



**Re-FREAM**  
Re-Thinking of Fashion in  
Research and Artist collaborating  
development for Urban Manufacturing

Hub “additive manufacturing”

# Deliverable 4.4

## Art&Tech Collaboration

### Final Report

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# Re-FREAM

Re-Thinking of Fashion in Research and Artist collaborating development for Urban Manufacturing

Working Package WP4

Hub “Additive manufacturing”

**Deliverable 4.4**

**Art&Tech Collaboration Final Report**

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<b>PU</b>	Public	x
<b>CO</b>	Confidential, only for members of the consortium (including the Commission Services)	
Type		
<b>R</b>	Document, report (excluding the periodic and final reports)	x
<b>DEM</b>	Demonstrator, pilot, prototype, plan designs	
<b>DEC</b>	Websites, patents filing, press & media actions, videos, etc.	

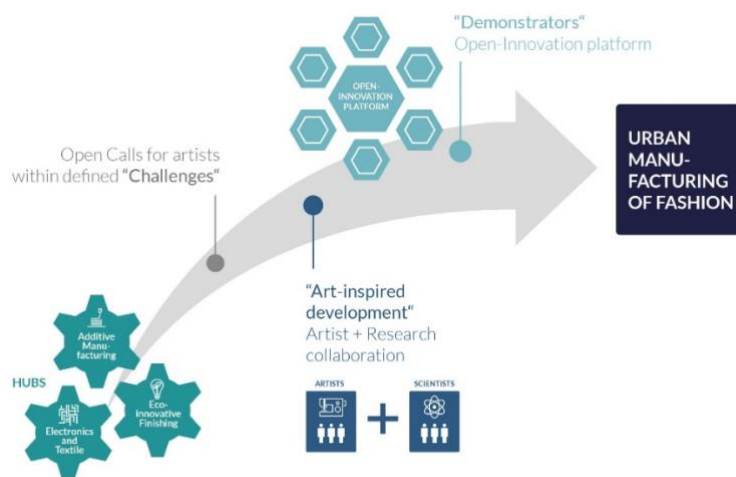
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## 0 Context Information

### 0.1 The Re-FREAM Project

Re-FREAM will support **art-driven innovation** in European R&I projects by inclusion of artists in research consortia via linked third-parties. The artistic community receives a strong support from art-related partners like the Art University of Linz (UFG) and the European Institute of Design (IED), creative hubs and facilitators like Wear-IT Berlin (FashionTech), AITEX, ARCA and CREATIVE REGION combined with remarkable technology from IZM Fraunhofer (E-textiles), STRATASYS, HARATECH (3D-printing), EMPA (3D body simulation), CARE APPLICATIONS (Garment nebulization) and PROFACTOR (Additive manufacturing).



Re-FREAM boosts **art-inspired urban manufacturing**, where the city becomes a new production space. Especially for **creative fashion**, urban manufacturing offers a great opportunity to create an alternative to the much criticized production in low-wage countries.

**Three technologies** (additive manufacturing, electronics on textiles and eco-innovative finishing of fashion) will be explored together. In **co-creation** 20 awarded Artist/ Researcher teams, digitalized manufacturing of fashion will be developed up to TRL 5 to enable small-scale production of fashion in urban environment. An **Open-Innovation Platform** will finally link the know-how and the communities of the hubs, will offer access to relevant facilities and make the Re-FREAM art-inspired urban manufacturing working model sustainable.

### 0.2 Document history

Version	Date	Change/Reason for change
V1.0	07.10.2021	Draft template prepared for partner input
V1.1	02.11.2021	Input WIB, IED, ARC, PRO
V1.2	24.11.2021	Input CRE
V1.3	29.11.2021	Input AIT

### 0.3 Purpose and Scope of Deliverable Report D4.4

Report about the Art&Tech Collaboration in WP4, 5 and 6. At the beginning of each Art-Tech collaboration project round there were two Art&Tech transfer events (kick-off and midterm event) and trainings in each hub, with the collaboration facilitators in regular meetings. An evaluation of the collaboration work is provided.

## 1 Executive summary

This document summarizes the Art Tech transfer guidelines which are described in the Art Tech Toolbox which was provided to the Art Tech facilitators (=hub manager). The toolbox was updated after each round especially necessary for the dealing with the current pandemic crisis.

