

Aarhus School of Architecture // Design School Kolding // Royal Danish Academy

FORSKI!

Peder Pedersen, Claus; Bundgaard, Charlotte

Publication date:
2018

Document Version:
Publisher's PDF, also known as Version of record

Document License:
Unspecified

[Link to publication](#)

Citation for published version (APA):
Peder Pedersen, C., & Bundgaard, C. (Eds.) (2018). *FORSKI! When Architects Research*. Arkitektskolen Aarhus.

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal ?

Take down policy

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.





When architects research



Professor Johan Verbeke was head of The PhD School from 2013 to 17 as a professor of research by design. He played a pivotal role in the development of the PhD education of the school, which also benefitted from his extensive international networks. He also initiated the FORSK! exhibition. Johan passed away in the summer of 2017 and was not able to experience the exhibition, which we have developed in his spirit. The exhibition is dedicated to his efforts and his memory.

Content	4
Essays	6
Charlotte Bundgaard	7
Preface	
Claus Peder Pedersen	10
Research through architecture	
Researchers	16
Biographies	57
Colophon	65

Anders Kruse Aagaard

Anne Mette Boye

Polina Chebotareva

Elizabeth Donovan

Jon Krähling Engholt

Udo Garritzmann

Angela Gigliotti

Karianne Halse

Rasmus Hjortshøj

Masha Hupalo

Gitte Juul

Mo Michelsen Stochholm Krag

Maya Lahmy

Niels Martin Larsen

Mathias Meldgaard

Espen Lunde Nielsen

Siv Helene Stangeland

Asbjørn Søndergaard

Katrina Marstrand Wiberg

Essays

Preface

FORSK! The title of this exhibition should be seen as an exclamation, an appeal, a statement, an encouragement, or invitation — to research! For research creates knowledge, it inspires, it is relevant to society, and it helps our discipline move forward. This exhibition focuses on current and recently completed research work by PhD fellows from Aarhus School of Architecture — and particularly on research by design as a research method.

The exhibition presents a diverse field of research, and the physical appearance of the exhibition is like a landscape where the visitor can move from place to place — between, through and along the islands and spaces of the exhibition. PhD fellows have populated the landscape of the exhibition with models, drawings, films, texts, objects, and prototypes. They are the new generation of researchers, and they are an important part of the research environment of Aarhus School of Architecture. The PhDs are active in the school's three research labs. They collaborate with senior researchers, publish their own research through recognised publishing channels, experiment in our workshop facilities, and bring their knowledge and expertise into play in courses for the school's students.

The exhibition spans two events. One is CA²RE — the Conference for Artistic and Architectural (Doctoral) Research, an international conference which brings together young and experienced researchers from many nations. The other, The Danish Science Festival, is an annually recurring nationwide science festival which communicates research to the public. This scope is indicative of the school's ambition to strengthen and develop our research in dialogue with the academic community and also open up and share knowledge for the benefit of the discipline and the society we live in.

Keeping in mind Aarhus School of Architecture's motto Engaging through Architecture, we constantly seek to reflect on and respond to the social challenges we face. Research gives us valuable insights and helps us develop and generate the knowledge we need to influence the world. However, to make this possible we have to cooperate with others. This is why we want to strengthen external research collaborations that involve other research institutions, architectural practice, municipalities, the construction industry, and other disciplines. The PhD projects exhibited at *FORSK!* exemplify this.

In our efforts to strengthen architectural research, we do not adhere to one single approach or method, but try to maintain a breadth of scope. We quite deliberately work with a broad concept of research that ranges from scientifically founded research over research by design to artistic development work. In research by design, the architectural design process shapes the very way we create new insights, knowledge, practices, or products. Critical questions are raised through design work. Through its focus on research

by design, the school emphasises the development of research that is in close dialogue with design methods, tools, and the processes of the discipline. It's all about using the methods of the architectural discipline, creating awareness by working directly and physically with the subject matter, initiating experiments that explore, develop, and challenge. The research by design field is constantly evolving, and we are not alone in discussing methods, relevance and criteria. We engage in close dialogue with other research institutions; research institutions that also focus on strengthening research by design and artistic-based research. We cooperate with a European network, and the CA²RE conference brings together parts of this network for three days of intense presentations, exhibitions, and discussions of research projects — particularly within research by design. But the conference is also open to a broader range of approaches to research.

Our special emphasis on research by design as a research methodology allows us to bridge the gap to practice. Reflective project development creates a common resonance between research and practice. Several of the exhibited projects focus on architectural practice — either forms of practice as a subject for research topics or practice as a knowledge partner in research partnerships. Some of the projects exhibited here are part of an EU-funded programme called ADAPT-r (Architecture, Design and Art Practice Training-research); a programme focusing on developing new knowledge about the processes and mechanisms that drive innovative, creative practices.

At the exhibition, researchers arrange events, debates, seminars, and round table discussions with guests from municipalities, architectural offices, knowledge institutions, and the political world. The purpose of this is to elucidate research issues from several sides, exchange experience, and start debates. Several events of The Danish Science Festival will be directly aimed at the public. At these events, researchers invite anyone who is interested to demonstrations and give them an inside view of the projects. These meetings between researchers, stakeholders and the broad public will further the dissemination of research, make it the subject of discussions, and bring in new dimensions.

We hope this exhibition will attract attention and communicate the many facets of PhD research in an inspiring way.

We invite you to explore the exhibition, talk with the researchers, experience the diversity, the seriousness, the courage, and the great knowledge it represents.

Enjoy the exhibition!

Research through architecture

Knowledge production is becoming increasingly important for the development of society. This, of course, also applies to architecture. Planning, designing and building have become more complex. More interested parties and fields of knowledge need to be involved; multidisciplinary is increasing, and there are more requirements we have to meet. Architects are faced with greater expectations for being able to argue for their proposals systematically and make probable the effects of these proposals. This development challenges architecture as a profession and discipline. It has also given research a more central role than in the past. Larger practices are setting up research units, and new research-based and specialised practices emerge in areas such as sustainability and IT. This increased attention on the knowledge foundation of architecture has expanded the conceptual foundation of architectural research. In recent decades, the most important academic discussions in the field of research focused on the production of knowledge that occurs in design and project development processes. Discussions centred on whether — and if so, how — this knowledge can be qualified as research and how research results can be documented and quality assured. These discussions still continue today, and we are still a long way from agreeing on methodological approaches and quality criteria. Nevertheless, a design and practice-based research field has by now consolidated itself within architecture.

Aarhus School of Architecture has followed this trend. And there has been a long-standing interest in design-driven research at the school. In fact, the first licentiate project to be enrolled in the school's newly created researcher training programme, in 1988, was design driven. The project was based on a concrete product development process in collaboration with a business partner. A cross-disciplinary team comprising both academic and design professional skills supervised the project design and ensured the balance between professional relevance and research-related depth. Since then, several PhD projects have involved design and project development in the research process. And in many ways design-driven research fits naturally in the school's academy-based teaching model, which gives a high priority to design and project development carried out in close contact with architectural practice.

FORSK! takes stock of today's researcher training programme at Aarhus School of Architecture. This is the first time the school organizes an exhibition that comprises all the projects of our PhDs. The exhibition is an opportunity for us to show the spatial, tactile and material aspects of our research. It contains physical investigations and experiments and provides an insight into how visualisations, material experiments and spatial arrangements become part of knowledge production — across very diverse research questions. The PhD projects fall within the school's prioritised focus areas: transformation,

habitation, sustainability and digitalisation. Within this thematic framework, some projects focus on current societal challenges, such as climate adaptation, sustainability, and the periphery of Denmark. Other projects look inwards at architecture as a discipline, exploring and challenging architectural knowledge about spaces, combinations of materials, and working methods. The range of methods is also very broad. Architectural research, like architecture, comes into contact with many subject areas and fields of knowledge and draws on research traditions and methods from technical, socio-scientific and humanistic research. These differences can be seen in the PhD students' individual contributions to the catalogue. In this text I will, therefore, instead try to identify a few characteristic approaches to design and practice-based research across the projects.

Several PhD students use architectural tools and techniques in their research. Their approach is not unlike the way architects work on new assignments. The PhD students register, draw and map. Information and observations are organized visually, and as the material accumulates, patterns and structures emerge that make possible the reading of new contexts and possibilities.

