



“Adding socio-economic value to industry through the integration of artists in research and open innovation processes”

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Executive Summary

This report formalizes the contents of deliverable *D7.4 – Final Public Report* of the VERTIGO project; supported by the European Commission under the H2020 ICT Program. Written for a broad readers' target upon the project's completion, it provides a synthetic presentation of VERTIGO's actions, results and impact and can be used as a first, self-contained entry point to the project.

VERTIGO was launched as a Coordination and Support Action in the framework of the S+T+ARTS (Science, Technology and the Arts) initiative supported by the DG-CONNECT of the European Commission, promoting the role of the arts as catalysers of technological innovation. Its action, therefore, followed 3 main objectives:

1. Organise the STARTS Residencies program involving artists in advanced research and innovation technological projects throughout Europe;
2. Set up and manage the starts.eu brokerage platform for the STARTS community;
3. Organise a yearly high visibility event and showcase Art-Science-Technology successful results. This objective was further extended to the organization of many other events promoting STARTS.

The report content is structured as follows:

- The **Introduction** section presents the general context of STARTS to which VERTIGO contributes; it provides a synthetic view on the STARTS Residencies program, with its key facts and figures, on the consortium and other involved stakeholders and on the starts.eu web platform;
- The **Methodology Highlights** section enters into detail about the methodology implemented for the STARTS Residencies, underlining important aspects for other residencies organisers;
- The **Residencies** section presents a summary of each the 45 implemented residencies grouped in 4 main themes;
- The **Dissemination** section presents figures and highlights on the events in which the project has been involved;
- The **Impact** section provides elements of analysis of the project impact;
- The **Conclusion and Perspectives** section gives a retrospective view on the process carried out and summarizes perspectives of continued actions beyond the project's completion.

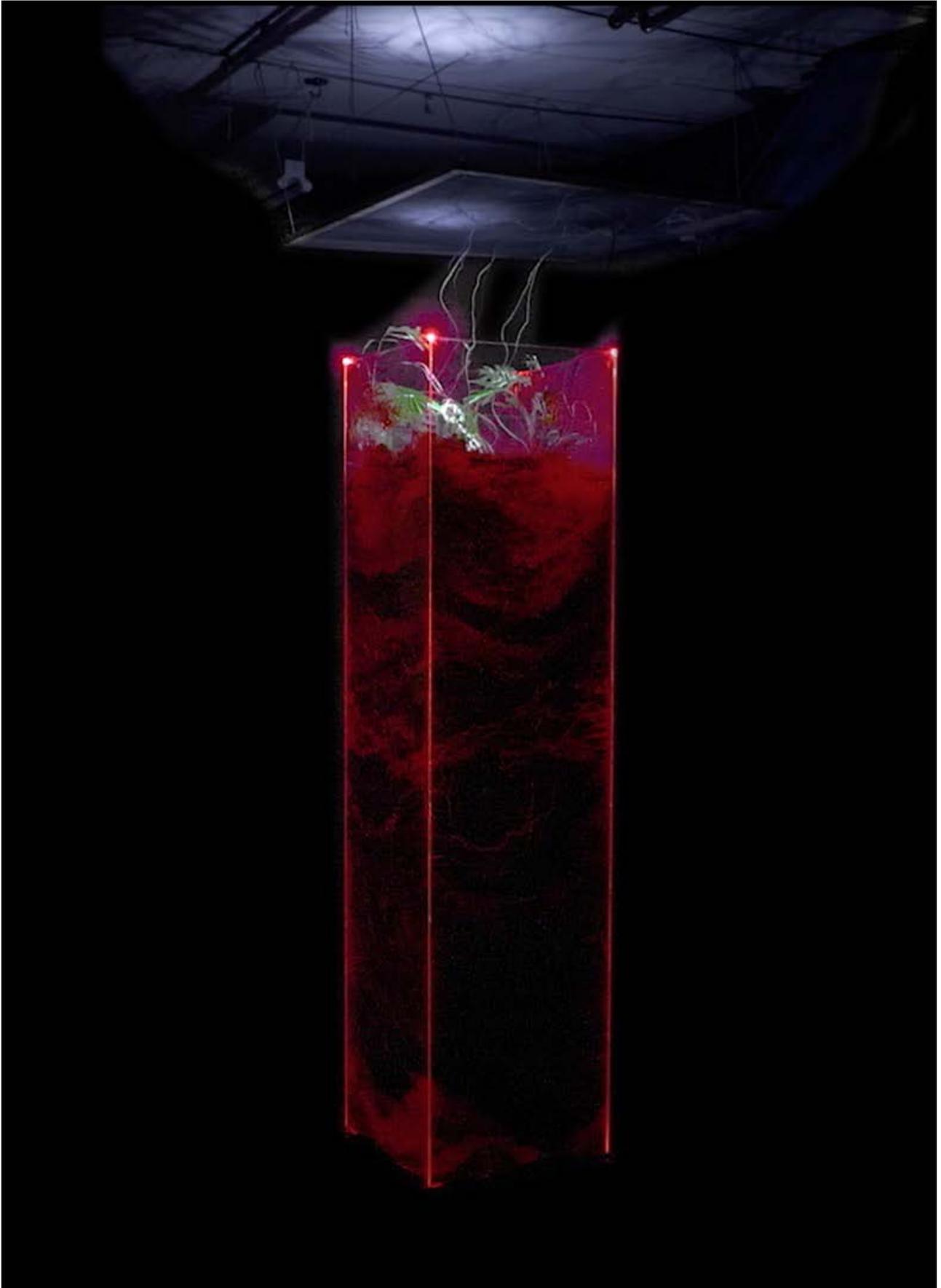
Introduction

Unleashing innovation through artistic creativity

If you think of art-technology interactions as a support to artists, or because they bring culture to the tech world, you might miss one of the core issues our society has to face: leading innovation to success! Because innovation is more than producing technical performance. It is about creating meaning with these technologies and inducing new practices, behaviour and adoption in our daily life. This has to deal with perception, cultural context, the anticipation of debate and critiques. Art has the capacity to bring these dimensions to innovation.

Who may get the benefits? Obviously, artists access to new topics, fields of exploration and resources. But citizens can expect a much larger impact if they can access to innovative devices and services taking into account real-life issues, including cultural and social context, emotional dimensions, collective psyché, fears and dreams. Eventually, the economy will be the ultimate winner of this transdisciplinary approach. Rather than bidding on some specific products, it can build propositions on humanist dimensions, combining performance with meaning, leading to sustainable business. Disruptive innovation opens the floor for long-term revenues. Does it just sound like wishful thinking? Remember the Bauhaus in the early 20th century. New technologies, machines and tools were emerging, allowing the production of big pieces of glass, metal or concrete. But not adapted to the rich ornament or Belle époque, en vogue at that time. Artists, architects and designers started to redefine how we conceive space and objects, how we deal with colour, how we consider materials. Our living environment has changed dramatically, opening our living environment, establishing new relations between the inside and the outside, rethinking the role of light, changing our perception. These new concepts opened an unlimited perspective of applications for the manufacturers.

Over the last decades, wrong beliefs had led us to dissociate right and left brains, inspiration and rationality. Neurosciences have shown us that creativity involves the whole brain. The time has come to organize these interactions back again. VERTIGO and its STARTS Residencies program have brought a major contribution to show at an unprecedented scale how artists can be integrated into technological innovation with concrete outcomes: real projects, artworks, tools, methodology, knowledge and publications. STARTS has gained international recognition and leadership through these three and a half years of efforts. It now continues with an ever-growing community of actors, integrating the arts in a variety of practices and organisations for the benefit of society, economy and culture.



By the code of soil – Kasia Molga

Art as a driver of technological innovation: the STARTS initiative

The STARTS initiative – which stands for innovation at the nexus of Science, Technology, and the ARTS – is Europe’s answer to a growing need for social and ecological innovation rooted in digital innovation. STARTS encourages collaborations between science, tech companies, the creative sectors and artists as a means to foster the development of human-oriented technologies.

High-tech companies embrace the Arts for their unconventional, playful exploration of technology and their critical take on the value of technology for society. Renowned art institutions such as Biennale di Venezia, V&A London, Centre Pompidou and ZKM Karlsruhe have harnessed and incorporated STARTS ideas into their activities.

Digital transformation of value to society requires increased emphasis on the human aspects of technology towards a better understanding of human needs and in order to develop technology more gracefully in future societies. The leading example here is Artificial intelligence, its promises and its pitfalls.

S+T+ARTS = STARTS promotes inclusive and creative thinking by artists in forward-looking projects funded by Europe and implemented through five pillars:



The annual **STARTS Prize** gives visibility to collaborations between artists and industry for new pathways to innovation, and artistic exploration of technology altering the use, deployment and perception of technology. Since 2016, the STARTS Prize has been awarded annually by Ars Electronica during its Festival Week.



The **STARTS Residencies** finance longer-term stays of artists at technology institutions to support match-making between science or technology projects and artists and to jumpstart collaborations between artists and technologists as part of interesting use-cases.



The **STARTS Lighthouse Pilots** support research seeking radically novel solutions and concrete results to major challenges for industry and society in close collaboration with artists as active members of the project teams. These lighthouse pilots explore novel uses of technologies and guide EU innovation actions towards more systematic inclusion of the Arts.



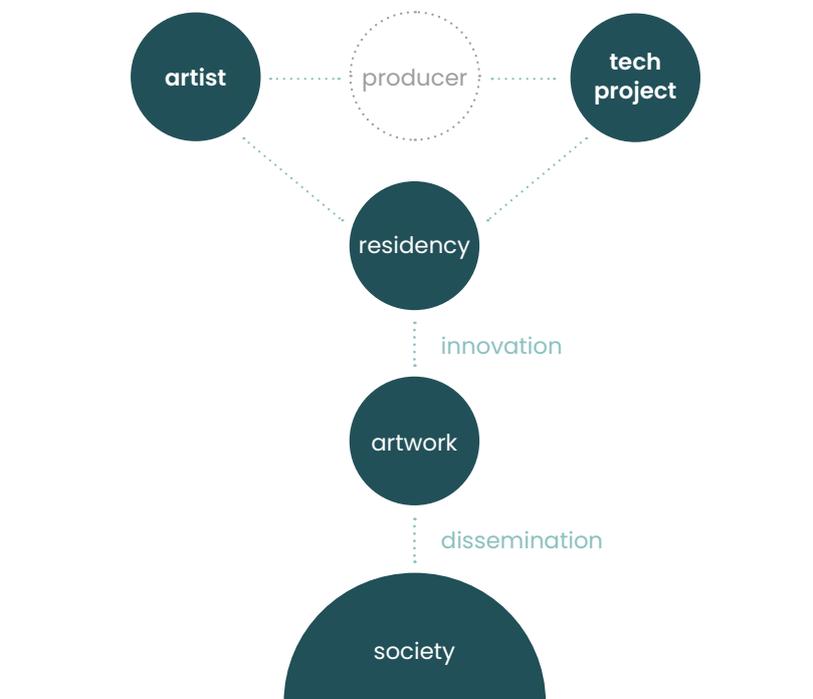
The **STARTS Academies** strive to bridge the gap between art and technology at all levels of education. They unite technologists and artists to teach digital skills to children and young adults in a playful way that also helps raise awareness of the opportunities, limits and potential pitfalls harbored by technology.

The **Regional STARTS Centers** intend to expand the STARTS initiative on a **local level** towards a number of European regions.

VERTIGO and STARTS Residencies in brief

The VERTIGO project is a coordination and support action supported by the European Commission under the STARTS initiative. The STARTS Residencies program managed by VERTIGO has organized 45 residencies of artists collaborating with technological projects throughout Europe. Its processes included 3 annual selection cycles, the residencies execution framework and support in publicising the residencies and their results. VERTIGO has been more generally engaged in supporting the STARTS community as a whole, in particular by developing the starts.eu platform.

The STARTS Residencies program, managed by VERTIGO, promoted and supported innovation processes involving artists who make original contributions to technology-based projects. Tech projects could take the form of collaborative research, development and innovation projects funded by public programs, or advanced technological projects hosted by a research team or a company located in Europe. A grant (of up to €30,000) was awarded to the artist as a contribution towards her/his participation in and expenses arising from the program. A producer could also provide additional support to the residency, the objective being to confront the artist with an emerging technology from which she/he develops an original artwork, shedding new light, giving new meaning or a critical viewpoint to the technology and conveying this onwards to larger audiences. The production of the artwork was also part of a co-creation process with the tech team. A total budget of 900.000Euros has been allocated for the artistic grants, supporting the implementation of 45 residencies between 2017 and 2020 on an as yet unprecedented scale.



The STARTS Residencies co-creation process

The program's promotion and selection have been organized into 3 annual calls which took place between 2017 and 2019, each one divided into a call for Tech Projects willing to host artists, a call for producers ready to support them, and then a call for artists who were proposed to select one Tech Project among those available and to draft a residency proposal. Artists of any nationality and artistic field were welcome. The Tech Projects were selected by an internal committee according to the relevance of their offer and expectation to the program. The artistic applications were first reviewed by their Tech Projects and then finally selected by a high-level international jury. In the course of the 3 calls, 127 Tech Projects were selected and 342 artistic applications submitted for the final selection of 45 residencies based on different Tech Projects. The final selection represents a wide range of technology areas and related application fields.

