UNPREDICTABLE FLESH

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Edited by Anna Maria Orrù and Malgorzata A. Zboinska

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Novel digital crafting, material research and encounters in interactive architecture

Edited by Anna Maria Orrù and Malgorzata A. Zboinska

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VEGETABLE LAMB PRESS

This publication accompanies the exhibition *Unpredictable Flesh - Novel digital crafting, material research and encounters in interactive architecture | Nya digitala hantverket, materialforskning och upplevelser i interaktiv arkitektur*. The project and exhibition is supported by the Swedish Research Council, Vetenskapsrådet, and has been part of an artistic research grant awarded to Malgorzata A. Zboinska on a project entitled "Architectural Convertibles: Towards an alternative artistic approach to designing interactive architectural environments" (2016-2019). The project has been hosted by the Department of Architecture and Civil Engineering at Chalmers University of Technology. The exhibition is curated by Anna Maria Orrù and presented at Färgfabriken in Stockholm from 5 to 16 November 2019.

Färgfabriken - Center for Contemporary Art & Architecture - is an international platform for contemporary cultural expressions, with an emphasis on art, architecture and urban planning. Färgfabriken is driven by a desire to reflect upon the heterogeneous and multicultural world we live in with the purpose of exploring and trying to understand the complexities of our constantly changing world. Its aim is to create conditions for free and creative thinking.

Stockholm, Sweden.
Vegetable Lamb Press is a small press that deals with big issues; swarms, vegetables, poetry, cartography, post-humanism. Set up in 2015, we release artistic research explorations outside of academic publication; freely and transparently.

First Edition 2019
Design: Anna Maria Orrù
Cover: paper - 'Curious Matter' partially made from potatoe peels
Editors: Anna Maria Orrù and Malgorzata A. Zboinska
Photo credits: Tina Axelsson (1: p.42-43, 2: p. 8-23) , Malgorzata A. Zboinska (2: p. 4-7, 24-25)
Printing: Chalmers Digitaltryck | Chalmers Digital Printers
ISBN 978-91-88249-09-8

ACKNOWLEDGMENTS

The making of this exhibition could not have been possible without the support and guidance of several people. First, gratitude to Malgorzata A. Zboinska for her trust and belief that the work should be curated by Anna Maria Orrù. And to the curator for her remarkable engagement. In the curating journey, the support and guidance from Helle Brøns (curator Søro Kunstmuseum), Annesofie Becker (curator), Morten Søndergaard (artist and poet) and Laurie Hurwitz (Maison Européenne de la Photographie) played a valuable role. In particular, special thanks to Laurie for her sharp eye and input. The team at Färgfabriken: Joel Albinsson, Anders Bergmark, Karin Englund, Joachim Granit and Pernilla Lesse, must receive generous thanks in believing in this work and giving us the opportunity to showcase in their space. Special thanks to Karin for her support and contact throughout. Thank you also again to Morten Søndergaard and to Krystian Tadaj for their tireless support in putting the exhibition up and making ideas come into fruition. A generous call out to Tabita Nilsson at Chalmers who with her energy, creative mind and building skills put together display cases. Thanks to the printing team at Chalmers Digital Tryck, especially Monica Stenfall and Ninoslav Luburic, who are always curious, patient and keen to work with Vegetable Lamb Press. At the opening of the exhibition, thank you to Carmen Olsson for her Performance piece that took into consideration the corporeal aspects of the work. And to Daniel Norell, Susan Kozel and Ambra Trotto for enriching the opening with their disciplinary perspectives. Thank you to Tina Axelsson for her energy, enthusiasm and talent in photographing the work. We thank Linda Bergman for her swedish translation. Thanks to Delia Dumitrescu and Hanna Landin for their exceptional input and engagement. Thanks to RISE Interactive - Peter Ljungstrand, Gunnar Oledal, Fredrik Trella – for your exceptional talent in physical computing, making the interaction scenarios come true. Eva Amborg should also be thanked for her eye and attention to each colour piece. Monica Billger for sharing her valuable research knowledge on colour. And finally, gratitude to the Artistic Research committee of the Swedish Research Council Vetenskapsrådet and to the project's remaining co-applicants - Pablo Miranda Carranza, Ulrika Karlsson and Fredrik Nilsson - without whom none of this would have been possible.

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PREFACE - Svenska
Att vara Nyfiken

Utan en dialog med omvärlden stryps kreativiteten. Färgfabriken måste vara och är därför en plats, där dörrarna är öppna för fängslande och nytänkande projekt som uppstår i ateljéer, laboratorier eller på någon helt oväntad plast i ett sammanhang vi aldrig tidigare har sett eller hört talas om. Malgorzata A. Zboinskas utställning och redovisning av sitt och hennes team forskningsarbete, som hon nu visar i vårt projektrum, är ett så tydligt exempel på just det. *Unpredictable Flesh* visar på ett fascinerande sätt hur viktigt det är att tänja på gränser för hur arkitektur, hantverk och design kan utvecklas i en nära framtid. Dessa taktila organiska former gjutna i silikon i kombination med ljus och ljud är utryck för möjliga framtida rumsupplevelser och sinnesintryck. De inspirerar till nytänkande, de fungerar som reflektionsytor och stillar vår nyfikenhet för hur interdisciplinära samarbeten kan se ut.

Färgfabriken har i nära 25 år varit en arena för många olika experimentella projekt och utställningar, där konsten, arkitekturen, stadsplanering finner nya vägar i möten med andra uttrycksformer och idéer. Eller står helt för sig själv utifrån sin egen integritet. Färgfabriken arbetar även på plats i olika delar av världen där vi finner intressanta flöden av tendenser, idéer, tankar och kontakter. Där vi i flera fall utvecklar koncept och utställningar gemensamt med dem vi möter och samarbetar med. Resultaten visar vi här på Färgfabriken och på andra platser i världen.

Sju stycken filmer har producerats inför publik av konstnären Ernst Billgren. Projekten Building Blocks där barn och ungdomar agerar beställare till arkitekter vilket genomförts i flera städer i Europa, Balkan och Asien. I samarbete med arkitekten och konstnären Luis Berios Negron realiserade vi hans projekt Earthscore Specularium, en byggnad där fåglar, fiskar och en

familj samsades. Det var ett ekologiskt, socialt experiment där konst, forskning och arkitektur integrerades med varandra.

En gigantisk flygbild där Stockholm med kringliggande kommuner synliggjordes på ett alldeles nytt sätt inför publik. Det skedde långt innan Google Earth. Vilket i sin tur skapade en livlig debatt på vilket sätt en stad och region kan utvecklas i framtiden.

Med dessa exempel på utställningar och projekt vill jag visa på Färgfabrikens attityd när det gäller att visa och skapa förutsättningar för projekt och utställningar, som i sin karaktär är processrelaterade och undersökande. Vilka i många fall har utvecklats till "hybrider" där flera olika utryck interagerar mellan varandra. En kulturproduktion som uppstår genom möten mellan materialitet, kunskaper, visioner och idéer.

Vi hoppas mycket på kunna vara ett stöd och delta i en process för att på så sätt bidra till att utveckla Malgorzata A. Zboinskas idéer vidare, i samarbete med curatorn Anna Maria Orrù som har gjort ett strålande arbete med att producera denna utställning här på Färgfabriken. En injektion som leder till nya tankar och uppslag för de projekt och utställningar vi fokuserar på just nu.

Joachim Granit - Konstnärlig | Kreativ Ledare Färgfabriken

PREFACE - English
To be Curious

Without a dialogue with the outside world, creativity is stifled. Färgfabriken must be and is a place where doors remain open to captivating and innovative projects that arise in studios, laboratories or on unexpected plastic in a context we have never seen or heard of before. Malgorzata A. Zboinska's exhibition and account of her and her team's research work, which is shown in our project room, is such a clear example of just that. *Unpredictable Flesh* shows in a fascinating way how important it is to push the boundaries of how architecture, craftsmanship and design can be developed in the near future. These tactile organic casts in silicon combined with light and sound are expressions of possible future room experiences and sensory impressions. They inspire new thinking, they act as reflection surfaces and settle our curiosity about what interdisciplinary collaborations can look like.

For almost 25 years, Färgfabriken has been in an arena for several different experimental projects and exhibitions where art, architectures, urban planning find new ways of meeting other forms of expression and ideas. Or they stand entirely for themselves based on their own integrity. Additionally, Färgfabriken works on sites in different parts of the world where we find interesting flows of trends, ideas, thoughts and contacts. There, in many cases, we develop concepts and exhibitions jointly with those we meet and collaborate with. We show results here at Färgfabriken and in other places in the world as well.

Seven films have been produced by producers Ernst Billgren. The projects are building blocks where children and young people act as commissioners for architects made in several cities in Europe, the Balkans and Asia. In collaboration with architect and artist Luis Berios Negron, we realized his project Earthscore Specularium, a building where birds, fish and a family

came together. It was an ecological and social experiment where art, research and architecture were integrated together.

A gigantic aerial view where Stockholm with surrounding municipalities was made visible in a completely new way to the public. It happened a long way within Google Earth. Which in turn created lively debates on ways in which a city and region can develop in the future.

With these examples of exhibitions and projects, I want to show Färgfabriken's attitude for showing and creating conditions for projects and exhibitions which are process-related and investigative in their nature. In many cases, they have evolved into "hybrids" where several different expressions interact with each other. This cultural production arises through meetings between materiality, knowledge, visions and ideas.

We sincerely hope to be able to support and participate in a process so as to help develop Malgorzata A. Zboinska's ideas further, in collaboration with the curator Anna Maria Orrù who has done a rigorous work in producing this exhibition here at Färgfabriken. An injection that leads to new thoughts and ideas for the project and exhibitions we are focusing on right now.

Joachim Granit - Artist | Creative Director of Färgfabriken

INTRODUCTION
Unpredictable Flesh

The notion of *flesh* implies thickness and extends surfaces into tactile, three-dimensional matter. Here, as an alternative to the "skin" metaphor frequently used in architecture, it is explored in pliable casts and volumetric moulds made from silicone that engage the visitor in order to provoke a response. Inviting a dialogue between observer and artefact, they also propose new, corporeal qualities in architecture - tactility, sensitivity, reactivity and interactivity. These artefacts usher in a new aesthetics of behaviour in which material performance, material agency, collaboration, authorship and interaction are critical parameters. In so doing, they blur the limits between the natural and the artificial and invite us to imagine new ways of working and living.

The architectural objects on display in *Unpredictable Flesh* are interactive pieces, hybrid artefacts, graphic animations and tactile samples produced over the past few years in collaboration with a team of experts spanning various disciplines.[1] They have been developed by architect and researcher Malgorzata A. Zboinska and her interdisciplinary team through an encounter between the mechanical and human, so that precision and imprecision coexist as critical design factors.[2]

As an ecological architect, artistic researcher and teacher, I use ecological and biomimicry-based approaches to explore an alternate approach to the fields of ecological urbanism, architecture, art and design. Much of my work deals with biology through biomimicry, and my expertise lies in the corporeal qualities of architecture, biomimicry and ecological sensitivities. Throughout my years of teaching, I have found that the body, the hand, the sensitivity and touch need to return into architectural practice, particularly in the surge of digital and computer architectural making, in order to maintain a human scale

and tactility - but also to retain the artful mode in architecture. This return of the 'hand-print' can generate a critical awareness in digital architecture and give back authorship and a sense of craftsmanship to the profession.

I therefore conceived this exhibition as immersive and experiential in order to highlight the objects, their colour, shape, form, and their impact on the observer. Each artefact is intended to be experienced using your hands, eyes, ears, brain. The room is dark, guiding you, inviting you to follow the light and colourful artefacts around the space. You will intuitively know how to interact: some of the artefacts ask you to get on the floor or stand up tall and move around them. Kneel down, stand on your toes, look under and over, touch them, try to listen. In engaging, there is an opportunity to meet this flesh using your body rather than just a screen interface.

My intention is to show how these pieces can create renewed intimacy, inviting visitors to get close, interact and touch the works. This interactive aspect is present in all the pieces - not just those that are intentionally and clearly designed to be touched, such as *Soft Body* and *Pliant Flesh* pieces (see pages 4-7, booklet 2). The works are embodied, best experienced using the senses, particularly our cutaneous senses, touching and feeling.[3] With these colourful tactile fleshes, we move closer to the body through a variety of ways. Technology is often used as a prosthesis to gain access to something that is remote, invisible, impalpable, a prolongation of our senses. But in this case, there is a 1:1 relationship between the technology and ourselves, and we are collaborators on the same scale. It is what sets apart this work in my mind and brings a collaboration between the human and machine closer to the origins of the architectural profession.

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Colour, tactility, transparency, geometry and texture become identities in the material's composition. In the process of making, the materials themselves become strong agents in the design's resulting forms. Each material has its own behaviour/its own language/its own character. And since this agency is unpredictable, imprecision becomes a design driver. What appears to be a highly predictable process is actually the result of fluid artistic investigation: the field of computational innovation is being extended by the introduction of unpredictability and manual co-craftsmanship into digital research. Working in the field of interactive architecture and design, Malgorzata A. Zboinska has looked at critical questions about artistically co-creating with machines in the age of digital and parametric design and the multiple agencies present in these processes and materials.