All Art&Tech projects are summarized and evaluated concerning their collaboration and co-creation work throughout the project Re-FREAM.

A conclusion of the collaboration work is given at the end of this report.

## 2 Dealing with COVID-19

When the COVID-19 pandemic started during the first round of Art&Tech projects in March 2020, it effected drastically the work between the artist and the tech partners. Not only the physical collaboration had to be stopped immediately, but also the projects itself suffered from the first shut down of facilities in Austria, Switzerland and Germany and longer delivering times for necessary tools/materials.

Some artists continued working from home and were able to produce the prototypes with the partners when restrictions went a bit more flexible or delayed their co-creation if needed. The projects were prolonged for two months in order to accomplish their work plans and the final presentation (originally planned at the wear-it-festival in Berlin in June 2020) shifted to the online event of the Ars Electronica festival in September 2020. Finally all projects were successfully performed.

For the Second Call the transfer guidelines were revised to adapt to the new situation (more online events, but still physical collaboration work needed) and artists delivered a negative PCR to the Hub Managers when arriving to the Hub to work with technicians. Travel restrictions especially at the beginning of this round made it difficult to start the projects with physical meetings to better get to know each other and set up easier a work plan for the Art Tech project.

## 3 Overview on Art/Tech transfer guidelines

The Art Tech guidelines are built on the WP2 strategy design to empower artist and technologist enabling best practices for innovation. The strategy developed was intended to try to support the Hub managers, seen as facilitators of the co-creation processes through a series of guidelines, tools and external support activities by WP2's partners (IED and ARCA).

The documents library is composed of the **Tech / Art Transfer Toolbox** that has been designed as a reference document and a possible source of inspiration, as well as a reference handbook for the selection of practical approaches. The Toolbox is divided in three main sections:

- 1) The first is suggesting both general reflections on hybridization of arts and scientific research, promoting the concept of "*conversation*" and evidencing the possible "*revolutionary*" role of arts in the sci/tech framework.
- 2) The second section is reporting a *set of tools*, to be applied in the tech /art transfer process.



- 3) Finally a selection of *inspiring stories*, interesting places and legacy projects will help the reader to find best practices and front-running approaches.

At the end of the first call for the project, the toolbox has been updated in the section dedicated to inspiring stories where we added the results and the prototypes developed by Re-FREAM's artists coming out from the first call. Moreover, as a lesson learned from the first call where we notice a certain degree of misalignment between the concept and understanding of the goals of the project, we asked to add the booklet to the call package. When the second call closed, during interviews with some artists we understood that the art tech toolbox helped artists to contextualize their project with Re-FREAM and had a clear idea of what the Consortium request from them.

Described in more detail in Deliverable 2.3, an overview on the two guidelines developed within the project is presented in the subchapters below:

### 3.1 Initial guidelines (call 1)

The Art/Tech Collaboration Training Guidelines were provided to the Hub Managers (from now on Art/Tech Facilitators) with **a protocol for the entire duration of project development**. There, specific guides and a curated selection of inspiring tools, references and documentation were accessible sequentially, so that the Art/Tech Facilitators could learn how to expedite the development of the projects at each stage and enabled best practices for innovation throughout the Art/Tech Transfer and Collaboration. It served as an ongoing learning tool that guides and inspires the Art/Tech Facilitator within the Art/Tech Methodology. During the implementation phase of the project, this manual was developed through a sequence of slides made available by Work Package 2 partners through a shared folder of Google Drive. A series of tools or exercises taken from the world of the design thinking with the aim to support the co-creation process also found their place in the same folder.



The Art / Tech Collaboration Methodology came alive in form of a **collaborative process divided in three Phases** with an overall duration of the nine months of the artist-tech projects.

