

GRIN CATALOGUE

*Art-driven innovation
for digital and green transition
in European Regions*



1.0 → INTRO

The Blue marble was a picture taken at a distance of 45,000 km in 1972 by the Apollo 17 crew, which depicted for the first time the Earth as a globe. According to Bruno Latour (Latour 2020), this is an image of totality, not of connection: it is no longer the Earth in which humanity lives, but an impersonal figure of the technological appropriation of reality.

Grasped from the outside, captured by the lens as 'other' than us, Nature, and the Earth, are thought of and exploited not as agencies and subjects of relationships, but as passive objects under human actions.

In this process, **the environment has lost the meaning it used to have** in the English language, i.e. "that which envelops us and surrounds us within its multiple flows". Also technology has contributed to reinforce the Promethean vision of the human being, which makes the overcoming of limits an identity value.

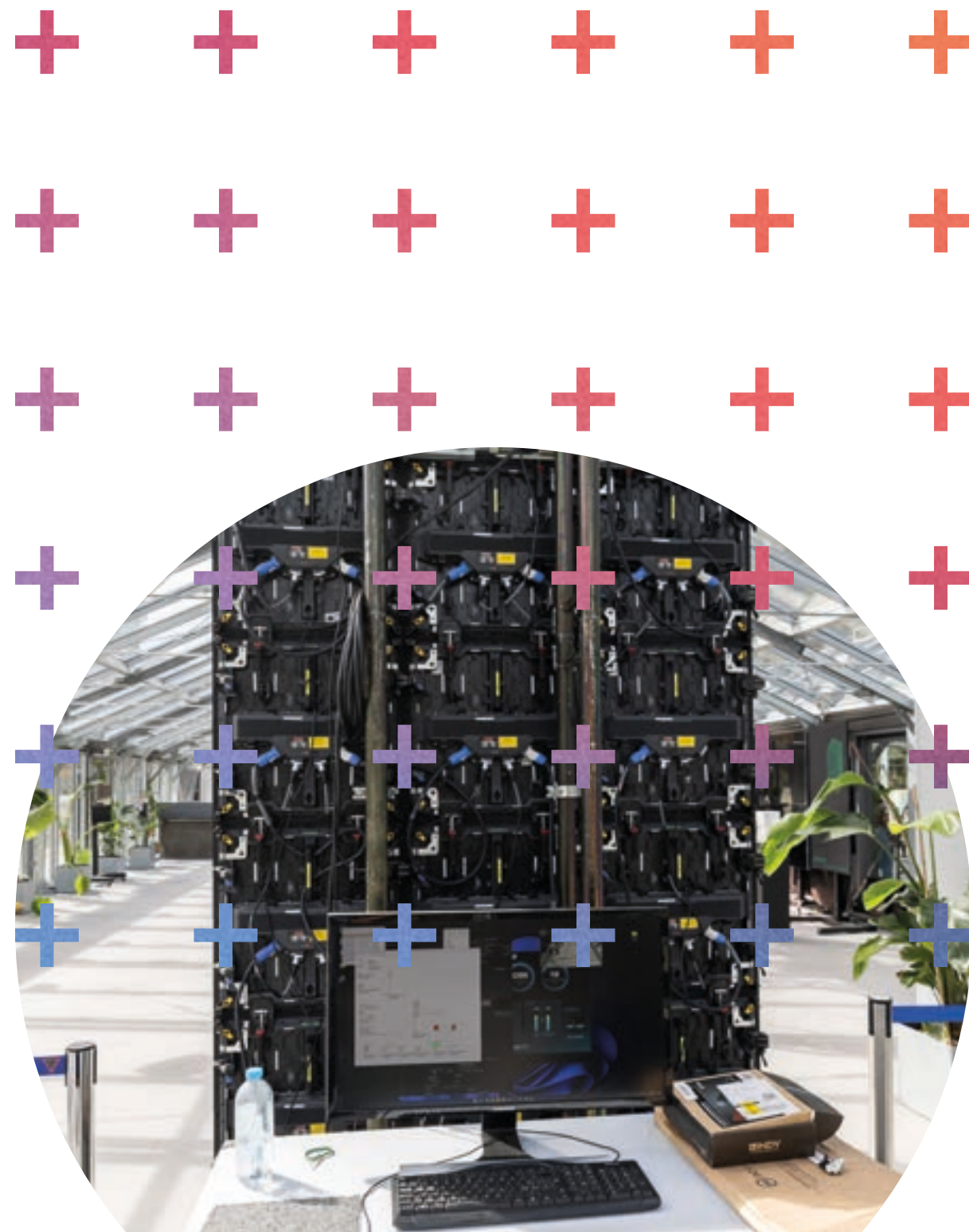
As part of the S+T+ARTS initiative, **the GRIN Project** ('Art-driven innovation for digital and green transition in European Regions') **has generated new perspectives and led to new practices** through the collaboration and **dialogue between art and science**.

