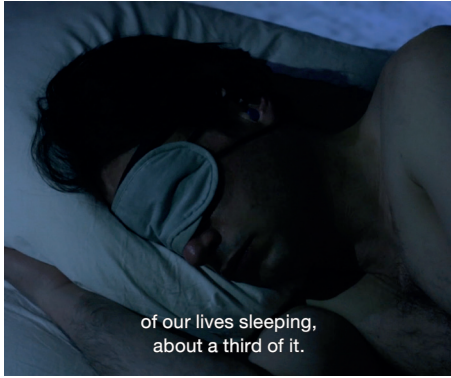
1. William Shakespeare, *The Tempest*, Act 1, Scene 2.



The day I imagined the ocean  
 deep and shallow  
 slow tide  
 bounded to no shore  
 the light folding into shadows



We spend an important part



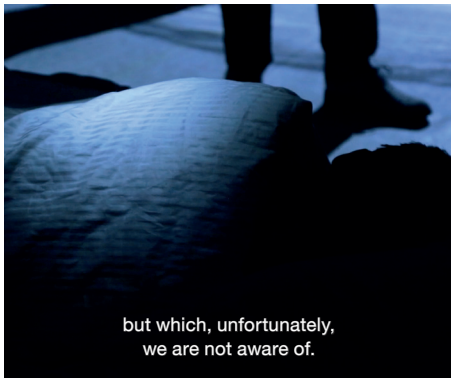
of our lives sleeping,  
 about a third of it.



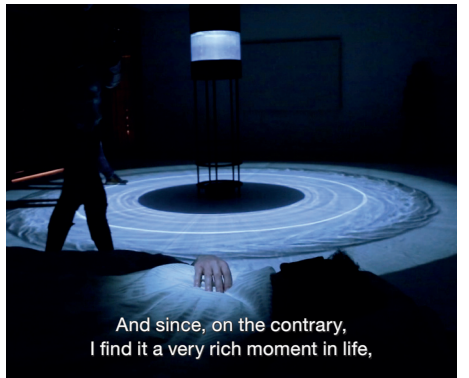
When you get to remember  
 a little bit or explore



we realize that this is  
 a time when the brain is very creative



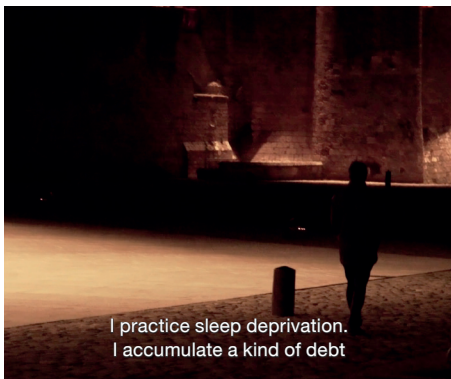
but which, unfortunately,  
 we are not aware of.



And since, on the contrary,  
 I find it a very rich moment in life,



I felt like showing it  
 and sleep in public



I practice sleep deprivation.  
 I accumulate a kind of debt



to show real sleep  
 as a result of being tired



So this sleep deprivation, which is for me a conditioning process,



has become a kind of ritual before any performance



during which I spend in general two sleepless nights to be able to fall sleep



no matter what the conditions are and no matter how many people



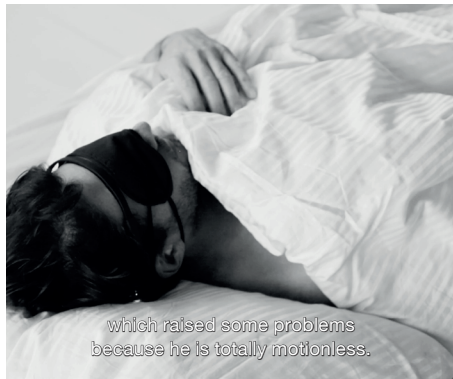
without sleep, I fall into sleep as if I was a little catapulted



into the depths of sleep.



Virgile suggested that I do something with sleep;



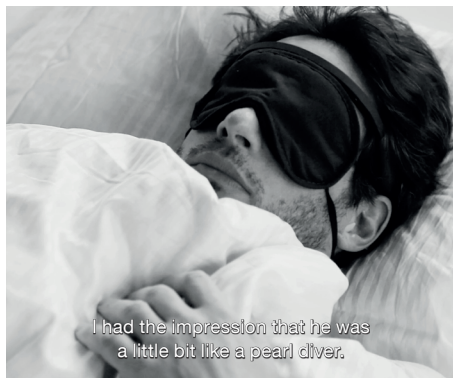
which raised some problems because he is totally motionless.