This exhibition explores all these efforts through four overlapping domains: modes of making, artistic investigation, embodied contact, and interface between machine and human. Though each domain is a vital part in the making of these works, they are also very much entangled in one another. First, the **modes of making** are investigated through the actual making of the flesh. Throughout the procedure of creating form, moulds and casts, the pieces can express diverse properties. These properties are fundamentally aesthetic and pertain to colour, tactility, transparency, geometry and texture exploration. In the process, both human and machine traces give each artefact their unique quality.

Second, with **artistic investigations**, the unpredictability of the pieces has come to fruition. The artistic intuition of the authors helps to compose the properties that emerge from the making and propose new ways in which to interact with our machine-making. Here the authors have played with colour, texture, tactility and geometry as parameters.

Third, the works collectively rely on our engagement and participation, and this **embodied contact** offers a renewed companionship through the proposed exchange. These characteristics all steer towards re-orientated forms of corporeal architecture that occur not only between the spectator and artefact, but also all the way through in the making process too. Therefore, the making, materiality and finished pieces are all embodiments.

Fourth, the **interface between machine and human** is present in all the works. Their traces are signed on the pieces, and the light helps find these marks. The works investigates the contact between human-machine-organism hybrid subjects from an angle of co-creation and co-research that create an ongoing discussion between the human and the machine. It is this that makes this making process quite unique. Therefore, the use of the digital tools and machines occurs in a more creative manner, rather than simply using the computer as a tool for representation. The human hand authorship is present throughout; in the making, in the contact, in the artistic explorations and in the collaboration with the machines.

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In my first encounter with these fleshy pieces, I found them organic and was drawn to them even though they were not based on biology. There is a strong research area that connects computing and biology led by scientist Rachel Armstrong in the Experimental Architecture team at Newcastle University.[4] Her vision extends thinking architecture as a “living entity,” in which synthetic

biology can start to influence city-making and living in order to consider ecologically compatible buildings by using protocells and life's growing process as underlining inspiration for how to make structures and materials. And although the exhibited designs are not driven by biological matter such as seen in Armstrong's research, they do nonetheless subscribe to an organic appearance that evolves in the process. Therefore, the spectator is invited to discover the pieces as if they were living and organic experiments. For example, I have chosen to exhibit the colour disk explorative pieces as if they were petri dishes filled with bacterial forms.

This organic theme evolves and is present also in the hand-making and craftsmanship. For it is this meeting between the organic (hand) and the artificial (machine) that enchanted the team as well as myself. It could be said that the architecture field has been so seduced by the digital turn: they forgot the hand, they forgot to draw, they forgot the significance of errors. They forgot. Things have looked too finished too quickly. Built too quickly. Built too finished. However, the artefacts in this exhibition give us renewed ways to think about the digital and the architectural professions role. And in this revived process, the criticality of transdisciplinary collaborations become a necessary ingredient as seen through the collaborative efforts of the project's authors.

Alongside these observations of the forgotten hand, I believe the artistic aspect of the digital craft has also taken a back seat. Currently, artistic research in architecture is being revived through various applications influencing the curriculum, more so still in the arts and in design than in architecture. The mode of artistic research and thinking with the hand within this project offers the ability for things to incubate so that they can mature and retain a scale *of* and *for* human living and quality. A softness and delicacy. A spatial and life suppleness.

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The artefacts on display arise from collaborative making, thus generating an alternative perspective on what contemporary digital architecture could become. Professor of innovative environments Marcos Cruz writes that 'technology is an expression of human knowledge, creativity and imagination' (Cruz 2013, p. 18). So, this collaborative making could not have occurred one without the other. The agents in this project rely on one another. Displayed together, these explorations give voice to both material and digital techniques, broadening the visitor's conception of surfaces as well as expanding the

designers' potential use of tools. In fact, such novel forms of artistic intuition and research into digital architectures propose new ways in which to interact with machines. Hence, a leading agenda for the exhibition has been to push the realm of digital architecture to include artistic and corporeal processes too, and this is in fact what brings the pieces to life and back to liveable scale.

A recurring underlining theme is also about *translation*. There are a number of translations occurring. The human translation into machine language and the co-craftmanship, co-creation and dialogue between them. The translation passing over between different authorships and collaborators. The translation seen in machine and human traces. The translation between the artificial and organic forms. Therefore, this work offers new forms of communication; with the tools used in interactive architecture, with the team collaborations, with combined hybrid of materials, with colour, with light, with textures and textiles, and between the spectator and the pieces.

Michael Fox, architect and professor of Interactive Architecture, writes that there is essentially something very human about making things that come to life. He states that "built environments that may viscerally feel worthy of our care and consideration like never before […] could also be a step in the sustainability revolution" (Fox 2016). My interpretation of his statement is that if care is an element in the making and experience, then so is awareness. Sustainable behaviour depends on our levels of both care and awareness that will us to act. These interfaces between human and the digital can create new aesthetics of behaviour both for the inhabitant, the observer and for the makers. Fox believes that such advances of active, responsive and kinetic environments can animate the material of the built environment (Fox 2016). This activation is also inherent in generating attentiveness and response. Hence, the word flesh appears to be the perfect keyword for this project because of its proposed architectural thickness.

Cruz supports this notion of flesh in architecture because "they encourage new corporeal qualities in buildings, and which encourages a heightened interaction between the body's sensory perceptions" (Cruz 2013, p. 19). Cruz defines this progress in interactive architecture as inhabitable walls. He states that these walls are understood as a new means of human interaction; interfaces with which we can engage and eventually merge' (Cruz 2013, p. 24). Edward T. Hall defines this as ¨wallism¨, one which fosters a high level of intimacy between the body and architecture (Cruz 2013). How observers evolve with objects and how they make contact with them is an important aspect of the project, and this exchange also extends into how the artefacts are made.

The thread which holds all ideas together is the dialogue between the making, the artistic, the hand, the digital and the corporeal involvement both as an observer and as a creator. Unpredictability also becomes an important vanguard. Chance and unpredictability imply an ability 'to let go'. The exhibited pieces in fact 'let go' of prescribed modes of parametric design to create artistic research processes that include designed-in unpredictability as an aesthetic resource. Such artistic intuition and research have been a critical part of the project's design and research process. These artful investigations of architectural materiality are focused on developing new expressions and unusual user experience within the realm of interactive architecture.

With this mode of making, three elements have guided the team's artistic process: an investigation of the material's agency, the emergence of a unique aesthetic language, and the merging of digital precision with manual craftsmanship. Seen together, the pieces give an artistic sense to the explorations and the work has been a close collaboration between varied teams which includes architects, digital designers, interactive programmers/designers, artists, textile design researchers, etc. To collaborate in such a manner brings unpredictability and the material develops an agency both in its authorships and sensibilities.

Collectively, these works seek to embody a wider understanding of architectural flesh. They speculate on the kind of digitalized environments that could emerge and push the realm of digital architecture by including artistic and corporeal conditions. Cruz sees this as an architecture as having very different material and inhabitable dimension – one that allows for a hypercommunication in which a new type of intimacy is introduced emerging from a hybrid situation between the body and the architecture itself (Cruz 2013, p. 196-197). In doing so, the artefacts invite us to reflect on the future dialogue between human craftsmanship and digital design in a way that also embraces their relationship with nature.

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In considering the future for this kind of making and living, I perceive two challenges ahead: ecological and artistic. Concerning the ecological, what I find crucial is how these pieces are made - the process - and what they are made from. What will be the future of these hybrid forms from an ecological perspective? I believe that these kinds of experiments are important, but simultaneously they also have a concern to take on an eco-ethics alongside. Regarding the artistic, the challenge is how to maintain and enhance digital

architecture as an artistic practice. One that still considers the architect as author. With both these challenges, the playful and artistic aspect of designing with the computer and with robots are vital but again to reiterate, attention has to be put on how things are experimented with in the test phase; what forms are being made and how they are being dealt with and what happens to the pieces and leftovers afterwards? Therefore, I am curious how this area will develop further for the team and how these questions will be answered in the future making. Perhaps this will lead to the next level in the research?

These are interesting moments for the field, and my hope is that this exhibition sparks new ways to think and discuss the future of digital architecture, hybrid making processes, interactive architectures, artistic research, and corporeal-inclusiveness in the making, thinking and meeting of forms generated. It has been a pleasure and honour walk alongside the work of this team and the knowledge I have gained has given me a renewed-found appreciation for the digital turn in architecture. I also found it particularly interesting and rewarding in working on this exhibition in that Malgorzata A. Zboinska is one of very few women working in the field, especially within the built environment, and has constructed a gender-balanced team which includes also other women that she has invited into the project.

The awe of computers has passed though new techniques are being developed, and in their wake new obligations begin to arise when this kind of co-craftsmanship occurs. In taking up the curating aspect of the work, I was delighted to contribute to the narrative for this digital work. I hope the show and experience of the pieces open up new ways of making and interacting both for the experienced and the newcomers. In this widening of the field, we are all explorers – however, ones that can meet hand-in-hand with an unpredictable digital future. My imagination steers towards a future of interactive space that begins to open up to new opportunities for ecological living. After all, without such considerations all collaborations would cease.

Färgfabriken seemed to me to be the ideal venue for this exhibition. It has an international platform dedicated to contemporary work within art, architecture and urban planning and brings in unique work that furthers discourses in these fields. Malgorzata A. Zboinska's project therefore fits perfectly into its mandate to expose innovative, multifaceted and complex work that pushes boundaries of creative thinking, making and doing.

As a result of our discussion in the months leading up to this show, we have been invited to join Färgfabriken's upcoming exhibition celebrating 25 years. The show entitled *Symbiosis* speaks profoundly to the work carried out

here, as it investigates the future of post-human design, in which machines robotics and our interaction with these entities is crucial. I look forward to this continuing endeavour.

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I now invite you to walk through this interactive exhibition with me together with the pages in booklet 2 showing the artefacts.

> After going through the entranceway, your first contact is with the black piece entitled *Pliant Flesh*, right ahead of you. This piece reacts to touch, so please move both hands around the surface to see how its internal red lights react to you. Nearby sits the yellow *Soft Body* piece, gleaming in its bright voluptuous skin. This piece is accessible from both sides, so more than one observer at a time can touch, push gently and feel its softness. Place your head against the soft pillow with your ear close to the body; can you hear its soft murmur? Adjacent, beside the black flesh piece, near the wall cased inside a lighted display box, is the *Erroneous Flesh* experiment – an exploration into repeated imprecision. Scan its surface carefully to look at the machine traces on this large form. To its side, hanging loosely on rods, are its twin skins in different colour tones and they welcome the viewer to play and lift them ever so gently. Can you feel the weight, softness and smoothness of each flesh?
>
> You are now drawn to the opposite side of the room where you notice that the artefacts begin to interact with the walls. However, before you reach them there is one piece on the floor. In order to touch this piece, you need to kneel down and place both hands on the bulbous cast entitled *Haptic Flesh.* This flesh is displayed on top of a light display box that illuminates the piece from underneath. You notice that in several points the flesh is so thick that the light cannot come through. You notice that the form of the Haptic Flesh is different, it is called *Bulbous Flesh.*
>
> If you stand up, your gaze is directed to the pieces making traces and patterns on the adjacent wall, including a large, translucent mould hung from the ceiling – *Hydrous Flesh*. My intention here is to bring out the machine traces of the form by shining a directional light through the piece, and onto the wall. This results in a shadow play of the lines, which are enlarged and flood the back wall behind the hanging mould. Walking around the mould, you begin to see how

your shadow interacts with these machine traces. To the side of this shadow play, in the corner, several small multi-coloured translucent silicone cast forms are suspended from the ceiling at differentiating heights. These *Colour and Form* explorations sparkle like coloured jewels, casting their colours on the wall behind them. Placed infront of the explorations, there is a small flesh lying on the floor. Again, you are invited to kneel down to inspect this delicate cocoon-like body called *Hybrid Corpuscle.* Crawl gently around the artefact. It is lit up from the inside, and you can almost imagine it glowing stronger and weaker, as if it were a small breathing body.

Finally, you are left standing in front of a lit-up shelf display that showcases different experiments (*Textured Flesh, Deepened Flesh, Body and Bulk,* and *Deep Colours of Flesh*) from the project's journey. On the bottom shelf you can see the *Haptic Flesh Explorations* that led to the finished piece that you just saw on display. Here, you are also invited to open a series of four drawers, each containing different explorations from the team's investigations. The drawers reveal lit up colour and texture investigations (*Layered Flesh,* and *Mould, colour and Textile*), a peculiar set of coloured disks that look like growing coloured bacteria (*Silicone, Colour and light*), and animation skeletons and images (*Flesh: cohesive, bloated, elastic*). With all these experiments, try to link them back to the large exhibited pieces to see what processes led to the finalized versions.

Before you go, when you exit the space, there is one more element to the exhibition: an animation graphic film demonstrating the animation process and narratives for the different artefacts. There is a bench for you to sit on and reflect on your experiences inside the room. If you wish, you can dip into the books selected for you on your reading bench. In these books, you can learn more about the field and its expansion. And why not go back inside for one more look?

Anna Maria Orrù - Curator

TOWARDS NEW MODES OF DESIGN AND MATERIAL ENCOUNTERS IN DIGITAL ARCHITECTURE

Architectural Convertibles

The fundamental interest of the artistic research project 'Architectural Convertibles' is the aesthetic expression of interactive living environments. One of the key elements of such environments are programmable electronic and mechanical devices that allow people to engage in a dialogue with the building's components. Such a dialogue can concern either very fundamental aspects, such as indoor climate regulation, or higher levels of needs, such as aesthetic sensations or stimulation of the senses.