Blending artistic practices and the use of the most up-to-date scientific data, the experimentation with AI, and the use of computational capacity, the GRIN Project has made complex data accessible to the most, has created safe spaces for **transdisciplinary exchanges**, opening up channels for **a dialogue between species and more-than-human agencies**.

The initiative emphasizes the equal relevance of the collaboration between scientists, tech experts and artists in the innovation process, as they influence and enrich each other's perspectives and practices.

This collaboration has led to new critical and experimental approaches that place technology at the service of a renewed humanism, aiming for an ecosystemic balance that counters anthropocentric and techno-utopian visions, in the direction of the European's strategic goals for an ecological and digital transition towards a more sustainable and carbon-neutral society.

GRIN has operated across key European regions, including Upper Austria, Emilia-Romagna, Aveiro, Porto District, and North Ostrobothnia, establishing centers for transdisciplinary collaboration among scientists, technology providers, engineers, designers and artists, culminating in 12 innovative STARTS Residencies.



2.0



Bologna's CHALLENGE

DIGITAL TWIN AND HPC FOR ECOLOGICAL IMAGINATION

In highly evolving contexts such as ours in which environmental issues are a pressing question, we need to find new and different approaches to these problems. GRIN and Bologna's residency try to merge advanced technologies and the scientific research methods with more holistic ones, such as those who belong to artistic practices to generate radical innovations that will carry us into an ever better future.

AI, digital twins and machine learning emerge as new tools to face, understand and explain climate change. At the same time, as they open opportunities, they also raise challenges and questions.

On one side these tools may serve the purposes of a capitalist, colonialist, extractionist and exploitative system, reinforcing a terraforming approach that has transformed landscapes and ecosystems through genocides and systematic exploitation.

On the other hand, if the epistemology that guides their use is fueled by ideas of interconnectedness, symbiosis, and co-responsibility, they may help decolonize our idea of the Earth and guide us through non-anthropocentric scenarios.

The complexity of decision-making and forecasting will increase with the ever-increasing amount of data and scenarios, and technology needs to integrate seamlessly with human practices that are almost forgotten. **Digital Twin technology**, for example, allows us to create and experiment with virtual doubles of real life objects, spaces, beings and complex ecological scenarios, opening the possibility of infinite simulations without the necessity to act on the real subject.

These 'synthetic worlds' **can help us visualize and understand the relations existing in complex systems** or long durations which are difficult to see or experience or imagine, to expand our gaze past what is immediately visible and to **escape a merely anthropocentric view**, creating new forms of art and narration that help to raise awareness among public opinion and support sustainable innovation.

An example of these fruitful applications has been showcased throughout the GRIN project where the great calculating capacity of pre-exascale **supercomputers like LEONARDO**, a world-class supercomputing system with a computing power of nearly 250 petaflops based in Bologna, **has enabled unprecedented experimentations between art and science** to enhance environmental sustainability and ecological imagination.