This is the way Anne Mette Boye works when she explores the remaining industrial areas of the welfare state. Her theory is that these urban areas represent an overlooked resource. Or, to put it more precisely, that this resource has already been discovered by local associations and business owners who have taken over the areas, while it has been less visible to the planning authorities who only see derelict monofunctional areas. Anne Mette walks through the areas. She records activities and maps the variety and diversity of the areas. Her purpose, unlike that of the practicing architect, is not to create a plan or a project for the areas, but to clarify developments that were until now hidden and make them accessible for a more well-considered assessment. This holds a critical dimension for research: what aspects of our current ways of understanding and working with the city prevent us from understanding these options? And how do we prevent the increased awareness of the areas from leading to the gentrification of yet another area of the city? But it also holds a constructive dimension that points to further development of the areas in dialogue with current theories of urban transformation.

Katrina Wiberg works with comparable mapping techniques. She examines the necessary climate adaptations of towns that result from increased precipitation caused by climate change. She maps 'The Wet City', which is concealed behind place names, contour maps and watersheds. By visualizing and comparing this commonly available information, it is possible to evoke features of the city that were obscured by the drainage and laying of

sewers of industrialism, but which have once again become topical due to increased rainfall. Katrina not only examines urban and geological conditions. She is also aware of how responsibility for the planning of the invisible 'Wet City' falls between the fields of responsibility of different authorities. This is why her research also focuses on planning and decision making, and on how we can create processes across stakeholders that make climate adaptation a resource for new public spaces.

Anne Mette and Katrina use architectural working methods in an analytical way. Other PhD students give more room to the aesthetic and artistic dimensions of the architectural profession in the research process. Rasmus Hjortshøj has based his project on theories about the Anthropocene in his exploration of habitation along the Danish coasts. He also works with mapping, but his starting point is primarily his photographic practice. He uses the camera as a tool for exploring Danish coasts and coastal cities. The cumulative overview provided by a map and photographic snapshots of the landscape sheds light on the area he explores in various ways that involve aesthetic choices about subjects, point of view and cropping. The photo also plays a major role in Espen Lunde Nielsen's research into everyday informal spaces such as stairways, the laundry, or the fast-food place. He explores the role of these neglected spaces in social coexistence and exchanges. As part of this research practice, he designs and constructs appliances that record and document spaces. This may be a door spy camera or a hot-dog stand surveillance camera that records and prints an image on a thermal strip every time a customer makes a purchase. The meticulously crafted apparatus acquire the nature of independent works of art and form part of a critical practice that looks for alternatives to the plans of architects.

Maya Lahmy, Anders Kruse Aagaard, Asbjørn Søndergaard and Jon Krähling Engholt all in different ways work hands-on with digital design tools and fabrication methods in architecture. They explore how technological development can support new forms of construction, material expression and design processes. Maya focuses on the digital design process, exploring the digital drawing as a creative and reflective media. Anders engages with the exchange between digitally based design processes and digitally controlled production, focusing on how the processing of materials can be integrated in design processes at an earlier stage than today. Jon examines how the unpredictability of concrete casting processes can lead to new aesthetic modes of expression through precision-controlled digital production. Asbjørn's research focuses on the challenge of realizing complex so-called topology-optimized structures by means of robotics technology. The research of the four PhD fellows hinges on hands-on experiments. The realization of these exper-

iments is not just the trivial implementation of theoretical knowledge. Experience from programming software, making machine settings, learning how the materials respond to being processed is an integral part of the knowledge development that cannot be thought before actually being carried out. It has to be experienced, developed and documented during the process as part of the research process. The projects work with an ideal design and fabrication process, in which the complex network of interested parties, functions, legal requirements and economics of building has been reduced to make possible an in-depth investigation of delimited research questions. The intention is to implement the new knowledge and the new skills in practice, as is the case with Odico Formworks, who use Asbjørn Søndergaard's research in the construction industry. But part of this research also points inwards, towards architecture as a discipline in a study of how digital technologies change conditions for thinking and developing architecture fundamentally.

A few PhD projects take design-based research away from Aarhus School of Architecture and instead work project-based in local environments. Mo Michelsen Stochholm Krag carries out research into the transformation of peripheral areas — more specifically, small urban communities in Thy. Communities where the architectural agenda is characterised by migration away from the area and decay rather than growth. Mo literally attacks houses scheduled to be demolished, cuts them up, leaving behind sculptural ruins. The ruins are an aesthetic response to current demolition practices, but they also provide a basis for dialogue with the local people, who are confronted with their local history through theatrical installations and citizen meetings. Mo takes back the citizens' reactions as well as actual biopsies from the demolished houses to the research project, where they become part of the dialogue with current theories on heritage. Mathias Meldgaard also works on specific development projects. He examines how small architectural interventions can be made into tools for rethinking tourism in Ringkøbing Skjern Municipality in interaction with the local community and everyday life of the permanent residents. Mathias' PhD is part of a larger research project funded by Innovation Fund Denmark. This means the project has funds, which allow him to realize small projects. They are initiated as an extension of temporary design interventions in the form of so-called provoscapes that create temporary possibilities of use, but which, first and foremost, seek to provoke a reaction from local residents that can provide a basis for the actual projects.

Whereas Mo and Mathias take their research out of the academic setting into a local context, other PhD projects place experience from practice into an academic context. Siv Helene Stangeland is a partner in the innovative Norwegian practice Helen & Hard. Her PhD was part of the EU-funded ADAPT-r

programme. (Architecture, Design and Art Practice Training–research). The focus of ADAPT–r is on developing knowledge about the processes and reflections that drive innovative creative practices. Siv’s research exposes the implicit knowledge which is embedded in the practice’s innovative processes and projects. Through a careful mapping of the projects of the practice, she uncovers design and decision–making processes. She also documents how the practice’s spatial organisation and interactions with the local environment are an important condition for work processes. The mappings are drawn by hand in Siv’s characteristic style. This also leads her to investigate and uncover her personal contribution to the way the practice works. The research process is not only retrospective. It is actively brought into play in the practice’s ongoing work, and reflections on how this affects the work of the practice becomes part of the research. Siv’s practice–driven research contributes to the profession’s knowledge by revealing best practice in a significant architectural practice, but it also helps develop further the specific practice by raising the awareness of actions which would otherwise remain unseen.

Angela Gigliotti examines how the Danish production of architecture has been organized since the introduction of the welfare state in the fifties. Her research is based on archival studies and interviews, and even though the research is aimed at architectural practice, it is not to begin with design based. Angela’s professional architectural competencies are however used to communicate her research. She has designed a physical archive, in which the extensive categorization of all architectural projects published in the Danish trade journal *Arkitekten* are communicated through 3800 individual index cards suspended from a steel structure. The archive gives the research a physical presence, as you are required to relate bodily to the many index cards. The spatial dissemination supports dialogue and exchanges among the visitors to the exhibition, and the deliberate aesthetic design of the archive contributes to the project also being communicated through online media and in specialist journals, which allows knowledge of her research to reach a wider professional audience.

The selected projects provide a glimpse of how wide the range of the ways architectural working methods are brought into play in design and practice–based research is. They are involved as analytical tools of study, they draw on aesthetic insights, they engage and provoke citizens to provide feedback and input to the research process, they derive from concrete experience gained by processing and shaping materials. They demonstrate an exchange between practice and academia, regardless whether knowledge from practice is developed into research, or working methods from the academic lab are disseminated to practice. The exhibition allows you to move across

these different approaches to research and experience the diversity of the projects. It is an important manifestation of the development Aarhus School of Architecture began in 2013, when the school created a professorship in research by design which included responsibility for The PhD School. This professorship was filled by Johan Verbeke. He provided fresh experience from having developed a design-based researcher training programme at Sint Lucas School of Architecture — now part of KU Leuven. He also contributed an extensive international network within architectural research and art research built up through his tireless involvement in many European networks and associations in the field. Johan gave The PhD School an international outlook and new directions and has left a permanent mark. He also initiated the FORSK! exhibition. Unfortunately Johan passed away suddenly in the summer of 2017 and was not able to experience the exhibition. The exhibition is dedicated to his efforts and his memory.