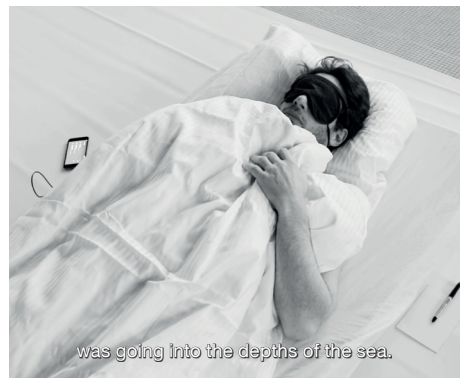
And when he described to me what he was doing in his sleep



and how he woke up to write down his thoughts at night,



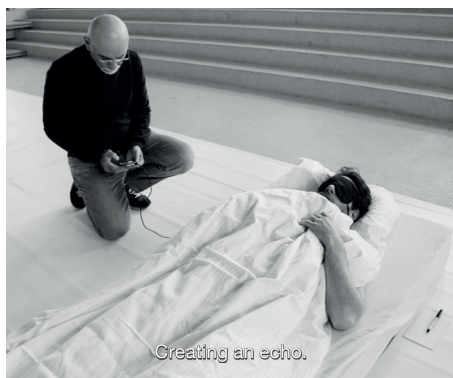
I had the impression that he was a little bit like a pearl diver.



was going into the depths of the sea.



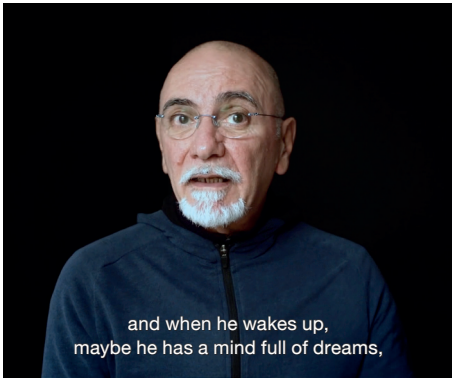
he rarely finished his sentences,



Creating an echo.



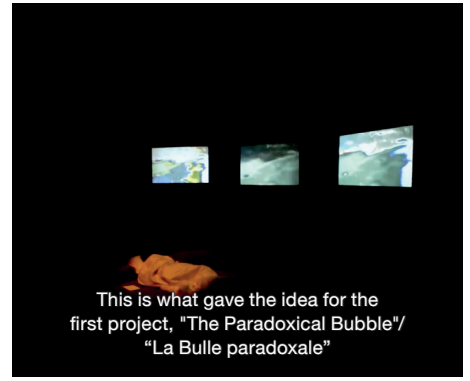
The sleeper dives into her or his sleep



and when he wakes up,  
maybe he has a mind full of dreams,



And when he wakes up,  
he forgets everything.



This is what gave the idea for the  
first project, "The Paradoxical Bubble"/  
"La Bulle paradoxale"



two installations that involved  
brain waves of sleep:



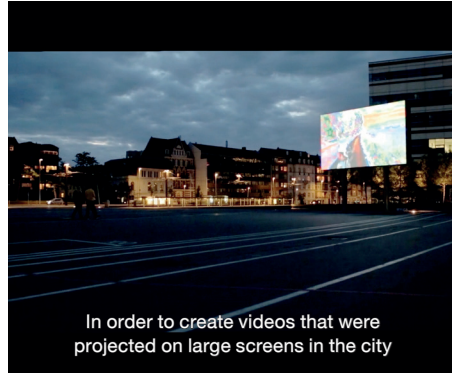
So, we connect a little bit the world of  
wakefulness and the world of sleep



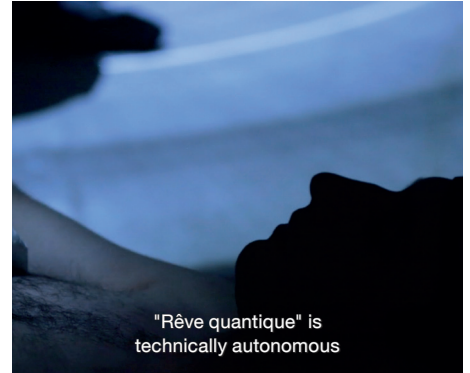
it was in Denmark, in Aarhus,  
it's called "Sleep in the City"



but in a collective  
and participatory way,



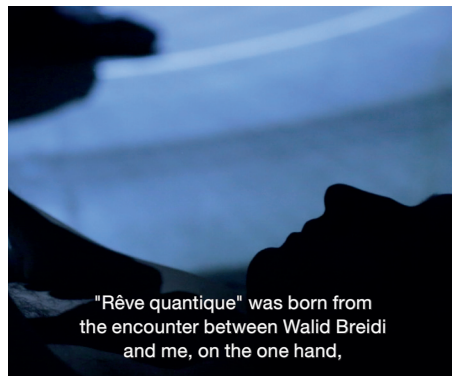
In order to create videos that were  
projected on large screens in the city



"Rêve quantique" is  
technically autonomous



because it is like a heart  
that beats by itself.