The collaboration between **CINECA** and **Kilowatt** in Bologna merges art, science and technology in multiple practices that nurture ecological imagination, exploring the implications of AI as an Instrument to expand our comprehension of environmental dynamics and **imagine more sustainable and possible futures**.

CINECA

Cineca is the largest Italian computing center, hosting and managing the European supercomputer Leonardo, one of the most powerful supercomputers in the world. CINECA operates in the technological transfer sector through high-performance scientific computing, the management and development of networks and web based services, and the development of complex information systems for treating large amounts of data. It develops advanced Information Technology applications and services, acting like a trait-d'union between the academic world, the sphere of pure research and the world of industry and Public Administration.

KILOWATT

Kilowatt is a cooperative formed by different professionals who work in social innovation, cultural production, communication and urban regeneration.

Kilowatt, has become an example and a best practice for culture based regeneration in public-private partnership, both nationally and internationally. Over the years Kilowatt has collaborated with various artists who have created site-specific installations that foster the perception of nature as a source of inspiration and aesthetic experience, therefore stimulating ecological behaviors and thinking.



2.1 → DESTINATION EARTH



BY SALOMÉ BAZIN

Photo credit: Lorenzo Burlando

Destination Earth, by Salomé Bazin of Cellule Studio in collaboration with composer Robert M. Thomas and artist Sebastiano Barbieri, is an immersive artwork that **invites viewers to engage with the Earth's vital rhythms, especially the ocean**, with its role as the planet's lungs. This piece explores the symbiotic relationship between humans and marine ecosystems, delving into how human activities—amplified by technological advancements—affect the delicate balance of our environment. The work serves as a **speculative investigation into a future where human and marine life coexist in harmony**, challenging the audience to reconsider our relationship with nature.

The installation takes the viewers to the **Grand Banks**, a critical and rapidly changing area **where the Labrador Current and the Gulf Stream converge**. Through poetic data visualizations and a dynamic soundscape, “Destination Earth” portrays the annual cycle of the ocean's currents and temperatures. The piece reflects on **how these natural processes are disrupted by human activity**, particularly highlighting the impact on whale populations that play a crucial role in carbon sequestration.

Destination Earth features a 4-meter-high by 2-meter-wide central monolith screen, equipped with motion tracking to interact with visitors. The installation is accompanied by a 360-degree surround sound system, which creates an evolving soundscape based on real-time data reflecting oceanic changes. The visual component is a looped, 15-minute animation that illustrates temperature variations and current flows in the global ocean, particularly around the Grand Banks.

Destination Earth has been realized thanks to the collaboration between the artist and the know-how and data provided by **OGS Trieste, CMCC Bologna and CINECA**, and it is powered by **Leonardo supercomputer** in Bologna. The curatorship is by Kilowatt and Quo Artis, with the economic support of Emil Banca, a cooperative bank of Emilia Romagna region.



ARTISTS

Salomé Bazin

is a french designer and artist, founder of experiential design studio Cellule. Bazin's work is a tension between digital art, experiential and scenography, in an exploration of new mediums to experience natural phenomenons, evolving technologies and human physiology. Her work with Cellule was showcased at the Science Gallery London, the Victoria and Albert Museum, Barbican center, Venice Biennale and Sadler's Well theater. She holds multiple prestigious awards and mentions and is a visiting lecturer at King's College London in BSc Biomedical engineering.

Robert M. Thomas

is a pioneering composer, sound designer and audio programmer. His work explores redefining the way music and sound is experienced. Unlike fixed recordings his music can intelligently adapt & personalize itself in real time through the bespoke software he creates. His work has been performed at the Barbican London, Walt Disney Concert Hall LA, Lincoln Centre NYC, COP26 Glasgow, Somerset House, NXT Amsterdam and exhibited at the Tate.