In addition to its calls structure, the program's methodology has defined the legal and organizational conditions for these transdisciplinary collaborations – most of the time between stakeholders who had never met before – through a monitoring process formalized in successive steps.

The residency outcomes were promoted leveraging various channels, including by supporting numerous public events and digital communication. The public dissemination relied mainly on the organisation of yearly events in Paris gathering the STARTS Residencies community and on the STARTS Partners Network, a network of 62 organisations worldwide set by VERTIGO and committed to hosting STARTS events.

VERTIGO developed the starts.eu web platform which became the main matchmaking hub of a growing STARTS community. This platform was also produced in order to be the support of STARTS Residencies calls, featuring an efficient system for online applications and their reviews. It was also used by other projects organising their calls for artistic residencies under the STARTS umbrella.



Key Facts and Figures



Period of execution: December 2016 – May 2020 (42 months)

3 open calls for Tech Projects, producers and artists from 2017 to 2019

127 Tech Projects selected for hosting residencies

342 artistic applications received to the residencies program

45 residencies completed (for a cumulated duration from 3 to 12 months)

150+ artists and technologists involved in residencies

€900k awarded in artistic grants

1 online platform starts.eu

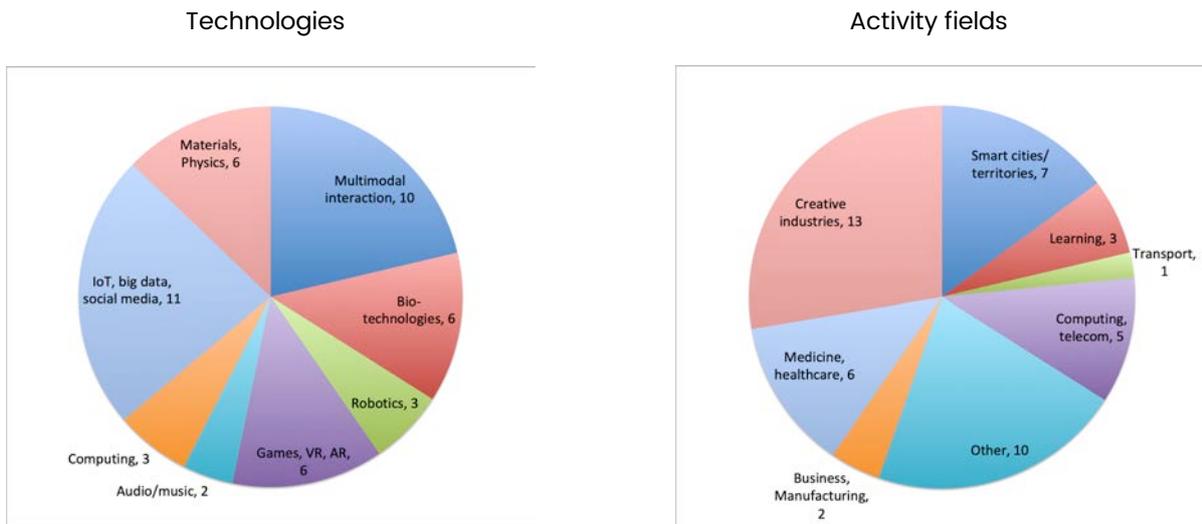
4 main yearly public events presenting the results at Centre Pompidou and CENTQUATRE (FR)

as part of more than **217 events with a cumulated audience of 244,000 persons** in venues including: Venice Biennale (IT), LABoral (ES), SXSW (USA), Ars Electronica (AT), Aarhus IoT week (DK), KIKK Festival (BE), CeBIT (DE), Festival d'Avignon (FR), Art Center Nabi (KR), Bozar (BE)

STARTS Partners Network: a world network of **62 partners** committed in STARTS dissemination through for the co-production of public events. A total budget of **€320k** was allocated to the network for the events organisations, which leveraged a cumulated amount of

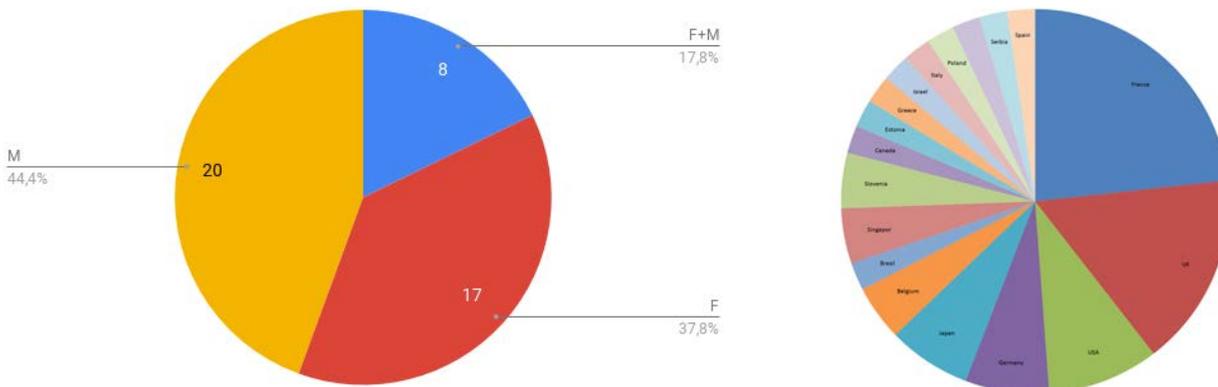
€391k invested by these organisations.

Distribution of Tech Projects in selected residencies



Projects in selected residencies covered a broad range of technologies and activity fields, representative of Europe's high-tech landscape

Distribution of Artists in selected residencies



Distribution of selected artists: genres (F+M concerns projects with several artists) and nationalities: 19 nationalities are represented with France, UK and USA as the first ones.

Residencies locations (inception meetings)



The VERTIGO consortium



ART-ICT research and cultural institution (France)
Project coordinator: Hugues Vinet



R&D - ICT Group of Fraunhofer Institutes (Germany)



R&D - Design and innovation, digital humanities (Switzerland)



Cultural innovation association (France)



Innovation management company (Portugal)



ART-ICT company (Portugal)



IoT company (Spain)



The VERTIGO consortium in Paris in February 2019

From left to right: Guillaume Pellerin (IRCAM), Greg Beller (IRCAM), Nicolas Henchoz (EPFL), Ana Solange Leal (Inova+), Pascal Keiser (Culture Tech), Marta Coto (Inova+), Patricia Delgado (Artshare), Thomas Bendig (Fraunhofer Institute), Luis Miguel Girao (Artshare), Louise Enjalbert (IRCAM), Cécile Drencourt (IRCAM), Marie Albert (Culture Tech), Pierre-Xavier Puissant (EPFL), Hugues Vinet (project coordinator, IRCAM).

The STARTS Partners Network

Complementary to its consortium members, VERTIGO set an international network of 62 institutions committed to relaying STARTS communication and supporting the co-production of STARTS public events: conferences, exhibitions, matchmaking sessions, etc. VERTIGO and these partners respectively invested €320k and €391k in these events. Upon completion of VERTIGO, the network included the following members :

Aalto University (FI), Ars Electronica (AT), Atomium European Institute (BE), Avignon Festival (FR), Azkuna Zentroa (ES), BMWi (DE), Bosch Corporate Research (DE), Bozar (BE), CeBIT (DE), Center for Complex Systems (PL), CENTQUATR (FR), City of Munich (DE), DART 17 (US), DeTao Master (CC), Digital Europe (BE), Digital National Assembly (BG), DLD (DE), Exadron (FR), Factoria Cultural (ES), Fly Global (TW), Frankfurt Book Fair (DE), Futur.e.s (FR), FutureEverything (UK), GLUON (BE), HER (IT), Hyundai (SK), IMEC (BE), INL (INT), IoT Week (CH), Kersnikova Institute (SO), KIKK (BE), LABoral (ES), Leonardo (US/FR), MAAT (PT), MDW (IT), Milan Triennale (IT), Municipality of Cluj (RO), Municipality of Estarreja (PT), NANO (BR), NATO (INT), NCIS (BR), OASC (INT), Onassis Foundation (GR), RIXC (LT), SAV (SK), Science Gallery (IE), Scopitone (FR), SONAR (ES), SRTP (NL), STATE STUDIO (DE), Stromatolite (UK/SE), Stuttgart Region (DE), SWSX (US), Tallin University (ET), TSRACT (CZ), Unternehmertum (DE), V&A (UK), Venice Biennale (IT), Volkswagen The Drive (DE), WAAG (NL), WebSummit (PT), ZKM (DE)

The STARTS Residencies high-level jury

A high-level jury made of 12 members from some of the best experts in art-science collaborations and technological innovation was gathered for the selection of STARTS Residencies' 3 calls. The quality of the jury was key in the calls attractiveness for artists.



The STARTS Residencies Call 2 Jury in May 2018

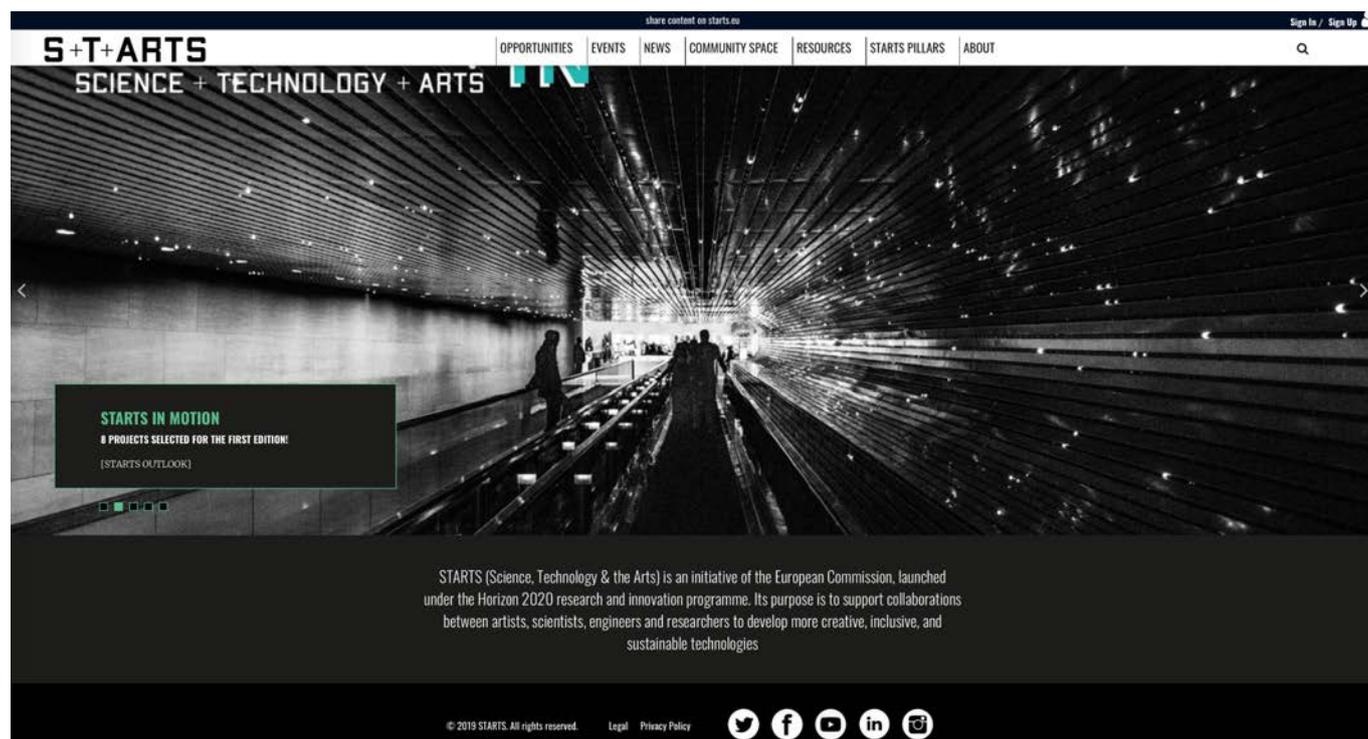
From left to right: Benoit Maujean (Mikros Image), Jérôme Vercaemer (Cisco), Maud Franca (Caisse des dépôts et consignations), Laurence Le Ny (Orange), Greg Beller (IRCAM, Chair), Irini Papadimitriou (Victor&Albert Museum), Chris Julien (WAAG), Francesco Bria (City of Barcelona), Paul Dujardin (Bozar), Camille Baker (University for the Creative Arts), Martin Honzig (Ars Electronica), Ludger Brümmer (ZKM)

The starts.eu web platform

In parallel to its residencies program, VERTIGO developed a web platform as the main matchmaking hub for the STARTS community. It is organised in two main subdomains: starts.eu and vertigo.starts.eu

starts.eu is the common hub of the STARTS community. It centralizes news, calls announcements, events, resources from all STARTS Pillars, blog posts from all stakeholders and provides links to them. Moreover, it manages a community of thousands of registered users – persons, institutions, companies... – who define their own profile according to their status and fields of interest and can be followed and visualised in an interactive map. Since the second semester of 2019, the management and editing of starts.eu have been transferred to the STARTS Ecosystem project in charge of coordinating the STARTS community.