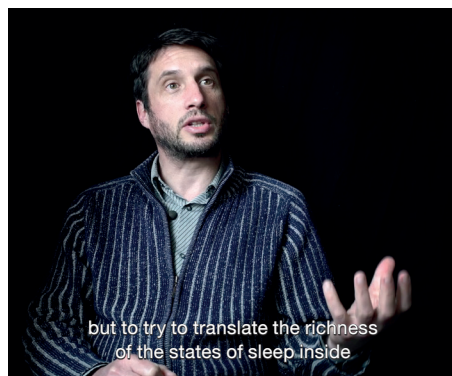
"Rêve quantique" was born from  
the encounter between Walid Breidi  
and me, on the one hand,



and between Jean-Marc Chomaz and  
Laurent Karst, from LaboFactory; in fact,



to finally materialize these sleep waves,

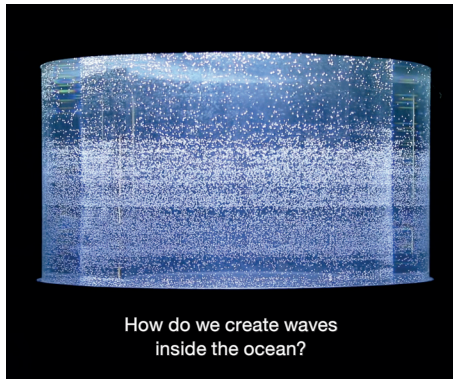
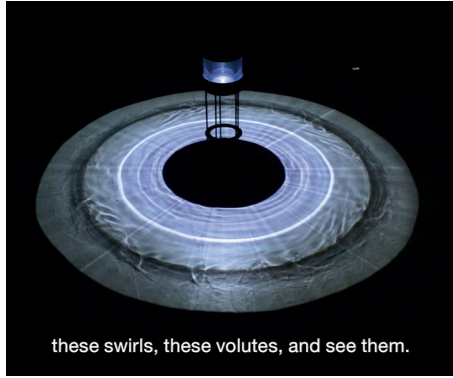


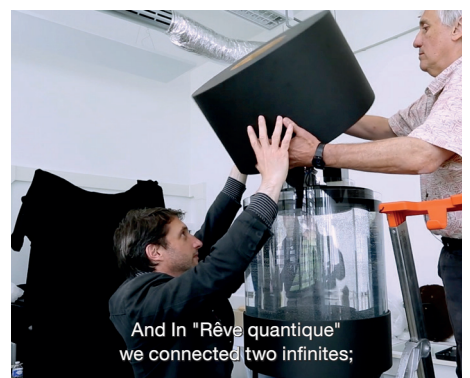
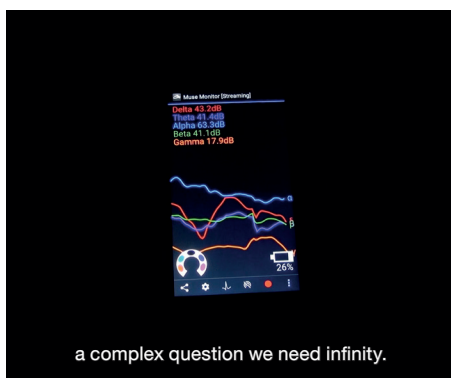
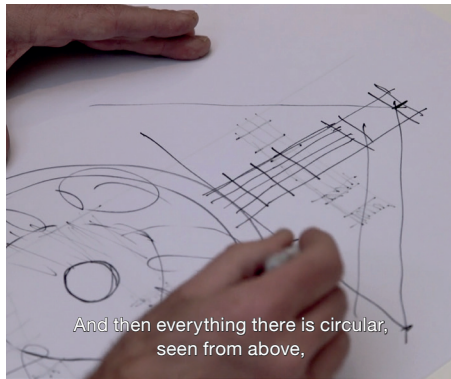
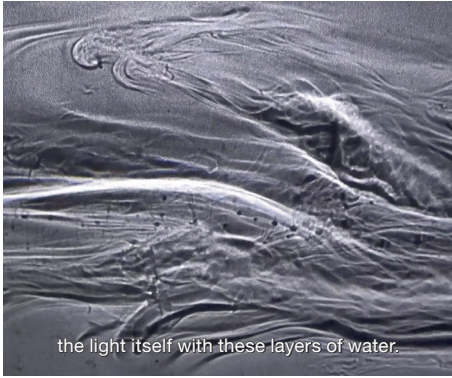
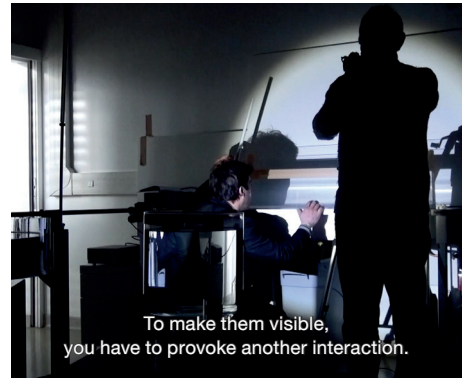
but to try to translate the richness  
of the states of sleep inside