Sebastiano Barbieri

is an Italian artist born in 1983. His research interest lies primarily in the fields of generative design, real-time graphics, and interactivity. He realizes his works by designing narratives through real-time processes using technology to generate art and algorithms to build installations, immersive spaces and interactive experiences. He takes inspiration from natural processes and patterns through a new artistic perspective using data-driven algorithms and machine learning, pushing aesthetic and technical boundaries of generative art form.

Salomé Bazin

"I see both art and science as an exploration and curiosity about how the world works. I think that **as artists we have the responsibility to reconnect technology to the human experience and redefine our role within nature.**

That's why I love working with scientists as it enables me to have complex and rich data sets which I can translate into experience that anybody can relate to. Spending several weeks with the Cineca technicians has greatly impacted the project. I had a strong intuition about a correlation between mammal migration, human breath, the atmosphere and the ocean flows.

Now this was all intuitive and not backed up on anything. Through interacting with domain experts I have learned so much and it was beautiful to see this confirmed by people who have been studying ocean flows for a decade!"

Antonella Guidazzoli (head at VisitLab Cineca)

"I am truly satisfied with the experience of the artistic residency at our supercomputing center, where Salome had the opportunity to collaborate with our data scientists and graphic experts from the VISIT Lab.

This interdisciplinary collaboration has been enriching, but what struck me even more was the natural integration of Salomé's work as a dancer with the performances, engaging the public so seamlessly. I felt a profound physical harmony with the message of the artistic work—a powerful and significant experience, as if we not only shared a common vision reflecting on the oceans, but also the same physical breath."



BENEFITS AND IMPACTS



The world is the way it is because of our actions, beliefs, habits. Slowing down our life would be so beneficial for the planet we inhabit, which, as our body, gets mistreated from a hyper productive society.

Salomé Bazin

2.2 → FUNGI SYMBIOTIC HARMONIES



BY MARCO BAROTTI

Photo credit: Lorenzo Burlando

FUNGI – Symbiotic Harmonies, by Marco Barotti is an innovative exploration of the hidden underground networks of Mycorrhizal fungi. This immersive installation transcends traditional artistic boundaries, blending art, science, and technology to reveal the ecological significance of fungal communities.

FUNGI is a **multi-sensory installation** that combines **advanced mapping techniques, DNA sonification, and 3D printing** to create an immersive experience. The core of the installation consists of ceramic sound sculptures, meticulously 3D-printed based on the structures of Mycorrhizal fungi collected from root samples in Estonia. These sculptures serve as resonance chambers for the sonified data, converting the complex interactions of fungal networks into an audible experience.

The soundscape includes a reimagined version of the **Aka people's polyphonic song "Song For Gathering Mushrooms,"** interwoven with biogeographical data of fungal ecosystems. This data is mapped onto sound parameters using an artificial neural network, creating a dialogue between traditional cultural expressions and modern technological processes. Additionally, the **"FUNGI ORACLE"** offers visitors a chance to interact with **an AI that synthesizes knowledge about fungal ecosystems**, further deepening the audience's engagement with the themes of symbiosis and ecological interdependence.

The research was possible thanks to the Arbuscular mycorrhizal fungi database "Ecobank" provided by the Institute of Ecology and Earth Sciences University of Tartu as well as the Mycorrhizal research group Supported By FUNFARM (Estonian Research Foundation grant no 1789) (Maarja Õpik, Tanel Vahter, Atefe Farshadi), the Center of excellence AgroCropFuture (Estonian Ministry of Education and Research, TK200U4) (Tanel Vahter, Martti Vasar) and Leonardo's supercomputer.

The work has been curated by **Kilowatt e Rebecca Pedrazzi**, in collaboration and with the support of Alfasigma, an international pharmaceutical company founded in Italy and operating in over 100 countries worldwide with a long track record in the research, development, production and distribution of innovative therapeutic indications.



ARTIST

Marco Barotti

is a media artist. His work is driven by a desire to invent an artistic language in which a fictional post-futurist era is expressed through kinetic sound interventions in natural and urban environments. His installations merge audio technology, consumer objects, and waste into moving sculptures triggered entirely by sound. The primary focus of his work is to create a “tech ecosystem” that plays with resemblances to animals and plants. These artworks serve as a metaphor for the anthropogenic impact on the planet and aim to make people aware of environmental and social issues.

