

Adding value to research and technology through integration of artists in projects and synergy creation between creative industries, entrepreneurs, researchers and arts

STARTS Residency Public Report

Residency name

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The art installation «Embryonic» mimics a medical development laboratory, a walkable space where reality and fiction come together. 3D-printed body organs as well as biomorphic art objects created from the artist are part of the work. Visitors are invited to sensually capture this clinically artificial space with the sense of touch, visual sense and sense of smell. The artist aims to create an impulse and to establish an awareness for the current development and transformation of health and life sciences.

In this project the technology development process is included into the art space and tells a story about the possible materiality of the future body and creation.

The collaboration during the residency was with the companies Inova DE and Create it REAL, they are developing 3D printing technology to produce silicone replicas of real organs. The company Inova is responsible for modeling and creating the virtual organs. The company Create it REAL is responsible for the hardware development related to the silicone mixture and control system. During the residency period Valeria was able to observe the ongoing development of the technology partners, she had the access and opportunity to work with the corresponding 3D printing technology and to use it for her artistic concept.

The collaboration of artists with technical development teams opens a new range of possibilities and creates new challenges. Requests from the artist to create certain elements challenge the team to address not foreseen printing possibilities and to develop their technology further, the artist also learns how to handle new materials and to envision new possibilities towards representations and story-telling possibilities.

Index Terms— awareness, interactive art installation, life science, new body, 3d printing,

I. INTRODUCTION

THE technology addressed in this residency is 3D printing, and in particular 3D printing of soft materials such as silicone. The technical project wants to produce the next level of 3D printing services for medical training and education: Realistic and accurate 3D models of a particular patient. The students can then use these affordable organs to study at their leisure. The 3D prints conform to the patient images with sub-millimeter accuracy and reflect the actual anatomic subtleties such as tissue hardness and fine-structures. These anatomically correct models would have the same elastic features as real organs, enabling a better learning experience.

The 3D PRIME project makes advancements in current additive manufacturing technology, in order to overcome the state-of-the-art and produce realistic organs from individual patients at a competitive price. It is based on this technology that Valeria Abendroth has designed the Embryonic artistic presentation.

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II. ARTWORK

The art installation «Embryonic» imitates a medical development laboratory, a walk-in space in which reality and fiction come together. The title describes that something new is emerging, it is at a very early stage in its development.

One finds oneself in a clinically cool atmosphere, which is formed by laboratory inventory and transparent plastic sheets. On the steel tables we discover 3D-printed body organs, bones and veins. These are prototypes that were created during the actual development process in the 3D printing studio. In addition there are abstract pieces of art made of artificial materials such as plastic, wax and silicone. These sculptural objects are reminiscent of prostheses, body parts and biological structures, but they do not reveal their identity to us and we are left to our imagination. In a state of mutation, they must be understood as the impending beginning of something that we cannot fully grasp and understand yet.

During the residence period, Valeria was able to observe the ongoing research of the technology partners. She had access and opportunity to work with the corresponding 3D printing technology and to use it for her artistic concept. The 3D PRIME team consists of the companies > INOVA.DE < from Heidelberg-Germany and > Create it REAL < from Aalborg-Denmark. They are currently developing 3D printing systems for the medical sector with the aim of printing body organs in soft materials in 3D according to patient files / CT scans. This gives doctors and students a realistic and accurate view of the human body.

Inspired by this new technology, Valeria's artistic concept was born, focuses on the materiality and design of the new human body.

The installation > Embryonic < represents a development process that shows how body parts are researched and built using 3d technology and synthetic materials. It shows how important it is in this research to produce a very realistic surface texture so that the organ models appear as real as possible. This means that developers have to find and develop the right synthetic material, which represents the organic quality as real as possible.

In relation to this important part of research, visitors are invited to experience the clinically artificial atmosphere, the objects and materials with their sense of touch, visual sense, sense of hearing and smell.

>I want to activate the deep sensibilities of the human body with my work: When we feel and touch, we create a sense of self and a realistic impression through the sense of touch. <

The aim of this collaboration is to create a symbiosis between art, technology and science, to give the general public access to a very important and current topic. The artist provides impulses and wants to raise awareness of current research and transformation in the health and life sciences.

The result is a physically experienceable space that addresses a development process of the human, artificial body parts.