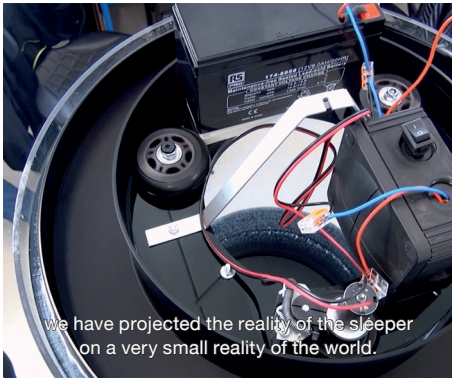


And when I spoke about this  
with Jean-Marc Chomaz,  
at LadHyX (École polytechnique)





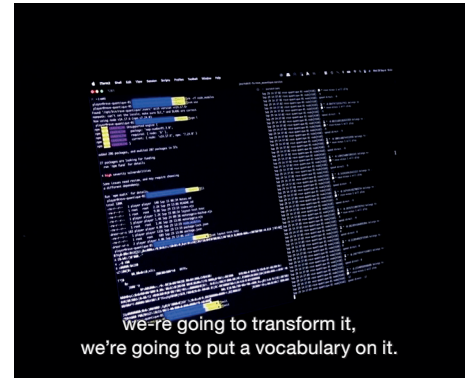




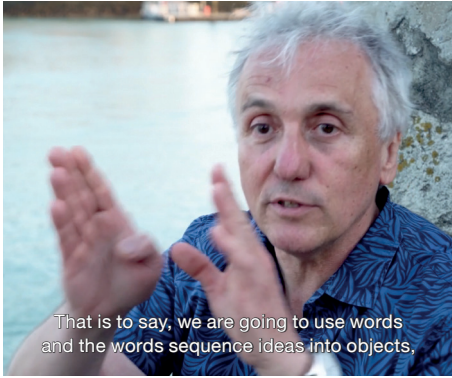
We have projected the reality of the sleeper on a very small reality of the world.



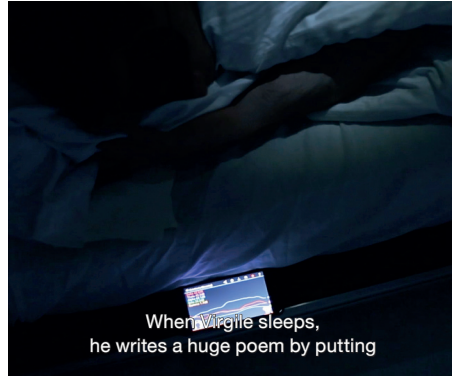
We're going to transcode this wave,



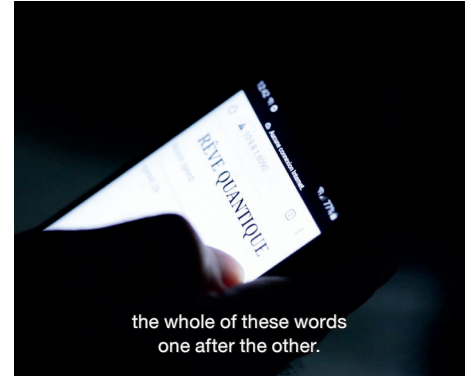
We're going to transform it, we're going to put a vocabulary on it.



That is to say, we are going to use words and the words sequence ideas into objects.



When Virgile sleeps, he writes a huge poem by putting



the whole of these words one after the other.



It's this that we will time afterwards, then.



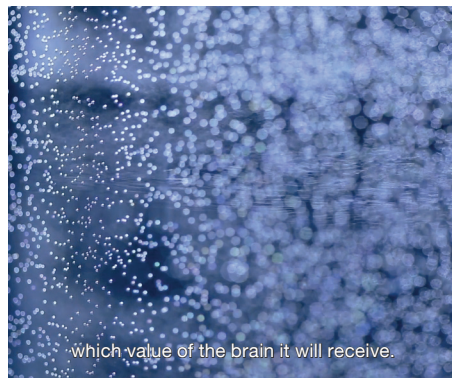
When we will control the speed, and after that it will stop.