Researchers

Bespoke fragments

Material and virtuality

The use of digital fabrication tools opens up a new approach to materials in an architectural context. The knowledge and intentions of designs and drawings can become informed and specialised through the understanding of the fabrication processes and their interface with materials.

Architects can utilise the connection between digital drawing information and digital fabrication to engage directly with materials. Direct intervention with and continuous feedback from materials allow architects to explore them in new ways in relation to architectural production. New material possibilities create a foundation for the discovery of new aesthetics, tectonics and constructions. It is the claim that this fused space of digitality and reality, immateriality and materiality, can allow architects to access and unfold options and opportunities for design. The correlation between digital drawing and materials through fabrication can establish an unbroken, but highly susceptible, link between early experimentation, design and component development and potential final fabrication.

The research is focused on three different materials. The materials — concrete, wood and steel — are selected both because of their different characteristics and because of their direct relevance and connection to building and thereby to architecture. They are not novelties themselves, but they represent an assortment of materials that are bound to long traditions of processing, constructing and refining and at the same time still very present and prevailing in contemporary buildings. All three materials can be found in almost any building today and are impossible to ignore, no matter what agenda one might have, in the context of building construction.

The materials chosen are also rather different in the state in which they are usually processed. Concrete is when looked on at a larger scale, an isotropic material. It is fluid for a limited period in which it can be given a shape, then cures hard as stone. The fluid state makes it not only possible to shape the material inside a formwork, but also to combine other materials or agents into

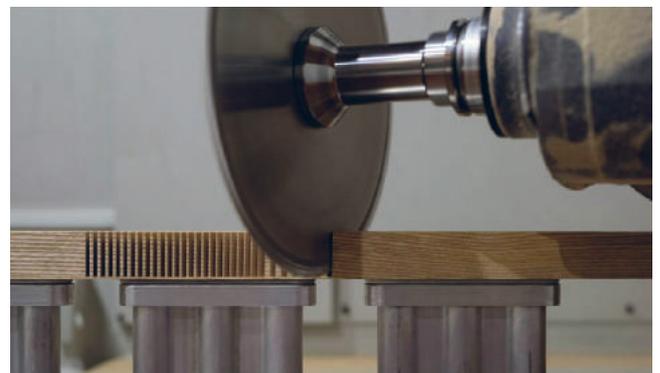
the mix. Concrete has a high density, and the great mass can impact the formwork and context during casting and curing.

Wood is a naturally grown material that comes from an almost infinite number of species each with specific characteristics. A general characteristic for wood is fibre directionality. Based on the particular species of wood the strength and elasticity of the grains will vary. The grains in the wood make it an anisotropic material that will respond differently to machining depending on the orientation of material and tool. The machining of wood is also dependent on the moisture content of the material. That will vary from species to species and be a result of the amount and type of storage before the machining. Due to the following drying, wood will warp or crack after machining.

Steel can be shaped from its fluid or solid state. To cast fluid steel intense heating in a forge is needed. The shaping of solid steel can be done using several machining types. In its solid state, steel is isotropic but often limited by industry standards to specific dimensions, geometries or sheet thicknesses. Parts routed from a single steel block will have a uniform material appearance with tool imprints defining the surface.

The research is based on a series of experiments carried out by the author, alone or in collaboration with others. The experiments serve as the central basis for discussing potentials and possibilities of using material investigations and digital fabrication in architectural design and form-finding processes. The experiments exist as physical artefacts as well as an associated series of processes.

The research is a two-sided piece of work where the physical fabrication of knowledge can be discussed as both a type of methodology and as knowledge relevant for the architectural discipline in a wider perspective. The intention with this combination is to build an argument that unites the qualities found in the enquiring, investigative nature of the produced research and the pursuits of realisation that can inform potential visions of architecture. The research aims to transfer knowledge towards the practice of architecture by showcasing a series of examples where form and design are originating directly from the interplay of architectural materials and digital machining processes and provide a contextual discussion concerning the underlying influencing elements.





The new urban

An urban strategic perspective on the transformation of industrial areas in change

Dance projects, karate clubs, senior communities, summer camps, yoga and massage, a 'football factory', a used goods market. St. John's wort, field scabious, cherries, blackberries, willowherb, and birch bolete. A chocolate factory, a dental technician, a steel rolling mill, a graphic artist, a scraps trade, and cleaning. Catering, a fitness centre, a production college, The Danish Home Guard, a brewery, metal processing. Youth art and skaters. Drinking end-of-day beers. Managers, storemen, teachers, bookkeepers, engineers, entrepreneurs, volunteers, and craftsmen.

Could it be that one of the greatest secrets of urban planning is that Denmark's perhaps most diverse urban areas are our younger industrial areas? They are there. Just outside our city centres. You will see them if you glance sideways when you leave the city on one of its approach roads.

And it is peculiar how little attention they get. Especially if you consider how we are attracted to diverse urban areas and are always longing for the city centres of the past and their back yards, which were home to craftsmen and 'the alternative.' And we envision new urban areas on harbours and goods railway stations with different people, mixed uses, and room for the unexpected and alternative to come into being.

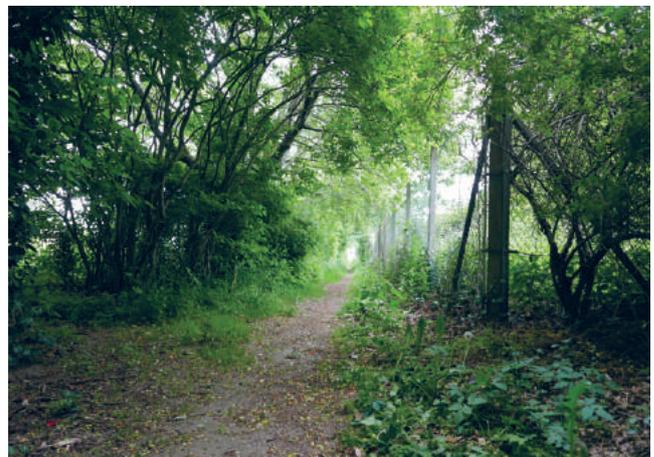
But let's be honest. Business and industrial areas are not very sexy, are they? In their current state. Prefabricated storehouses made from corrugated metal sheets and storage spaces filled with containers and stacked Euro pallets. A mix of building sites, abandoned buildings, and hedgerows growing wild. There they are. Side by side with newly refurbished offices and production facilities. Surrounded by the aesthetics of single-family houses — mown lawns and flowerpots. No, it's not a place that calls for preservation, a pleasurable walk, or visiting a cafe. When, today, business and industrial areas are home to more than businesses and industry, it's because there are other forces at work than those we can plan for. We produce in a different way than when the areas were

planned in the 1960s. Business and industry make different demands on infrastructure. The migration from small towns to bigger towns has changed the conditions for attracting specialised labour and local innovation. There is little willingness to invest. It, therefore, makes sense to consider what role this type of area should play in the future. They are well situated. Close to the city centres, close to nature, and they have good infrastructure. An obvious choice for urban development!

So.. demolish the rubbish (damn it)!

Well, perhaps. But let's just give it some thought first. For there is also the matter of local entrepreneurship. It is local businesses that sponsor the associations of local communities and provide jobs to local residents. New entrepreneurs and enterprising associations find room to unfold their dreams when the cost of renting is low enough. This dynamic means that, today, business and industrial areas contain activities and a diversity of people it would be difficult to find space for elsewhere. We need to take a nuanced look when we begin transforming these areas and start making new strategies for working with urban transformation in an agile way.

It is these needs I examine in my research project. I use three business and industrial areas in different urban situations: Odder Nord, Aarhus Syd, and Viborg Baneby to present a nuanced picture of the qualities the areas offer today and visions of how they can evolve in the future. This is where the research methods come into play. For how do I produce knowledge? I walk in the areas with different stakeholders and interview them. I make photographic surveys and observations, examine data from statistics, and bring in knowledge from reports made by others. I build on existing theories within urban development and landscape architecture and point out the qualities that make for good urban areas. These activities establish the framework for gathering knowledge. I use the information to draw new maps of the areas. Maps of networks, spatial qualities, uses, and biotopes. But also maps that reach beyond the business and industrial ar-





eas, describing some of the dynamics that are involved on the national and global level — but which leave a significant imprint locally. My mappings make me aware of new contexts and qualities that I may not see at first glance. They exist behind the facades and in between the buildings. The diversity of people and nature and a strong drive for creating activities and businesses. Perhaps this precisely occurs because of the rational architecture of the areas and because the areas have been allowed to ‘mind their own business.’