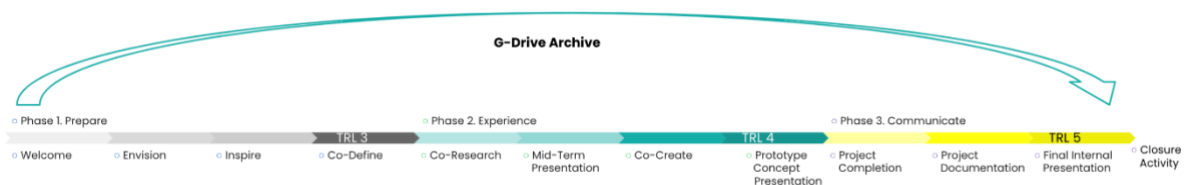
Each Phase integrates stages within a **common timeline which indicates fixed milestones / deadlines** for the kick-off meetings with artists, regular meetings and workshops and approximate dates are proposed, allowing the Hub Manager to schedule and organize the workflow depending on the specific needs of each project. As for the first version of the manual, the physical presence of the artist was expected for at least three months out of the 9 of the co-creation period.

### 3.2 Updated guidelines (call 2)

In preparation for the second call, WP2 and the coordination team decided to start a complete revision of the manual which on the one hand incorporates the indications of the facilitators after the experience of the first call and on the other takes into consideration the change that occurred with the outbreak of the Covid 19 pandemic which would have made it difficult if not impossible for artists to travel to the hubs of Linz, Berlin, and Valencia.

The revision of the manual took place in two phases, in the first IED and ARCA revised the manual in light of the progress of the project, the epidemic situation, and the studies of other projects of the STARTS ecosystem, in the second the Art/Tech Facilitators were involved and the technicians who had collaborated with the artists in the first call. Through an intense two days of co-creation we came to a renewed version of the manual which contained the following key points:

- 100% Online Co-Creation Process, with an extensive use Zoom/Breakout Rooms, Whatsapp, Facetime, Slack , Miro to co-create;
- Timeline with set milestones. Flexible dates to be scheduled by Art/Tech Facilitators according to the project;
- Established minium of 216 hours of face-to-face Co-Creation.
- Online Welcome Day, Midterm and Final Presentation (Internal for Consortium and External for Communication);
- Overlap Phase 2/3 to allow time to finish Prototype;
- Monthly reports to include specific Art/Tech methodology Q/A.;
- Two important tools to be used over entire process;
- “G-Drive Archive” (Document learnings and templates in the cloud).;
- Planetary Design Circle” (aka Eco-Design Process).



### 3.3 Learnings

The two cycles of co-creation of teams made up of artists and technologists have demonstrated the ability to work groups made up of heterogeneous teams to produce innovation. But they have also shown that the management of these teams, especially when the groups are not chosen but are forcibly put together, that the management of them requires discipline and a great capacity for facilitation and support on the part of those who have to guide these people through the journey of co-creation. In our project, we have tried to guide this process through our manual without however suffocating that part of mystery and unknown that these activities must necessarily carry with them. Another very important lesson was undoubtedly imposed on us by the pandemic where we saw that a lot can be done in virtual mode but the part of the journey dedicated to the discovery and use of the technologies available and then to the subsequent phase of prototyping must take place in person. Another big lesson came from the need to build an even larger team to support the artist and the technicians where IP, administrative and accounting management of the project have sometimes absorbed a lot of the energies of the facilitators.

## 4 Art Tech collaboration in Hub Linz

Co-creation project	Team (Artists and tech partners)	Collaboration Highlights
Digital Vogue	Julia Körner  Partners: Stratasys Haratech Profactor University of Art and Design Linz	Within the Re-FREAM project “Digital Vogue – Between Organic and Synthetic Processes”, Julia Koerner researched 3D to 2D to 3D relationships in 3D-Printed Fashion. The research focused on digitally translating patterns into algorithms and exploring multi-colour 3D printing on fabric, inspired by microscopic imagery of natural artefacts. The ultimate goal within Re-FREAM is that the design workflows can be fully automated; from design to production leading to ‘local production’ and ‘mass customisation’ and ‘rethinking urban manufacturing’. After benchmarking adhesion for a wide variety of fabric testing with her partners, including different weaves and dyes, a sustainable hemp-based non-dyed fabric best fulfilled the purpose and goals of the project.