Marco Barotti

“The collaboration with the scientific community of the Institute of Ecology and Earth Sciences at the University of Tartu and Cineca has been crucial for FUNGI. It has enabled me to enhance the artistic work with authentic scientific data, balancing scientific accuracy and artistic expression. The GRIN S+T+AR-TS residency confirmed the importance of a common language between these two disciplines, two complementary worlds. I believe that art can make complex topics accessible and generate empathy towards the ecosystem, in an era where technology and the natural world are increasingly interconnected. I see technological evolution as an opportunity to amplify the dialogue between man and the environment, thanks to tools such as artificial intelligence, sensors and neural networks, which enable dynamic interactions with the public and the environment.”

Donatella Sforzini (*Data Analyst at Cineca*)

“Where the Data Analyst would have represented the connection between the data through sophisticated statistical models, Marco Barotti expresses it in a completely different way, even though they start from the same set of data. Different points of view help interact with the data in different ways, allowing a better understanding of the phenomenon. The collaborative approach allows complementarity with other mindsets and approaches to analysis, in a continuous two-way exchange.”

BENEFITS AND IMPACTS





My artistic practice and the FUNGI project reflect an ecological vision, in which each organism is part of an interconnected system. FUNGI explores mycorrhizal networks as a metaphor for this interdependence, showing how invisible but essential fungi support soil health and plant symbiosis. I believe that our relationship with nature should be based on respect and collaboration, not exploitation.

Marco Barotti



2.3

→ TALES FROM RECEDING EDGE



BY CALIN SEGAL

Photo credit: Lorenzo Burlando

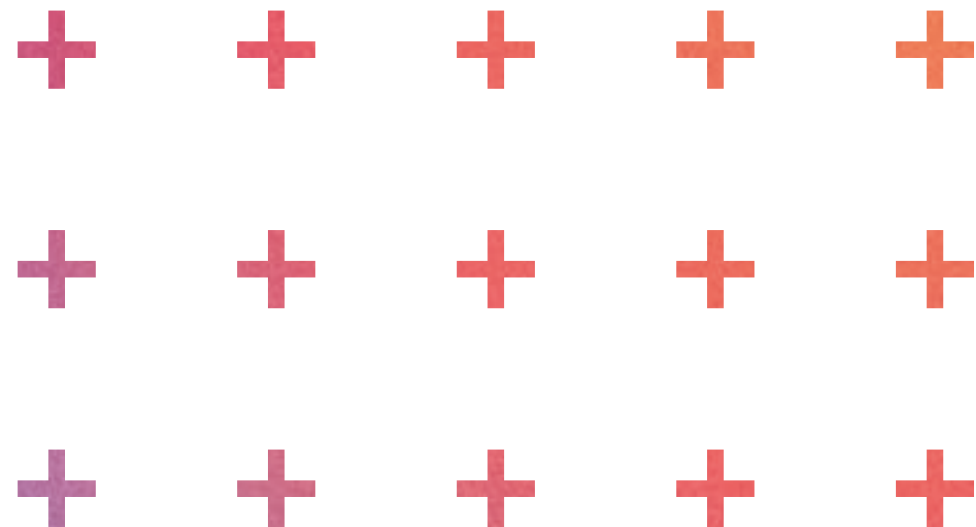
Tales from the Receding Edge, created by Romanian artist Calin Segal, is an evocative exploration of coastal erosion in the context of climate change. This interactive installation challenges conventional views of erosion as merely destructive, instead highlighting its dual role as both a sculptor and storyteller of landscapes. This work has been developed in collaboration with scientists from Cineca's supercomputing center and utilizing extensive data from the National Institute of Oceanography and Experimental Geophysics (OGS).