The idea of the project is that the mapped qualities are a crucial asset in the transformation process. There are many unknowns in the conditions for developing the areas; and although official city plans can control parts of developments, history also shows that urban areas have their own lives. This is why it may become important to point out the qualities stakeholders should be brought together to develop.

This brings me to the second question: how? I have studied similar transformations outside Denmark and examined international trends and the strategies and tools used to create good transformations. I transfer this international knowledge to the Danish business and industrial areas in a critical manner. By using my maps

of the areas and knowledge of strategies and trends to produce new future scenarios, I contribute to the way development organisations, economic incentives, the establishment of park areas, innovation hubs, clubs and societies, and new types of residential areas can promote the development of business and industrial areas. Not just the areas, but the areas as an important asset in the economies of towns, the labour market, innovation, and civilian diversity.

A shift in attention

I would like to introduce you to my research and exhibited work. But first, if you don't mind, take a look around you. Try not to look only at the objects and the people. Instead, focus on the air in-between. And don't just use your eyes, use all your senses. Take a deep breath. How does the air smell? What are the sounds travelling through it? Take a moment to sense how the in-between space makes you feel. Perhaps moving around the room might give an even stronger experience of the surroundings. While doing this, my work might escape your attention. And this is exactly my ambition. My exhibited work is designed to draw your attention to the surroundings and invite you to explore the in-between space. Just like this small exercise.

There are several burnt tree logs placed around the exhibition space. This is my exhibited work, inviting you to experience an idea that I explore in my research. In themselves — as an object — the tree logs might seem rather insignificant. There is nothing to read, not so much to study. But as you walk past them, their burnt materiality and seemingly 'out-of-place' presence might give an uncanny feeling and invite you to look around and re-orient yourself. While you look around, you become more aware of your body, of your senses, and this might make you aware of how the surroundings affect you. As your attention is drawn away from the object, you begin to explore the environment. Such exploration, according to theorists from ecological psychology and ambience theory, can lead to developing new habits and more reflected actions.

Doing this might not seem important in an exhibition hall. But at any time and place, what we do and what we see is tinted by the air — or, more specifically, the ambience — in-between. However, most often we are not aware of this influence and we therefore do not explore other ways of doing and seeing. By becoming attentive to the ambience around us, we can reflect and explore anew. This is something that Olafur Eliasson has worked with in his art, and something that I hope I can contribute to urban design and architectural practice through

a research by design approach. Imagine if architecture could make you more sensitive to the world around you. It could help you develop new ways of *reading* the air.

In my research, I am designing an architectural installation at a large road crossing in collaboration with architect Kato Hiroshi and landscape architect Gaochao Zhang. The design process has resulted in important research insights. Our site, for instance, was expanded following some initiating discussions about the ambience of the crossroad. Whereas the site was originally a corner of the crossroad, it shifted to be the small islands in the middle of all four pedestrian crossings. And, following numerous conceptual design discussions, we agreed on a very minimal intervention. On the islands of the pedestrian crossings we would create a small landscape of burnt wood stumps, covering the cobblestones. A more sensual surface would emerge — a surface that interacts with the weather and the users. Just like the wooden logs in this exhibition, the small installation will not in itself be an object to examine, but it will draw attention to the surroundings and invite you to see the crossroad in a new light. For instance, you might notice the benches on the corner that invite to sit on, or, perhaps, you will notice the seagulls using the heat from the road for uplift. You start to see the things that were before invisible.



Traversing sustainable architecture

To traverse can mean to travel across or through, to move back and forth or sideways or to consider the whole extent of a subject. These three definitions have defined my approach towards exploring the field of sustainable architecture. This exhibition showcases some of the studies I have completed to better understand the relationship between sustainable architectural discourse and practice. A variety of visual methods have been used to organise, process and analyse information collected throughout this three-year PhD process. This has been crucial in not only making connections and seeing patterns in the information but also allowing other people to engage with it.

Sustainability may be considered a contemporary ideology or theory, however, within the built environment, sustainable architecture — and its many other synonyms have been present for many decades. Throughout history, sustainable architecture has manifested in a variety of forms, which extend beyond the camouflage of the shallow-technical-add-ons of solar panels and green roofs, which are publicized by contemporary 'greenwashing'. Sustainable architecture has developed in response and reaction not only to world environmental catastrophes but also to political, financial, social and cultural concerns and crises. This exhibition showcases *one hundred years* of sustainable history and an exploration of the visual form — *two hundred shades of sustainable* architecture.

This complex history is represented by one hundred hanging acrylic squares, which represent the historical narrative of one hundred years of sustainable architecture. Presented in their decades, each transparent square is an ink-transfer of the abstract representation of the events, theories and movements, publications and built examples that were relevant to sustainable architecture during that year. Allowing you to look through history and understand the complex and responsive nature of this field. The progression of sustainable architecture requires looking at our history as a catalyst for changes in our built environment. This piece illustrates the relationships and complexity between the many factors of our

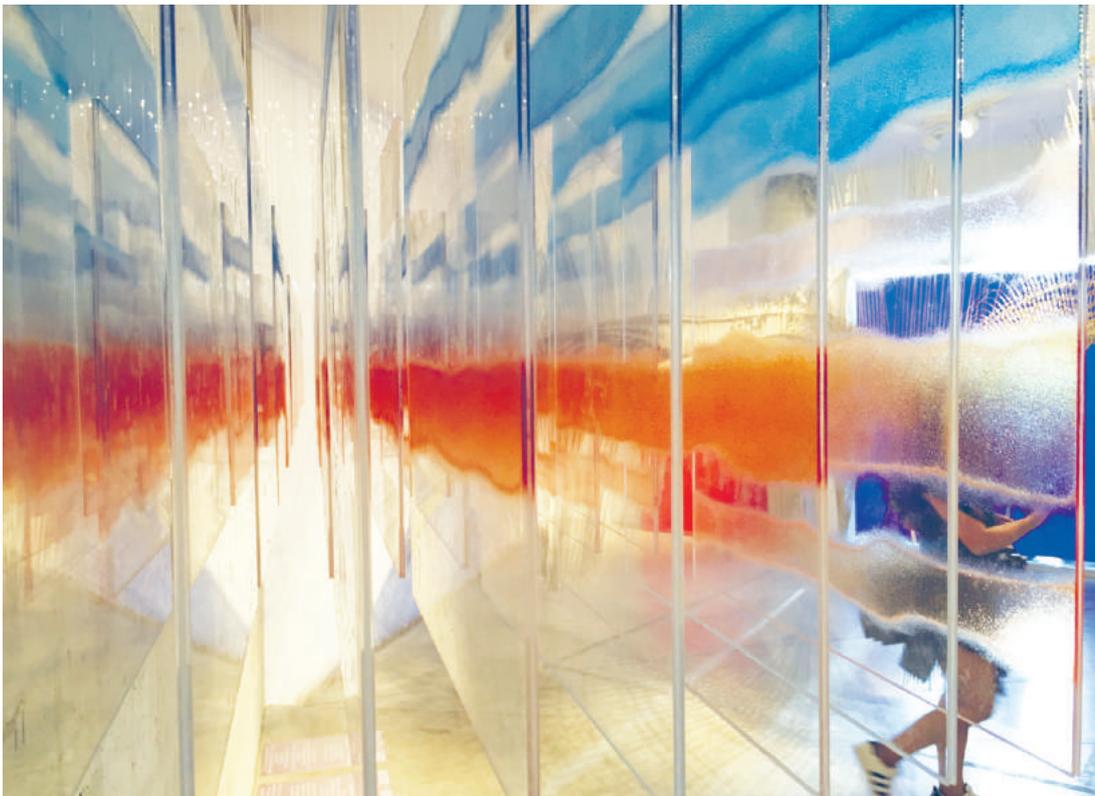
past, which can inspire a more holistic sustainable future.