The particular contribution made by this project relates to new ways of designing the aesthetic attributes of interactive environments and tackling their design process in a way different than usual. Namely, to approach their design from the standpoint of fundamental aesthetics and sensory experience, instead of from the technological standpoint that would focus on designing the structure's kinetics and programming its electronic devices.

The aim of the project was to explore the possibility of designs that create an unusual corporeal experience of digitalized materiality. Such an experience would extend beyond mere interaction with technological devices towards interaction with a hybrid materiality, in which the technological components are seamlessly combined with the material tissue of architecture. Such a materiality would engage the physical properties of materials as triggers of the most fundamental sensations – vision, touch and sound.

Therefore, the project's ambition was to investigate how to organically embed digital technology in architecture's physical form; how to communicate people with buildings through materials; how to make interactive technological components approachable and natural to interact with; and, how would such new material interfaces look and feel like.

The new interactive flesh of architecture

The theoretical foundations for the project embraces the concept of 'convoluted flesh' [1] (Cruz 2013) and the extended concept of 'skin' [2] (Lupton & Tobias 2002). These two concepts were important to base this work upon, as they enabled the advancement from a reductive concept of a building skin as a thin, uniform, panelised surface, to the concept of building flesh - a multi-layered, artificial organ with varying thickness; a knowledge-gathering device responding to external stimuli just as the human tissue does.

The adoption of those concepts in the project has led to the questioning of the conventional role and appearance of a building element. The speculative proposal that emerged was that of a new typology of a building component – not assembled from separate elements forming a whole, but rather a continuous, voluminous entity; a substance that spatially embraces and enfolds. Such a substance could have many instantiations - from an envelopment existing on its own, through an insert within a conventional wall, up to a bulky architectural body loosely claiming a part of an already existing space.

The new flesh developed in the project, expressing and embodying the concept of a voluminous interactive substance, is made from a combination of man-made and machine-made components; synthetic materials and electronic devices. Owing to this hybrid composition, it communicates both through its physical attributes and through its programmable devices. These devices discretely but profoundly amplify a different from usual experience of architectural material and its volume. As thickness and softness vary, this affects how the hands and the body accommodate when in contact with this substance. The new flesh, through its provoking geometry and apparition, gives an impulse to discover it – view it, touch it, hear it and feel its organically embracing presence, hypersensitive to minutest human activity.

Convertibles, conversions and convertibility

Similar to defining the new materiality of the flesh, the process of making was of equal importance in the project explorations. In this respect, the ambition was to explore and develop a design process of the flesh that features a variety of conversions. A spatial conversion from an idle flat wall to an animate amorphous substance. A compositional conversion from thin surface to voluminous bulk. A conversion from digital to physical. A conversion from one state to another. A conversion between states - digital states, material states, chemical states and machine states.

All of these conversions, pertaining to creating and making, affected the final aesthetic expressions of the design samples, artefacts and demonstrators

– the architectural convertibles, embodying the new flesh. These speculative instantiations of the new flesh carry the traces of convertibility in various forms. They represent robust tensions between versatile agencies, including the generative agencies of digital modelling and animation tools, the designer's manual crafting interventions, the spontaneous behaviours of materials pertaining to elasticity, plasticity and liquidity, the programmed activities of electronic devices embedded in the hybrid materials and the unpredictable results of actions of the digital fabrication machines. Finally, they also mark the name of the project 'Architectural Convertibles' to convey a possibility for a novel way of designing that conceptualizes and explores conversions in a myriad of ways.

Artistic research in the architectural domain

From the beginning, the methods of research inquiry in the project were assumed to evolve in tandem with the new knowledge captured during the artistic design development. However, the core methodological framework for the project is practice-based research, in particular research through design, allowing the research team to work in a dual mode, combining personal perspectives of designers and objective views of researchers.

The research methods of the project embraced design experiments, prototyping and orchestrated simulations of interactions with people, accompanied by parallel developments at the level of architectural theory and design methodology. Design, materialization and placement in contexts with users were the main vehicles for knowledge generation. On the one hand, they allowed for the development of physical instances expressing the possible aesthetic of the new flesh of architecture and conveying the possibilities for interacting with it in alternative ways. On the other, they allowed for the extension of the existing concepts of architectural flesh and skin in the context of interactive architecture theory. They also enabled the development of methodological foundations for designing the physical demonstrations of the new flesh.

The knowledge development mode in the project can be described as hybrid - combining artistic and scientific inquiry. This entails unfolding and accumulating knowledge at times spontaneously, intuitively and speculatively, at times in a rigorously structured, lab-like and goal-oriented manner, and at times using the combination of the two. Such a hybrid mode of artistic-scientific inquiry is still quite unusual in digital architecture research, which often chooses the scientific and engineering modes of knowledge generation. This hybridity of the research method is further reflected in how the project

results are communicated, i.e., through publication of scientific texts, popular dissemination and exhibitions of the research prototypes.

Finally, it is important to denote that the project embraced fundamental research in architecture. This entails that, in contrast to applied research geared towards particular implementations, this project was driven by curiosity and the desire to expand basic knowledge in the research area. This was done by exploring the fundamental aspects of architectural design, pertaining to artistic expression, creation, aesthetic experience and means of design such as geometry, form, colour, texture and material features. In this way, the project's ambition was to lay the foundations for the future developments in interactive architecture, both fundamental and applied.

Research foci and interdisciplinarity

The six foci of research undertaken in the project pertain to the developments in architectural design theory, artistic research methods within digital architecture, architectural aesthetics, architectural materiality, architectural interaction, user experience and hybrid modes of digital craft.

These trajectories were prompted by the gaps in the current knowledge on interactive architecture. The most important of these gaps pertains to the aesthetics and design expression of interactive environments, which seem largely unexplored. Therefore, the project's intention was to focus on the most fundamental aspects of creation of such environments. Working within this broad framework, a team of scholars with expertise in applied aesthetics, human-computer interaction, physical computing, robotic fabrication, smart materials and textile thinking was constructed, so that they could contribute to the work with their disciplinary perspectives. As a result, the project embraced various constellations of researchers, each focused on exploring chosen aspects of designing the new interactive environments.

Towards an alternative aesthetic and novel sensations

The alternative aesthetic for interactive architecture strives to embody the mentioned hybrid materiality, in which discretely combined physical and digital means of expression non-obtrusively awaken the basic sensations, provoking reflection upon the human physicality and its ability to adapt to artificial surroundings. The project experiments with a wide repertoire of design expression means to achieve this.

The new flesh is therefore generously spacious, tangible and bulky; digitalized but surprisingly humane; alien but strangely familiar; startling in expression and unforgettable in experiencing. To engage the senses, it employs

geometry, form, volume, coloration, transparency, opacity, texture and spatial relationships. These elements of design are amplified through technology. The electronic devices embedded in the materials extend the basic sensations, to engage people in a dialogue with technology that deeply moves and extends far beyond the reductive touchscreen experience.

Extended human-machine synergies

The human-machine synergies were explored in the project from two standpoints: the designer's perspective of creating interactive architecture and the user's perspective of experiencing it.

In the first context, the project sought for ways of enriching the traditional interaction between the designer and the 3D modelling software. To explore alternative encounters with the digitally modelled 3D forms, animation software was employed. This added a temporal factor to the exploration of 3D forms, facilitating a designer's interaction with their spatial transitions in time. In addition, narratives were written for each of the 3D forms, to enrich their minimalistic digital representations with verbal attributes conveying their further aesthetic properties.

At the later stages of design materialization, this logic was continued by exploring extended interactions between the designer and the digital fabrication machines. Traditionally, the machine is simply a tool to materialize the design. What was discovered and explored in the arranged extended interactions with an industrial robot arm were completely new modes of creation. These broke the convention of scientific rationality and perfectly engineered precision accompanying architectural computing, by demonstrating that computation and fabrication can be driven by artistic inquiry, chance and intuition.

The deliberate inclusion of artistically-driven robot programming in this strand of the project's inquiry opened a vast and rich territory for creative explorations. It yielded design typologies that would have never arisen if precision were the only design goal. It also broadened the conventional perspective on digital fabrication goals, implying that more liberal methods of working with the materials and the machines and the move from computational control towards uncertainty can be of high value from the design standpoint.

The second context of human-machine synergies investigated the possibilities of extending the man-machine interaction through the medium of programmed matter. In the developed approach, the programming of material behaviours was shaped either through changes of chemical states of materials, or through the use of programmable electronic devices altering the physical appearance or tactile sensations of materials. What was explored here was

how to meaningfully combine the agencies of materials and electronic devices to facilitate the experience of convertibility of the new flesh – convertibility and change that are not immediately obvious but instead need to be discovered and reflected upon.

Hybrid craft

Within this line of investigations, the role of hybrid craft was explored, combining manual and digital making. Here, handicraft and material behaviours took on a generative role in the computational process. Through the introduction of imprecise manual and unstable material conditions, the convention of perfectly engineered aesthetic was challenged with a new paradigm of an imperfect aesthetic whose beauty lies in the erroneous features of the artefact.

Developing and experimenting with orchestrated, intentionally imprecise design materialization workflows, featuring a combined agency of human designers, fabrication machines and materials, revealed that these can mediate in the bottom-up emergence of aesthetic attributes of designs that would be unattainable using the traditional top-down and control-oriented approaches. An important discovery that accompanied the close-up probing of the transitions from digital concept to material artefact was that some digital tools, processes and procedures are not as precise as commonly imagined. This refreshing discovery marks the emergence of a new territory for further exploration in architectural design aided digitally.

Malgorzata A. Zboinska - Architect and researcher

‘FLESH’ VISIONS FROM COMPLEMENTARY DISCIPLINES

The following essay contributions encompass the personal perspectives of interdisciplinary team members on the various aspects of architectural flesh. Each team expert came from a different professional background: art, applied aesthetics, interaction design, and textile design. Therefore, to make it possible for them to create their own flesh interpretations, they were presented with some initial questions from the project brief that they could answer and interpret in their own ways. Some of these early questions were as follows.

For the design of flesh materialization processes, the main question was how the process of transition from digitality to materiality of the flesh could proceed. How does the process produce or mediate in the spatial expression of each flesh embodiment? How does it relate to the form or appearance of the flesh changing over time? Does the making process end once the flesh is materialized? Or does it continue on with its existence? Does the material process concern only the flesh surface? Or does it take place in the cross-section of the flesh? Does the material process concern a material that is homogenous, or a layered material? Are the traces of the process visible in the forms, detailing or ornamentation of the flesh? Does the materialization process have a connection with the closest architectural surroundings of each flesh instance? For example, for the flesh being an infill in an existing partition – does the materialization process affect only the flesh, or does it spread and erode the border between the existing and the new?

For textile design and materiality, the initial questions concerned the selection of materials and their properties that can express the thick materiality of the flesh. Could we work with unusual materials that behave or look similar to textiles, for example, silicone, latex, plastic, rubber, or foam? Is

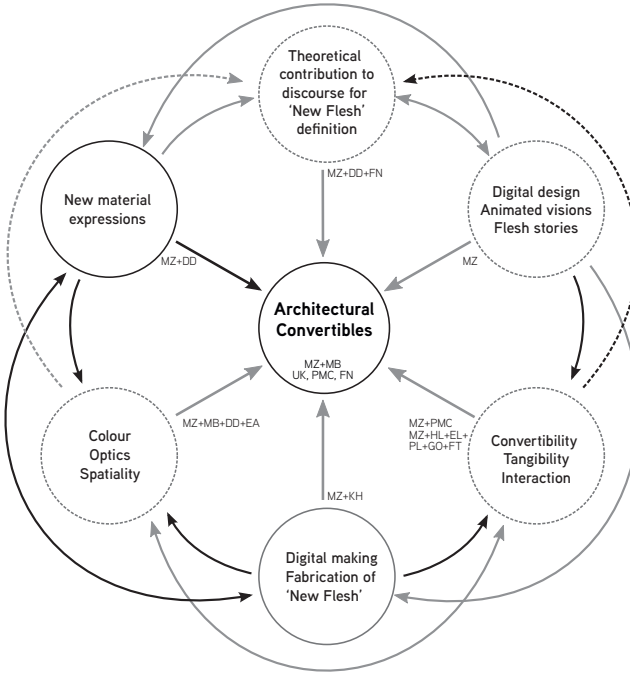
Malgorzata A. Zboinska

the material thick enough to produce bulkiness? Or are there infill materials involved? If infills occur, are these wet, such as gels of some kind; dry, such as foam, polystyrene pellets; or perhaps natural, such as organic fibres? Is the flesh material the same throughout its body? Or is it a heterogeneous material that has several layers, like the human tissue? Or maybe a dual material with an outer and inner layer?

For colour and aesthetics, the first questions pertained to the visual and tactile perception of flesh. Is the colour of flesh homogenous? Or do hues and tones occur on its surface and within its depth? If so, how are they distributed? Are colours saturated or watercolour? Do they allow light to pass through? Do they allow vision to pass through? Is the flesh surface glossy or matte? Smooth or rough? Does colour underline its geometrical complexity or does it distort it? Can optical phenomena be used to amplify the reception of thickness and bulk of the flesh? Can colour, optical effects and textures amplify the experience of touch of the flesh? How do colour, optics and texture relate to the flesh changing or being in motion? Do the aesthetic attributes of the flesh melt with the architectural surroundings? Or maybe gently accentuate the newness flesh? Or perhaps they are in complete contrast with the existing architectural elements?