WeAreAble	<p>Ganit Goldstein</p> <p>Partners: Stratasys Haratech University of Art and Design Linz</p>	<p>Goldstein used a series of 3D CAD manipulations to transform 3D body scans to 2D flat patterns, then built highly customized 3D designs with parametric software. The final results of this reverse-engineering process are multi-color 3D Polyjet printed garments. The new workflows developed resulted in assembly through direct printing onto fabric, as well as a proof of concept for unique 100% sustainable garment production using up-cycled materials. The project culminated in a Virtual Reality display of the final collection, which has led the designer onto new paths of innovation.</p> <p>The visually sensational Re-FREAM co-creation project garnered worldwide attention through exhibitions, and was highly publicized – including a nomination as the best experimental design by Fast Company. The project has driven Ganit to explore new textile compositions required by new manufacturing techniques. After completing her MA at the Royal College of Art, Goldstein decided to delve into further material research with a Master of Science at the Massachusetts Institute of Technology in Boston.</p>
Re-Think Manufacturing	<p>Yokai Studios</p> <p>Partners: Profactor Haratech Empa</p>	<p>Yokai studio’s robotic fashion manufacturing melds design with automation, upcycling – and spectacle. The goal of the founders Michael Wieser and Viktor Weichselbaumer is to build a system for both localized and customized clothing production. Working with robotic arms and software, they transform traditional flat garment production into a three-dimensional and kinetic process.</p> <p>Though performative automation may not be the Yokai team’s end goal, the appeal of their production process has proven to be a viable and unusual new business model. One example is the studio’s collaboration for deadstock upcycling through robotic customization with the fair sportswear label Das Merch. The made-to order customized Roboprint Tshirts each featured its own unique generative design, and customers had the option to attend or watch the production performance Their robotic manufacturing arms have also generated income for the studio through events at malls in the Middle East and company events.</p>
Needs-Based Clothing Design	<p>Silke Hofmann</p> <p>Partners: University of Art and Design Linz Empa Profactor</p>	<p>Hofmann’s collaborations included the <b>Fashion &amp; Technology department at UFG Linz</b> (digital garment creation) and <b>Empa</b> (textile preferences, fiber testing, and textile digitizing). She also explored 3D printing trials with <b>Profactor</b>. In this project, Viktoria Prantauer became the project’s participant and the co-designer of two custom bra alternative versions according to her own clothing needs after breast cancer. In addition, Hofmann activated a community of experts, including character designers Nedim Šećeragić (digital avatar creation), engineered knit studio Case Studies (3D knit composition), and product design Studio Wint Design Lab collaborated on the breast support construction.</p> <p>This project required a lot of different expertise. With her additional partners Hofmann held various personal development meetings whilst working mainly digital with her Re-FREAM experts. This extended art-tech collaboration required special coordinative effort from the artist.</p>
Thalassic Masks	<p>Filippo Nassetti &amp; Vincenzo Reale</p> <p>Partners:</p>	<p>In their collaboration, Filippo Nassetti &amp; Vincenzo Reale used Polyjet 3D printing by Stratasys directly on fabric to customize medical masks. The translucent designs are adapted to average measurements of thermoregulation and sweat, enabling increased</p>



	Empa Haratech University of Art and Design Linz Stratasys	comfort. They partnered with Stratasys, Haratech and the Fashion & Technology department at the Kunstuniversität Linz , using 3D scanning and the latest 3D printing innovation. Empa provided detailed bodily data analysis. Due to the Covid 19 pandemic situation and travel restrictions, the team realised the whole project by only having online meetings and calls.
Syntropia	Sophia Guggenberger & Eugenia Morpurgo  Partners: Haratech Empa University of Art and Design Linz	The Re-FREAM partners Haratech and the Fashion & Technology department at the Kunstuniversität Linz collaborated on 3D printing techniques, and material development to produce the 3D-printed components of the shoes. Empa provided counsel on material properties and testing. Sander Hofstee from the University of Arts and Industrial Design (UFG) reengineered the grading steps for the shoe lasts digitally on Rhinoceros and Grasshopper. Agnes Psikuta from Empa shared insights on the shoe's thermal regulatory system, while Guillaume Clement and Florian Bauer from Haratech advised on the possibilities for 3d printing, testing and creating samples, and put the designers in touch with WoodKplus. Together they developed 3D printable fiber-reinforced filaments. Also Sophia only had the chance to meet with Haratech in person. All other collaborative developments were done by online meetings and calls, due to the ongoing pandemic.
Footwear Time Based Design	Assa Ashuach  Partners: Stratasys Haratech Profactor Fashion & Technology department at the Kunstuniversität Linz	Assa Ashuach partnered with Stratasys, Haratech, and Profactor, using 3D scanning and the latest 3D printing innovation. The Linz Hub and the Fashion & Technology department at the Kunstuniversität Linz provided a framework of networking opportunities and guidelines. Additional consulting was provided by Maximilian Müller from Moticon and footwear expert Camilla Petrocchi. In cooperation with the Re-FREAM industry and science partners, Ashuach developed a printable repairable post-consumer waste shoe, as well as an evolving 3D printed model with structures based on veins, skins and tissues. Also this team did not have the chance to meet in person for co-research and co-creation, and realized the whole project by online meetings, except the last phase for content creation.