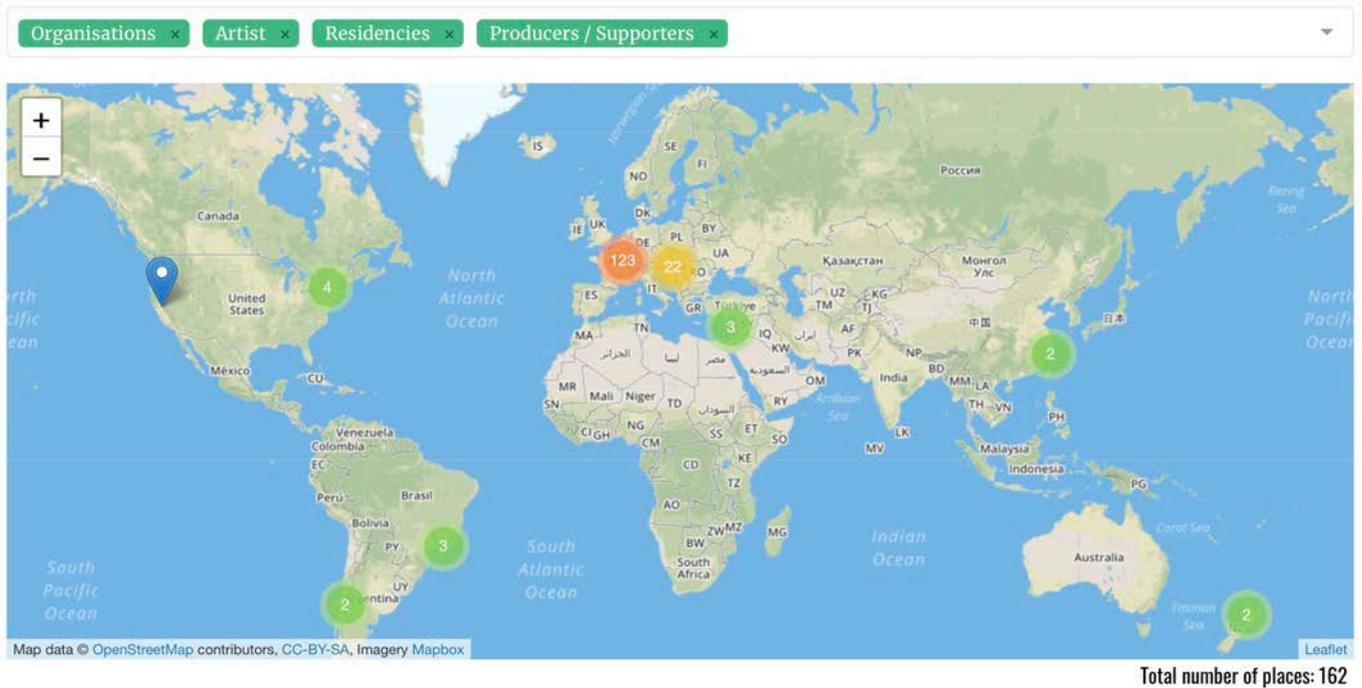
vertigo.starts.eu is the specific subdomain dedicated to the VERTIGO project and the STARTS Residencies program. It presents its 45 residencies in detail as well as all the stakeholders involved in its calls: artists, projects, producers. Based on developments made for the Ulysses¹ European project, this platform was also developed for managing its 3 calls with all their complexity in various steps – calls for Tech Projects, for Producers and for Artists – and for managing their review and evaluation online. It has been also used by the STARTS Lighthouse projects Re-Fream and MindSpaces for managing and evaluating their own artistic calls.



The starts.eu homepage

¹ <https://www.ulysses-network.eu/>

VERTIGO – STARTS Residencies – Final Public Report



starts.eu: the interactive map of STARTS stakeholders

The screenshot shows the website interface for the STARTS Residencies. The top navigation bar includes "starts home", "starts news", "starts community", "what is starts?", "Sign In / Sign Up", and a search icon. The main content area features a large image of the artwork "Sensorial Skin" by Annemarie Maes. The artwork is a black metal frame with a white sensor strip and a red light source. The text "Sensorial Skin" is displayed above the image, followed by the description: "Photosynthetic bacteria grow into a reflective shield and create a power source for environmental sensors". Below the image, the artist's name "Annemarie Maes" and the project title "Applied photosynthesis" are shown. A timeline indicates the "Start of Residency" and "End of Residency". The bottom navigation bar includes "Artistic Proposal", "Tech Project", "Artist", and "Outcome".

Artwork L'Origine du Monde - Exhibited at CENTQUATRE - Paris during the STARTS Residencies Days - February 28 to March 1st, 2020

vertigo.starts.eu: presentation of the residencies

Methodology Highlights

Make it happen!

How can the global methodology established by STARTS Residencies be turned into action and success? 45 projects and 3 calls have enabled this European program to develop implementation tools. Most of the features have been integrated into the project's digital platform. Highlights on lessons learned from this experience.

Launching artist residencies require facing some constraints. First, the process must be lean to channel as many resources as possible toward the co-creation teams. It must also be perceived as relevant, useful and enjoyable by the participants. Usually, technologists and artists already share one thing before any collaboration: their aversion to administrative tasks! However, a co-creation process that starts with misunderstandings and a lack of information has very little chance of being successful. So after three years of development and testing, the STARTS Residencies programme has integrated its tools into its digital platform, with the following features:

- **Attract Tech Projects** and encourage them to express their technology as challenges for artists. The experience gathered with the 127 applicants allowed us to design short and simple forms while preserving crucial information.
- **Launch a call for artists** and have clear content assessed by a jury and future tech partners. Part of this content remains confidential, while the other part serves subsequent communication efforts. The platform manages the flow of information serving the project until the end of the residency.
- **Formalize clear roles and collaboration rules**, including Intellectual Property management, in a co-production agreement signed by all the stakeholders involved at the beginning of the process.
- **Support the jury's work.** Integrating features dedicated to the jury activities allows administrative work to be streamlined and success to be managed: a high number of applicants becomes much easier to handle.
- **Announce laureates.** Visibility and public recognition are vital for artists' careers. The prestigious jury and public announcement of projects selected by the jury drive motivation and engagement. Thanks to the information flow architecture of the digital tool, content can be extracted from the artists' initial input.
- **Monitor project development** and provide help if needed. Creativity requires freedom and cannot only be driven by tools. The platform does not formally request regular reports through forms, but it does provide a blogging tool to facilitate exchange and follow-up. The inception meeting, midterm review and final assessment should remain physical meetings, implemented by a mediator.
- **Present the results** of the residencies. Most of the artworks combine visual artefacts, but also interactions, concepts, as well as new visions for scientific data and technologies. The capacity to merge video, text, sound and image is key to attaining the visibility expected from artists in this kind of context.

Unchaining innovation and art through residencies

Managers know the potential of transdisciplinary innovation, technologists would like to increase the impact of their work, and artists are eager to explore new fields of possibilities. In such collaborations, success means attaining personal objectives by achieving a common goal. STARTS Residencies unveil some key principles for making this happen!

This European initiative is all about innovation. Art is not just a cultural varnish or marketing tool: it is a way to introduce disruptive perspectives, raise critical issues and involve human and emotional dimensions through creative forms of expression. It is also an open field of opportunities for artistic practice. Residencies cannot limit themselves to artists working on their own, nor to well-established common knowledge. The goal is to induce a co-creation process which produces new visions. Here, we take a look at how the STARTS Residencies programme has defined and implemented a methodology to achieve this goal.

Technological Projects: Express your Challenges

STARTS Residencies calls start with scientists/ technologists, as, through their research, they are the ones to provide the tools and knowledge to explore new fields of innovation. Technologists are asked to explain their proposition as a challenge. In other words, they have to describe their proposition above and beyond its scientific performance by including questions, concerns and perspectives to arouse the interest of artists and open a dialogue. Online forms help them to clearly present their challenge and highlight key issues such as expectations, available resources, location, etc. Editorial support may bring a significant increase in efficiency, especially for teams not familiar with such residencies. A first committee selects the promising challenges, carefully checking that the challenge's expectations can match those of an artist and liaises with the researchers to enhance their proposal.

Jam Session: Meet the Technologists

Events where technologists can present their challenge to artists in a free, open and informal way with a view to starting a dialogue and enhancing mutual understanding. This type of event is not mandatory but can be very productive, especially if it requires only short-distance travel by the participants.

Artist Projects: Discovering the Proposals

A Call for Artists is then published online, disclosing the selected projects' challenges. Artists can choose a challenge and propose a residency application based on it. A specific online form gathers the essential information for the collaboration: the artwork concept, technical approach, foreseen process, resources needed to produce the work, type of deliverable, etc. In STARTS Residencies, an independent jury of experts selects the projects with the freedom to make unexpected matches between artists and challenges. It also formulates recommendations for implementation.

Co-creation: Monitoring the Residency Process

Both literature and the experience from STARTS Residencies demonstrate the benefits of a mediator. Thanks to a well-defined digital platform with specific forms, the initial inputs from the technologists and the artists provide a solid basis for starting the collaboration. But the mediator remains crucial for three main steps of the residency:

- the inception meeting, where all parties sign an agreement and align their goals and expectations;
- the mid-term review to discuss the quality of the collaboration, the partners' commitment, and unexpected results or ideas;
- the closure meeting assessing the outcome, finalising the knowledge transfer and opening the valorisation strategy.

Results: Show and Innovate

Valorisation is a major driver for all partners and needs to be planned in advance to be successful. Technologists are eager to open up perspectives and explore new visions for their technology, enhancing its impact. Co-created prototypes facilitate mutual understanding and knowledge transfer for both parties, while documentation is instrumental in pushing some ideas forward. For the artist, the usual outcome is to share new ideas with a large audience through the exhibition of an artwork. This requires the production of convincing artefacts and planning their public exposure. A common understanding of valorisation strategies leads to a win-win situation: drive innovation, creativity and awareness for both parties.

The methodology implemented by STARTS Residencies can benefit any entity interested in organizing their own call. To implement this methodology successfully, the organizer has some key issues to tackle:

- **Ensuring that technologists expect disruptive creative thinking** from the artist and not a work of applied design or communication to improve marketing strategies.
- **Boosting the motivation of participants.** Motivation is mostly driven by the unknown and the existence of challenging tasks toward an overall common goal, while at the same time forwarding personal ambitions.
- **Sharing a common language:** checking the words frequently used by the team and that they mean the same for all members.
- **Checking the resource** made available by the challenge: technologists have to provide not just tools and data, they have also to spend time with the artist to understand and leverage her/his vision.
- **Discussing the co-creation environment:** it should be conceived as an in-between space, allowing heterogeneous identities and mutual access to artefacts.
- **Dealing with time and the unknown:** the different approaches related to the disciplines mean discoveries and the unexpected need to be handled from different points of view. Co-creation happening in a setting of this kind cannot be rushed.
- **Defining intellectual property and collaboration rules,** funding and principles for return on investment at the launch of the initial call. Making these clear for participants to avoid blocks, frustration and losses at a later stage.

Residencies

Melting art, science and technology is a way to think out of the box. This is what the 45 STARTS Residencies did. They challenged the matter, explored environmental questions, contributed to social experiments and implemented augmented artistic experiences. In this section, one can discover the STARTS Residencies supported by the program between 2017 and 2020, grouped in 4 main themes. Complete details are given online².



Inside-Out – Carolin Vogler

² <https://vertigo.starts.eu/calls/residencies/>

Challenging the matter

Knitting DNA, creating a ballet of drops in levitation, printing organs in 3D, making an atom visible to the naked eye, navigating in nanomaterial, these examples illustrate the richness of the meeting of art and fundamental science. While defying the laws of physics and life, the artists and researchers open doors to the infinitely small and the infinitely large.



Reactive Matter – Scenocosme

ALFRED

DEAN (CEA) X COLLECTIF TOAST

How well do we anticipate the impacts of the technologies we develop? The Collectif TOAST challenged the DEAN Project on a new material the tech team created at the French Alternative Energies and Atomic Energy Commission (CEA). This new intelligent material is a polymer that can be modified with heat. The artists analyzed the different physical states of the material and created various objects, helping DEAN to discover potential uses and limits of this new material. ALFRED offers the public to see some of the sculptures made by the collective alongside a camera linked to an AI. It finds the closest looking image in a dataset of 1000 images. The resulting associations are displayed on a screen behind the conveyor. The AI software is constantly trying to assign meaning to what it sees, much like the artists when they were working with the material. The resulting installation, with its never-ending cyclic motion and strange associations, aims to make the public question the very state of innovation today.