In relation to interactivity of the flesh, one of the main early questions concerned the ways and means of triggering dialectic behaviours between the flesh and its inhabitant. Is it a person's behaviour that triggers a reaction from the flesh? Or is it the flesh that triggers human behaviours? Or maybe both? If so, what are these behaviours? Is it a gentle machinic signal from underneath the flesh that lures the user to touch it? Or is it the touching triggered without the help of devices, only through the aesthetic or material properties of the flesh? Are electronic devices just barely visible from underneath jelly-like, thick matter? Or are they completely hidden from the eyes? Or perhaps completely exposed? Maybe they are hidden from the eyes but not from the hands? Perhaps their rough edges can be felt with the hands, looming out from underneath an opaque, organic architectural body? Do the devices send soft or pronounced signals to people? If so, what kind of signals? Which sensing technologies enable these digital dialogues with people?

The above questions enabled the members of this diverse team to establish their own interpretations and imaginings of what the new architectural flesh could be, how it could look like, how it could feel, how it could behave and how it could be materialized. These individual imaginings have therefore importantly influenced the nature of investigations and explorations within the project.



Team Members

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Malgorzata A. Zboinska

SILICONE CASTINGS

I have always been fascinated by the combination of colour, light and transparency. As a child, I could lie down for hours looking up at the clouds that wandered across the sky. The drama, beauty, change and movement of light constantly gave me new associations, new imaginations. When I first saw the silicone castings from Malgorzata's project, I saw this same combination of colour, light and transparency being materialised. It made me think of glass art and aquarelle painting, so I began my own work by painting with watercolours – layer upon layer. My task was to explore how the colours affected the forms of the castings (see page 23, booklet 2). In the next stage, when I started moulding with the actual silicone, I wanted to take these initial watercolour experiments further.

I pigmented the silicone with primary colours – red, yellow, green and blue – and cast each layer of colour on top of the other in different order. My aim with this method was to study how the feeling of depth changed. What happens when you put two or more colours in layers within one casting? When does the transparent become opaque?

I explored with making pigment patterns; In one experiment, I stirred different pigments into the silicone mass which would make the castings appear in new directions. In another, I poured different colours of silicone in stripes and squares into the casts so that the colours spread more orderly like a pattern. And finally, I tried embedding beads, fibre optics and other objects into the mass that carry light and could further the intention of giving thickness. An essential part of my examinations was to hold the castings towards different types of light in order to see how the pieces appeared. I questioned; How do the colours change if the light source or the angle of light changes? What happens if the casting is held against a back wall?

In my reflection, the work of casting silicone has been a truly rewarding and enjoyable experience for me. I felt the same desires I so often experienced as a child; to play, to investigate, to do new experiments, to try things in different ways and to see colour and light take shape through new combinations. My discussions with Malgorzata have also been a source of inspiration that helped me to develop and dare to experiment in new and exciting ways.

Eva Amborg - Artist

EXPLORING COLOURS IN MOTION

Colour research has predominantly been based on the two-dimensional. In architecture, however, colour has been researched in the three dimensions of the built environment. In this project, we advance the notion of colour three-dimensionality even further, onto colours in motion. Such colours are set in motion either by viewing them dynamically when moving through three-dimensional space, or by applying them onto objects that are in motion. Is it the interaction between the person and the object that gives the movement, or do we incorporate movement such as vibration into the forms we create? Our experimentation with silicone was the starting point; the possibilities and limitations of the silicone as a material that carries colour are what we explore. Initially, we had ideas about connecting the colour phenomena to vibrations in the material. Would one be able to subtly reinforce the visual sensation of discrete movement, such as vibration, using varying compositions of colour, thereby creating colour-blending phenomena? Would we be able to achieve this by applying carefully selected colour combinations non-continuously onto a continuous surface? What difference in the perception of three-dimensional form would it make if we created bands of colour gradients or contrasting stripes in the silicone?

Transparency has been our theme, as were the reflections between surfaces; the play with experience of light and shadow, where surfaces on which light falls on act as filters. What has intrigued me most is the contrasting effects of different kinds, such as the contrast between light and dark, or between cold and warm. What would happen if you combine transparency and contrast?

I have also been fascinated by the connection between colour and light, and all the different kinds of light that affect how the colours will be experienced: backlight, trailing light, incident light… How can we model with the light and what effects can we achieve through this?

All of these issues and assumptions, the drive and the curiosity to investigate and study, have been a motivation for laboratory work throughout the project. The results we have thus obtained have not been predictable and have opened up new opportunities and directions for further exploration.

Monica Billger - Professor architecture and visualization

NOTES ON MATTER AND TEXTILE THINKING

Matter is the substance of things; its character and agency convey form, and give expression to things. Every substance/matter has its own distinctiveness. Thus, it entails an accurate understanding mediated by the authority of each creative practice.

Matter and substance shape form; they steer design thinking and processes. Yet, design thinking unfolds the character of matter; it alters substance and converts matter/substance into form - the objects we live with or in. The parcourse of every design process starts with an unknown journey; it unfolds around matter-process-form as fundamental notions that enable design thinking to unlock methodologies, and unravels novel design practices.

Altered by the thinking and the methodologies of each creative practice, matter in design can take different forms. In textile design, matter defines form as a surface; it is the way the surface is formed so it can hold, be embellished and be experienced. The character of matter, the thread, and the technique chosen to inform the typologies of form. The forms present in weaving, knitting or printing – each suggests a certain expressional vocabulary. Form in textile thinking initiates always from the near; from exploring the design potentialities of matter starting with the delicate scale of the fibres and textile structures. Here, the design attributes of form emerge from the near perception of the surface, intertwining both visual or tactile stimuli in the process. Forming the near in textile design alters the attributes of the far: texture, colour, the way we perceive shape, and the way we relate to things.

In architectural design, the forming process starts from the far; form can be decided on before the material. The material absence in digital architecture creates advantages for the expression of form. Matter can be unknown here for the benefit of form.

Matter in interaction design can have both physical and digital nature. Its agency in objects can be controlled by the digital, so the expression of matter can transform to various states.

The cross-disciplinary nature of interactive architecture unfolds the agency of the unknown matter; the matter of the surface, the matter of interaction, the matter of architecture. It brings different perspectives of design thinking and practices together, defining a novel hybrid practice. Here, matter-process-form can be looked at from multiple points of view: detail, material, body, space, things and new experiences of them.

Looking at interactive architecture through the lens of textile design unfolds a considerate way of looking at the transformative potentialities of matter. The opportunity here is to see matter as a set of sequential expressions that consider the near as related to the far. Matter in textile thinking considers the closeness of the body to the designed object and the expressiveness of its detail. To form matter through textile thinking is to employ the design potential of substance that can stimulate one's curiosity to interact with it in a direct way – giving it textile-like attributes of texture and colour.

Delia Dumitrescu - Textile design

ON INTERACTION

A mirror reflects the light so that we can view ourselves from a distance. An interactive object can function in a similar way. It can reflect our thoughts and preconceptions of things so that we can view them from a distance.

How do we live with the spaces we place ourselves in? How do we think of buildings, rooms and walls? How do we interact with them? In this project the flat surface of a wall has been stretched out continuing into the wall so it also has a depth. A depth not just through its materiality but also through its interaction.

We might be thinking that architecture is a matter of dividing and creating space. Another perspective presented here, is thinking of architecture as being a matter of filling space with substance and content, substance and content revealed by humans.

What would it mean if we made architecture more tactile? How would it be? A substance we can interact with. What does it tell us about the way we think, live and relate to our surroundings today? We have constructed interactive objects as a way to reflect on how we relate to the architecture of today. We do this in order to get a better understanding of it. We have built mirrors.

When you interact with something you reveal things about yourself. You have to relate to the world outside of your own body and mind. Sometimes it is therefore easier to act than to be, easier to play than to live. The way you interact with the room, with the space, with the situation reveals something about your ideas of that room, space and situation.

Hanna Landin - Interaction Design

MEDIATING SOFT ARCHITECTURAL MATTER THROUGH PHYSICAL COMPUTING

RISE Interactive institute was involved in the project in order to provide technical knowhow and expertise in the interaction design of smart materials. Exploring the possibilities for close-range proximity interactions with architectural elements led to capacitive sensing using soft conductive fabrics coupled with embedded variable tactile feedback. Capacitive sensing is used in touchscreens on smartphones and tablets and it can enable interaction without physically touching the electrodes.

We created a prototype using a microcomputer and just one capacitive sensor (where we used aluminium foil as an electrode) to test the feasibility for the desired interaction model. We also explored other sensing and interaction principles based on resistive sensing, orientation sensors, etc. Since capacitive sensing worked well, we scaled up the hardware to afford multiple electrodes of different shapes, and differential sensing. We also explored the optimal conducting material for the embedded electrodes. Capacitive sensing can be fairly complex and depends on the exact size and placement of the electrode, the capacitance of the person interacting with it, the ground plane, other conductive materials in the vicinity and also the ambient electromagnetic radiation. To create a stable system, we designed an algorithm that automatically would calibrate the sensitivity and range of the sensors. Another challenge was that since the interaction included the use of vibration motors for tactile feedback, a second layer of complexity was added to capacitive sensing, since the motors would create electromagnetic interference and thus affect the sensors. This was solved by shielding all cables and the motors themselves and by creating a Faraday's cage using conductive tape, thus allowing the tactile sensation to be felt but effectively shielded from electrical interference. All interaction electronics were embedded at different depths inside the Soft Body prototype, with their sensitivity and tactile sensation fine-tuned according to the user experience model developed for the project.

RISE Interactive Institute Gothenburg
Gunnar Oledal- Technology oriented designer
Fredrik Trella - Researcher & developer interaction design
Peter Ljungstrand - Hacker & maker

NOVEL DIGITAL CRAFTING
Co-making with Computers

Why do you use computers in your design work? The question seems simple but the answer is complex. What have computers brought into my creative practice as a digital architect over the last 15 years? What is my enchantment with them truly about?

Most fundamentally, the co-making with computers has extended my imaginative capacities, in a way that goes beyond the visual and extends onto the tactile. Yes, the computer enables me to work within the difficult territory of geometrical complexity and non-standard design expression. But not only that. It has also triggered the emergence of an invisible hand in my mind; a tactile extension of what my eye perceives when confronted with 3D forms shown on the computer screen. Owing to the computer, I can really tailor matter – digital matter – in any way I wish. Owing to the computer, I can think not only about form but also about process. About reshaping architectural form that is enlivened, temporal and tangible. Even though I cannot touch it physically, the invisible hand of my imagination understands very well how the digital behaves and how it feels like; it senses its presence and it stimulates my perception of what its materialization could be.

My encounter with computers does not only refer to 3D modelling though. It also entails work with physical computers – material and electronic ones. The material computers I imagine as smart material constructs that change their physical states – shape, texture, colour, transparency, temperature, stability – upon carefully programmed stimulation. Here, the reaction of the material is slow and unobvious. You need to interpret it in your own way. The electronic computers, on the other hand, allow me bring to life the typically inert physical matter of architecture. They let me think freely of the digital architecture of

the future. They let me imagine such architecture as implanted with slow technology. A new kind of electronic architecture that shapes a novel but still fundamentally familiar experience of space and its materiality.

What working with computers also gives me is access to a novel co-making mode. It gives me a unique opportunity to work in trinity: designer-robot-material. Within this territory, anything can happen, and I accept that. For me, this uncertainty is a creative opportunity, a design driver. With such a presumption, I do not need to strive for exactness and ultimate precision. I allow my robot programs to alter the material behaviours in ways I could not imagine. And the materials that my machines and robots are processing can respond in their own, excitingly unexpected ways. I can choose to react to those creative surprises and fabrication errors in any way. They alter my thinking about the final design – not as a top-down construct perfectly mirroring my vision, but rather as a live product, unfolding from a peculiar negotiation between my design intention, my programmed intervention through the medium of the machine, and the intricate response of the material being affected by it.

Last but not least, my encounters with computers have, paradoxically, strengthened my connection to architecture's foundations – aesthetics, design, artistry and craft. They have strengthened my confidence in the importance of craft in the machinic making. The manual intervention of the human hand within the framework of the digital – this is something one of a kind. It is not the same as crafting alone. And neither is it anywhere close to design aided exclusively with digital tools. This hybrid mode of digital craft, allowing for intuitive human intervention to legitimately enter the computational process broadens my horizons. Where I find myself now is a new territory – a hinterland somewhere between digital precision and craft-inherent uncertainty. The awareness of being at this location is extremely invigorating to me as a designer.

Text: Malgorzata A. Zboinska
Photos: Tina Axelsson


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CONCLUSION
The Future of Living in Interactive Environments

In today's era of apps gathering personal data, intelligent building automation systems steering the indoor climate and various sensors embedded in the surroundings to react to human needs, the provision of technological solutions that are functional and efficient often dominates over other fundamental aspects of design, such as aesthetics and user experience. The importance of developing alternatives that question this pragmatic approach in the context of digitalized living spaces relates to sustainability. Such spaces shall not only comply with the technical and environmental requirements, but also extend much further, onto aspects of human health and wellbeing.