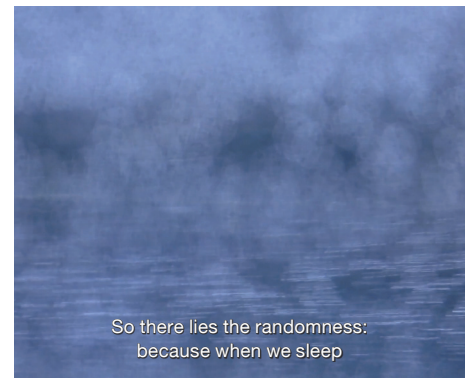
There, you see all the states



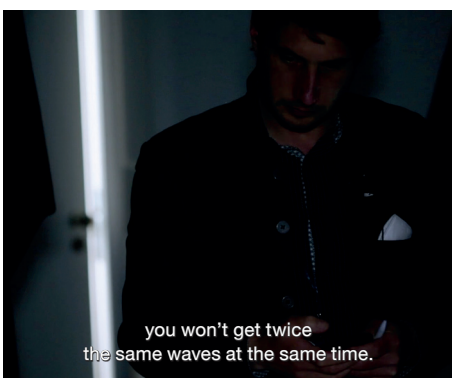
there are variations because we don't know



which value of the brain it will receive.



So there lies the randomness: because when we sleep



you won't get twice the same waves at the same time.



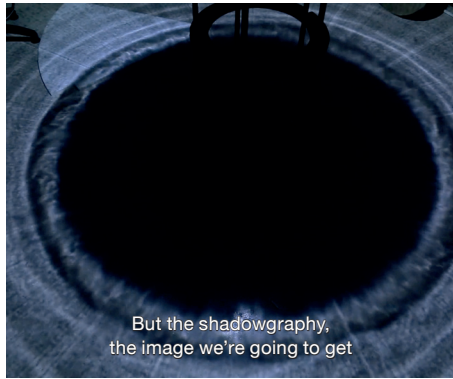
We define states with speeds.



And then afterwards, the ocean will respond according to its own state.



is entirely dependent on this basin.



But the shadowgraphy, the image we're going to get



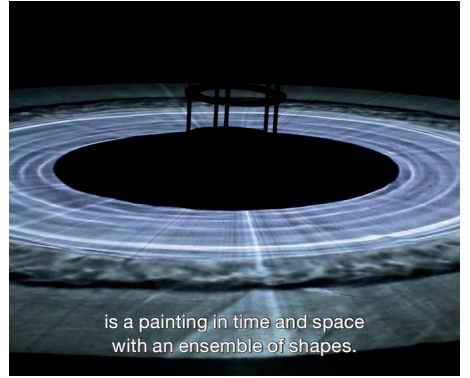
There, already, the speed,



trying to control an let go simultaneously,



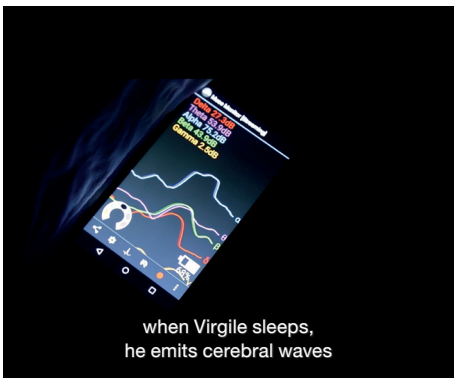
is an artistic method, a creation of an artistic universe.



is a painting in time and space with an ensemble of shapes.



during sleep, we don't really realize that the brain is active



when Virgile sleeps, he emits cerebral waves



There are cleaning waves



of the cephalic-spinal fluid within the brain



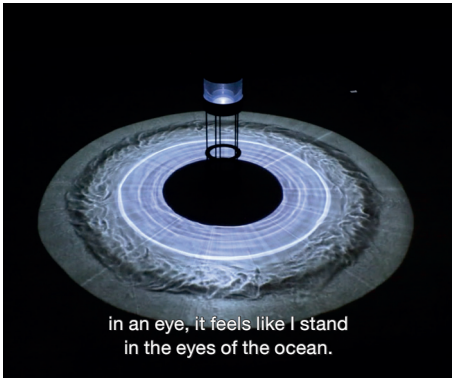
It will come to clean the neurons and remove the plaques of proteins



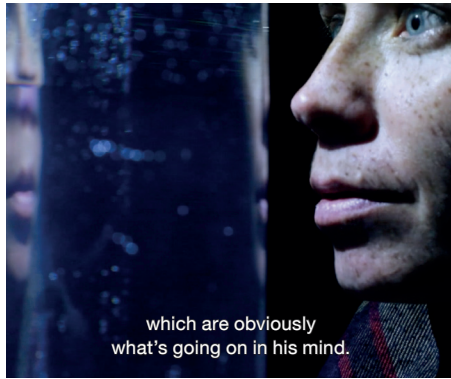
There is also the feeling of time that stands still