### General challenges and learnings

The major issue of the second round was of course the Covid-19 pandemic situation and travel restrictions. While the artists from the first round had the chance to meet their technical partners in person, holding workshops and personal development meetings, the artists from the second round started their project during a phase where many countries were in lockdown. Except of one artist (Sophia Guggenberger), all other artists of Hub Linz round 2 realised their project by only having online communication with their tech partners. It was not possible and reasonable to travel between England, Israel, Germany and Austria. While in the co-research this was easier to handle, this restriction was causing a lot of difficulties and additional effort in the co-creation phase. Especially in terms of testing samples. Printing samples needed to be shipped from the tech partners to the artists and sometimes also the other way round. Shipping within Europe often take days which caused latency time until a confirmation or common decision for continuation of a process or technique could be done.

Retrospective, in general a personal exchange was missed a lot as it is essential for a common understanding, a faster project progress and exchange. The major learning is, that especially all tasks with a creative aspect, require the social dynamic of personal meetings. While research is a task which can be done mainly individually, especially co-creation needs that personal exchange.

## 5 Art Tech collaboration in Hub Berlin

Co-creation project	Team	Collaboration Highlights
LOVEWEAR	Ivan Parati Emanuela Corti  Partners: IZM EMPA	Due to the Covid-19 crisis, the team was in Dubai and could not travel to the hub after the start of the pandemic. The collaboration was therefore mainly done online and via the help of the artists' collaborator Aesun Kim who was able to be present at the IZM Lab to work on the development and testing of the prototypes.
Alma	Giulia Tomasello  Partners: IZM EMPA	Despite the pandemic, the team was able to keep the conversation and collaboration going via online meetings. The lockdown period was used by the team as a phase of preparation for the work to be done for the final prototype. Once travel was allowed again, Giulia was able to fly to Berlin to work with the team at IZM on the development of the sensor and underwear.
Constructing Connectivity	Jessica Smarsch  Partners: IZM EMPA	The collaboration between Jessica Smarsch and the team at IZM was very successfully throughout the project. At the beginning they were able to work in close collaboration at the lab to develop the TexPCBs and to work on the product cycle and system. After the first lockdown, Jessica was able to go back to the lab to create the technical samples to be assembled after. In collaboration with IZMs Eco-design Experts, Jessica developed the concept for the Service Design / Stakeholder workshop which gathered around 12 participants.
Ignotum	Jan Wertel  Partners: IZM EMPA Profactor Stratasys	Because of restrictions, the team created a Miro Board for all partners to work together. It was a great way for the team to share files and images without having to meet in person. A big part of the co-research and co-creation was done by the Ignotum team itself and therefore not shared with other tech partners. This was determined by the nature of the project itself, especially the software / AI part. Besides the main technical partner IZM, who conducted optical analysis and co-developed the final demonstrators, they however worked in close contact with a member of another hub: Stratasys and PRO which helped carry out tests for conductive light strips and provided guidance to the teams.
Second Skins	Malou Beemer  Partners: IZM EMPA Profactor	The collaboration between Malou Beemer and the team at IZM was successful. The online co-research and co-creation enabled the team to be in contact regularly and to have faster feedback. This was also quite helpful when it came to practical meetings, which were more efficient. Malou was able to go to IZM and work with the team there twice over the course of the co-creation phase. This really helped the team narrow down the prototype to be created for the project as well as to work in a more creative and efficient way at the lab. In collaboration with Robin Hoske and Max Marwede from IZM, Malou organised a user test online event. This helped the team define the goals and questions for the project. Collaboration of Malou with PRO was possible just in the virtual word. Despite of this, PRO provided several 3D printed light blocking masks based on design provided by Malou.