How to design the new digitalized surroundings in a humane way? How to make them performative and efficient, but also liveable, engaging and thought-provoking? These are the questions for fundamental architectural research today. Such knowledge is necessary if the architecture of the digitalized spaces is to offer high quality of living, up to the highest levels of needs - safety, a sense of belonging, self-esteem and self-actualization.

Therefore, this artistic research project sought to develop foundational knowledge that could be of use for tomorrow's design of interactive human-centred architecture that has the capacity to combine unconventional means of artistic expression with cutting-edge technologies to shape unique, meaningful digitalized spaces for living.

Through the conceptual framework of architectural flesh, the presented research inquiry challenged the preconceptions about architectural components - what they are and what they could be. By developing interactive pieces of the voluminous substance, seen through the lens of the flesh, it demonstrated that conventional walls, ceilings, floors and other architectural

components can be designed differently – as tactile, bulky, deformable, adaptive material entities for sensing and communication, mediating new visual and sensorial dialogues with architecture and its digital devices.

Through its visions and samples expressing the new architectural materiality, the project also presented a wide array of possibilities for shaping novel tangible relations between people and physical materials of architecture. In this sense, it linked to the human-centred vision of architecture, advocated by an influential architect Juhani Pallasmaa [1] (2013) in which the multisensory perception of physical space shapes our enjoyment of the built surroundings. This concept applies well to interactive architecture of the future, by reorienting it towards its aesthetic and experiential roots that exhibit a great capacity to enhance our experience of living surrounded by technology.

Malgorzata A. Zboinska

PROJECT TEAM

Artist, researcher & project leader: Malgorzata A. Zboinska

Exhibition curator: Anna Maria Orrù

Guest researchers: Delia Dumitrescu, Hanna Landin, Peter Ljungstrand, Gunnar Oledal, Fredrik Trella

Guest artist: Eva Amborg

Guest technical exhibition developer: Tabita Nilsson

Guest assistants: Karin Hedlund, Erik Landmark

Project co-applicants: Monica Billger, Pablo Miranda Carranza, Ulrika Karlsson, Fredrik Nilsson

Guest institutes: Konstfack, KTH-ABE, RISE Interactive Institute - Gothenburg, University of Borås Swedish School of Textiles

CONTRIBUTORS

EVA AMBORG
Eva Amborg is an architect and artist. She teaches in the Architecture department at Chalmers Univ. in Gothenburg. She is especially interested in artistic processes and spatial experiences. In Gothenburg, she has also been working as a stage director at Folkteatern and Stadsteatern, & as a teacher at the Interior Design of Art College in Gothenburg.

TINA AXELSSON
Tina Axelsson has been a photographer and filmmaker for over 20 years. She has extensive experience in a variety of genres such as personal portraits, record covers, music videos, advertising, reportage, exhibition and documentary photography as well as books. She has worked and photographed environments and individuals around the world, and through her close and direct imagery over the years, has made for herself a strong name both as a photographer and a filmmaker. She lives in Björkhagen, Stockholm.

MONICA BILLGER
Monica Billger is a full Professor in Architecture and Visualization at Chalmers and director for Visu-alization Research Center Gothenburg. She has a background in multi-disciplinary research on simu-lation of colour and light in three-dimensional spaces, with the objective to develop assessment techniques to compare physical spaces to virtual environments.

DELIA DUMITRESCU
Delia Dumitrescu is professor in textile design at the Swedish School of Textiles, University of Borås, Sweden. Her research focuses on the development of smart textiles aesthetics and design methods using practice-based research methodology. A central aspect of Delia's research is how the smart textile design knowledge and aesthetics can be expended to related design fields, e.g, fashion, interiors, and architecture with the aim to develop cross-disciplinary practices.

KARIN ENGLUND
Karin Englund is Project Manager at Färgfabriken, and has a background in cultural theory. She has led processes for several complex multidisciplinary cultural projects, often related to urban planning and architecture. In her role, she develops strategies for different forms of collaboration and ways for various fields of knowledge to meet and cooperate.

JOACHIM GRANIT
Joachim Granit trained at the Royal Academy of Fine Art in Stockholm. He is Creative Director at Färgfabriken, Center for Contemporary Art & Architecture. The centre's work is experimental and interdisciplinary. Granit's role is to create and provide conditions for new thinking, innovative ideas and unusual exhibition projects bringing together different perspectives and interests from art, architecture and social science. As an artist, he moves between different expressions; painting, video, sound art.

HANNA LANDIN
Hanna Landin is a senior lecturer in interaction design at the Swedish School of Textiles, University of Borås. In her work she explores aesthetics of interaction with regard to the design process, searching for a rich understanding of how we can design the way we live with digital systems and services.

PETER LJUNGSTRAND
Peter has a background as a hacker and maker and works within R&D in interaction design and related fields since 1997, at the University of Gothenburg, Chalmers, the Interactive Institute and RISE. His research interests are within innovation, exploring and understanding novel opportunities with new technology - technical as well as social, artistic, organizational and user-centered perspectives. In 2001, he co-founded and still teaches in the MA program in interaction design at Chalmers.

TABITA NILSSON
Tabita Nilsson is a fine woodworker by profession, educated at Stenebyskolan, and she also holds a Bachelor of Arts in Ethnology. After pursuing ten years with her own firm, mainly focusing on museum exhibitions, she has been teaching at Chalmers Architecture School since 2008. Based in the workshop, she teaches bachelor and master students as well as collaborating on several research projects

GUNNAR OLEDAL
"I see myself as a technology oriented designer. I've transitioned my focus the last few years towards physical computing, which I find very exciting. Being part of the development process from concept idea to a working prototype is so rewarding! With my background in music, I also love to work in the area where technology meets music, building new strange music instruments, or repurposing existing technology for a musical context."

CARMEN OLSSON
Carmen Olsson, dancer and choreographer with Swedish and Spanish heritage. From this background and with influences from Japan, she has formed a remarkable and personal expression. She calls it Mibudo. During the 1990's she studied Butoh in Japan. This, and her subsequent meeting with the performance art Noh-Kyogen have inspired her quest to constantly deepen her expression.

ANNA MARIA ORRÙ

Anna Maria Orrù works between biomimicry, artistic research and in curating performative research, providing alternate approaches to ecological architecture and design. She is based in Sweden and Italy and holds a PhD in Architecture/Artistic Research ('Wild Poethics' 2017). She is a senior lecturer at Konstfack University of Arts, Crafts & Design. In her spare time, she is a beekeeper and takes care of an olive grove.

FREDRIK TRELLA

"I believe in the ideals of the Renaissance, in the holistic approach to problem solving and creation, something requiring skills in many scientific disciplines, combined with an appreciation and interest in humanities, art and design. This, in combination with a great curiosity, have led me to explore a variety of different subjects: from embedded systems and electronics to filmmaking and artistic photography. As researcher and developer within interaction design I get to live out my curiosity in the intersection of different fields and explore the unknown."

MALGORZATA A. ZBOINSKA

Malgorzata A. Zboinska is a researcher at Chalmers University of Technology, with a PhD in digital architectural design and research positioned at the intersection of art, architecture and technology. In her previous studies, she explored the influence of digital techniques on architectural aesthetics and developed digital toolsets enhancing creativity. Her current work is focused on the creative and experiential aspects of digital design, including design aesthetics, artistic robotic fabrication and the material experience of architecture.

UTSTÄLLNINGSUTLÅTANDE

Unpredictable Flesh

Nya digitala hantverket, materialforskning och upplevelser i interaktiv arkitektur

Flesh anspelar på tjocklek. Som en arkitektonisk metafor utvidgar flesh begreppet yta till ett taktilt tredimensionellt ämne. I denna utställning, skapandet av flesh - som en ersättning av termen "skin", ofta överanvänd i arkitekturen - utforskas i mjuka gjutningar och böjliga formar gjorda av silikon som visuellt och taktilt engagerar besökaren att reflektera. De inbjuder till en dialog mellan betraktare och artefakt och föreslår nya kroppsliga kvalitéer i arkitektur.

Verken som visas är interaktiva hybrida artefakter, animerad grafik taktila exempel som har utvecklats i mötet mellan det mekaniska och det mänskliga i spännvidden mellan det precisa och oprecisa. Vad som kan verka som en förutsägbar process i den digitala världen är i verkligheten resultatet av flödande konstnärligt undersökande: arkitekten och forskaren Malgorzata A. Zboinska och hennes interdisciplinära team har utvidgat fältet för computational design innovation i sin forskning genom ett samskapande mellan det icke exakta och oförutsägbara hantverket och datorstyrda maskiner.

Sammantaget, ger dessa undersökningar röst både till materiell och digital teknik, vidgar besökarens uppfattning av yta samt utökar designerns potentiella användning av verktyg. Verken som föds ur dessa samverkansprocesser genererar här alternativa perspektiv till vad modern digital arkitektur skulle kunna vara.

Traditionellt ser vi teknologi som något som avlägsnar oss från det invärtes men här närmar vi oss kroppen. Teknologi används ofta som en protes för att få tillgång till något som är avlägset, osynligt, omärkbart, en förlängning av våra sinnen. Men i det här fallet finns en 1:1 relation mellan teknologin och oss själva, vi är medverkande i samma skala.

Därav, tre element har guidat gruppens konstnärliga process. Undersökning av materialets agenda, skapande av ett unikt estetiskt språk samt blandning av digital precision och manuellt hantverk. Och även om designen inte drivs av ett biologiskt ämne, abonnerar den likväl på ett organiskt utseende utvecklat i processen. Utställningen utforskar dessa försök genom fyra överlappande domäner: tillvägagångssätt, konstnärligt undersökande, förkroppsligat samband och gränssnitt mellan maskin och människa.

Sammantaget söker dessa verk förkroppsliga en bredare förståelse av arkitektoniskt flesh. De väcker frågor kring vilken typ av digitaliserade miljöer som kan uppstå i framtiden och driver på utvecklingen av den digitala arkitekturen genom att även inkludera konstnärliga och kroppsliga villkor. På så sätt bjuds vi

Translated by Linda Bergman

EXHIBITION STATEMENT

Unpredictable Flesh

Novel digital crafting, material research and encounters in interactive architecture

Flesh implies thickness. As an architectural metaphor, the notion of flesh can extend surfaces into tactile, three-dimensional matter. In this exhibition, the making of flesh – as a replacement for the term "skin," often overused - is explored in pliable casts and moulds from silicone that engage the visitor and provoke a response. Inviting a dialogue between observer and artefact, they propose new corporeal qualities in architecture.

These interactive pieces, hybrid artefacts, films and tactile samples have been developed through the encounter between mechanical and human, precision and imprecision. What appears to be a highly predictable process is in fact the result of fluid artistic investigation: architect and researcher Malgorzata A. Zboinska and her interdisciplinary team have extended the field of computational innovation by introducing imprecision, unpredictability, craft and co-creation with machines into their research. Seen together, these explorations give voice to both material and digital techniques, broadening the visitor's conception of surfaces as well as expanding the designers' potential use of tools. The artefacts on display arise from collaborative making, thus generating an alternative perspective on what contemporary digital architecture could become.

Traditionally, we see technology as something that moves us away from the visceral but here, we move closer to the body. Technology is often used as a prothesis to gain access to something that is remote, invisible, impalpable, a prolongation of our senses. But in this case, there is a 1:1 relationship between the technology and ourselves, and we are collaborators on the same scale.

Hence, three elements have guided the team's artistic process: an investigation of the material's agency, the emergence of a unique aesthetic language, and the merging of digital precision with manual craftsmanship. And although the design is not driven by biological matter, it nonetheless subscribes to an organic appearance that evolves in the process. This exhibition explores these efforts through four overlapping domains: modes of making, artistic investigation, embodied contact, and interface between machine and human.

Collectively, these works seek to embody a wider understanding of architectural flesh. They speculate on the kind of digitalized environments that could emerge and push the realm of digital architecture by including artistic and corporeal conditions. In so doing, they invite us to reflect on the future

Anna Maria Orrù - Curator

FOOTNOTES

INTRODUCTION - Unpredictable Flesh

1 See project team for full listing (See page 48).

2 The project has been supported by The Swedish Research Council – Vetenskapsrådet - and their journey began in 2016. The funding comes from an artistic research grant awarded to Malgorzata A. Zboinska.

3 Our cutaneous senses are the senses related to or affecting the skin.

4 See http://thenewbridgeproject.com/portfolio/experimental-architecture-group/

ARCHITECTURAL CONVERTIBLES - Designing, Expressing and Materializing New Flesh

1 'Convoluted flesh' is defined in an article of the same title by Marcos Cruz and Marjan Colletti (Cruz & Colletti 2008, p. 38): "The concept of Convoluted Flesh, [...] entails an organic spatial and strategic vision that includes the significance of atmospherics and bodily experience in conjunction with the designer's technological and poetic awareness. Simultaneously, the understanding of 'flesh' in architectural terms stands in opposition to the common, yet reductive, metaphor of skin as a flat and thin membrane that denies the virtue of inhabitable thick walls. [...] the aim of Convoluted Flesh [...] is to stress the urgency of a thick embodied flesh that encompasses new ornamental, sensual and corporeal qualities in architecture."