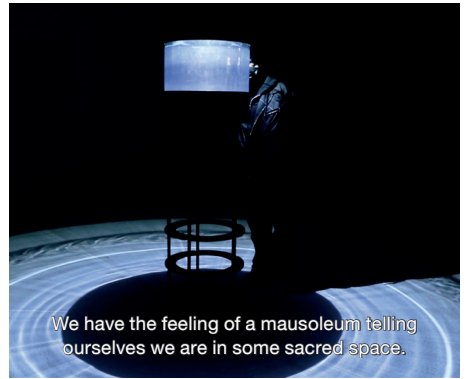
to meditate or to reflect



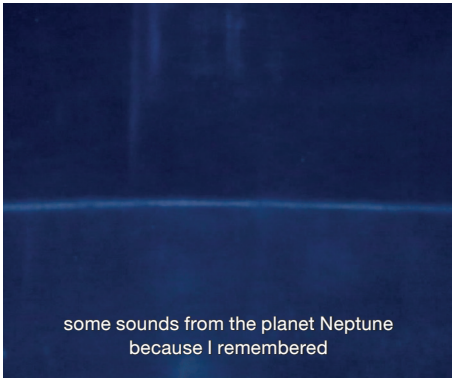
in an eye, it feels like I stand  
in the eyes of the ocean.



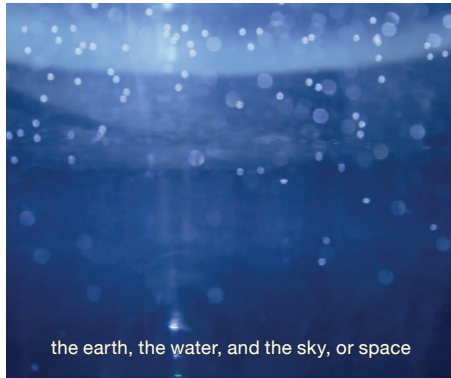
which are obviously  
what's going on in his mind.



We have the feeling of a mausoleum telling  
ourselves we are in some sacred space.



some sounds from the planet Neptune  
because I remembered



the earth, the water, and the sky, or space



- and the mirror of things.



We always talk about the "day";  
say: the day I was born,



that a day is the interval between  
sunrise and sunset.



are somehow frustrated by this part  
of our life that we don't know;



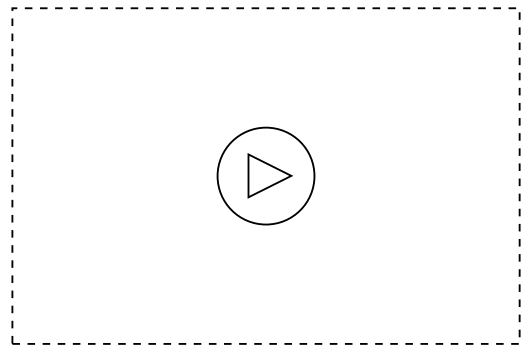
And I think, we'd be more fulfilled,  
happier, more balanced.



if we knew our sleeping life better.

This contribution was published on [www.able-journal.org](http://www.able-journal.org) in a video.able format:

[www.able-journal.org/en/reve-quantique](http://www.able-journal.org/en/reve-quantique)



## credits

---

### authors:

Virgile Novarina, sleep artist

Walid Breidi, digital artist

LABOFACTORY: Jean-Marc Chomaz, physicist-artist (CNRS, École Polytechnique) and Laurent Karst, architect-designer

### in collaboration with:

Didier Bouchon, computer engineer, Chaire Arts & Sciences

Antoine Garcia, engineer, LadHyX, École Polytechnique

Giancarlo Rizza, physicist, LSI, École Polytechnique

### “Entre deux insondables - À la recherche de Rêve quantique”

**film direction and editing:** Hélène Bozzi

**sound composition:** Walid Breidi

**interviews and editorial mediation:** Julie Sauret, Chaire Arts & Sciences, assisted by Anna Acevedo and Lior Toledano

**captions integration:** Christophe Pornay

**sound mixing:** Frank Williams

**guitar:** Martin Machieu

**piano:** Stéphane Cochet

**stock footage:** Frédéric Picazo, Lasse Ronne

**3D images:** Vladimir Kolosov

**ship images:** Océane Richet

### acknowledgements:

The installation-performance “Rêve quantique: The Day I imagined the Ocean” was collectively conceived from 2018 to 2022 at the Hydrodynamics laboratory of École Polytechnique (LadHyx), CNRS – École Polytechnique, with the support of La Chaire Arts & Sciences of École Polytechnique, École des Arts Décoratifs, and La Fondation Daniel et Nina Carasso.

