Re-FREAM

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

Working Package WP 4

HUB “additive Manufacturing”

Deliverable 4.1

First printed prototypes fabricated using optimized software

Grant agreement no.:	**825647**
Call identifier:	**H2020-ICT-2018-2 – ICT-32-2018 – STARTS**
Objective:	**The Arts stimulating innovation**
Start date of the project:	**01.12.2018**
Duration	**36 month**

Due date of deliverable: 31.05.2020

Actual submission date: 31.05.2020

Lead Beneficiary for this deliverable: UFG

Contributions by: -

Project co-funded by the European Commission within H2020 Framework Programme		
Dissemination Level		
PU	Public	X
CO	Confidential, only for members of the consortium (including the Commission Services)	
Type		
R	Document, report (excluding the periodic and final reports)	

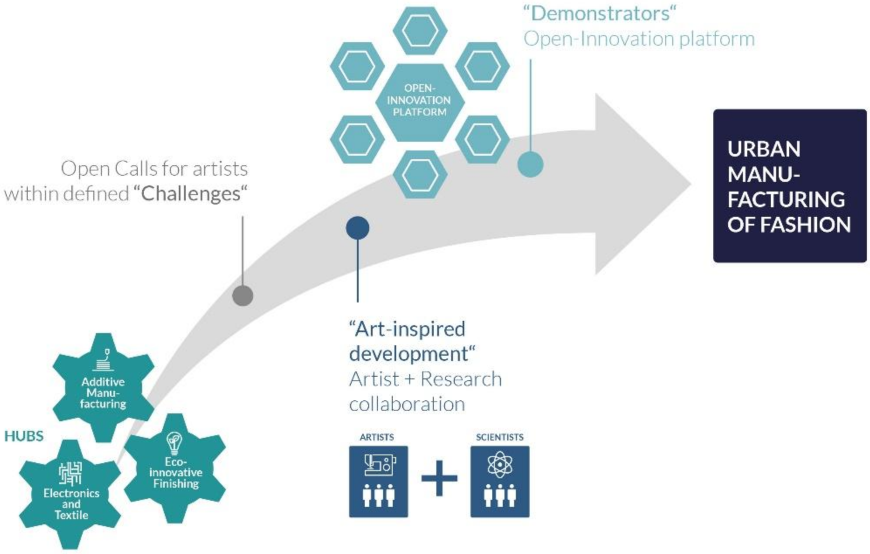
DEM	Demonstrator, pilot, prototype, plan designs	X
DEC	Websites, patents filing, press & media actions, videos, etc.	

Contents

1 Context Information

1.1 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.

1.2 Description of the Work Package concerned WP 4: Hub "Additive Manufacturing" -

Work package number	4	**Start Date or Starting Event**							1.12.2018			
Work package title	Hub "Additive Manufacturing"											
Participant number	**1**	2	3	4	5	6	7	8	9	10	11	12
Short name of participant	**CRE**	PRO	AIT	WIB	CAR	IED	ARC	HAR	UFG	STR	IZM	EMP
Person-months **Planned**	**17,5**	18	1	1	0	0	1	5	5	9	0	3

Objectives

1. Development of urban fashion manufacturing framework in the field of "Directly printed Fashion".
2. Provision of an individualized support package (training on collaboration and creative techniques, collaboration facilitating, design, technical, prototyping, validation/fab labs) to the awarded projects in the course of prototype development;
3. Development of a sustainable urban fashion manufacturing ecosystem in the field of "directly printed fashion"

Tasks

Task 4.0: Coordination of HUB "Additive Manufacturing" [CRE]

Task 4.1: Mapping Additive Manufacturing ecosphere and networks [PRO]

Task 4.2: Art & Tech Collaboration Support & Facilitating & Monitoring [CRE, STR]:

Task 4.3: Software optimization for Voxelprinting [HAR, UFG]

Task 4.4: Printing strategies for 3D Colour Printing of Fashion [PRO]

Task 4.5: Elastic PolyJet material application development & optimization [PRO, STR]

Deliverable							
Del. No.	**Deliverable name**	**Lead beneficiary**	**Type**	**Diss. level**	**Delivery date from Annex 1 (proj. month)**	**Delivered Yes/No**	**Actual / Forecast delivery date**
D 4.1	First printed prototypes fabricated by using optimized software	9 – UFG	Demonstrator	Public	18	No	31.05.2020
D 4.2	Mapping "Additive Manufacturing" Ecosystem and Network Report	2- PRO	R	Public	20	No	31.07.2020
D4.3	Optimized material applications prototype	10-STRAT	Demonstrator	Public	33	No	31.08.2021
D4.4.	Art & Tech Collaboration Final Report	2- Profactor	Report	Public	36	No	30.11.2021
D 4.5.	Hub "Additive Manufacturing" Final Report	1-CREARE	Report	Confidential	36	No	30.11.2021