RESIDENCY FROM SEPTEMBER, 2018 TO MARCH, 2020 – FRANCE

ATOM CHASM

5TH PHYSICS INSTITUTE & QUANTUM FLAGSHIP X EVELINA DOMNITCH & DMITRY GELFAND

Can we see an atom with the naked eye? Passionate about quantum physics, the ArtAtom research team dreams of presenting to a large audience the small unit they are using: the atom. To meet their goal, they partnered with the artists Evelina Domnitch and Dmitry Gelfand. The Atom Chasm residency focused on the development of a laser-cooled ion trap enabling purely optical observations of individual atoms and quantum jumps. After several scaled up prototypes, the team started designing a computer-controlled linear trap coupled with a unique magnification system. Instead of having to look into the eyepiece of a microscope extending from an ion trap, viewers experience a constellation of glowing atoms as if it were hovering in the darkness of outer space. With the support of two quantum optics laboratories, each of the collaborators contributed to the ambitious staging of the first-ever atomic-scale artwork. The sensorial and philosophical impact of the installation has served as the guidepost towards which the collective aligned its efforts.

RESIDENCY FROM NOVEMBER, 2018 TO MARCH, 2020 – GERMANY

BIOBOT/INSIDER

KAMBIČ X ZORAN SRDIĆ JANEZIČ

Can we grow biological robots? The residency team created an environment for the Biobot, a robot with functioning biological muscle and neurons, to grow and survive. In collaboration with the biological equipment manufacturer Kambič, the team designed and produced the Insider incubator that is both a living and exhibition environment for the Biobot. Insider serves as the visual display of life's drama, happening within artworks incorporating live material. Based on innovative technologies and design, this device is a step forward both for bio artists and biologists. Now that the incubator has been tested and approved for artistic purposes, the team is working on a standardized incubator to release on the market. Apart from the innovative breakthrough, through this project, the artist raised ontological and ethical questions about the status of those new art forms using living materials and our attitude toward them.

RESIDENCY FROM APRIL, 2019 TO MARCH, 2020 – SLOVENIA

EMBRYONIC

3D PRIME X VALERIA ABENDROTH

Can art help us reflect on the evolution of the human body through technology? Embryonic proposes a sensorial experience between reality and fantasy. The two companies involved in the project Inova DE and Create it REAL develop silicone replicas of real organs in the European Project 3D PRIME. From realistic 3D printings of human organs designed for medical training, the audience is invited to discover a fake laboratory combining these organs with art objects created by the artist. Compared to classical anatomic imaging, the ability to manipulate these physical objects brings a new dimension of awareness of their characteristics – size, shape and texture.

RESIDENCY FROM NOVEMBER, 2018 TO MARCH, 2020 – GERMANY



Embryonic – Valeria Abendroth

IMMERSIVE MINIMALISM / ALWAYS DEAD OR ALIVE

IMMERSIFY (POZNAN SUPERCOMPUTING & NETWORKING CENTER) X THERESA SCHUBERT

What if pixels were considered as interacting agents able to self-organize? The residency combines research on the evolution of patterns in nature and self-organization of forms with generative video. With PSNC developing an advanced toolkit, encoding and innovative content for high-resolution immersive displays, the artist created 'Always Dead and Alive', an 8K computational video and surround audio experience. It takes the audience in a flow of light, colour and sound, playing out a sequence of patterns based on cellular automata rules. The resulting scenarios between geometric abstraction and minimalism challenge our usual boundaries of perception.

RESIDENCY FROM NOVEMBER, 2018 TO JUNE, 2019 – POLAND

INSIDE-OUT

CHROMDESIGN X CAROLIN VOGLER

Can you imagine the beauty of chromatin? The happy meeting between textile technology and scientific research on chromatin organization turned into a fashion design hit. "Inside-Out" proposes an engaging experience where the blueprint of life, knitted DNA, is visible to the human eye and visitors are invited to actively participate in the installation and finger feel it. Using the research from the scientific partner CRG and ChromDesign project, the artist Carolin Vogler informed people about the beauty, complexity and structures that lie hidden within their bodies and inspire them to learn more about the genetic code.

RESIDENCY FROM MAY, 2019 TO JANUARY, 2020 – SPAIN

JANUS 2155

HYBRID OPTOMECHANICAL TECHNOLOGIES (HOT) PROJECT X STEFANE PERRAUD

How to understand and demonstrate the interaction with light and matter? In collaboration with two researchers of the H2020 HOT project, the artist looked for a way to demonstrate an experimental study on an optomechanical micro object that reacts with the light of a laser. The concept evolved into a video installation showing the process of manufacturing an optomechanical object created to interact with the light in order to generate a chaotic effect. Through this installation, depicting the scientific experiment and the new methods of creating an object, the artist's intention is to unveil the incredible complexity of such a process and in parallel present human production's modes, and its relation to light through the ages.

RESIDENCY FROM DECEMBER, 2018 TO MARCH, 2020 – FRANCE

OS:WAAM (WIRE ARC ADDITIVE MANUFACTURING)

PRINT PIONEERS (B.I.G GROUP) X SEBASTIEN WIERINCK

How to bring large-scale metal 3D printing to society? Thanks to Flying Parts, a company specialized in large-scale metal 3D printing, and through the artistic input, this residency pushed the technical limits of large-scale metal 3D printing. The main goal was to develop a new workflow for the production of a series of structures halfway between the public art piece and the urban furniture. It has resulted in increased public awareness on the multiple possibilities of this new design and production system at several scales, from small objects to larger environmental and architectural integrations.

RESIDENCY FROM OCTOBER, 2019 TO APRIL, 2020 – GERMANY



OS:WAAM (Wire Arc Additive Manufacturing) – Sebastien Wierinck

REACTIVE MATTER

PROGRAMMABLE MATTER X SCENOCOSME: GRÉGORIE LASSERRE & ANAÏS MET DEN ANCXT

What if programming could turn interactive objects into organic matter? The artists worked with micro-robots, i.e sub-millimeter moving computers developed by the Programmable Matter project, that have the ability to move around each other, communicate, change colour, and latch to other micro-robots to form different shapes. Thanks to artists intervention the project pursued the achievement of a programmable matter capable of changing its physical properties according to an internal or external action. Liaising a hardware component (micro-robots) and a software approach (using various algorithms), this residency supported the development of a new smart system that allows reaching an intended form. Based on this technology, the team created a sculptural and interactive artwork with organic behaviours.

RESIDENCY FROM JANUARY, 2018 TO JANUARY, 2020 – FRANCE

SUSPENDED MOMENT

LEVITATE X DOMINIQUE PEYSSON

Can ultrasound levitation be nimble enough to create poetry? “Suspended Moment” is a ballet of two liquid drops in levitation, dancing around in a slow and fragile manner, until they finally merge. The inert matter then starts a proto-life: the drop begins to divide itself under the audience’s eyes. Behind the poetry, lies in-depth technological research. The team combined ultrasound levitation and chemistry to find the liquid that can levitate, merge and divide without damage as well as performing the perfect trajectory of the drops.

RESIDENCY FROM MAY, 2019 TO MARCH, 2020 – SCOTLAND

SCI-FI MINERS

CRITCAT (INTERNATIONAL IBERIAN NANOTECHNOLOGY LAB) X JOÃO MARTINHO MOURA

Can nanotechnologies replace rare materials? This residency team explored how, with the help of scientific advances in nanotechnology and artificial intelligence, a new generation of nanoclusters are replacing critical natural resources becoming very rare on planet earth. At INL, they used the data generated nanoparticle parameters such as size, shape, surface structure, and computational simulations to create the final artwork. “Sci-fi Miners” is an audio-visual, interactive and virtual reality performance where the artist takes the audience on a journey on the nanometric scale of matter. Through the artwork, the team raises awareness on the importance of this research for humankind and for the sustainability of our planet.

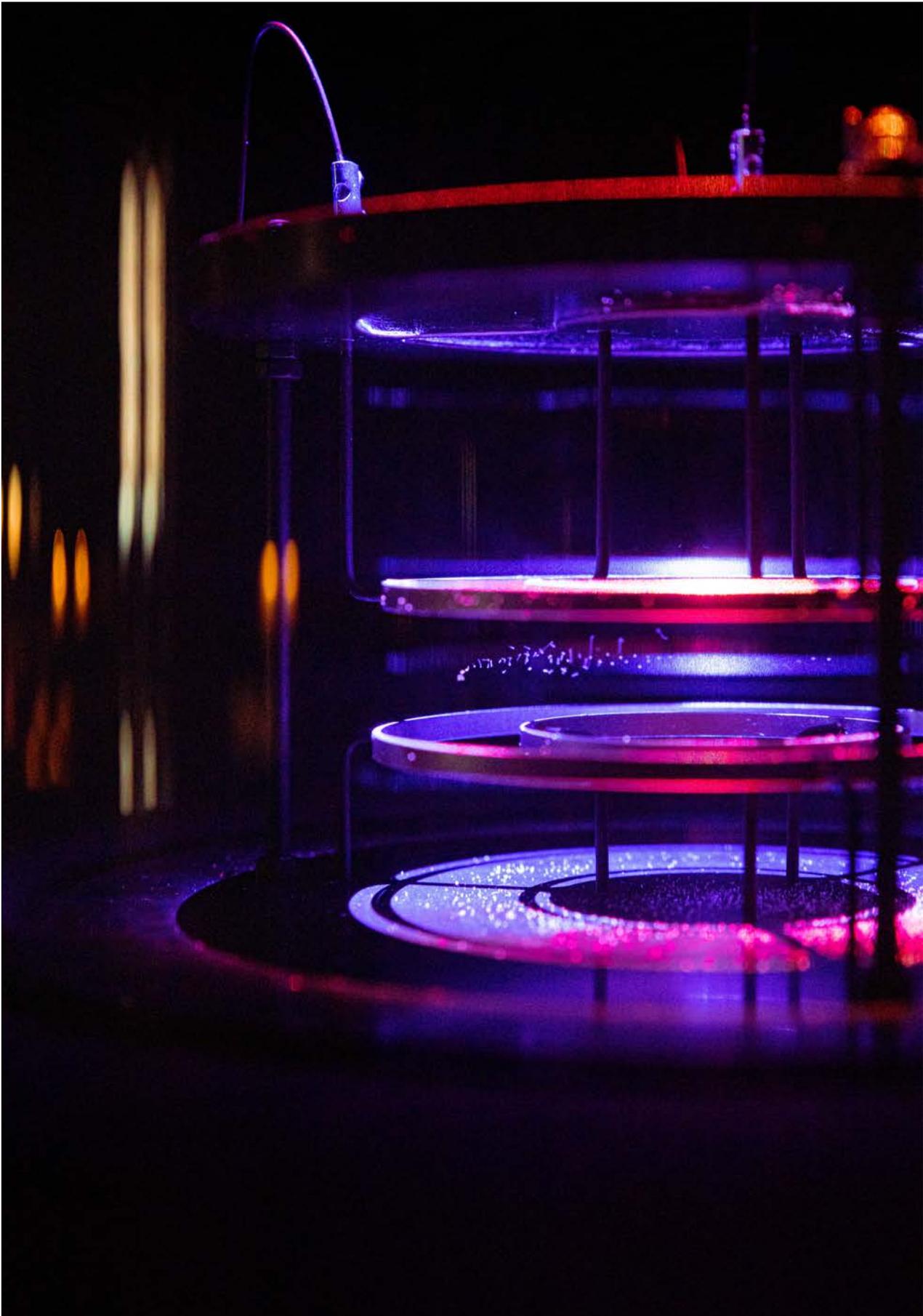
RESIDENCY FROM SEPTEMBER, 2018 TO APRIL, 2020 – PORTUGAL

SMART>SOS

BIO4COMPT X TIM OTTO ROTH

Do you know the paradigm of bio computation? The artist paired up with the Bio4Comp research aiming at developing a sophisticated mechanism to create a bio computer. Together they created a sound and video installation revealing the new paradigm of bio computation. The artist conducted experiments with the research team and designed a ring-like network helping optimizing the structure. The creation of this nano-structure was a success and a big step in Bio4Comp research. The structure’s shape was used as the basis for SMART>SOS artwork.

RESIDENCY FROM SEPTEMBER, 2017 TO APRIL, 2018 – GERMANY



Hilbert Hotel – Evelina Domnitch & Dmitry Gelfand

Ecological explorations

Participate in the residency teams' ecological explorations and discover how to control water pollution and monitor soil fertility, build a self-sustained beehive, assess our carbon footprint and create street furniture from recycled plastics. Additionally, explore unknown territories such as the planet Mars. The variety of artistic approaches reveals the importance of environmental issues.



O.R.S – HeHe

BECOMING.ECO(LOGICAL)

ACTUR X MIHA TURSIČ & ŠPELA PETRIČ

How to visualize the impact of humans on carbon emissions? Like data journalists, the artists research climate data to build an understanding of the human condition within a changing environment. With this wide set of data, a model of anthropospheric carbon flows, running on the ARCTUR supercomputer, and the help of this High-Performance Computing (HPC) company, the artists visualized an understanding of human impacts on global carbon flows. While processing the data, they worked on two anatomies: temperature as a climate fact and carbon flow as a climate fact. They finally decided to observe humans as environment agents. They demonstrated the embeddedness of human agency into the environmental condition and the transition from technological into the ecological world. As contemporary activists, they used this project to advocate for more open and accessible research data while shedding the light on models and simulation biases.