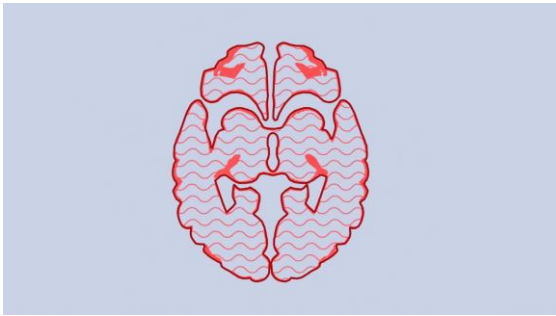
Installation view, Anna Nova Gallery- St.Petersburg, 2020

III. METHODOLOGY

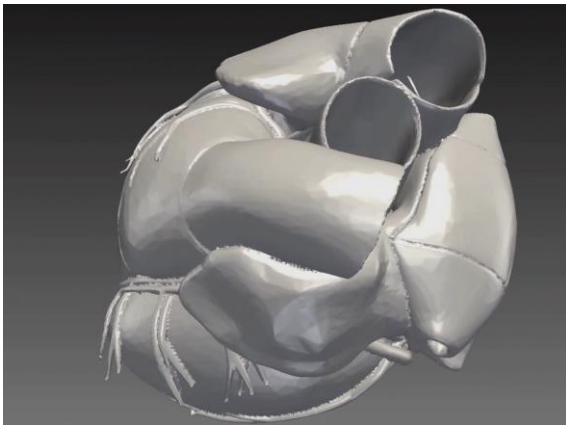
The beginning of the residency began with getting to know the working process of 3d PRIME. I observed their work process which consisted of developing and improving the 'Organ Print' software. I studied the image files of this software, they represent the process of building up the printing-layering process. I recorded the image files in the work process and processed them into a digital sculpture, the video called 'slicing' which is integrated into the installation by a projection.

I was allowed to work with the software 'Organ Print' and try it out, then with the help of the team I was able to have my own models printed with the 3d printer. These are the vein and artery models in the exhibition.

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Videoart `Slicing`, 3.52 min



Videoart `3d organs`, 3.46 min

The next important step in the development of my work was that I was allowed to visit and document the research departments in the university clinic in Heidelberg. This spatial and visual inspiration was very important for my artistic process, which gave the installation its clinical laboratory atmosphere.

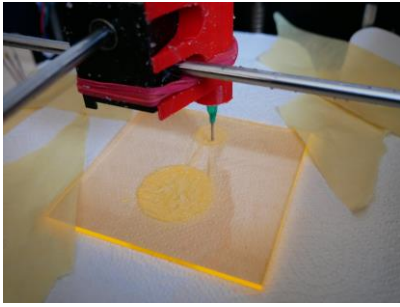
During the residency period, efforts were made to enable quick and easy working with the software. To do this, the manual segmentation process of an organ had to be further developed into an automatic segmentation process. A segmentation means that the organ has to be marked layer by layer from the CT image file by hand, this is a very lengthy and complicated process. The automatic segmentation is generated by the software itself, so that it is easy to operate.

After the corresponding organ has been summarized as an object by the software, it is converted into a 3D model and printed in an FDM printing process.

I was also allowed to try out the programs myself and give my feedback as a user to the team.

In May 2019 I traveled to Aalborg in Denmark to work with the Create it REAL team. The aim was to research how different silicone compounds and the 3d printer behave during the printing process and which problems arise.

A very important part of this research is to find the right consistency of the silicone mixture. For this, different types of silicone and silicone grease were mixed in different mixing ratios. These silicone mixtures were printed as small test samples using a silicone printer. These samples were given to the doctors in the clinics, by using evaluation sheets they assess the consistency and classify the samples into organs and tissue types.



3d printer is printing silicone



different silicone samples

At the moment it is possible to print only a few layers of silicone with the printer. The silicone mixture must be developed in such a way that it remains viscosity for a long time and at the same time maintains its shape during the printing process. In order to be able to print out entire organs in this way, this process has to be further developed. Because it is not possible to print the organs directly with silicone using the 3d printer, yet, they used the casting mold technique to create prototype models. A positive mold of an organ was printed in 3d in order to pour it out in silicone, thus creating a negative 3d model.

Due to the many preoccupations with the subject of anatomy and body transformation, sculpture ideas emerged which i could realize with the support of the technology team, for example the utopian long spine with the title 'Spina'.



Installation view, 'Spina', Anna Nova Galery, 2020

In my studio I rented specifically for the project, I worked on building the installation and producing biomorphic sculptures. These sculptures which are reminiscent of biological forms and tissues mostly consist of plastic, wax, silicone and zirconium, dentures are made from this material and it comes from a dental laboratory.