1.3 Purpose and Scope of Deliverable Demonstrator D4.1

The Demonstrator D4.1 will show the progress made on optimizing the software for creating full colour 3d prints with a polyjet printer directly from files generated by a parametric and generative design definition. These definitions are created by UFG in cooperation with artists Ganit Goldstein and Julia Körner. The definitions are small open-ended modules which can be incorporated into larger custom definitions or to be used standalone for testing purposes.

2 Optimized software for 3d printing

Generative Design Workflow

Contrary to architecture and industrial design, where generative design methods are widely used for visualization as well as digital fabrication purposes, fashion designers are still in the experimental stage when it comes to implementing generative design principles in their workflow. The artists working in HUB Linz all have generative design embedded in their projects.

The HUB Linz artists as well as UFG are mainly using the grasshopper plugin within Rhino as a generative design tool. Grasshopper offers a node-based visual programming environment, where 3D geometry can be created, analysed and reparametrized in real-time, based on a vast array of input options.

Grasshopper is an excellent tool for 3D mesh generation and manipulation, ready for 3D printing. Smart planning and programming decisions can ensure support-material free models and 3D structures with full colour baked in the mesh which can be exported in VRML format for full-colour 3D printing at PRO or STRAT.

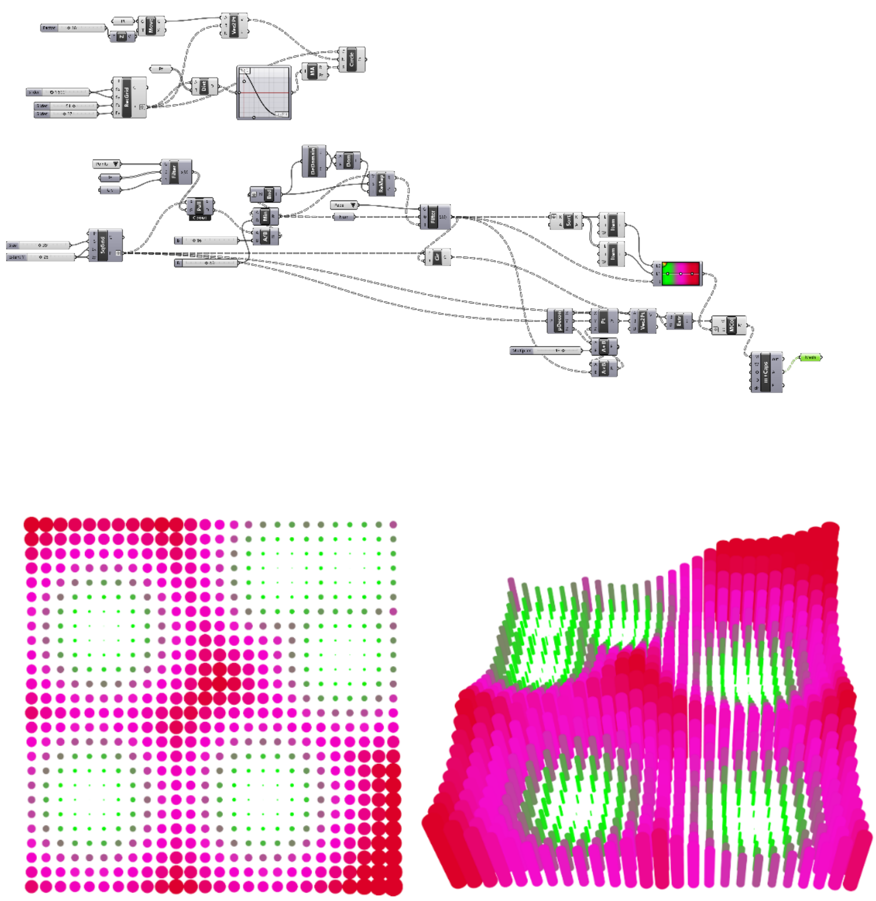


Figure 1: Grasshopper definition which creates cylinders based on various attractors, they determine height, diameter as well as the colour of the generates meshes

Author: S. Hofstee (UFG)

Full colour mesh generation

Rhino/Grasshopper offers vertex-based colouring of mesh structures which can be controlled by the same kind of input parameters that define the actual shape of the mesh. This offers a great amount of creative freedom compared to texture map-based colouring of 3d, which maps a static image to the UV coordinates of a mesh.