Sustainable architecture is often referred to as a trend or a movement; however, unlike many architecture movements, there is no stylistic dogma or universal visual aesthetic. As mentioned, the perceived image of sustainable architecture is plagued with solar panels or green roofs and often considered ugly. Lance Hosey states "the ugly truth about sustainable design is that much of it is ugly."¹ This opinion motivated this study to understand what the visual language of sustainable architecture is. Two hundred sustainable buildings from the 1960s until today were collected, coded and analyzed looking for visual patterns, connections and development. This has highlighted the plethora of approaches and the consequent diversity in built forms, showcasing that there are many ways in which sustainable architecture can materialize. However, in saying that, it is also evident that some distinct visual language can be traced through this recent history. For example, some reoccurring forms can be seen in the strands which emerged for the solar architecture of the 1960s and 70s. Large sun-catching spaces with long sloping roofs and thermal mass structures — used for passive heating purposes — have reappeared consistently and have developed and informed more contemporary approaches. This research has traveled across, often moving backwards, forwards and sideways to consider the sustainable architecture in a broad sense in the hope of finding better connections between discourse and practice.

¹ Hosey, L. (2012). *The Shape of Green: Aesthetics, Ecology and Design*. Island Press, Washington, DC.



25



Concrete unpredictability and expression

Why is concrete so dull — and how can the unpredictable make it more exciting?

Concrete is the single most used material in the world after water. The material, therefore, has a significant impact on Danish building practice, where large building elements are cast in factories and assembled as load-bearing parts on the building site. This practice ensures precision, but unfortunately, it also means a significant degree of repetition of standard elements with surfaces and forms that do not necessarily contribute positively to the experience of the finished building. Concrete production is regulated to such vast extents that new forms and processes cannot emerge. In my project, I loosen the grip on control and predictability and instead pursue the unpredictable forms that might emerge during the casting process. By doing so, I hope to find new qualities in the material and experience concrete as something soft, natural, or even sexy.

I think unpredictability in the casting process opens up to experience concrete as something more than and different from an industrial product; as something captivating and beautiful. The unpredictable is unfortunately also imprecise. It is necessary to use precise casts in the building industry, but not all surfaces and corners need to fit into the puzzle of the building site. Joints need precise control, while other parts require fewer degrees of control. A column needs to transfer loads from top to bottom, and in these two extremes it also needs to fit into the rest of the construction — but as long as the column can carry its load, it does not need to be square or round. Between top and bottom, the formwork can be elastic, warped or leaky, allowing unpredictable forms to emerge during the cast.

In the project I depart from two fundamental properties of concrete: The material weighs a lot, and it is mixed together as a fluid while solidifying and hardening later. My work thus, on the one hand, focuses on how I can adjust the formwork — and thus the control over something fluid and heavy — and on the other hand how the concrete behaves when I release that control. A selection

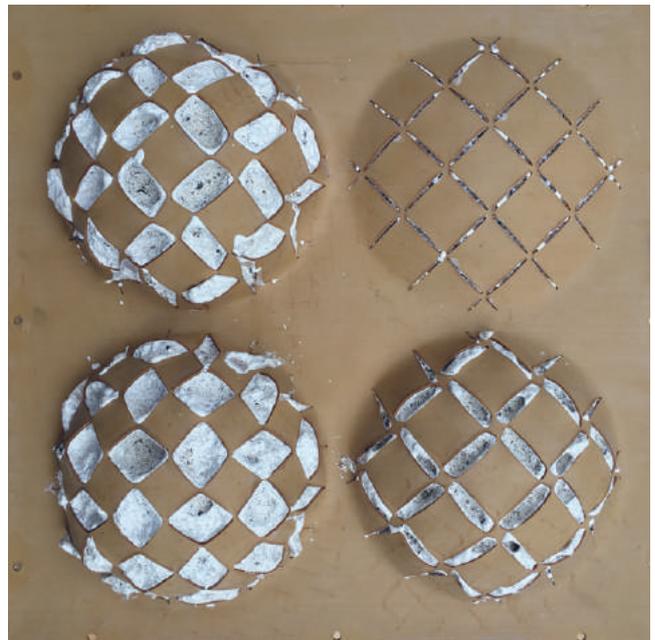
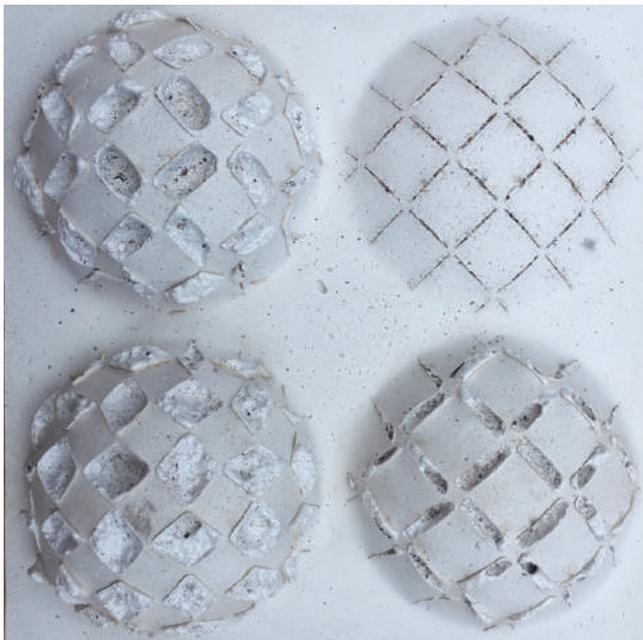
of digital tools helps me to understand the material behaviour. With these tools, I model and simulate how concrete and formwork behave — and conversely, I use the physical casts to improve these tools. This process allows me to begin to understand how the unpredictable takes place in the concrete. I continuously use this knowledge to refine the experiments and transform unpredictable to more predictable processes. The results thus begin to suggest how it might be used in a real building process.

It takes a significant degree of precision to make formwork that in some places is rigid and hard — and thus capable of controlling and resisting the pressure of the concrete — and in other places soft and malleable against the dense material. If both parts are manufactured precisely, the cast can demonstrate a clear balance and distinction between the predictable and the unpredictable. This degree of precision I find in digital production machines. Digitally controlled machines can follow very detailed instructions and thus provide the perfect conditions for making precise formwork. The precise formwork, however, is challenged when it is filled: The concrete pushes against the formwork, while it strenuously attempts to keep the content from seeping out. Depending on the formwork design, it will do the job with less or greater success. You could say that material and technique is “negotiating” about the final form. My experiments investigate what happens when you start to let the concrete affect or escape the formwork — or what you can do if there is no formwork.

The physical experiments are essential in my project. Through the experiments, I explore how concrete and formwork can negotiate to give exciting and unpredictable forms. These forms can only emerge in the physical casing process and therefore do not exist before concrete and formwork meet. One could say that this exploration is a kind of digital craft, where technical knowledge goes hand in hand with the faculty to apprehend and imagine what comes out of the process. Sometimes it is enough to imagine an outcome — without predicting it precisely — and let the concrete do the rest.



27



Framework for Tectonic Thinking

This research is situated in the field of architectural design theory. My intention is to contribute to the understanding of the term *tectonics*. It is a term in which two aspects of architecture, its *forms of construction* and its *forms of appearance*, are considered as complementary.¹

With my research I would like to address diverse architectural positions that deal with this integration of *technique* and *aesthetics* in equally engaged, but different, ways. This suggests an inclusive approach to the understanding of the term tectonics, which means that its understanding should be broadened. I am also looking for meaningful distinctions within the field of tectonic approaches, which means that the term should be differentiated.

To arrive at such a broadened and differentiated understanding of tectonics, I propose a classificatory system, which I have called *Framework for Tectonic Thinking* (FTT). It combines three constructional categories, each with two oppositional poles:

1. Loadbearing construction:
loadbearing versus non-loadbearing
2. Conjoining construction:
solid versus filigree
3. Constructional expression:
tectonic versus atectonic

The constructional categories should be seen as vectors that exert their conceptual influence on a space of potential constructional appearances where *tectonic* forms express aspects of loadbearing construction and conjoining construction, while *atectonic* forms of appearance suppress or dissimulate any reference to these. The FTT distinguishes eight — conceptually pure — tectonic expressions can be distinguished:

Four of them coincide with the primordial applied arts:

1. textile
2. ceramic
3. stereotomy (stone construction)
4. carpentry

The other four constitute their opposites:

1. atectonic textile
2. atectonic ceramic
3. atectonic stereotomy
4. atectonic carpentry

These conceptually pure constructional appearances should not be understood as idealistic essences that should be approximated as close as possible. For any of the pure positions, a multitude of appearances is conceivable.