We would like to thank the places and structures that have supported and exhibited the successive prototypes of “Rêve quantique” during the research period: musée des Arts et Métiers, Paris – Night of Ideas 2020; CC91 La Science de l’Art Biennial – la Piscine d’en Face, Sainte-Geneviève-des-Bois; Festival access)s( – Le Bel Ordinaire, Pau; Nemo Biennial – La Scène de recherche ENS Paris-Saclay; Festival ZÉRØ1 – La Coursive, La Rochelle; Festival Les Nuits d’Orient – Un singe en hiver; Dijon; Institut Français, and La Chaire Arts & Sciences.



## about the authors

---

**Virgile Novarina**, after studying mathematics and physics, devoted himself to the artistic exploration of his own sleep through writings, drawings, photographs, and films. The very act of sleeping has become an integral part of his work through performances during which he sleeps publicly. His encounter with digital artist Walid Breidi led to different projects involving brainwaves, interactivity, and digital art.

**Walid Breidi** is a multidisciplinary digital artist. His creative tools come from the digital technology that surrounds us and on which we increasingly depend in our daily lives. His encounter with Virgile Novarina in 2010, led to three projects articulating sleep art with digital art: Paradoxical Bubble, Sleep in the City, and Quantum Dream.

<https://walidbreidi.com>

**LABOFACTORY** is an experimental artistic collective created in 2005. It explores a territory between arts and sciences, a research space favourable to a shared imagination and new narratives, to redefine the vision and ethics of science and art in a sensitive and poetic narration of the world.

**Jean-Marc Chomaz** (PhD) is an artist physicist, director of research at the CNRS, professor at the École Polytechnique, co-founder of the LABOFACTORY collective, and co-bearer of the Chaire Arts & Sciences

**Laurent Karst** is an architect-designer, graduated from the Strasbourg School of Architecture and the Domus Academy of Milan in industrial design.

# rights and references

---

## illustration rights and references

Copyrights 2023 by the authors.  
Reproduced with Permission.

See credits for more information.

## bibliography and references

Artiushin, Gregory, and Amita Sehgal. 2020. "The glial perspective on sleep and circadian rhythms." *Annual review of neuroscience*, vol. 43.

Boly, Mélanie, Vincent Perlbarg, Guillaume Marrelec, Manuel Schabus, Steven Laureys, Julien Doyon, Mélanie Péligrini-Issac, Pierre Maquet, and Habib Benali. 2012. "Hierarchical clustering of brain activity during human nonrapid eye movement sleep." *Proceedings of the National Academy of Sciences*, vol. 109, n°15.

Barreiro, Marcelo, Alexey Fedorov, Ronald Pacanowski, and George Philander. 2008. "Abrupt climate changes: how freshening of the northern Atlantic affects the thermohaline and wind-driven oceanic circulations." *Annual Review of Earth and Planetary Sciences*, vol. 36.

Crary, Jonathan, and Grégoire Chamayou. 2016. *24/7: le capitalisme à l'assaut du sommeil*. Paris: La Découverte.

Davis, Hallowell. 1939. "Electrical phenomena of the brain and spinal cord." *Annual Review of Physiology*, vol. 1.1.

Dement, William, and Nathaniel Kleitman. 1957. "Cyclic variations in EEG during sleep and their relation to eye movements, body motility, and dreaming." *Electroencephalography and clinical neurophysiology*, vol. 9.4: 673-690.

Fogli, Alessandro, Luca Maria Aiello, and Daniele Quercia. 2020. "Our dreams, our selves: automatic analysis of dream reports". The Royal Society Publishing: <https://royalsocietypublishing.org/doi/10.1098/rsos.192080>

Garrett, Chris, and Eric Kunze. 2007. "Internal tide generation in the deep ocean." *Annual review of fluid mechanics*, vol. 39.

Goldstein, Andrea, and Matthew Walker. 2014. "The role of sleep in emotional brain function." *Annual review of clinical psychology*, vol. 10.

Gottesmann, Claude. 1971. "Psychophysiology du sommeil". *L'année psychologique*, vol. 71, n°2. pp. 451-488.

He, Bin, Abbas Sohrabpour, Emery Brown, and Zhongming Liu. 2018. "Electrophysiological source imaging: a noninvasive window to brain dynamics." *Annual Review of Biomedical Engineering*, vol. 20.

Holman, Bruce, Glen Elliott, and Jack Barchas. 1975. "Neuroregulators and sleep mechanisms." *Annual Review of Medicine*, vol. 26.1.