UFG has developed several small modules which can generate full colour meshes, these can be implemented at various stages of the design process and can be easily adapted to accept various input methods which will determine the final output.

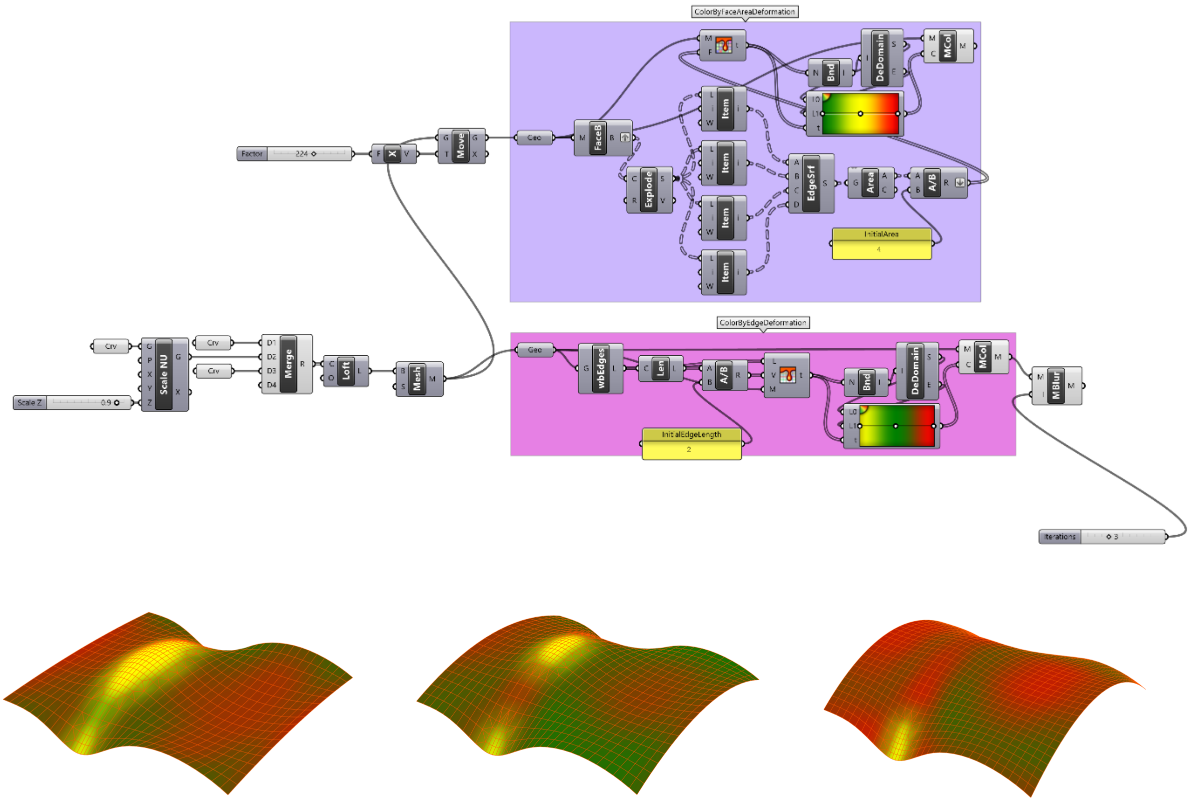


Figure 2: Grasshopper definition which produces a mesh which colours are determined by the curvature of the surface

Author: S. Hofstee (UFG)

Input sources

The first modules deal with both internal and external input sources. Internal sources are directly linked to certain attributes of the mesh itself such as surface curvature or height and can serve to map this data onto itself.

External sources exist in the shape of geometry which interacts with the mesh such as attractors, or external data such as an image which can be interpreted, reparametrized and mapped on the generated mesh.