Between these pure tectonic expressions there is a field of hybrid tectonic expressions in which characteristics of the pure tectonic expressions are combined. They are considered equally valuable.

WHY is this project relevant?

Tectonics is part of the professional jargon of the architect's metier. However, discussions in practice and in academia show that a precise definition of the term is often missing and that at this juncture description and value-judgement are often confused.

This research takes a descriptive and analytical approach. The *Framework for Tectonic Thinking* proposes a broadened and differentiated vocabulary for tectonics that should make such discussions clearer. This is especially relevant for architectural education.

WHAT is the potential of the research project?

The *Framework for Tectonic Thinking* should foster the self-conscious employment of tectonic thinking in design practice and in academia. It considers tectonic thinking as a 'tool of the architect' for analysing and interpreting buildings from the past, to be operative in design practices of the present, and to trigger imaginations for the future.

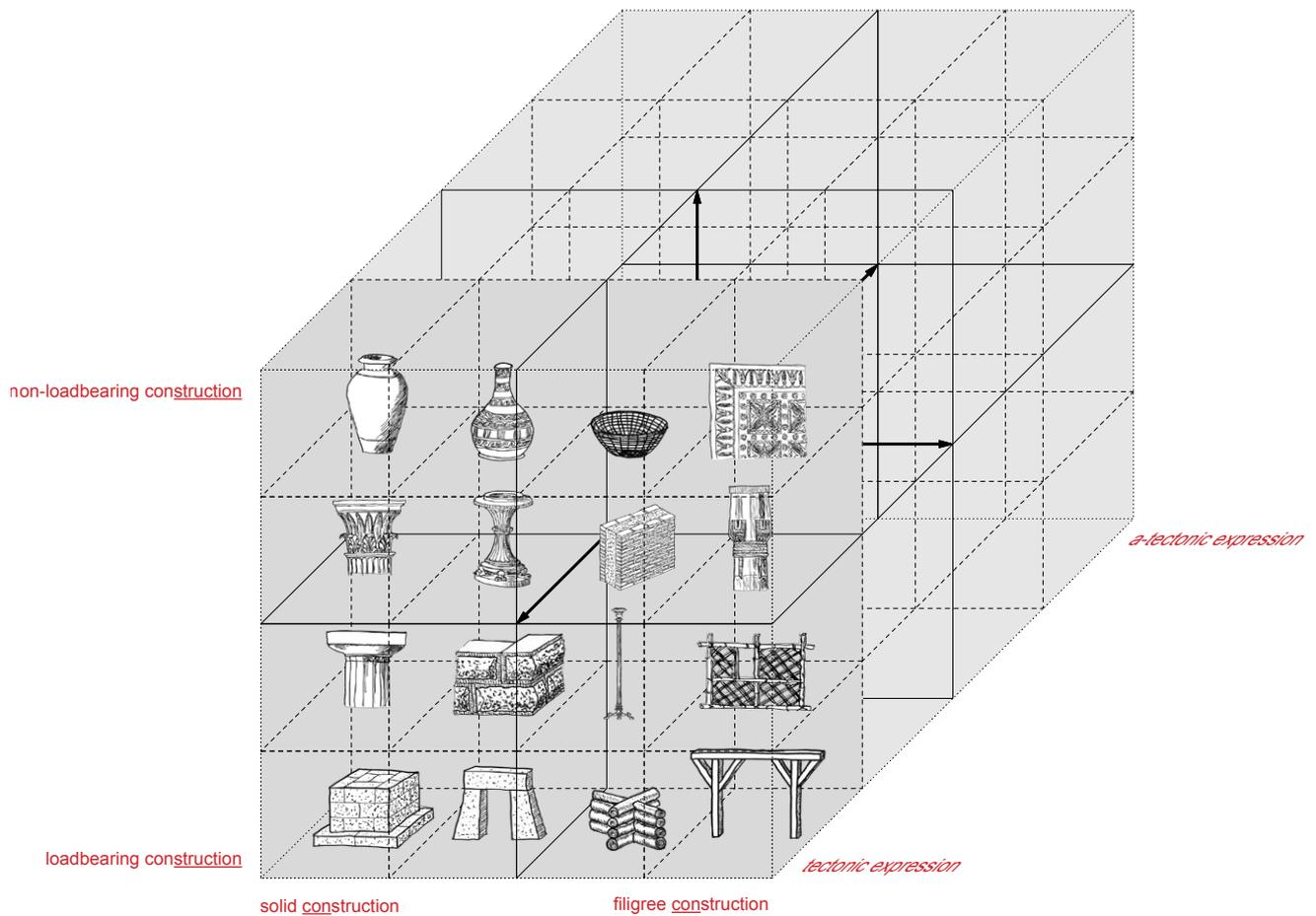
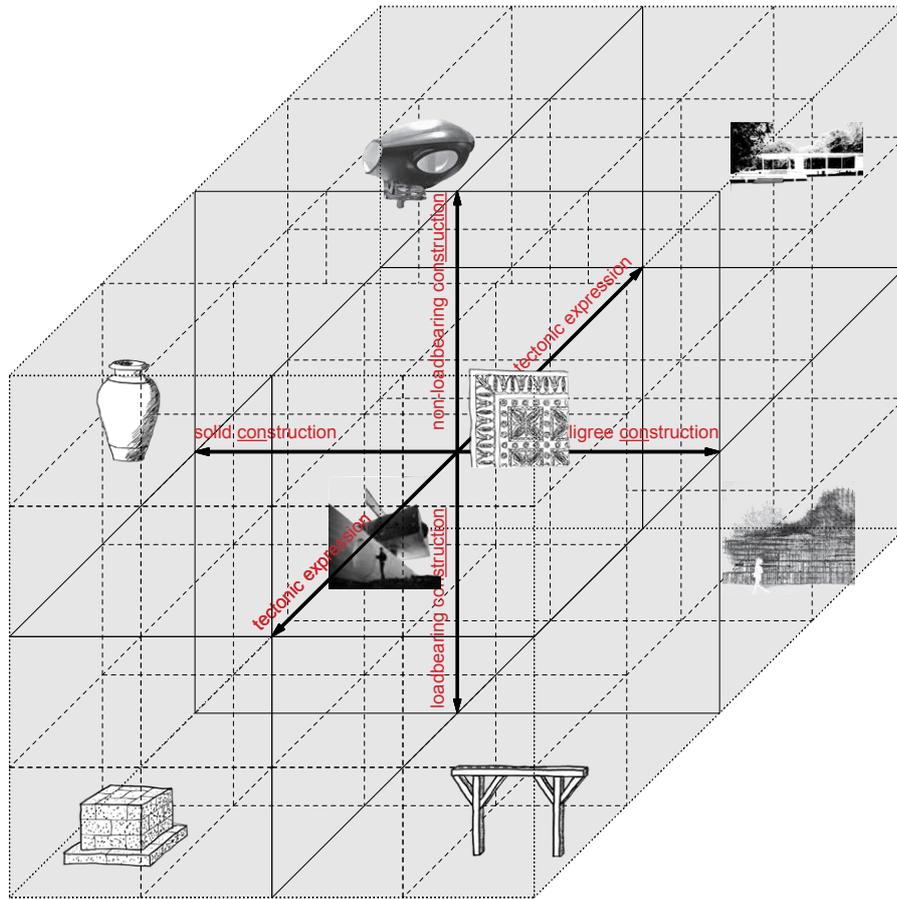
Also new construction techniques can be addressed with the FTT. In recent years the construction techniques of, for example, brick masonry have changed dramatically. The mastic filled expansion joint or the montage joint of prefabricated brick masonry often crave for tectonic consideration.

HOW has research by design influenced this study and the research process?

This research is not research by design in the strict sense of the word. However, I adopt the position of the designing architect. The question that drives my investigation is: What difference does a more nuanced understanding of tectonics make for the designing architect? A perhaps more correct interpretation of a historical theory of tectonics would be very interesting to me, but my real motivation is to find insights that are relevant for present day design positions.