RESIDENCY FROM MAY, 2019 TO MARCH, 2020 – SLOVENIA

BY THE CODE OF SOIL

GROW OBSERVATORY X KASIA MOLGA

What if you could see and hear the soil speak? The artists and the H2020 GROW Observatory worked with soil data as their material, creating "soilscapes" and data portraits of the GROW places. When launched on participating computers as a harmless "computer virus", the artwork always looked and sounded differently, governed by data from GROW's soil moisture sensors distributed all over Europe. It portrays a system of interconnected and interdependent processes conveying the condition of the land – unique and different to each place, materials and our attitude toward them. As a beta tester of the technology, the artist discovered its vulnerabilities and found ways in collaboration with GROW to solve them. Apart from helping to improve the tools, she also opened new doors of reflection and development when she started to study earthworms as soil quality biosensors.

RESIDENCY FROM NOVEMBER, 2017 TO DECEMBRE, 2018 – SCOTLAND

CONTINUUM

EYES ON MARS X FÉLICIE D'ESTIENNE D'ORVES

What if you could see a Sunset on Mars in real time? Through 3 different artifacts, Continuum is an artistic investigation of the Martian landscape, allowing one to feel what s.he would feel if s.he was on the red planet. First, an extra-large scale audiovisual projection immerses the audience in the poetic experience of the sun slowly dying behind the Martian horizon. Then, a smaller installation acts as a permanent, real-time window on the Martian landscape. Finally, bas-reliefs give a comment of the Martian topographic and its shadows. This declination throws new light on Mars that paradoxically invites the audience to reflect on its own planet. In order to recreate this distant reality, the artist collaborated with scientists to translate raw data into sensible meanings. The goal of the residency was to introduce the "real-time" component to the work, based on real time data from the laboratory, to create an actual window on the Martian landscape rather than an interpretation. The team achieved to go beyond data, and talk about science in an emotional way.

RESIDENCY FROM JULY, 2019 TO APRIL, 2020 – FRANCE

O.R.S

NANO2WATER (INTERNATIONAL IBERIAN NANOTECHNOLOGY LABORATORY) X HEHE

How to reveal water quality through art? The O.R.S (Orbital River Station) is a large-scale floating sculpture. Its form suggests an oversized life ring, alerting people to the potential danger that arises from flooding. The artists partnered with the Nano2Water team, which explores a portfolio of technologies including biosensing devices for selective recognition and capture of water contaminants. Together they worked on a device embedding such technologies allowing water quality monitoring to be included on the O.R.S. The concept of a moving station in the river that could provide water monitoring over a large area allowed the use of passive sampling systems based on COFs (Covalent Organic Frameworks) to check their performance in a real water scenario far from the lab. Thanks to this residency, the scientific team was able to test the presence and richness in several lipophilic organic pollutants in the Rhône River. If used in a continuous and consistent way, this methodology could help to follow temporal trends that would provide a better understanding of the massive use of pharmaceuticals and the efficiency of the wastewater treatment to remove them or verify the implementation of a pesticide ban.

RESIDENCY FROM NOVEMBER, 2018 TO MARCH, 2020 – PORTUGAL

POLLUTION EXPLORERS

HACKAIR X LING TAN

Refine air quality data by exploring the city with wearables! Pollution Explorers is a collaboration between artist Ling Tan and hackAIR, an EU supported project that built an open technology platform that can be used to access, collect and improve air quality information in Europe. During the performance, Pollution Explorers browse the city equipped with wearable monitoring devices. They wander the streets in groups and stop at specific locations to express their feeling about air quality through specific gestures. This ritual is repeated over and over, slowly drawing a subjective pollution map of the urban environment. Over the course of this monitoring, data is sent over to a global database of air quality data. Through citizen engagement, subjective data completes objective data – with the aim of raising global awareness on pollution.

RESIDENCY FROM OCTOBER, 2017 TO DECEMBER, 2018 – GREECE

SENSORIAL SKIN / L'ORIGINE DU MONDE

HYBRID FORMS LABORATORY OF RAOUL FRESE X ANNEMARIE MAES

Can we use bacteria as a power source? To reach the goal of creating biosensors for beehives, the artist partnered with the Applied Photosynthesis project from the Faculty of Science, Biophysics Photosynthesis/Energy of VU University Amsterdam. “L'origine du monde” is an artistic representation of research into the possibilities of cyanobacteria and micro-algae as a source for renewable energy and novel biodegradable materials. The installation shows a strongly enlarged bacterial chain made from glass cells. Every cell is filled with cyanobacteria producing real-time photosynthesis. Together they form a complex microbial population that communicates via quorum sensing and reduces CO2 emissions whilst producing oxygen and biopolymers.

RESIDENCY FROM MAY, 2019 TO MARCH, 2020 – THE NETHERLANDS



L'origine du Monde – Annemarie Maes

THE CROWD PLASTIC WASTE PRINTING PROJECT

PTWIST X THE NEW RAW

Turn your plastic waste into digital value, and get plastic furniture locally 3D-printed! For the project Print Your City, the artists collaborated with PlasticTwist, an open platform for plastics lifecycle awareness and monetization that provides crowdsourcing tools, blockchain-based facilities and a marketplace, amongst others. The final outwork is a locally-sourced and locally-produced massive piece of urban furniture, co-designed by the citizens in regard to their needs and 3DPrinted out of the community's plastic waste. The goal of the residency was to use the artwork as a statement to raise awareness on the potential value of recycled plastic as a relevant and marketable raw material.

RESIDENCY FROM AUGUST 2018 TO JULY, 2019 – THE NETHERLANDS

THE PLANTS SENSE

FLORA ROBOTICA X MARIA CASTELLANOS & ALBERTO VALVERDE

How to communicate with plants? During the artists partnered with Flora Robotica Project developing braiding robots, robotic nodes, and intelligent filaments. Together they created the Plants Sense: an installation that allows the audience, to know and experience the secret language of plants. The work consists of an interactive garden in which different sensors measure the electrical oscillations of the connected plants, and show their biochemical reactions to the human presence and the environment that surrounds them. All this information is processed and translated into vibrations and low frequency sounds that allow the visitor to perceive the plants through a wearable. Likewise, different interfaces in the garden provide the public to experiment and feel in their own hands the registered reactions of the plants, through different electronic devices.

RESIDENCY FROM SEPTEMBER, 2017 TO JUNE, 2018 – DENMARK



The Crowd Plastic Waste Printing Project – The New Raw



Pollutions Explorers – Ling Tan

Social experiments

Artists and researchers use and question the latest scientific and technological advances to reinvent human relationships and bring people together. They invite citizens to think collectively about data protection issues, understand data exchanges, study the role of sound in hospitals and participate in collective and interactive performances.



Constella(c)tions – Michelle Agnès Magalhaes

ARTIFICIAL INTELLIGENCE AND ITS FALSE LIES

CONFIRM RESEARCH CENTER X MIKA SATOMI

Will AI replace our jobs? Will AI threaten our identity? These were some of the questions moving the artist Mika Satomi in the residency “Artificial Intelligence and its False Lies (AIFalseLies)”. In this residency, she worked with the CONFIRM, a research project focused on smart manufacturing, aiming to develop methods for automated decision systems. Together, they discussed the role of technology in our lives and, specifically, its impact on our jobs. Instead of observing fearfully from a distance, Mika Satomi proposes us to reflect on these questions by challenging us to get closer to the machine’s world. If we could wear AI, would it influence how we do things? The resulting artwork consists of a series of embroidered Artificial Neural Network prototypes, accompanied by a short film that captured the ideas discussed during the residency. The final prototype, a whole-body garment, was shaped like a ghost, built to allow us to become a body of a machine that learns from us and continues “dreaming” about us in our absence.

RESIDENCY FROM MAY, 2019 TO APRIL, 2020 – IRELAND

BEYOND ABSOLUTE

LUCA PROJECT X REIKO YAMADA

What if we could communicate how we feel to the doctors without words? In collaboration with the Laser and Ultrasound Co-analyzer for Thyroid Nodules team, the artist Reiko Yamada created a tool that translates psychological and medical data into music. The team is revolutionizing the patient-doctor relationship considering music as the main mean of communication. After each consultation, the patient comes home with a soundscape reflecting his/her psychological and physiological state. This soundscape becomes a basis to start the discussion between the patient and the doctor. The final artwork is a performance featuring a selection of these soundscapes performed by a singer moving among and engaging with the audience.

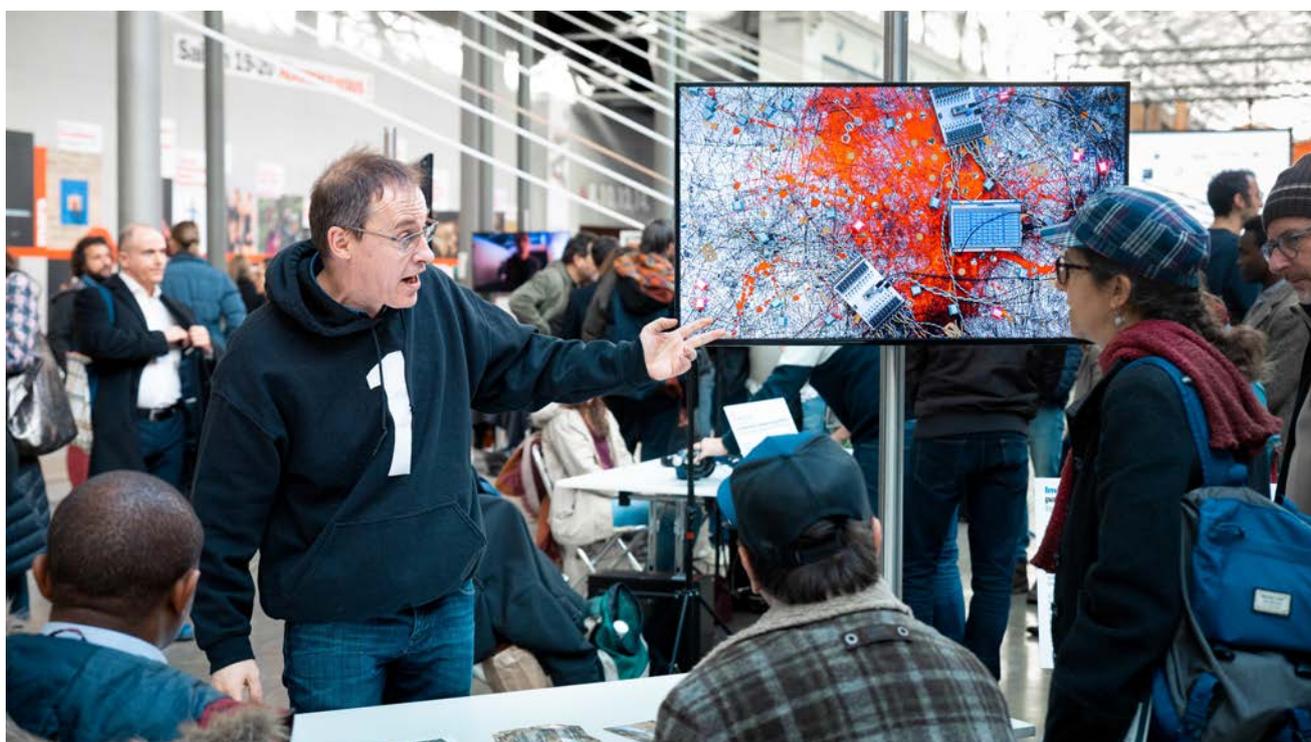
RESIDENCY FROM MAY, 2019 TO MARCH, 2020 – SPAIN

BLUEPRINTS FOR AN EMERGENT PERSONALITY

AMORE X THEO (KATE ASPINALL)

Can one produce a visual representation of non-human personality? Visual representations of the AMORE computational system seek to represent non-human personality using both objective analysis of the system's data with subjective interpretation, treating the system as a developing mind. The artistic process included close observation of the AMORE lab, above all the city of Barcelona, the lab itself and the participating researchers, as well as analysis of the data with the help of qualified psychological and neurological experts. The interaction with the artist provoked further considerations regarding big-picture perspectives on AI as well as potential future research topics, while the science directly impacted the art by providing all the data, as well as insight into the connection between language and mind.

RESIDENCY FROM APRIL 2018 TO JANUARY, 2019 – SPAIN



Invisible Agency – Stanza

CONSTELLA(C)TIONS

BECOME PROJECT, ISMM TEAM (IRCAM) X MICHELLE AGNÈS MAGALHAES

Can smartphones become collective performance devices? Creating alternative uses of mobile technologies, Constella(c)tions proposes a musical experience built out of physical and metaphorical connections between performers and the public. An artistic proposition to repurpose smartphones as collective musical instruments, where the audience can engage actively in the performance. *Constella(c)tions* unfolds as a set of collective musical games and interactive pieces involving various gestures, body movements and action of performers and/or public within open musical environments. During the residency, the team developed new paradigms for screenless and collective musical interaction, repurposing web and mobile technologies. The project was inscribed in a practice-based methodology with the aim of exploring and developing further technological tools dedicated to playing sounds using the motion sensors embedded in smartphones. The results are thus intrinsically of a hybrid nature, beyond strict scientific and artistic boundaries, and allowed to reconsider the technical setup from a novel epistemic point of view.