2 'Skin' as an extended concept is discussed in a book "*Skin*" by Ellen Lupton (Lupton & Tobias 2002, p. 29), in the following way: "Skin is a multilayered, multipurpose organ that shifts from thick to thin, tight to loose, lubricated to dry, across the landscape of the body. Skin, a knowledge-gathering device, responds to heat and cold, pleasure and pain. It lacks definitive boundaries, flowing continuously from the exposed surfaces of the body to its internal cavities. It is both living and dead, a self-repairing, self-replacing material whose exterior is senseless and inert while its inner layers are flush with nerves, glands, and capillaries. Contemporary designers approach the surfaces of products and buildings as similarly complex, ambiguous forms. Manufactured skins are richly responsive substances that modulate the meaning, function, and dimension of things."

CONCLUSION - The Future of Living in Interactive Environments

1 The vision of architecture designed with multisensory perception in mind is argued for in a book "*The Eyes of the Skin: Architecture and the Senses*" (Pallasmaa 1996).

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UNPREDICTABLE FLESH

2

Edited by Anna Maria Orrù and Malgorzata A. Zboinska

WALK THROUGH

The following pages guide you through the displayed artefacts in the exhibition *Unpredictable Flesh*. Their sequencing is derived using the four overlapping domains for the show; embodied contact, interface between machine and human, modes of making, and artistic investigation. Welcome to walk through.

Future visions for Flesh

The displayed Flesh artefacts, samples and demonstrations represent the imaginings of complete interior and exterior building elements. They shall become tactile, bulky, deformable walls, floors, pillars and ceilings of buildings. They shall become soft facades, cushioning urban screens and adaptable furnishings within the future city landscape.

The visions for these structures convey the emergence of a new typology of architectural elements - material entities for sensing and communication, mediating dialogues with digital devices in an unprecedented way – marked by visual, bodily and multisensory communication. This implies novel encounters with digitalized materials that sustain, enrich and humanize our experience of living in places surrounded by technology. By touching this new substance in different ways - using your hand, your different body parts and different pressures - you will be able to send signals to a building's core, informing it of your needs. The building will then respond back. It will alter its spatial enfoldments to accommodate, protect and shelter your body; it will shrink or enlarge its space; it will warm up its surfaces; it will filter the incoming light; it will change from transparent to opaque; it will alter its colouration – all in the way you need and desire.

In such a vision, architecture is not yet another data-gathering device. Instead, it becomes a highly personalized part of your living ecosystem; one that actively sustains thriving, dwelling and well-being in the new urban setting of ubiquitous computing. It entails tomorrow's slow-tech, human-centred architecture to combine unconventional means of artistic expression with cutting-edge technologies.

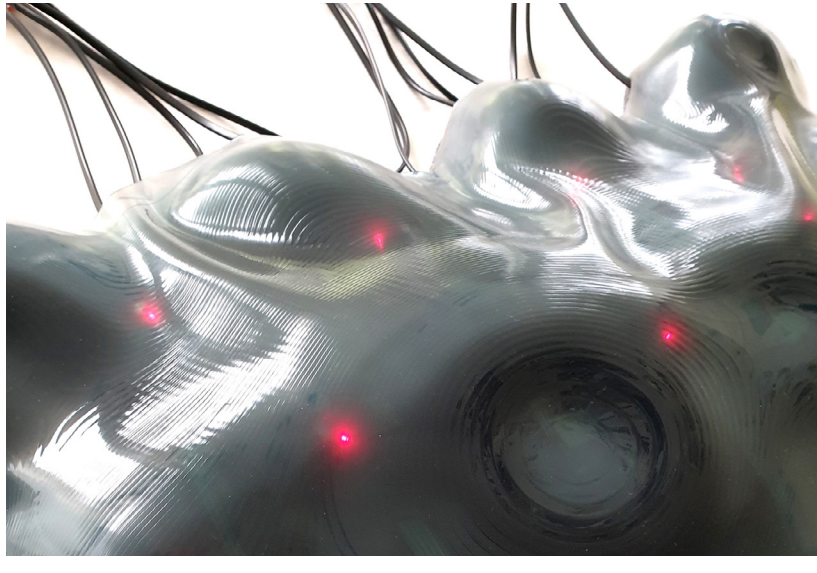
Texts: Malgorzata A. Zboinska
Photos: Tina Axelsson (p.8-23), Malgorzata A. Zboinska (p.4-7, 24-25)

PLIANT FLESH

This semi-firm architectural body envelops two layers of flesh-like membranes and a network of electronic devices. It embodies a new typology of an architectural interface - a composite substance consisting of the material and the digital, conversing with people through tactile contact. The piece exemplifies how it would feel to encounter an architectural object made from a hybrid combination of materials.

2017-2019
Delia Dumitrescu, Karin Hedlund, Hanna Landin,
Pablo Miranda Carranza, Malgorzata A. Zboinska

Visuo-tactile interface, hybrid materiality, sensation of form, pliability

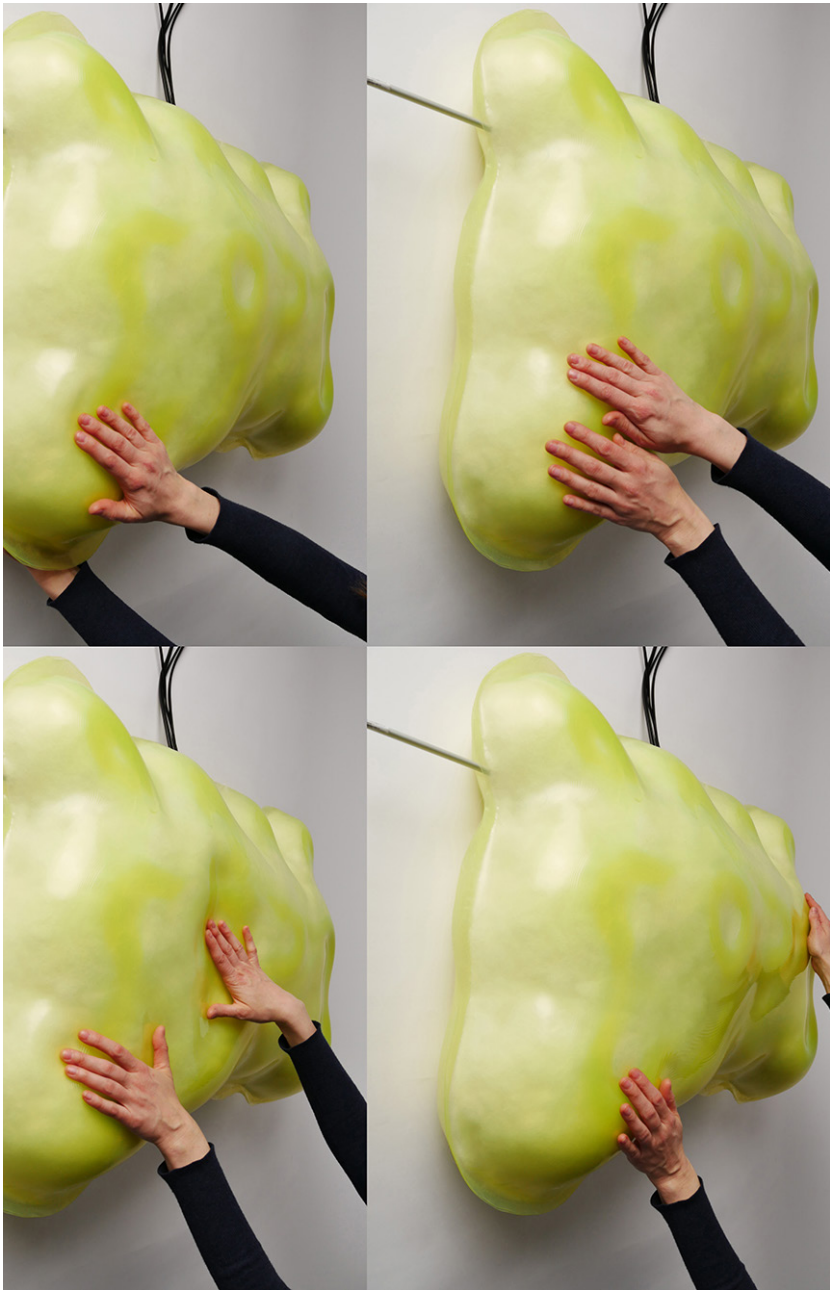


SOFT BODY

This architectural body is a soft bulky bowel with electronic devices encapsulated within its inner filling. Here, technology is hidden from sight but not from touch. The encounter of a soft, highly responsive material extends the conventional experience of architecture and digital devices. It demonstrates how it could be to sense electronic architecture with a strong material presence and a highly corporeal connotation.

2018-2019
Delia Dumitrescu, Karin Hedlund, Hanna Landin, Erik Landmark, Peter Ljungstrand, Gunnar Oledal, Fredrik Trella, Malgorzata A. Zboinska

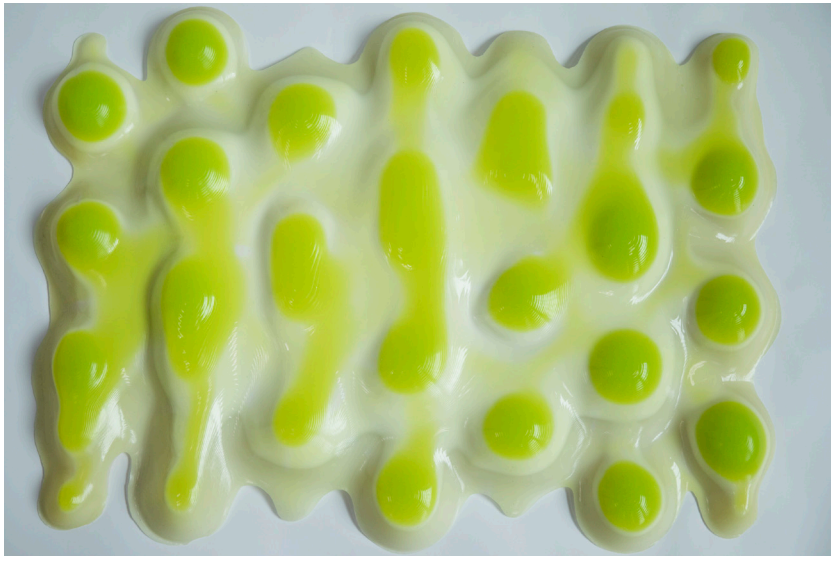
Visuo-tactile interface, vibrational communication, material sensation



ERRONEOUS FLESH

These thick silicone membranes illustrate the exploration of flesh depth by manipulations of colour depth perception. We developed three different colouring strategies for the silicone layers in the membranes. In the first strategy, the cast layers proceeded from transparent and colourless towards increasing amounts of blue and green pigments. In the second strategy, the casting progressed from pigmented but transparent layers towards opaque, milky ones, all with the same chartreuse hue. In the third strategy, the pigmenting followed the progression of colour types by graded transition from primary, secondary and tertiary back to secondary and primary colour palettes. In the membranes, all these different colour strategies are visible upon viewing at an angle. When viewed frontally, however, they overlap and blend, changing the perception of form, geometry and its depth.

2018-2019
Delia Dumitrescu, Karin Hedlund, Malgorzata A. Zboinska
Artistic robotics, deliberate computational imprecision, fabrication errors as aesthetic traits / Explorations: Depth of colour, depth of flesh, colours



HAPTIC FLESH

Here, we explored how colour can be used to shape the tactile perception of three-dimensional form. We chose a specific combination of colours with varying translucencies for the silicone mass that we cast into a geometrically expressive robotic mould. Our piece reveals how tactile expectations towards such a geometrical form can be challenged using colour: a form that seems visually soft can be surprisingly different upon actual touch.

2018
Delia Dumitrescu, Karin Hedlund, Hanna Landin, Malgorzata A. Zboinska

Visuo-tactile interface, colour, perception of form, altered sensations

HYDROUS FLESH

Here, we explore the aesthetic aspects of robotic moulding in casting instances. We sought to understand how this technique could add new artistic features to the silicone flesh. We used an industrial robot arm to shape a flat polymer sheet into a double-curved geometry that expressed a softly undulating flesh body. During shaping, this geometry was deformed due to internal strains caused by the sculpting. Some areas sank while others were pushed upwards, generating new convexities and concavities. The mould's surface was marked by curves delineating the paths of the forming tool. The resulting form acquired a soft, rounded boundary that changed the edge condition between its halves. Such transformations introduce new aesthetic qualities to silicone casting as it accumulates thickly around convex regions and thins out in concave areas. This causes transitions of colour intensity and translucency in the cast's form, underlining its curvilinearity, bulk and spatiality.