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During the residency I collected material that was falling off as a by-product of the 3d Prime production process, some of which can be found in the exhibition. There are parts such as 3d printed organ and casting molds, 3d misprints, silicone mixtures samples. The equipment of the installation has also grown by collecting and assembling different items from laboratories and clinics.

IV. CO-CREATION PROCESS

The communication between me and the team was mostly that I stayed in the studio of Inova in Heidelberg. Once I visited also the studio of Create it REAL in Denmark and worked together with them.

There were also a few skype conferences where all 3d Prime team members were present and exchanged information about the development status.

In May 2019 the whole 3d prime team came together in a consortium meeting in Heidelberg. Here each part presented its development of the process, discussions about improvements and further process of the project.

The company Inova is responsible for modeling and creating the virtual organs. They develop the necessary software that works with real patient files, CT scans, selects the organs and can convert them into 3d models. A 3d printer is also available for printing tests and prototypes for various studies. The company Create it REAL is responsible for the hardware development related to the silicone mixture and control system, it has a range of 3D printers available.

The University hospital in Heidelberg and Tübingen provides the patient files, they give advice on the anatomy and the feeling on the nature of the educational organ models.

Valeria Abendroth's task is to present the 3d PRIME project in an art installation and thus make it accessible to the general public. This is intended to raise awareness of the current development of the human body.

V. IMPACT

A. *Research Impact*

The collaboration with the artist brings new ideas of how to address certain challenges, but also pushes the developers to find solutions for artistic needs that haven't yet been considered. Simply put, the technical partners were pushed in this challenge to create solutions that have a development impact in their project, and a potential to create a new product. It was also possible to test with the artist how well the tools handle themselves in the hands of not-experienced users. This kind of usability testing is necessary to create new approaches to facilitate the reach of this technology across society. This added value is not to be underestimated as it results in a higher uptake of this technology.

But much more than the technical challenges to resolve the collaboration with Create it REAL has inspired the all research and development team by visualizing the future of the technology the team is currently developing. Visualizing the future of medicine through the installation made things much more concrete, showing that it is possible to create this technology and motivating the team to invent this organ printing technology where organs are 3D printed as spare parts to extend our lives. Create it REAL also learned that presentation is key for people to understand and appreciate the technology.

B. *Artistic Impact*

The emergence of the ideas of the artists will have a new origin and perspective, which will be inspired by the new technology, instruments and materials. This will expand and change the artistic language and presentation, new ways of exhibiting artworks will develop that more and more correspond to reality.

The 3D printing technique makes it possible to let the artistic ideas become reality which cannot be produced by painting or sculpting. It is an extension of the possibilities for representing artistic concepts. The interaction between those very different actors (artists, researcher and developers) also inspires the artist to address future challenges that such technology will bring: could be esthetical or ethical.

VI.

VII. ART-SCIENCE INTER-RELATIONSHIPS

Through direct access to the technological development I was able to understand it better and their limits, also asking relevant questions that contributed to the creation of the artistic concept. I convey my experience and perspective through the artistic work 'Embryonic'. The project could only arise through the good cooperation between science and art. This possibility gave me a completely new inspiration, information and an instrument through which I could express my ideas and creativity in a new form of creation. This form of creation and representation is ultra-modern and is adapted to today's Zeitgeist. Through art an issue as important as physical technological development can be carried out and discussed in a new way of accessing the outside world in order to achieve a collective awareness of this transformation.

Awakening imagination and interest in science and scientific development is the goal of my artistic representation.

Art can be used to introduce concepts and ideas to the scientific that will go and invent it. This avant-garde approach of art as a inspiration, a motivation to improve science is key to the evolution of science. In the current project, the artist manage to inspire a technical team that is actually able to realize the vision of the artist and make it a reality.

VIII. FUTURE DIRECTION AND ACTIONS

I will submit this installation to exhibitions and competitions to make it known to a wider audience. I would like to continue to use the contacts I have made to develop new projects. I would also like to continue working with 3d printing technology.

IX. CONCLUSION

The direct contact to scientists and developers, to explore their laboratories and work techniques was a great asset for my artistic work and for me personally. My artistic path has developed in a certain direction, I work on topics that are very topical today and have got to know important contacts and instruments that I will continue to use.

I would have liked that at the end of the residency in my installation I could show an end product from 3d Prime, an organ made of silicone that comes directly from the 3d printer. My concept of Embryonic was to address the process of creation with an open end, so I achieved my goal.