RESIDENCY FROM MAY, 2019 TO FEBRUARY, 2020 – FRANCE

DATA UNION FORK, TOOLS FOR DATA STRIKE

DECODE X LARISA BLAZIC

Educate people about their data and provide them with tools for digital strike. The artist partnered with DECODE an experimental project aiming at developing practical alternatives to how we use the internet today. The goal of the residency was to develop a collective, empowering and democratic response to the socioeconomic and cultural implications of mass-scale data harvesting and to fully leverage the value of that data in the interests of democracy, equality, and justice. What does it mean for the people, who owns data and has rights, to strike digitally? Tools for Data Strike have been developed through a series of panels and workshops with citizens, designers, thinkers and activists around the notion of collective bargaining. The result of this co-creation work is presented as an installation that the audience can connect to and collectively decide and discuss strategies to organize, mobilize, set targets and strike.

RESIDENCY FROM SEPTEMBRE, 2018 TO MARCH, 2020 – THE NETHERLANDS

INVISIBLE AGENCY

ARTANTENNA X STANZA

Can we see the agency of invisible data waves surrounding us? In collaboration with the tech partner WaveCom, leading wireless experts from Portugal, the artist developed Invisible Agency, a series of dynamic artistic data visualization interfaces connecting real-time city spaces aiming to investigate data manipulation across distributed technology networks. Data signals from WIFI access point across Portugal are interpreted via a custom-built software system and visualized as an electronic artwork with LEDs and electrical circuits that comes alive responding to thousands of data points. The team demonstrated that the virtual world is full of invisible agency and layered networked connections that can be brought together. The artworks create further understanding of the environment we inhabit and interact within and that we are all complicity interacting in a complex interwoven web as part of this agency.

RESIDENCY FROM JUNE, 2019 TO FEBRUARY, 2020 – PORTUGAL



Magic Lining – Kristi Kuusk

MAGIC LINING

MAGIC SHOES X KRISTI KUUSK

Can clothes make us feel better? MAGICSHOES is a scientific project that explores how sound can alter the experience of one's own body and aims to test the feasibility and potential value of using wearable technology integrating sensory-feedback and body-tracking for improving body-representation, motor behaviour and emotion. From the insights of MAGICSHOES project – based on shoes and sound –, Kristi proposed to open the project to all the body and work notions such as vibration and garment, aiming to draw the attention to the unused internal side of the garments and textile as a space to alter people's self-perception for more positive behaviour.

RESIDENCY FROM NOVEMBER, 2017 TO AUGUST, 2018 – SPAIN

MUTED

CONTENT4ALL (FRAUNHOFER HHI) X CHRISTOPHE MONCHALIN

A journey through signed language. Content4All explores the relationship between how human beings describe things and visual and linguistic paradigms. It aims at translating spoken language automatically in sign interpretation. In this context, the residency team worked on the creation of a photorealistic 3D avatar, which implied lots of challenges around data collection, user experience and aesthetics. Muted residency used the technology developed at HHI to poetically express the story of two abandoned sisters who invent their own language during their childhood. The visitor is invited to fall into a dedicated VR environment in which sign languages is expressed through dancing avatars. MUTED residency has proposed a new usage for photorealistic 3D avatar coupled with a new way to create a strong emotional link to it.

RESIDENCY FROM NOVEMBER, 2018 TO MARCH, 2020 – GERMANY

RANDOM BEAUTY

SOUNDS FOR COMA (IRCAM & HOPITAL SAINT ANNE) X ALI TOCHER & JOE ACHESON

Improve the Intensive Care Unit environment through ever-evolving soundscapes. The Random Beauty residency addresses an unknown problem in hospitals: the bad quality of the sound environment, and its impact on the recovery of the patients. This is even more crucial in the context of the Intensive Care Unit (ICU) in which it impacts patients, causing stress even in a coma, as revealed by studies. By using cutting edge audio technology created for the gaming industry, the artists designed a dynamic soundscape that infinitely varies and can be dynamically controlled by staff or patients to improve the soundscape of the ICU environment. Random Beauty is an app through which the hospital caretakers can implement a never-ending, ever-evolving soundscape whose sounds and patterns are designed to measurably support the patients along the path to recovery.

RESIDENCY FROM APRIL, 2019 TO APRIL, 2020 – FRANCE

SLEEP IN THE CITY

AARHUS CITY LAB X WALID BREIDI & VIRGILE NOVARINA

Can our sleeping experience be shared in a smart city? In the Sleep in the City project, video streams are generated from the combination of data from multiple sources, including brainwaves of people sleeping in several places, as well as pollution and sound data. They are continuously changing in form and colour, creating a contemplative experience about the richness of sleep involving citizens from all walks of life. This project invites us to reflect on the importance of sleep. Sleep in the City aims to synthesize the profound importance of sleep through performance, interactive art and network. With Aarhus City Lab as tech partner, Sleep in the City connects city sleep with networks and open data in order to create interactive poetic videos projected all around the city in real-time during the participants' sleep time.

RESIDENCY FROM NOVEMBER, 2018 TO JULY, 2019 – DENMARK



Sleep in the City – Walid Breidi & Virgile Novarina

SMOKING GUN

DATA STORIES X FANSHEN

How to playfully explore the power of data? Smoking Gun is a collaboration between artists Rachel Briscoe, Dan Barnard and Joe McAlister and Data Stories Tech Project from the University of Southampton. It is a playful and interactive approach exploring the power of data in the age of disinformation. It's a thriller which unfolds via the audience's phone, placing them at the heart of a potential whistleblower scandal. The audience is invited to solve puzzles, scrutinize documents, wrangle datasets and chat about the evidence with fellow players to uncover what is really going on at the heart of government. The objective is to see how people engage with data if it's made meaningful to them through narrative and game mechanisms.

RESIDENCY FROM MAY, 2019 TO FEBRUARY, 2020 – ENGLAND



Data Union Fork, Tools for Data Strike – Larisa Blazic

CHATROOM OF THINGS

CREATE-IOT X SO KANNO

CREATE-IoT, bringing together 18 partners from 10 European countries, aims at stimulating collaboration between IoT initiatives, fostering the take up of IoT in Europe and supporting the development and growth of IoT ecosystems based on open technologies and platforms. During this residency, they teamed up with So Kanno to reflect on data privacy and security. Together they created the installation “Chatroom of Things” where all objects in this smart environment are connected to the internet and send information about the audience and their movements to data space. While “listening” to the conversation between these objects one realizes how much information can be known about oneself in our brave new digital world. Privacy and security of data become then very important to ourselves when the couch has an inbuilt sensor and talks to the TV set about how much weight one gained in the past few days. To whom else might the TV be talking to?

RESIDENCY FROM OCTOBER, 2017 TO JANUARY, 2019 – NORWAY



Artificial Intelligence and its False Lies – Mika Satomi

Augmented experiences

An opera assisted by artificial intelligence, antique sculptures generated by data analysis, a work of Boris Vian in 360°, poetic experiments in virtual reality or with robots... Artistic creativity pushes modelling technologies to their limits.



Cosmologies of the Concert Grand Piano – Aaron Einbond

AIBO

GOPROSOCIAL X ELLEN PEARLMAN

Can AI be sick? AIBO (Emotionally Intelligent, Artificial Intelligent Brainwave Opera) is an immersive, interactive love story about our infatuation and trust in artificial intelligence played out between a human character Eva, and AIBO, a custom-built 'sicko' AI. Eva wears a bodysuit of light with her live time EEG brainwaves displayed as colours on her body, akin to an exterior nervous system. She intones a libretto about their love affair. Her brainwaves trigger databanks of videos and audio of emotionally themed memories. AIBO raises issues about a time when humans and machines potentially merge consciousness and explore if AIs can create memory through databanks that emulate human emotion. AIBO was created using the Art-A-Hack™ methodology that examines networks of both animate and inanimate 'actors' and how they interact with each other. It linked the artist Ellen Pearlman, and the Tech Project GoProSocial, Tallinn University, as well as other European institutions such as ThoughWorks.

RESIDENCY FROM JULY, 2019 TO FEBRUARY, 2020 – ESTONIA

ALTAS

WEKIT X YANN DEVAL & MARIE G. LOSSEAU

Explore and build a dream-like world in multiple layers of reality! Atlas is an experience based on an archipelago of hand-made tiny houses. The audience can first immerse in this physical space without a device, exploring it as is. Then, they are invited to re-explore it in AR, revealing digital, invisible buildings, that coexist with the real, physical ones. One can also build new structures by throwing seeds! Finally, people are invited to browse the all-digital layer, a landscape made up of all the buildings created by previous users over time. By blurring the edges between physical and digital through 3 intertwined layers, Atlas questions our link with space, time, the reality and the dream. It was developed thanks to the technology-enhanced by WEKIT, using new augmented medium mainly for professional training. While providing technical guidance and mentoring on one side and exploring without any other boundaries than soft/hardware limits on the other side, the co-creation team reached measurable results and was able to output knowledge out of the work produced, in the field of AR aesthetic and interaction principles, in particular how the mapping of the field of view of the Hololenses in AR helps to feel depth and reliefs and to interact with the surrounding environment.

RESIDENCY FROM APRIL, 2017 TO NOVEMBER, 2018 – ENGLAND

CONSTELLATION OF THE FLESH

MOVING DIGITS X KA FAI CHOY

Can we digitize the dance of the supernatural? With Technological Flesh residency, artists Choy Ka Fai and Maria Judova in collaboration with the media department of the University of Applied Sciences Duesseldorf (Hochschule Düsseldorf), explored the possibilities of digital dance technics as a supernatural dance experience. Using digital technologies like data visualisation, motion capture, augmented and mixed reality, Technological Flesh re-imagined the perception of our body and provided an immersive participatory dance experience. The team carried out research on trance induction and sensory stimulation. The aim was to focus on the auditory, kinesthetic and spiritual induction for both the dancer and the audience. The outcome of the residency is a participatory Supernatural Dance Experience, allowing both audience and performer to interact beyond our physical sense.

RESIDENCY FROM JUNE, 2019 TO MARCH, 2020 – GERMANY

CONTENT AWARE STUDIES

DATA PITCH X EGOR KRAFT

Will AI preserve or erode our classical sculpture traditions? This was the main question asked in this project based on the EU-funded open innovation program around shared data Data Pitch. Data Pitch set up an innovation space that offers the technical, legal, and ethical infrastructure for organizations owning data to be able to share it safely, securely, and responsibly. This residency used algorithms to first analyze and after create new pieces of original sculptures following the principles of the classic culture from ancients Greece and Rome. Brand new sculptures were generated and 3D printed. Ancient historical sculptures found partially broken could see their gaps filled allowing us to contemplate them closer to their original source. Ancient traditions and future possibilities are combined towards more informed reflections about classicism through sculpture.

RESIDENCY FROM OCTOBER, 2019 TO MARCH, 2020 – ENGLAND

COSMOLOGIES OF THE CONCERT GRAND PIANO

OM#/OM-SPAT (IRCAM) X AARON EINBOND

A journey into the secret inner life of a concert grand piano. By combining experiences and motivations, Aaron Einbond and OM7/om-spat Project explored artificial intelligence and machine learning and interrogated the musical microcosm of the piano interior as it is exploded out to space. Radiation patterns of acoustic instruments were analysed, allowing the computer to “learn” from their rich interactions of timbre and space. The electronic sounds were then diffused in an ambisonic loudspeaker system to situate the listener in a 3D sound space, while machine learning techniques were applied to choose sounds based on their timbral characteristic and map them spatially. The final result is a unique experience where the listener is situated inside the virtual instrument and stimulated to explore the intricate interdependencies of timbre and space.

RESIDENCY FROM MAY, 2019 TO APRIL, 2020 – FRANCE

CYBERSPECIES PROXIMITY

HUMAN ROBOT CO-MOBILITY (SCHINDLER) X ANNA DUMITRIU & ALEX MAY

What would it be like to share your space with a robot? The Human-Robot Co-Mobility residencies questioned our links to robots, and more specifically when it comes to sharing space together. What will it mean to interact and coexist with robots? What technological, societal and ethical challenges and questions will it raise? The team developed an exploration of robotic movement to investigate what our future co-existence with intelligent embodied robots might be, based on a deep investigation of human and robot interaction and movement, focusing on proximity, touch, body language and interactivity with socially-aware robots. By meeting a mobile humanoid, intelligent robot, the audience is invited to investigate these questions and to make its own opinion. The robot interacts with participants by approaching them, exhibiting and reflecting body language, in order to explore how we might feel in future cities living with robots on our sidewalks, elevators, homes...