Tales from the Receding Edge is an immersive installation that integrates large-scale data processing, generative art, and 3D printing to simulate the complex dynamics of coastal erosion. The project draws from a rich dataset encompassing wave dynamics, geological and geophysical changes, and sea-level monitoring. Through advanced data visualization techniques, these elements are transformed into interactive simulations that allow participants to observe and predict the behavior of natural forces in real-time.

Central to the installation are 3D-printed models that depict the evolving coastal landscapes shaped by erosion. These physical forms, generated from digital simulations, offer a tactile representation of the relentless actions of tides, waves, and winds over time.

By blending artistic abstraction with scientific precision, "Tales from the Receding Edge" not only illuminates the ongoing process of coastal transformation but also prompts a broader dialogue about our role in shaping the natural world. The work transcends the typical environmental discourse, advocating for a collective reimagining of our relationship with the planet, where art, science, and technology converge to reveal the profound complexities of ecological change.

The curatorship of the installation has been led by Kilowatt, Marco Mancuso with the support of BOOM, CRIF's knowledge and innovation hub and technological innovation.



BENEFITS AND IMPACTS

Calin Segal

"Technology has become my medium, my brush and canvas. Using tools like coding, 3D modeling, and digital fabrication, I can manipulate elements of unpredictability within a controlled environment in a way mimic the organic processes of nature."

Being immersed in an environment where I could constantly interact with experts allowed for a continuous flow of ideas. These interactions not only refined the technical aspects of the project but also enriched the creative process, helping to shape the narrative and overall impact of the installation.

The collaboration ensured that the final result was not just scientifically sound but also emotionally resonant and meaningful."

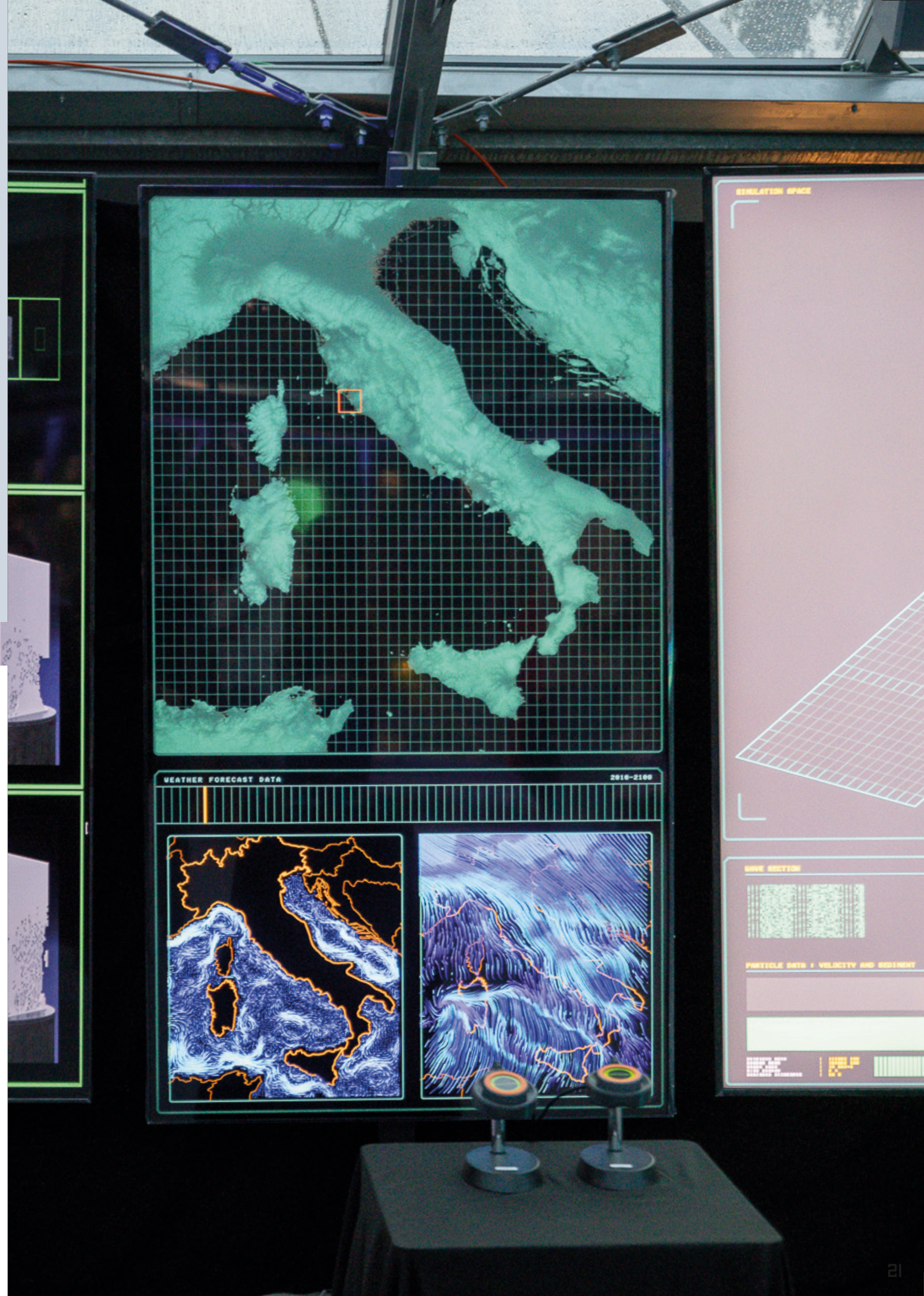
Maria Chiara Liguori, Digital Humanist at VisitLab Cineca