2018-2019
Karin Hedlund, Malgorzata A. Zboinska
Robotic forming, architectural moulds, aesthetic features, machine traces

BULBOUS FLESH

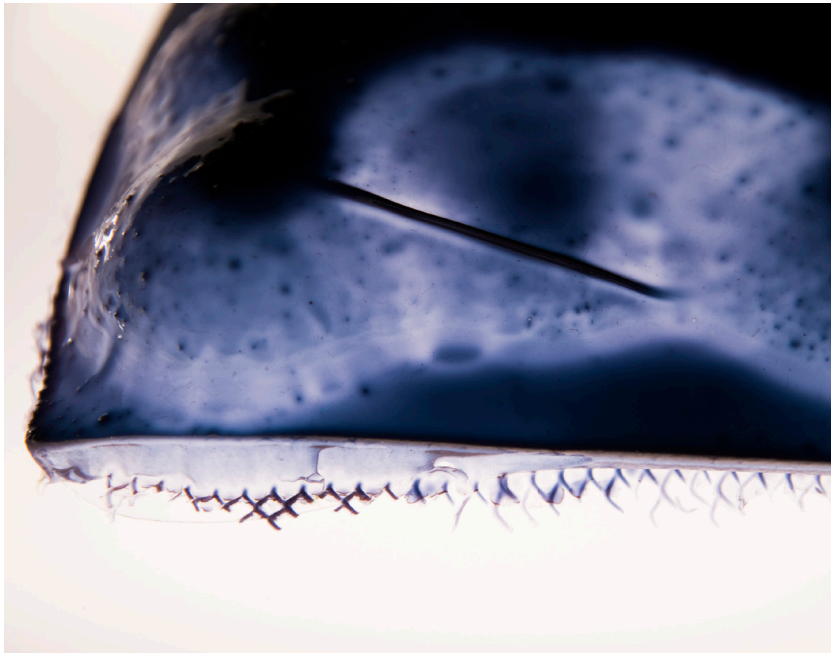
This exploration builds on the 'Hydrous flesh' in a new geometrical direction. Using the same principle of digital form generation, we created a bulbous form with a higher density of undulations and intense curvaceousness. Again, our goal was to discover how aesthetic attributes are affected if robotic forming is used as a materialization method, but the geometry was deformed in another way. Here, the entire bulbous form was bent outwards in both curved directions, as if inflated from within. The inner areas of the geometry became twisted and displaced along some curvatures, which caused small ridges and valleys to emerge but had not been part of the original design. Together with the new bulbous form, these geometrical transformations introduced yet another set of possibilities for expressing the flesh' materiality. Silicone could be cast into the mould in layers of thick colour with varying translucencies, and its thickness followed local mould deformations, underlining the form's spatial expressiveness and generosity, giving the flesh its necessary depth.

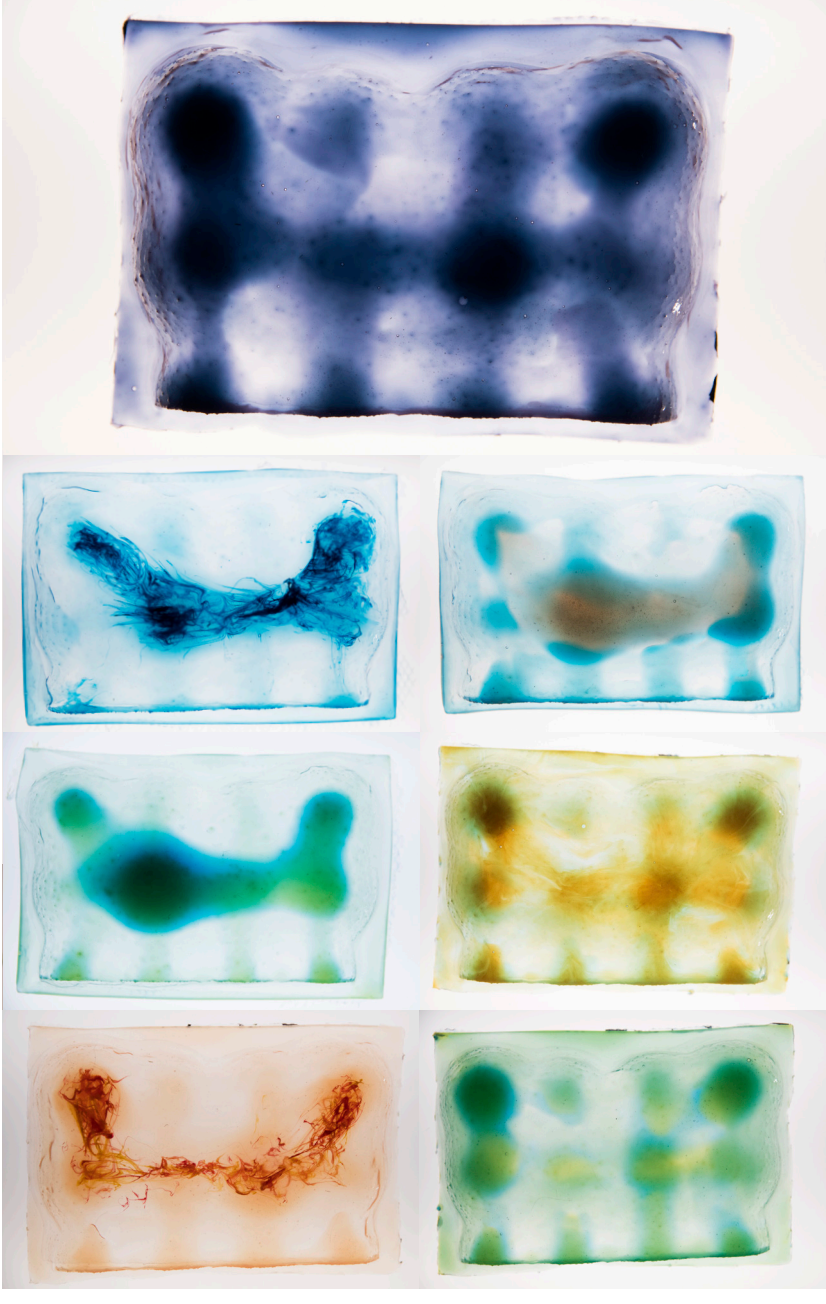
2018-2019
Karin Hedlund, Malgorzata A. Zboinska
Robotic forming, architectural moulds, aesthetic features, machine traces

COLOUR AND FORM

Here we explored how colours affect the spatiality of three-dimensional form. Silicone was pigmented with primary, secondary and tertiary colours, then cast in layers in various orders and combinations. Pigment patterns were also created within the silicone mass. The created silicone casts were then put together to form singular volumes representing the flesh. The aim of these explorations was to study how a spatial form's perception of depth is changed by different juxtapositions of transparent colours, various light sources and diverse illumination angles. Transparency has also been a theme, as were the reflections between surfaces, and the play with sensation of light and shadow, where surfaces on which light fell on acted as filters. Finally, our explorations were steered by contrasting effects of different kinds, such as the contrast between light and dark, and between cold and warm.

2019
Eva Amborg, Monica Billger, Malgorzata A. Zboinska
Hue, light, geometry, colour compositions, three-dimensionality

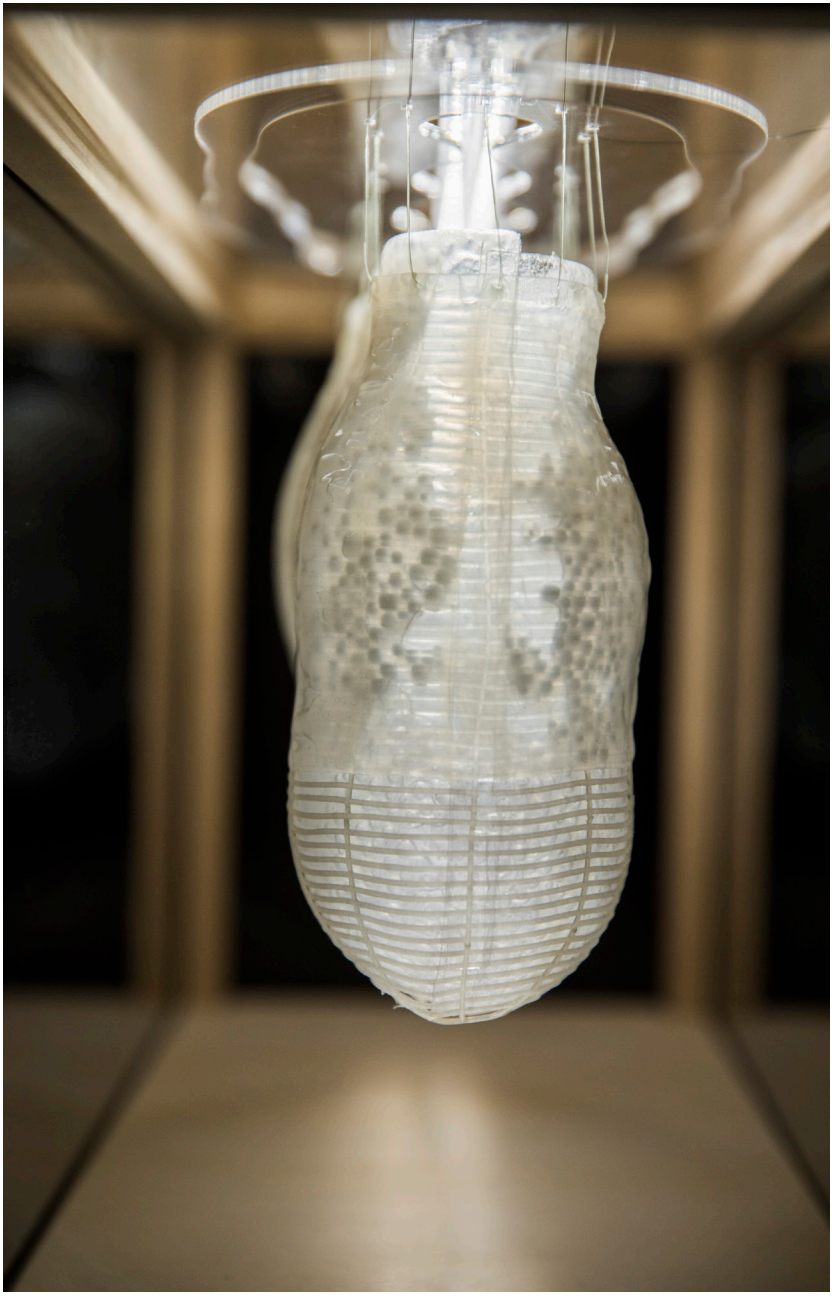


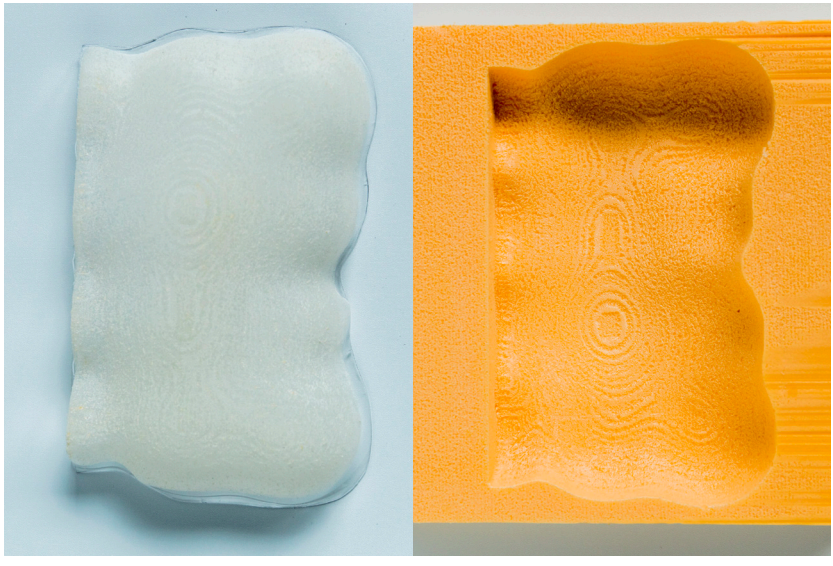


HYBRID CORPUSCLE

This piece is one of the first materializations of the new flesh explorations. It arose from a combination of digital procedures and handicraft. 3D printing of pliable materials, computer-driven milling and vacuum thermoforming were accompanied by manual crafting of materials in both fluid and solid states. What emerged is a bulky architectural volume embodied through a layered combination of materials that exhibit varying physical, optical, textural and geometrical properties. The outermost layer is transparent and plasma-like, with a smooth texture that reveals itself upon viewing. The middle layer is formed by a delicate network of translucent flexible bands. The innermost layer of the flesh is given the bulkiest, heaviest and thickest form. Illuminated, the body reveals its heterogeneous material composition with dispersed particles in the upper part and lighter, aerated materiality in the lower part.

2017
Delia Dumitrescu, Malgorzata A. Zboinska
Bulk, geometry, hybrid material composition

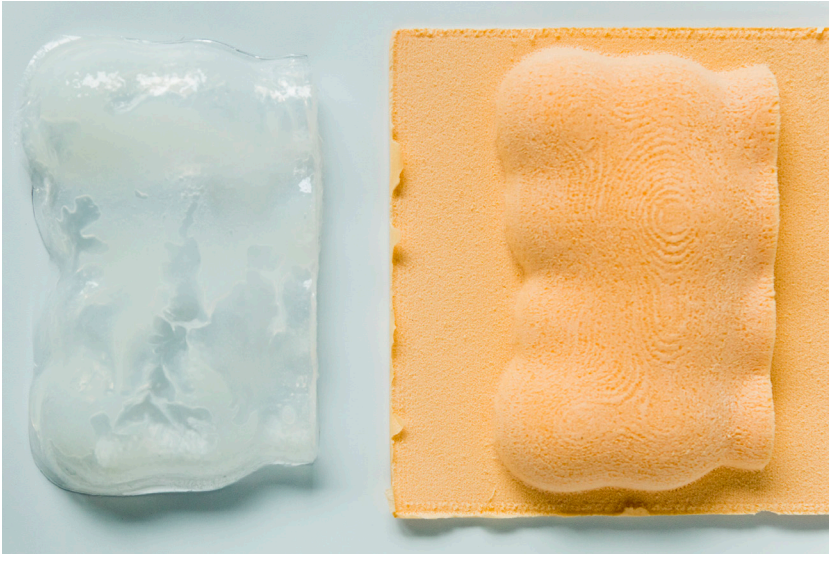




TEXTURED FLESH

These pieces exemplify the potential of a mould to shape unique aesthetic flesh features that are cast from it. Here the mould is fabricated using a digital milling machine. This method of mould creation left toolpath traces in the most flat areas of the mould's surface. The shape of the tool, when in contact with the soft highly porous material, endowed the mould with a rough surface finish. That finish was further affected through sanding done by hand, which reduced the surface rough-ness but did not erase it completely. Ultimately, the intricate features of the mould, resulting from material properties, machine processing and crafting by hand became collectively translated onto the silicone flesh cast. This indicates the potential of this specific process of blended digital and manual crafting to generate expressive features not present in the initial design.