Embroidered Touch / Life Space	Anke Loh Partners: IZM EMPA Profactor	Overall, the Art / Tech collaboration worked quite smoothly. The virtual aspect of the second round saved money and time as well as carbon footprint from all the traveling. It also enabled different partners to get involved and give input and feedback on the project. However, it was important for the team to conduct the co-research phase in person. Anke Loh was able to join the team at IZM in May and June 2021 and to work together in the lab with the machines. It made the communication smoother and creating with the textiles more intuitive. Before that the samples were sent by mail from one team member to the other which was overall doable but slowed the process down and made it more unpredictable.
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### General challenges and learnings

The main difficulties faced in Hub Berlin was that most of the collaboration was done online. This was the case for both calls of projects with teams located in different parts of the world, and a very important part of Call 2 in particular as the projects were started during the pandemic. The travel restrictions put in place made collaboration and co-creation in particular very difficult. It indeed slowed down the process for most projects where the artists were not based in or near the Hub. Samples had to be sent via post between partners and all processes therefore cost more time and money for the teams. When it saved some time and travel costs for most teams it also prevented the teams to get to know each other from the start of the project. It would have been important for each art / tech collaborator to meet in person at the very beginning of the project to create this working bond and to get to know all members of Re-FREAM.

The Co-creation and dissemination phases planned in the Art / Tech Manual therefore overlapped. The prototypes were being finished and straight after being filmed and photographed for dissemination. This did not allow the artists to have enough time to present the final prototypes and garments before the end of the project.

For future projects it was suggested that the dissemination part of the project could start after the co-research phase. The artists could therefore plan more time to take part in events and also present their design thinking and prototyping processes instead of only focusing on the final product.

## 6 Art Tech collaboration in Hub Valencia

Co-creation project	Team	Collaboration Highlights
Leather for Vegetarians	Fabio Molinas Partners: AITEX CARE APPLICATIONS	Fabio Molinas decided to move to Alcoi for the 9-month co-creation project. Therefore, he was able to learn a lot and learn from the researchers at AIT and CAR. Three different lines of products were developed instead of the one foreseen, as his willing to learn and fresh ideas allow inspiration to be in the air. The co-creation with Fabio resulted in a successful relationship, especially between CAR and Fabio, who have continued working together and won another 70k€ funding award, ELIIT. Fabio has acquired the ECOFinish nebulization machine and they keep working together and helping each other.
Fragment Garments	Elisabeth Jayot Partners: AITEX CARE APPLICATIONS Profactor	Elisabeth foreseen her presential co-creation for the lasts months of the project, while working remotely in the prior months. Unfortunately, she started the co-creation in Linz just when the lockdown came and so she had to turn back to France. However, at the end of project, she was finally able to come to Hub Valencia and,

		as a result of the enthusiasm and willingness to work, she ended up producing seven prototypes instead of the one initially foreseen.
Marinero	Jef Montes  Partners: AITEX HARATECH EMPA	Jef Montes project was the more conceptual work, his aim was to create and develop a new mindset regarding filaments. What he called the archifilament was developed in parallel, with different techniques in Aitex and Haratech, and also validated in Empa. Jef is a very enthusiastic person full of ideas, although he was not the one who “makes” but who “observes”. He reported the whole process in detail and make photos of everything.
Cooking new materials	Youyang Song  Partners: AIT	Youyang came to AIT with his assistant during the first half of the co-creation, (then she worked with AIT remotely due to lockdown). The co-creation was sometimes difficult due to language barriers but she was always willing to learn and work. At the beginning, it was difficult for her to learn that research requires time and patience, and not every trials is successful. Then she relaxed a bit and enjoy co-research with technicians.
Sustainable Evolution	Loreto Binvignat  Partners: AIT	Loreto spent more than 5 months of co-creation in AIT, working closely with technicians in the lab and learning a lot about bacteria and dyeing processes. She was very open to work (and to have fun) and had very nice relationship with all technicians.
NeoBotanical Tailoring	Alexander Bello  Partners: CARE APPLICATIONS AIT HARATECH	Alexander Bello had an intensive co-research period with Care Applications for natural dyeing processes and also worked with Aitex in laser design and at Haratech for the development of a jacket stand. He spent the 9-month co-creation at the Hub. He is very hard-working person and always had a nice mood and willingness to learn. His project has been inspiring for both AIT and CAR.