RESIDENCY FROM APRIL, 2019 TO MARCH, 2020 – SWITZERLAND



Froth of the Daydream – Julie Desmet Weaver

FROTH OF THE DAYDREAM

LE CUBE (BLACK EUPHORIA) X JULIE DESMET WEAVER

Can we experience the classics of literature? Black Euphoria studio created a 360°-cylinder structure with circular screen and spatialized sound. Amateur of Boris Vian, and already occupied with the staging of a play by the author, Julie Desmet Weaver has made this structure her playground. After a long period of reflection and necessary framing, the team developed an immersive and interactive collective experience based on Boris Vian's famous novel. For Froth of the Daydream, working with the ambitious artist Julie Desmet Weaver revealed Black Euphoria's developers' sense of craziness which allowed them to boost their technology. It led to the development of an innovative volumetric capture technology while being a thrilling human experience.

RESIDENCY FROM JULY, 2018 TO OCTOBER, 2019 – FRANCE

LE BAPTÊME

GENGISKHAN PRODUCTION X LAURENT BAZIN

How to translate human emotions with VR? How to feel closeness when immersed in a virtual environment? This residency explored the concepts of proximity and intimacy, through the virtual reality close-up technique. After a few months of experimentation, Laurent Bazin perceived that the complex technology initially used was not producing the effect he imagined. The rig of multiple cameras filming in stereoscopy was not grasping emotions of human proximity because it represented too many constraints for the artistic direction. Eventually, the team opted for a brand-new rig using only 2 cameras (Sony Venice cameras, used mostly for Hollywood feature films). This rig was much easier to use at the technical level for film directors, and best captured the feeling of closeness at the centre of this residency. The added-value of this work is certainly the shift operated at a technological level to suit the artistic purposes. The whole articulation between techniques, dramaturgy and meaning has evolved over time, giving birth to a new piece: "Le baptême".

RESIDENCY FROM OCTOBER, 2018 TO JANUARY, 2020 – FRANCE



Le Baptême – Laurent Bazin

MARK II SPIKING PERCEPTION

CHIPAI X MATTHEW BIEDERMAN

An invitation to reflect on the current state of artificial intelligence and its technological past. In this residency, the artist worked with ChipAI Project, a project that aims to develop an energy-efficient technology using neuron-like nanoscale light sources and detectors capable of addressing the predicted future needs of Artificial Intelligence systems and computing processors. Biederman proposed to look at the trajectory of machine learning and artificial intelligence from one of the earliest iterations, the *Mark I Perceptron* developed by Frank Rosenblatt in 1957, to the current research project ChipAI, aiming to highlight their common features. The *Mark II Perceptron* residency resulted in an interactive, light-based sculpture reflecting on the biomorphic genesis and continuing field of machine learning and artificial intelligence. As viewers approach the sculpture, they see a fractured reflection of themselves, which sets off a chain reaction through the artwork – a simulation of a neural network that is witnessed in real-time through the flickering halos of light from behind each mirror.

RESIDENCY FROM NOVEMBER, 2019 TO APRIL, 2020 – PORTUGAL

SENSORIUM AUDIO THEATRE

FUTURELAB X RAFAL ZAPALA

Can music monitor the evolution of our physiological states? This residency built on FutureLab powered by Poznań Supercomputing and Networking Center which studies the role of technology in research and education, noticeably for enhancing students' concentration. The objective of the residency was to create a musical environment to let one hear their psycho-physical reactions, experience (through composed music) their changeability, as well as comprehend the possibility of exerting control over them. The "Sensorium Audio Theatre" proposes a new kind of auditory experience: the listener is equipped with biosensors used for controlling the generation of music over time, thus providing him/her feedback on his/her physiological state and the possibility of exerting control over the musical process.

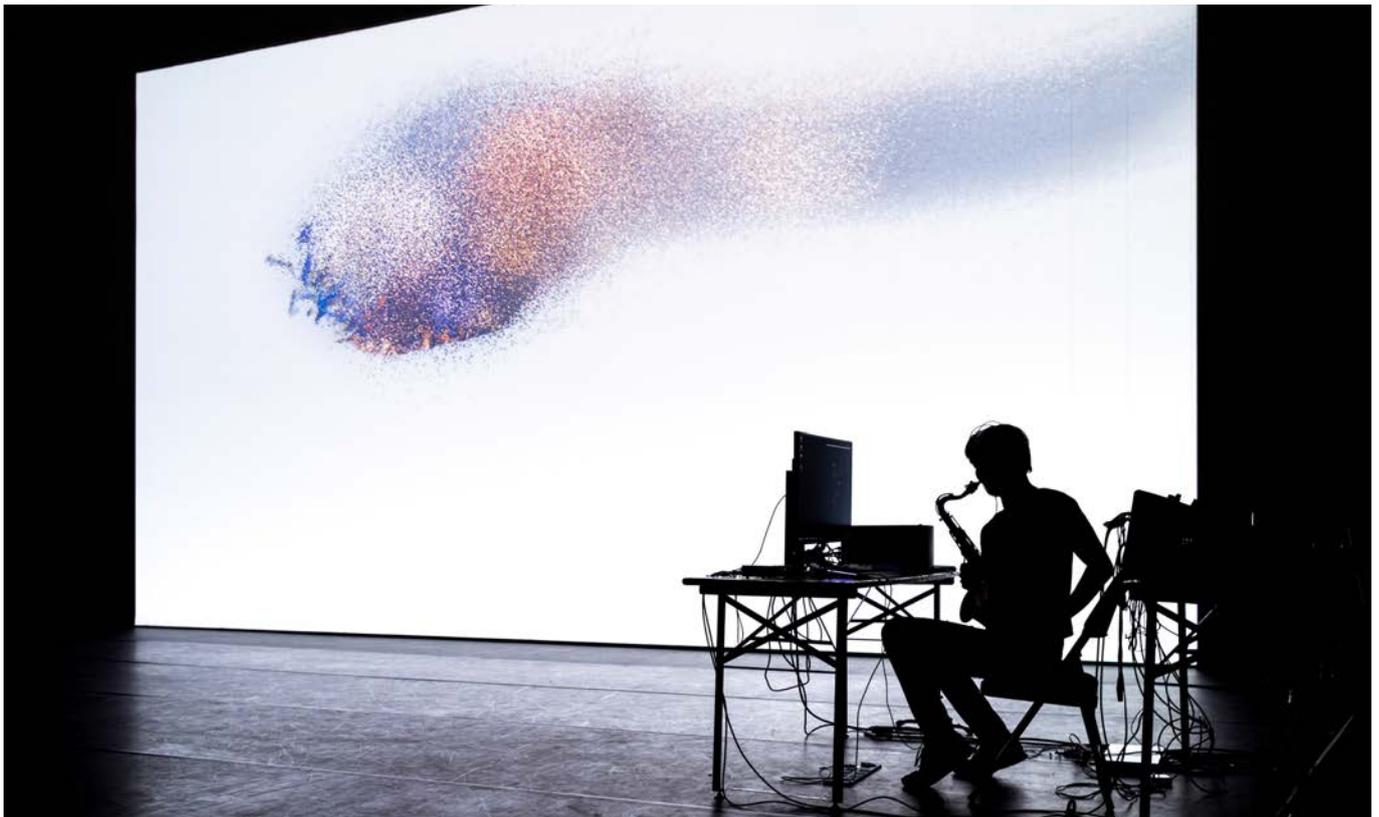
RESIDENCY FROM JULY, 2019 TO MARCH, 2020 – POLAND

STILL

VVVV X NATAN SINIGAGLIA

Can we recollect and embrace a fulfilling sense of time through a multimedia performance? The team pushed the limits of the vvvv real-time multimedia software in a performance tackling the question of the perception of time, overcoming immediate interaction and opening spaces for contemplation. Alone on stage, the artist plays the saxophone. He manipulates the audiovisual immersive scene through his movements sensed by a full-body 3D tracking device, establishing a dialogue with the custom software system. The artist Natan Sinigaglia has been using the vvvv live-programming environment for years. Yet, during the residency he worked with the vvvv team in Berlin, sharing their office and reflection for the first time. In order to create his electro-acoustic dance performance, Natan Sinigaglia in collaboration with vvvv developers had to improve the environment and create new features. While doing this, he brought new ideas and interrogations to the team and helped vvvv founders to really understand how the artists use the environment. Thanks to this cooperation, the live-programming environment became more efficient, user-friendly while at the forefront of technology.

RESIDENCY FROM APRIL, 2019 TO MARCH, 2020 – GERMANY



Still – Natan Sinigaglia

TRANSHUMAN EXPRESSION

WEDRAW X LIAT GRAYVER

How does one incorporate the use of computers and machines in the very intuitive and gestural practice of making a painting? During this residency, Liat Grayver collaborated with the weDRAW project that developed multisensory technology to learn maths combined with arts and improve creativeness of children. The artist produced a series of visual imagery in the form of paintings, as well as digital - and video-based materials created by the interaction between human, computer and robotics – investigating the relationship between the physical actions (manipulation of materials) and the visual outcome, namely a painting. The artist also collaborated with the University of Konstanz on the e-David Project, exploring various approaches to integrate robotic and computer languages in the processes of painting and creative image-making.

RESIDENCY FROM SEPTEMBER, 2018 TO DECEMBER, 2018 – ITALY

WIND AVATAR

DANCE X HASEEB AHMED

Have you ever seen the face of the wind? This is what Haseeb Ahmed and DANCE research Group at the Brain and Emotion Laboratory of the University of Maastricht created for the project Wind Avatar. This project directly links a person to the wind. The movements and emotions of a subject are translated into expressions of a character composed of wind turbulence patterns. Wind Avatar offers a tactile sensory experience of a visual phenomenon by employing the full-body sensation of wind blowing on a person's skin. By allowing people to literally inhabit the wind, this project allow a person to develop new forms of emotions with all the freedom of the wind.

RESIDENCY FROM SEPTEMBER, 2017 TO DECEMBRE, 2018 – BELGIUM



Cyberspecies proximity – Anna Dumitriu & Alex May

Dissemination

Dissemination has been an important dimension of STARTS Residencies: launched from a small circle of pioneering actors, the project had to raise awareness and interest on the new STARTS framework by spheres of activity which had initially few connexions between them: artists and the cultural world, technological research and innovation projects and companies, policymakers and the general public. This was firstly necessary in order to get a sufficiently large and comprehensive set of high-quality applications for the residencies program, then to promote them and more generally the STARTS brand as first concrete, relevant and various examples of what STARTS can bring to the society.

This dissemination took various forms, including the activation of VERTIGO Partners' cultural, research and innovation networks and the use of starts.eu both as a call application platform and as a STARTS information and community hub including numerous contents, news and media and publications.

An important part of the activity was dedicated to the organisation or participation in many events aimed at the various identified targets: **more than 217 events with a cumulated audience of 244,000 persons** as of May 2020.

4 STARTS Residencies Days yearly events organised in Paris from 2017 to 2020 were the main milestones of the project's public exposure, in relation to the Mutations Creation Art-Science yearly cycle at Centre Pompidou. Hosted at Centre Pompidou (2017-2019), CENTQUATRE (2020) and IRCAM, they included the presentation of ongoing residencies in various forms (conferences, installations, movies, workshops, performances), the announcement of the call laureates, thematic panels, and networking sessions for the growing STARTS community.

The activation of the **62 members of STARTS Partners Network** who acted as co-producers of many of these events was also instrumental in disseminating STARTS Residencies and the STARTS brand.

Highlights on events



Launching event at Centre Pompidou on March 14th, 2017, with the opening of the exhibition “Imprimer le monde”, in presence of Serge Lasvignes (President of Centre Pompidou), Paolo Cesarini (European Commission), Bernard Blstène (Director of the National Modern Art Museum), Frank Madlener (Director of IRCAM).