2017
Delia Dumitrescu, Malgorzata A. Zboinska
Mould mediacy, surface texturing, machine traces



DEEPENED FLESH

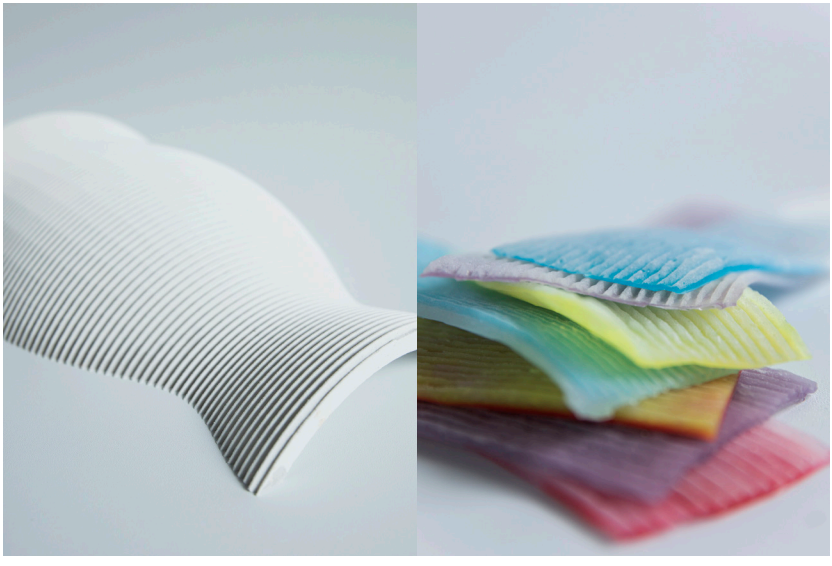
These pieces exemplify a hybrid crafting approach to explore new aesthetic flesh features. Here, two polymer moulds were produced mechanically through vacuum thermoforming using digitally milled polystyrene dyes. The two techniques that produced the final moulds introduced the first set of features. They caused the rough texture from the polystyrene dye to be acquired imprecisely by the polymer mould. It became sharply defined only in the roughest points of the polystyrene underlay, while the rest of the mould surface achieved a smoother bumpy texture. These features translated directly onto the silicone cast. Furthermore, during the process of manual material casting, the two polymer moulds parted, causing the air to enter the coagulating silicone solution. This disrupted its compactness and yielded a number of spontaneously distributed air bladders. Owing to this method, the resultant flesh acquires unique features of texturing, spatiality and depth.

2017
Delia Dumitrescu, Malgorzata A. Zboinska
Hybrid crafting, material depth

BODY AND BULK

These pieces illustrate a variety ways of expressing Flesh as a thick, bulky, and voluminous substance. Here, we combined silicone with other materials, such as polystyrene pellets, to create material compositions that would convey bulk. We also developed craft-based moulding strategies underlining thickness, including 'dispersed moulding' in which removable elements are inserted into the silicone mass to emphasize its capacity to vary in cross-section and in depth.

2018
Delia Dumitrescu, Malgorzata A. Zboinska
Thickness, bulk, volume, substance, spatiality, corporeality



LAYERED FLESH

Here we examined the process of digital crafting, combining the precise with the imprecise. Using an accurate 3D printed dye, we created an imprinted mould from alginate with in-mass imperfections. Through this, the less precise surface qualities of the alginate and the perfect outlines of the 3D printed dye were blended. The silicone casts made from this mould encapsulate the traces of this blending into a unique material expression marked by perfectly even patterning and intricately imperfect texturing and cross-sectional colouration.

2018
Delia Dumitrescu, Malgorzata A. Zboinska
Mould, imprint, textural imperfections, colour layers, material cross-section

MOULD, COLOUR AND TEXTURE

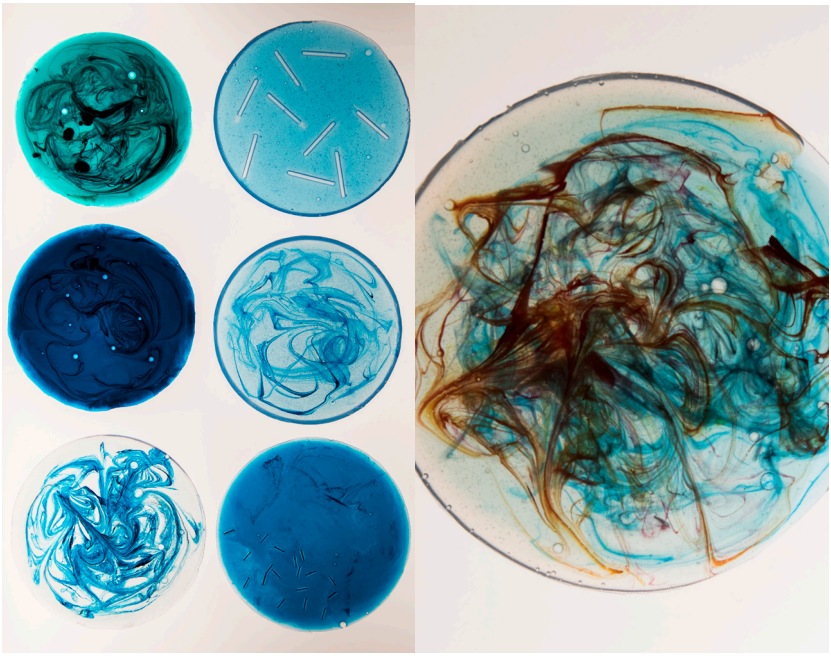
These early samples explore silicone as a design material. Here, a thick silicone coating was applied on knitted textiles to provide enhanced tactility. Other experiments embraced knitting three-dimensional textiles, placing them in a 3D printed moulds, and applying the silicone. The aim of these explorations was to investigate how the expression of the knitted structure and the fine lineage of the mould could interact. Finally, imprint moulds were also explored in order to investigate different methods for creating colour mixtures and interactions with the mould's texture.

2017
Delia Dumitrescu
Mould, colour, texture, early-stage experiments

SILICONE, COLOUR AND LIGHT

This artistic inquiry intuitively explored the fundamental properties of translucent pigmented silicone as a material that is able to carry light and create depth. Herein, different pigments were stirred into the silicone mass to make it appear three-dimensional. Additionally, for a few selected samples, beads, fibre optics and other objects were implanted into the mass to carry light and promote the intention of giving thickness.

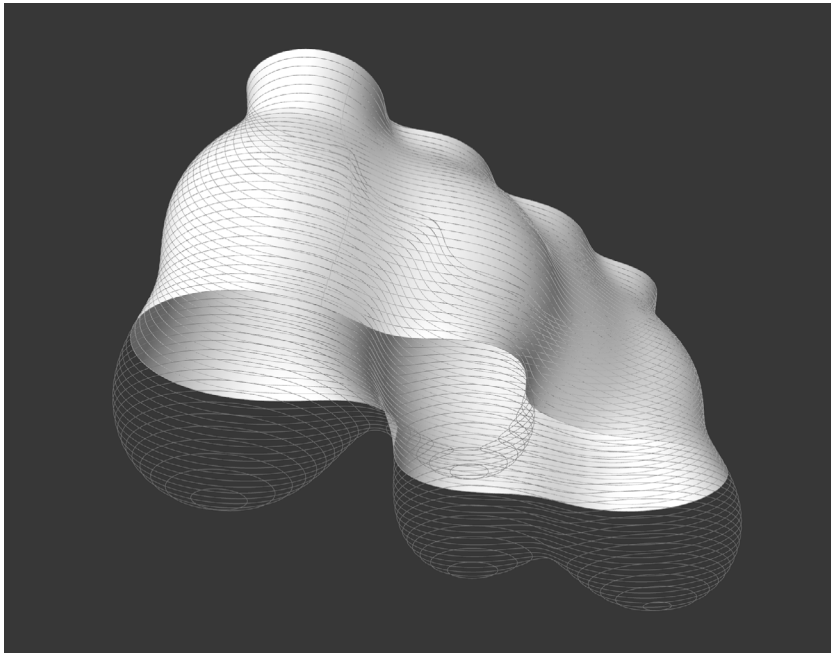
2019
Eva Amborg, Malgorzata A. Zboinska
Carriers of depth, carriers of colour, carriers of light

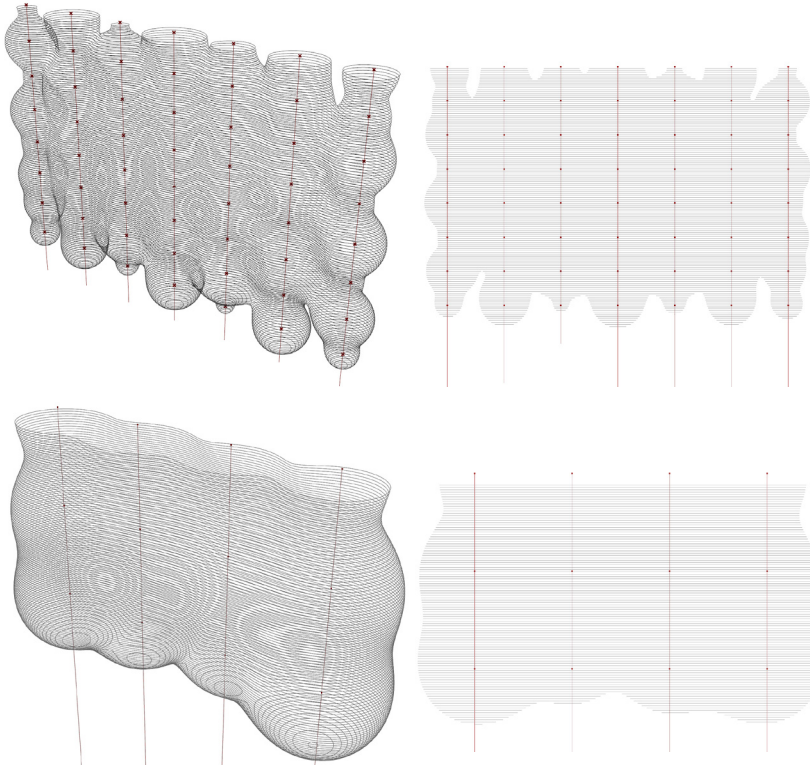


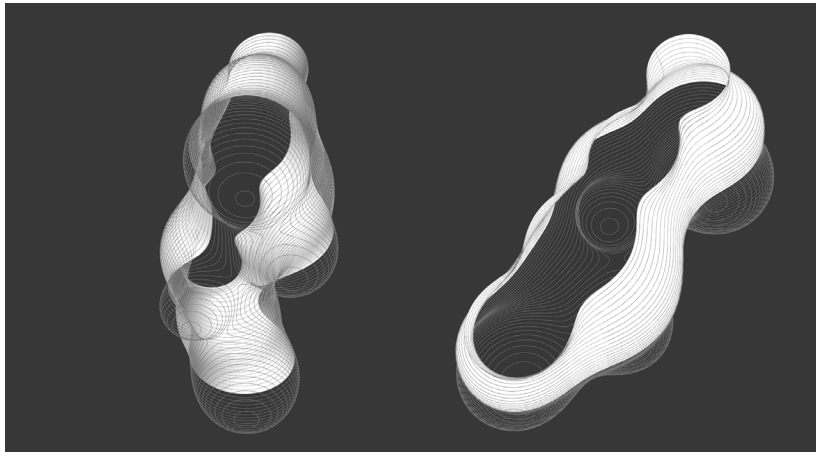
FLESH: COHESIVE, BLOATED, ELASTIC

These graphics capture the first attempts to characterize the spatial, architectural and tangible attributes of the new flesh using digital medium. These explorations were inspired by envisioning flesh as something pliable and animate, a bulky substance that is prone to deformation. As a result, animation-based modelling was chosen to intuitively explore deformations of digital matter using three interventions: stretching-shrinking, inflation-deflation and elastic deformation. This process yielded three flesh instantiations: cohesive, bloated and elastic.

2017
Malgorzata A. Zboinska
Visions of flesh, digital geometry, animate forms







Carmen Olsson's performance at the opening of the exhibition is a contemplation on 'Unpredictable Flesh'. This text is a preamble for the choreoraphy.

FLESH BEING

Being - in the flesh

The body is a tool. But that is not all.

The body is a medium between the outer and the inner.

It is the temple of our senses, a place where we need to be at home.

Through the body we can feel, we can smell, taste, hear and see.

It gives us the ability to learn about what surrounds us,

to relate and to collaborate.

Should we wait or keep on moving.

The mind, the imagination can leave the body,

but we need to come back again and again.

Carmen Olsson - Choreographer