In my research I have tried different graphic mappings of key terms in tectonic theories and their interrelations before I arrived at the FTT. This is a more designerly approach to architectural theory than a purely text-based approach. It has strongly influenced the insights of this study.

¹This definition is inspired by the German architect Hans Kollhoff.



Behind the scenes of the contemporary modes of architectural production

There is a controversial — but close, real and urgent topic in the profession of architectural discourse that faces the delicate, undeniable, relationship between the economic system and the modes of production of architecture. Architecture is a profession that needs money to be realized and, being liberal, it is finalized to generate an economic turnover. If so, why is the rapport between money and architects so arduous? For the majority of professions, money is the abstract medium to exchange a service. Architects, instead, have a sense of existential guilt in asking for money that results in negotiating conditions which are usually below what they deserve. The research acts within this framework and considers the Danish case within the “Architecture and Labour” research field, looking at the evolution of the modes of production of architecture within offices, considering the relationship and in/dependency between the Danish Welfare State and the architectural practices.

The research reflects on the evolution of the profession of architecture in Denmark. My point of departure is the definition of the influencers that are able to shape the profession in order to delineate the mechanisms (i.e. modes of production). To understand the present, the Contemporary Twenties (1993–2016), another period will be investigated as a precedent: Les Trente Glorieuses (1945–75); using both archive works and fieldwork to collect data from the two timespans. Based on this, using the grounded theory method, a number of contemporary practices will be investigated to delineate the specific mechanisms they use to face the challenges of today. The outcome of the research will be a definition of those mechanisms and the development of a take on the Danish case within a field that has not been addressed until now.

The narrative I am deploying to disseminate architectural research contents lies within the use of exhibition design. In this activity my credentials as a researcher who also has a background as practitioner with a specific focus on Exhibition Design (OFFICE U67 ApS) have been significant in widening the audience of my research. So,

in introducing my research in contexts abroad related to the field of “Architecture and Labour”, using my knowledge on the Danish case as a contribution has been an important part of my dissemination plan.

An example of this was when, in spring 2017, I participated as an invited contributor within the collective exhibition “Capitalism is Over” — curated by Raumplan and Cascina Cuccagna for the Milan Design Week 2017, Italy.

The installation named “Index Room” transforms an archive review method into a physical display that contains a classification of each project published in *Arkitekten* (1945–75). About the content: each project published in the 31 years of the magazine was classified in Excel sheets — a total of 3809 rows and 10

columns. For each project an index card with ten pieces of information was produced: the year of publication; the name of the author; if any, co-authors; the issues in which it was published (noting whether weekly or monthly edition); the project name; its location; eventual competition ranking; specific class of belonging; year of design when mentioned; the client. More than 3800 architectural projects were indexed and exhibited as a physical archive — a total of 15 kg of paper cards suspended from a white lacquered steel ring.

If “Index Room” was an occasion to disseminate a first timespan of my research, the next one the “Red Room”, exhibited at FORSK!, is an occasion to disseminate a grounded theory approach and therefore my second timespan.

It considers how some junctures in the economy of Denmark (two financial crises — in the early 90s and again in 2008) played a role in the definition of the modes of architectural production and its labour organisation in the last twenty years (1990–2017). Specifically, in terms of content, it looks to some paradigmatic data, collected using a grounded theory method. The data are the ones related to 11 in-depth, semi-structured interviews with CEOs and directors of Danish architectural offices selected as representative cases of specific findings developed during the research.

In conclusion, I strongly believe that the interaction between theoretical arguments and the design of an exhibition, and therefore the occupancy of a physical space combined with a facilitated interaction with a broad audience, are powerful experimental fields when doing research in architecture.

Unfolding architectural potentials of weakness

The ideal state of a building is often conceived as immediately after being built, and still appears as it was drawn by the architect. However, inevitably, the forces of nature affect and change the architecture. Currently, we use considerable resources on counteracting the wear and tear caused by, for instance, wind and weather, to maintain this original state of buildings.

An example is the Opera House in Oslo – exceedingly published in magazines and one of the most prominent architectural icons in Norway. The building is often described as a landscape, with its significant appearance of ice floes floating in the water. However, maintaining this perfect image requires extensive resources. A budget of 20 million NOK is spent every year to keep the marble white and clean from the dirt, stains of coffee and wear from the many tourists visiting. The marble naturally become more yellow over time and is on a regular basis treated with chemicals to stop this process of discolouring. Furthermore, the ground conditions in the area are unstable and substantial cracks have emerged between parts of the building.

The essence of a landscape is to change over time. If the Opera House really was developed as a sort of landscape – and not just an image of one – the building would have been integrated into these local environmental dynamics.

Weakness

Opposing the idea of architecture as a strong and rigid entity, the project investigates how weakness can act as a response to environmental influences – working with the forces and processes.

Weakness is a term which usually comes with negative connotations. However, in the field of biology, weak bonds are vital. Most of the molecules which are essential for life have many interchangeable elements, and it would require too much energy to rearrange if they were strongly bonded. Similar properties in architecture could allow the building to adjust and respond to the environ-

mental forces – and potentially make the architecture more adaptable.

Such an approach would save resources and provide a more sustainable way of building. In this scenario, the architect would also be the co-designer of how the building is affected after its construction. And the changes – which are happening anyway – would be intentional and an integrated part of the design. The architecture would act as a series of changing spatial conditions developed over time, generating changing experiences and qualities.

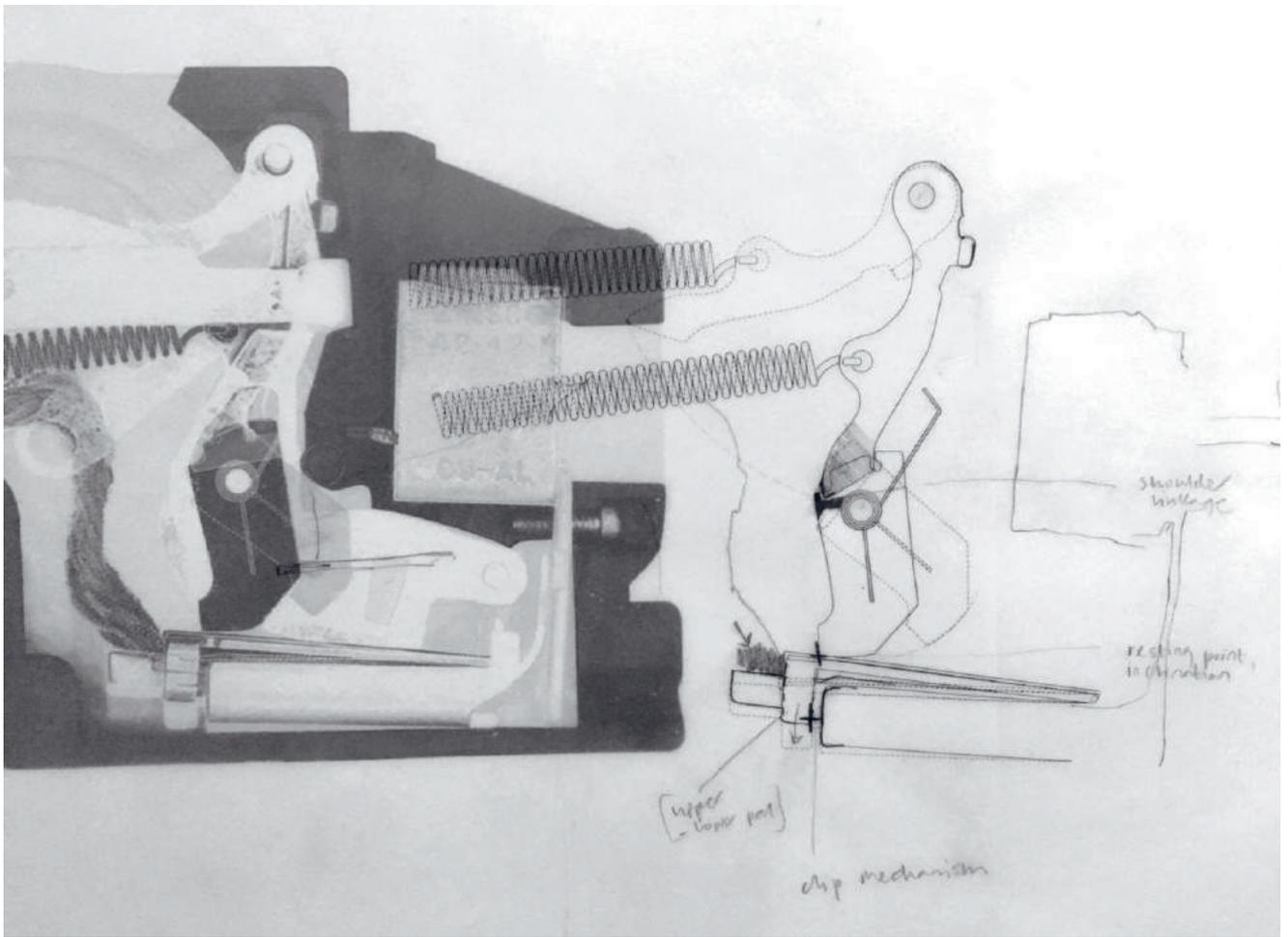
When you re-visit a building, perhaps it has changed since last time you were there. It is evident that time has passed. The materials might appear a bit differently in texture or colour. Or parts of the building have moved slightly, so that the light conditions are a bit different. Or, perhaps, there are even parts which are no longer visible or accessible.