Announcement of the laureates of Call 1 at Festival d'Avignon on July 11th 2017 with, from left to right, Greg Beller (IRCAM), Pascal Keiser (Culture Tech), Hugues Vinet (IRCAM), Paul Rondin (Managing Director of the Avignon Festival)



STARTS Reception at Azkuna Zentroa, Bilbao for the IoT week, June 4-8th 2018



STARTS Talks at CeBit in Hannover, June 11-15th 2018



STARTS Residencies Days on June 15th 2018: SMART>SOS installation by Tim Otto Roth and networking evening at IRCAM



STARTS Residencies Days – June 27–28th 2019: a participatory performance by Ling Tan – Pollution explorers around Centre Pompidou



STARTS Residencies Days – June 28th 2019: introduction of a high-level panel by Serge Lasvignes (President of Centre Pompidou) with Liza Przioda (Bosch), Pierre J. Magistretti (International Brain Research Organization), Annelieck Sijbrandij (Verbier Art Summit) Silvio Napoli (Schindler), Ralph Dum (European Commission), Nicolas Henchoz (EPFL+ECAL Lab)



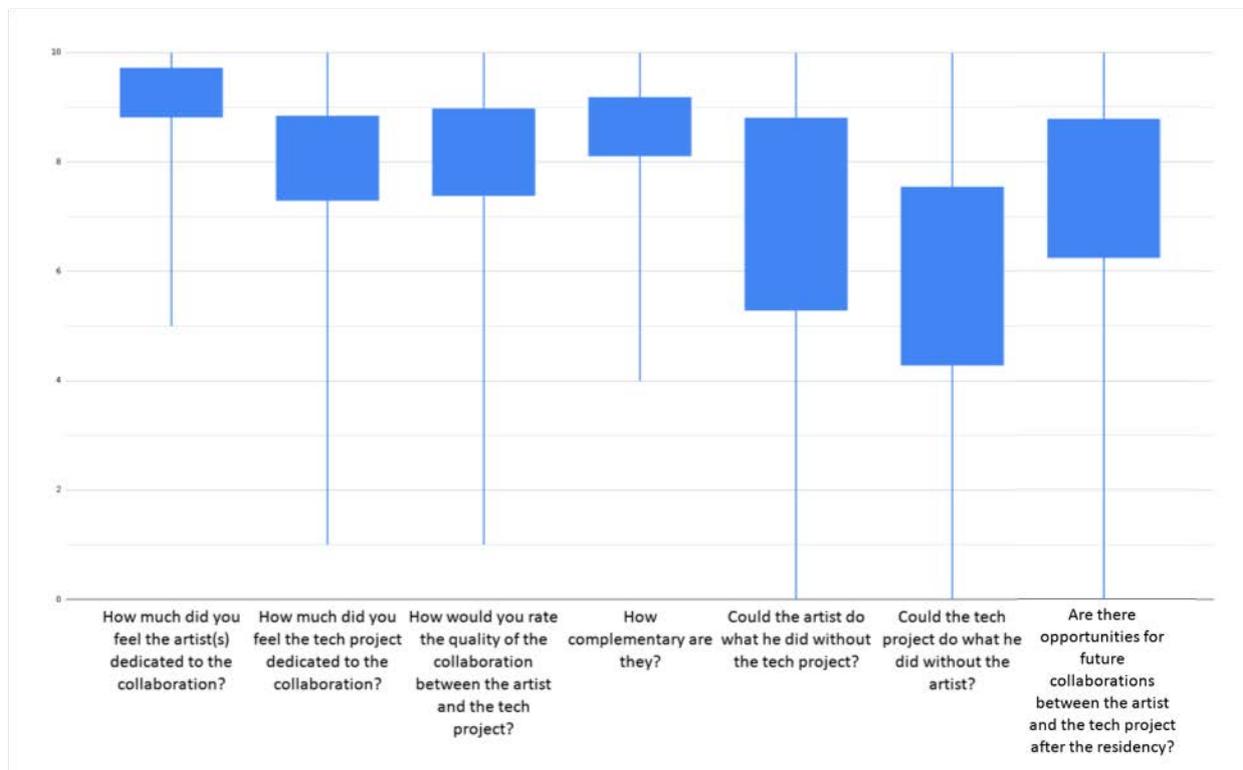
STARTS Residencies Days February 28th- March 1st 2020 at CENTQUATRE: Opening event cocktail, Sci-Fi Miners performance by João Martinho Moura and residencies booths

Impact

Impact on the residencies stakeholders

Art-science collaboration and co-creation process

For most residencies, the feedback on the collaboration process has been very positive. Exceptions occurred when one of the stakeholders was less available than initially foreseen or when time or means constraints were too strong. Although most of them did not know each other before, they were invested in the collaboration and the human experience resulting from these transdisciplinary situations, requiring first openness to new knowledge, language and practices, was rewarding. About half of the teams foresee to continue collaborating after the residencies completion. The STARTS community events were also the opportunity of setting new transdisciplinary networks.



Statistics for all residencies on quotations by STARTS Residencies monitors on the collaboration process. The score of 5 (middle) refers to a neutral situation.

Artists

according to artist Helen Evans from HeHe ***“It was inspiring to be mentally challenged and to imagine new artworks outside our safety zone”.***

The benefit for involved artists was obvious: they had access to new advanced research and technology topics, to significant funding and production means, and for many of them to a broad exposure in top cultural venues in Europe which often leveraged new opportunities for their career. STARTS Residencies provided them with conditions to implement a project that would have otherwise taken them several years to achieve.

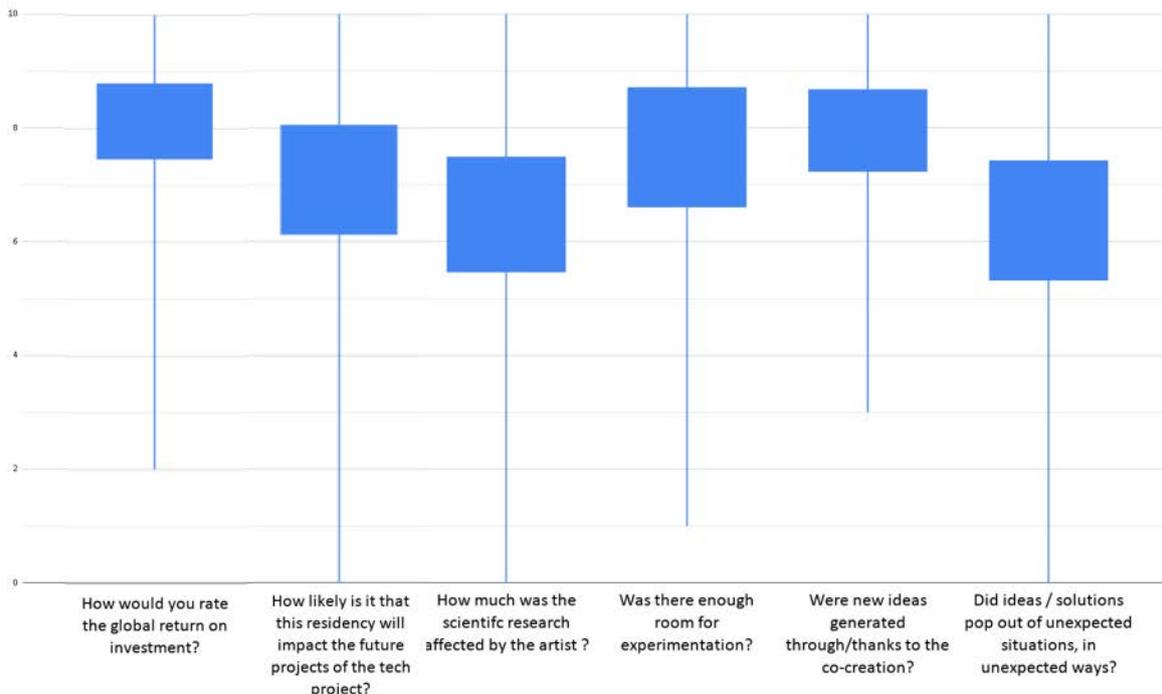
Tech Projects

According to Kambić’s director who developed a new cell incubator for meeting the objectives of Biobot: it is **“a new product, not an improved previous product, but something very new, very unique”**

Black Euphoria CEO involved in Froth of the Daydream, said: **“apart from the technology, it was a great human experience that allowed Black Euphoria’s coders to express their creativity and touch of craziness”**.

STARTS is dedicated to supporting technological innovation so the main expectation on the residencies program concerned the benefit for involved Tech Projects, which included the following aspects:

- **Communication and public awareness:** The various public events in which the artwork and the residency were presented provided unique opportunities for communication on the technology, or even created conditions for collective reflection or community engagement on it.
- **User feedback:** The residency enabled in some cases to test the technology in real conditions for the first time, to enhance the user experience, to provide expert user feedback.
- **Enhancements:** Artists perspectives challenged the technology and brought new ideas for enhancements of the existing features.
- **New features and products:** Divergent thinking and technology hijacking by artists led to brand new approaches in terms of features or even products.
- **Methodologies and reflexivity:** Beyond immediate benefits for the technology and the increase of its readiness level (TRL), involved scientists and technologists relate that this transdisciplinary collaboration and communication process opened up new perspectives on their research methods and on questioning the meaning of their work, with a potential longer-term impact on their professional activity.



Statistics for all residencies on quotations by STARTS Residencies monitors on benefits for Tech Projects.

Impact on society

About half of the residencies just completed at the end of the project and more time will be needed to measure the actual impact of STARTS Residencies on society. This applies in particular to the economic impact of the various technology enhancements and new products identified in the completed residencies. In addition to direct benefits for the residencies stakeholders, preliminary findings on the project's societal impact can be drawn on the following aspects:

Public awareness and engagement on societal issues: as evidenced during the last STARTS Residencies Days at CENTQUATRE, artistic experiences are good vectors of transmission of advanced research to a very broad audience. They bring a new meaning on complex technologies and can also support community engagement on key societal issues such as environment, data protection, healthcare or telecommunication networks.

Production of new knowledge on art-science collaborations: the effort invested in the design and implementation of the STARTS Residencies calls and monitoring methodology has been significant due to the large scale and the multiple constraints on which the program was built. The amount of knowledge gained from this experience is considerable and major related publications³ started to be issued during the project execution. The interest raised at international level on the Symposium on art-science residencies methodologies organized at the final event also evidences the momentum of the gained expertise and the maturity of the methodological topic towards the setting of a new community. An open dataset⁴ on the main public STARTS Residencies data was also produced at the end of the project and provides a sustainable repository for future studies on the project.

Development of the STARTS community and brand: the development of the starts.eu web platform was instrumental in disseminating STARTS activities and in leveraging the emergence of a growing STARTS community whose first members were individuals and organisations involved in the residencies calls. Our communication efforts through various channels and our participation in numerous events, public or private, labelled STARTS and dedicated to the various targeted stakeholders – cultural world, research, industry and technological innovation, policymakers and the general public – also greatly contributed to a significantly increased awareness of the STARTS brand as a leading international reference on art-science collaborations. The involvement as co-producers in these events of a large number of major cultural institutions evidences not only the growing importance of advanced science and technology in contemporary art but also the relevance of STARTS' proposal of re-thinking the role of art in society. In addition, a relevant number of organizers has been and is willing to use the STARTS brand as an umbrella to their events. It indicates that not only the STARTS brand contextualizes activities that previously would not find a proper fitting, but moreover, it attributes added value and networking value to those activities.

³ Nicolas Henchoz, Pierre-Xavier Puissant, Ana Solange Leal, Tânia Moreira, and Hugues Vinet. 2019. Artist residencies for innovation: development of a global framework. In *ACM SIGGRAPH 2019 Art Gallery (SIGGRAPH '19)*. Association for Computing Machinery, New York, NY, USA, Article 10, 1–5. DOI:<https://doi.org/10.1145/3306211.3320140>

⁴ <https://zenodo.org/record/3843435>

Conclusion and Perspectives

VERTIGO was launched as a Coordination and Support Action in the framework of the first STARTS call of the H2020 ICT program. This context put it in the pioneering situation of being the main support of the development of this emerging initiative while launching a large scale residencies program implementing an unprecedented art-science collaboration framework: the few existing organisations supporting art-science residencies were mostly targeted to contributions of science and technology to artistic creation, whereas the perspective introduced by STARTS inverted the roles with an ambition focused on supporting technological innovation through the arts. The status of design in innovation was probably the closest to the role expected from the arts in the process, but with strong differences: instead of being involved on product design at a late stage of technology readiness, artists were expected to collaborate on research projects on emergent technologies at low TRLs; most importantly, in order to be sufficiently attractive to established artists, to give them the necessary freedom and avoid them to feel instrumentalized, a strong ground of the vision held by VERTIGO since the very beginning has been to involve, fund and promote them for the production of an artwork, which would be the main support of the co-creation process with the Tech team and also of the public exposure of the residency.

The project was implemented within strong constraints – legal, means, timeframe – especially for conforming to the initial expectation of building and running new teams from pre-existing but yet unidentified Tech Projects. The first call and first version of the web platform were launched only 3 months after the project started and the rhythm needed for sequencing the successive calls and ensuring their success remained high. Fortunately, the consortium partners could rely on strong networks of Tech Projects and cultural institutions which brought their support for setting a high-level jury and contribute to the project's communication and public exposure.

The global result is very positive indeed. As for the STARTS Residencies program, calls were successful, with a significant number of high-quality applications increasing over time. The global feedback of the involved teams is also very positive, as exposed in the previous document sections. Various kinds of difficulties were encountered; they were handled in so far as possible and fed the knowledge gained from the experience. The project's dissemination and its role in structuring and promoting STARTS has been also strong, with already clear impact clues as presented in the previous section.

Care was taken for ensuring the project's sustainability in its various dimensions. The code of the starts.eu platform is distributed under an open-source license and the platform management was already transferred to STARTS Ecosystem, a new CSA for the coordination of STARTS started in April 2019. The call platform was already used for residencies calls promoted by other STARTS projects, including Re-Fream and MindSpaces – Lighthouse projects. The knowledge produced on the residencies methodology was published and the symposium organised on methodologies of art-science residencies created the conditions for the emergence of a new international community on this methodological topic. Part of the public documentation on STARTS Residencies was also transferred to an open data repository in order to feed future studies on the program. The STARTS program continues to develop with new projects recently selected, including STARTS Regional Centres and thematic projects such as MediaFutures starting in September 2020 which will implement a program of artistic residencies targeted to collaborations with startups on big data for the media. A new STARTS Expo supported by VERTIGO and exhibiting artworks from STARTS projects is also to be premiered in Berlin in July 2020 before touring to other cities.

The partners of the VERTIGO consortium are glad and proud to have contributed to this great project and thank all of its participants and supporting institutions. They hope it will broadly benefit all concerned stakeholders.