"A preview of Calin Segal's installation was presented at the Bologna Technopole, during the G7 2024 meeting on Science and Technology. The preview, held among specialists, was highly appreciated and offered positive confirmation of the art's ability to promote debate and reflection among spectators."

ARTIST

Calin Segal

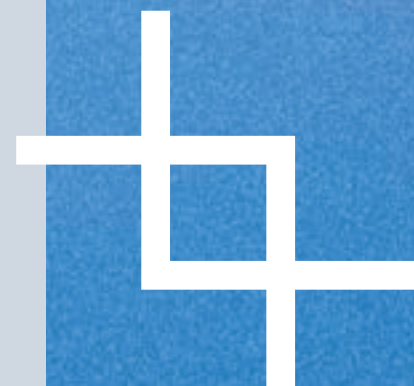
is a Romanian computational design artist based in Paris, with a distinct emphasis on generative systems. His academic journey began at the Ecole Speciale Architecture in Paris. Here, he delved into robotic manufacturing and digital design. He then pivoted towards a self-guided career in interactive and generative art, fueled by his fascination with digital mediums. His skill set spans design, craftsmanship, coding, and 3D modeling, and his creations are defined by their balance between calculated control and organic unpredictability, leveraging intricate mathematical models and algorithms.





Technology allows me to infuse life into these ideas, transforming abstract concepts into dynamic, evolving compositions. It's about discovering the poetry in algorithms, the beauty in mathematical models, and the emotion in digital processes. In my work, integrating artistic, scientific, and technological skills feels like a natural fusion, where each discipline enriches the other. I see them as distinct languages that, when combined, create a more nuanced and layered narrative.

Calin Segal



3.0 S+T+ARTS:

INNOVATION AT THE NEXUS OF SCIENCE, TECHNOLOGY AND THE ARTS.

Science, technology and arts form a nexus at which insightful observers have identified extraordinarily high potential for innovation. And innovation is precisely what's called for if we're to master the social, ecological and economic challenges that Europe will be facing in the near future.

S+T+ARTS is driven by the conviction that science and technology combined with an artistic viewpoint also open valuable perspectives for research and business, through a holistic and human-centered approach.

With the S+T+ARTS initiative, the European Commission's focus is on projects and people that have the potential to make meaningful contributions to this effort.



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