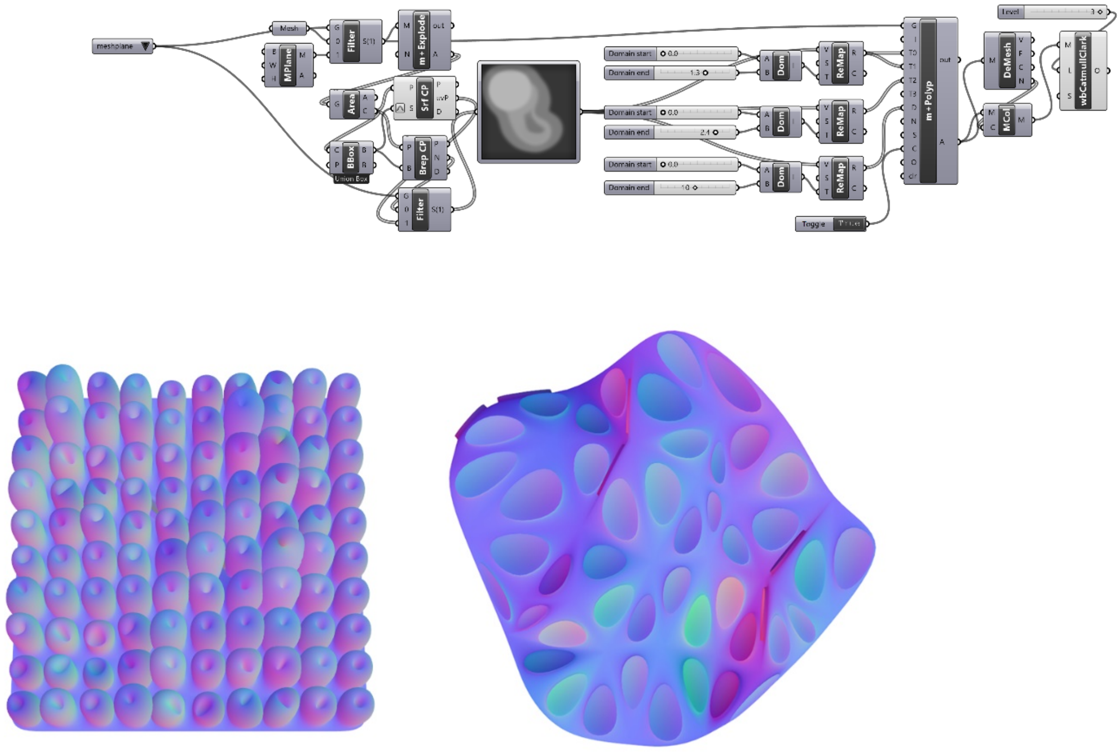


Figure 3: Grasshopper with an external input source, an image sampler which can translate various attributes of the referenced image and control the design on various levels.

3 Demonstrator D4.1

Output

Any mesh geometry generated in Grasshopper can be “baked” and can be exported in various file formats which are widely used for 3D printing, such as .STL, by exporting a .VRML file the colour information can be transported as well and used for 3D printing.

The following photos show the very first stages of the generative design modules, more printing tests will follow, in cooperation with HUB Linz partners HAR and STRAT.

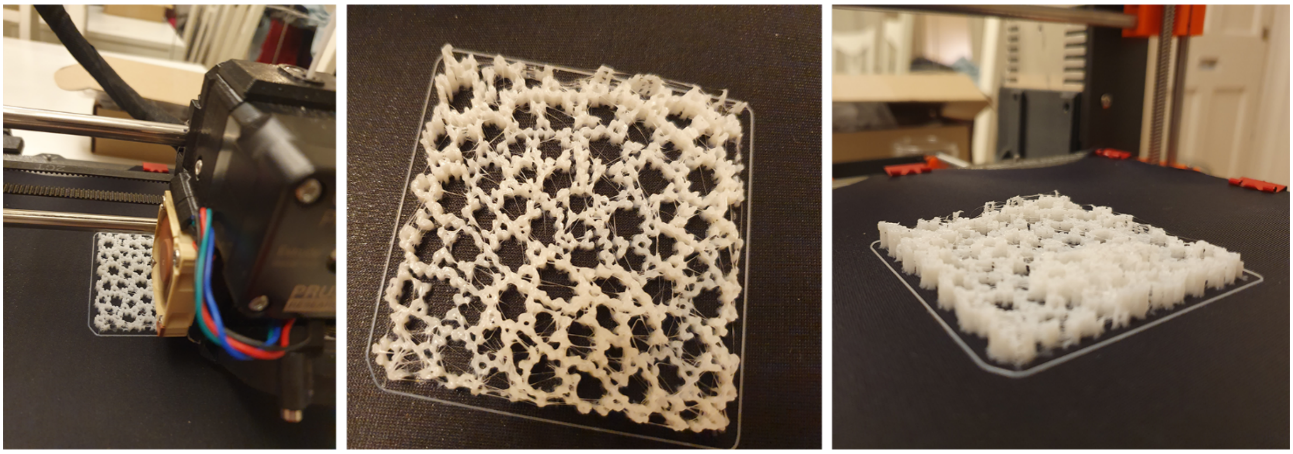


Figure 4: First printed prototype by artist Ganit Goldstein, fully generated within grasshopper