Legg, Sonya. 2021. "Mixing by Oceanic Lee Waves." *Annual Review of Fluid Mechanics*, vol. 53.

Maxworthy, T., and F. K. Browand. 1975. "Experiments in rotating and stratified flows: oceanographic application." *Annual Review of Fluid Mechanics*, vol. 7.1.

More, Rishabh, and Arezoo Ardekani. 2022. "Motion in Stratified Fluids." *Annual Review of Fluid Mechanics*, vol. 55.

O'Hara, Casey, and Benjamin Halpern. 2022. "Anticipating the Future of the World's Ocean." *Annual Review of Environment and Resources*, vol. 47.

Paller, Ken, Jessica Creery, and Eitan Schechtman. 2021. "Memory and sleep: how sleep cognition can change the waking mind for the better." *Annual review of psychology*, vol. 72.1.

Rogers, Alex David. 2015. "Environmental change in the deep ocean." *Annual Review of Environment and Resources*, vol. 40.1.

Royant-Parola, Sylvie. 2017. "Le manque de sommeil nous tue". Interview par Pascale Kremer: [https://www.lemonde.fr/m-perso/article/2017/11/17/le-manque-de-sommeil-nous-tue\\_5216480\\_4497916.html](https://www.lemonde.fr/m-perso/article/2017/11/17/le-manque-de-sommeil-nous-tue_5216480_4497916.html)

Royant-Parola, Sylvie. 2022. Comment retrouver le sommeil par soi-même". Paris: Editions Odile Jacob.

Samson, David R. 2021. "The Human Sleep Paradox: The Unexpected Sleeping Habits of Homo sapiens." *Annual Review of Anthropology*, vol. 50.

Sipton, Harold. 1975. "EEG Analysis: A history and a Prospectus." *Annual review of biophysics and bioengineering*, vol. 4.

Solms, Mark, and Olivier Turnbull. 2015. *Le cerveau et le monde interne*. Paris: Presses Universitaires de France. Translated by: Fabian Guenolé and Geoffrey Marcaggi.

Strassberg, Richard. 2022. *Wandering Spirits: Chen Shiyuan's Encyclopedia of Dreams*. Berkeley: University of California Press.

Thakor, Nitish, and Shanbao Tong. 2004. "Advances in quantitative electroencephalogram analysis methods." *Annual Review of Biomedical Engineering*, vol. 6.

Thorpe, S. A. 2004. "Recent developments in the study of ocean turbulence." *Annual Review of Earth and Planetary Sciences*, vol. 32.

Walker, Matthew. "You're Not Getting Enough Sleep—and It's Killing You". *The Wired*: [https://www.wired.com/story/youre-not-getting-enough-sleep-and-its-killing-you/?client\\_service\\_id=31209&service\\_user\\_id=1.78e+16&client\\_service\\_name=wired&supported\\_service\\_name=instagram\\_publishing](https://www.wired.com/story/youre-not-getting-enough-sleep-and-its-killing-you/?client_service_id=31209&service_user_id=1.78e+16&client_service_name=wired&supported_service_name=instagram_publishing)

Wunsch, Carl, and Raffaele Ferrari. 2004. "Vertical mixing, energy, and the general circulation of the oceans." *Annual Review of Fluid Mechanics*, vol. 36.1.



## to cite this article

---

Novarina, Virgile, Walid Breidi, Jean-Marc Chomaz, and Laurent Karst. 2023. "Rêve quantique, the day I imagined the ocean." *.able journal*: <https://able-journal.org/en/reve-quantique>

MLA EN Novarina, Virgile, Walid Breidi, Jean-Marc Chomaz, and Laurent Karst. "Rêve quantique, the day I imagined the ocean." *.able journal*, 2023. <https://able-journal.org/en/reve-quantique>

ISO 690 EN NOVARINA, Virgile, Walid BREIDI, Jean-Marc CHOMAZ, and Laurent KARST. Rêve quantique, the day I imagined the ocean. *.able journal* [online]. 2023. Available from: <https://able-journal.org/en/reve-quantique>

APA EN Novarina, V., Breidi, W., Chomaz, J.-M., & Karst, L. (2023). Rêve quantique, the day I imagined the ocean. *.able journal*. <https://able-journal.org/en/reve-quantique>

**follow us on social media: @ablejournal**

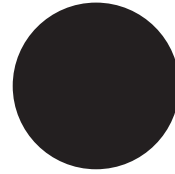
•instagram •facebook •twitter •linkedin •vimeo •youtube

**an image-based journal at the intersection  
of art, design, and sciences responding  
to the complexities of today's society**

[www.able-journal.org](http://www.able-journal.org)



**• able**



**able**