### General challenges and learnings

From AIT side, co-creation has been very enriching, as projects had been inspiring and helped open new research lines. COVID situation especially affected Elisabeth Jayot’s project, but the rest of the projects have occurred smooth and successfully, having all artists at the Hub for longer time than the minimum required. This had been sometimes overwhelming for technicians, who have not foreseen that many amount of hours and sad for the artists, who expect to be in always in the lab working in their projects. However, this was solved at the beginning of the co-creations and both parts were happy to work together.

## 7 Other activities

### 7.1 Cross hub initiatives

Co-creation project	Cross-hub actions
Ignotum by Jan Wertel	For the Ignotum project, Stratasys was also involved and helped develop LED strips for the garment. STR ran a couple of tests for light conductive strips with Agilus but these turned out to be irrelevant for the project as they were not adapted to the prototype. The STR team supported the project for the conceptual phase.
Marinero by Jef Montes	He collaborated with EMPA and HAR with good communication and results
Fragment Garment by Elisabeth Jayot	She also worked with Profactor in the development of 3D printed buttons and zippers

NeoBotanical  
Tailoring by Alex Bello

He collaborated with Haratech for a 3D printed jacket stand development

## 7.2 Communications and know-how exchange

The Hub managers organised regular meetings online. We also had a slack channel for each co-creation team to ask questions and discuss current topics. This was very helpful for all the administrative part and to prepare common meetings such as the final presentations.

In order to face the lack of physical meetings due to the Covid-19 crisis, all hub managers organized monthly **reflection calls** for all partners of each project and their hub manager to present and discuss the progress of the project over the past month. These helped with the general organization of the project and also to get feedback from the partners on specific topics.

## 8 Summary and Conclusion

The collaboration has been very enriching, as projects had been inspiring and helped open new research lines. However, it requires a good plan and strong management of those projects.

The Art Tech collaborative projects have been designed for 9 months duration with 3 different phases. First phase is for the preparation of the project: to welcome the artists, understand their envision and **co-define** the project for both sides. In phase two the actual **co-research** starts to develop something new together. The mid-term presentation defined the end of the co-research to conclude the new results and findings. Then **co-creation** can start to develop the prototype for this project. At the end the communication phase is important for the project **completion**, documentation for future activities and the final presentation.

Generally the collaboration showed, that the **management of these teams**, especially when the groups are not chosen but are forcibly put together, **requires discipline, a detailed work plan** and a great capacity for facilitation and support on the part of those who have to guide these people through the journey of co-creation. However, a certain mystery and unknown that these activities must necessarily carry with them, to catch the full potential of those projects. Another big lesson came from the need to build an even larger team to support the artist and the technicians where **IP, administrative and accounting management** of the project have sometimes absorbed a lot of the energies of the facilitators.

The COVID-19 pandemic showed a lot can be done in **virtual mode**, however underlined on the other hand the **importance of physical meetings**:

At the beginning of each project start it helps to meet all project partners in person, do workshops and personal development meetings. A common understanding of the project goals can be better build up. It would have been important for each art / tech collaborator to meet in person at the very beginning of the project to create this working bond and to get to know all members of Re-FREAM.

While in the co-research only virtual mode was easier to handle, and can be done mainly individually.

However, for co-creation a personal exchange was missed a lot as it is essential for a faster project progress and exchange. The travel restriction was causing a lot of difficulties and additional effort in the co-creation phase. Especially in terms of testing samples. Printing samples needed to be shipped from the tech partners to the artists and sometimes also the other way round. Shipping within Europe often take days which caused latency time

until a confirmation or common decision for continuation of a process or technique could be done. Samples had to be sent via post between partners and all processes therefore cost more time and money for the teams.

The Co-creation and dissemination phases planned in the Art / Tech Manual therefore overlapped. The prototypes were being finished and straight after being filmed and photographed for dissemination. This did not allow the artists to have enough time to present the final prototypes and garments before the end of the project.

The major learning is, that especially all tasks with a **creative aspect**, require the social dynamic of **personal meetings**.

Moreover, for future projects it was suggested that the dissemination part of the project could start after the co-creation phase. The artists could therefore plan more time to take part in events and also present their design thinking and prototyping processes instead of only focusing on the final product.