Research by design

In this project, weakness is used as an overall philosophical and theoretical approach; a way of thinking. Furthermore, existing examples with an embedded weakness is the starting point for the research by design driven experiments.

The examples derive from various fields, spanning from architecture (vernacular building technologies), traffic and transportation engineering to smaller devices and components. All of the examples use weakness to create an intentional response to external impulses. In some of the examples, the component is weak and is potentially sacrificed to protect more valuable parts of the system – as the galvanic anode (submerged vessels) or parge coat on buildings. In other cases, the links between the components are weak to enable transmission of forces – as the circuit breaker and in traditional Venetian building techniques.

The material displayed at the exhibition are fragments of the on-going investigations. The research by design methodology combines theory with practice-based experiments. Investigations through artistic media such as drawings, images, and material experiments reveal architectural potentials of the examples, without being limited or restricted by their initial purpose, context or scale/size. This way of doing research builds on the way we operate as architects – drawing, building, creating and inventing. The research becomes generative – fostering new ideas and architectural speculations. Potentially contributing to an alternative discourse within architectural practice.



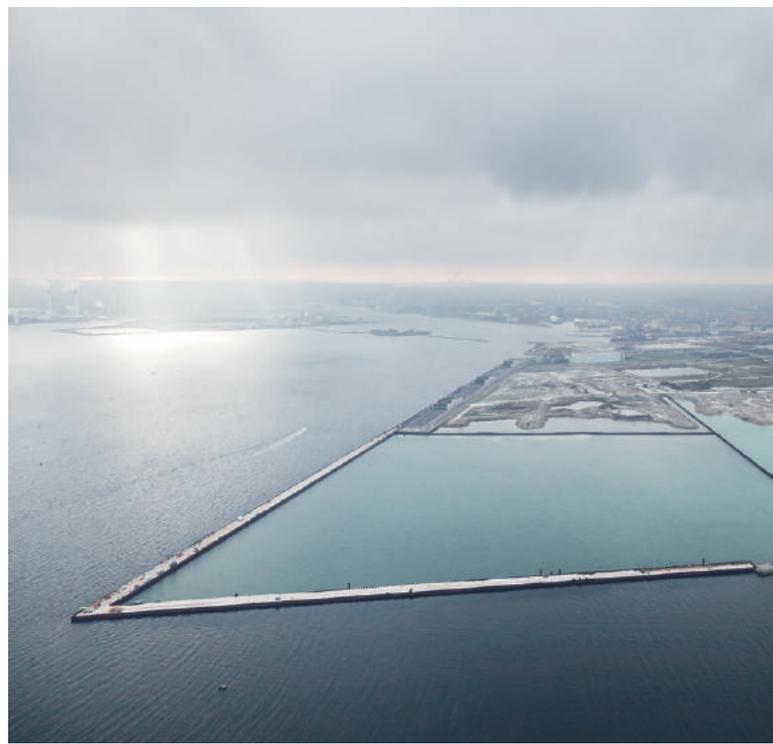
33



Rasmus Hjortshøj

Seachange

Transformations in Coastal Territories



Seachange is a PhD project that seeks to aesthetically frame the entanglement of society and nature in coastal territories in a time when mankind is no longer merely subjected to nature, but where nature is equally being shaped and transformed by human desires.

In the coastal territories of the Anthropocene the distinction between what is natural and what is man-made has become increasingly vague as human and non-human actors redefine their natural habitats through increasingly complex networks of interactions. Landscapes perceived as natural are often constructs of man, and what is clearly man-made is always rooted in a natural context: erasing the dichotomy between cultural and natural territories and thus creating a shift in how architectural and landscape-architectural strategies are both being formulated and communicated. This condition of territorial entanglement is particularly visible in the coastal territory, where the urban fabric consists of superimposed dynamic landscapes. In this territory you may argue that the natural forces that remain as the premise of human settlement are being underprioritised: thus bringing to attention a lack of negotiation between dynamic territories and urban intervention.

To engage with a concept as elusive as 'Coastal Territories in the Anthropocene', I argue that an aesthetic framing may aid in identifying and understanding such bodies of complexity. A framing of territories on the coast in which the entanglement of natural and cultural dynamics is particularly present may assist in characterizing the complex hybrids emerging in the intersection between architecture and the environment in the time of the Anthropocene.

The aim of this PhD project is thus to address how an aesthetic framing through photographic and cartographic representation, with each their ability to communicate across time and scale, may uncover territorial conditions capable of providing valuable insights into the collective properties (aesthetics) of the coastal territories. Emphasizing not only the cultural and natural challenges inherent in a geological epoch of man's own making, but also

the capacity artistic representation holds in questioning and informing architectural strategies that do not adequately address the need for a more distinct and adaptive coastal urbanism.



Terminals of flow

Spaces produced by parking requirements and regulations

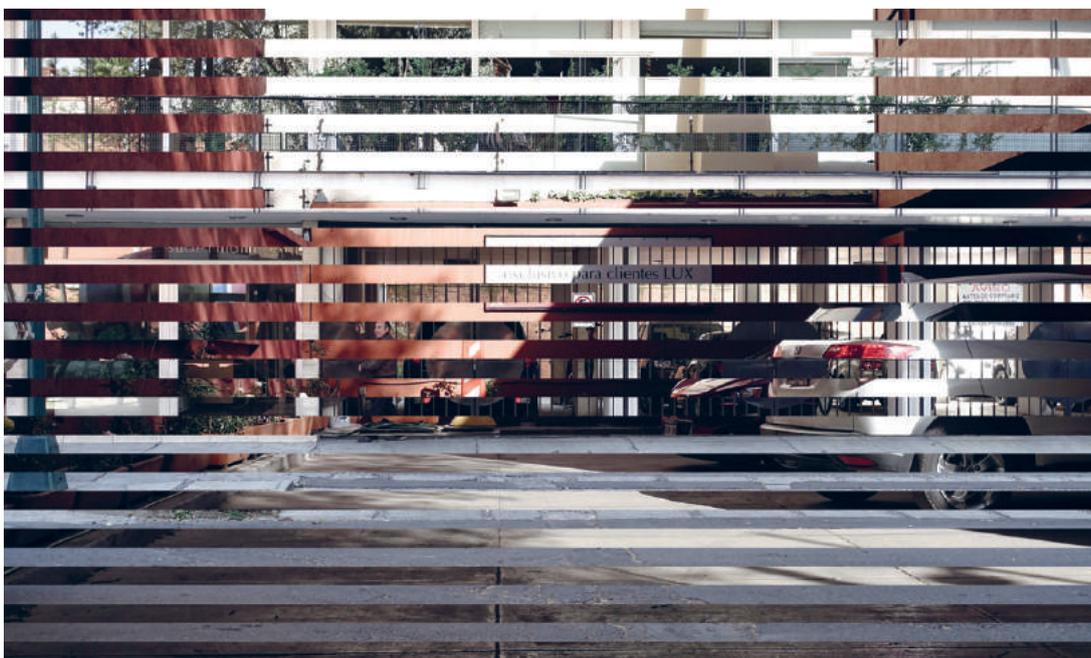
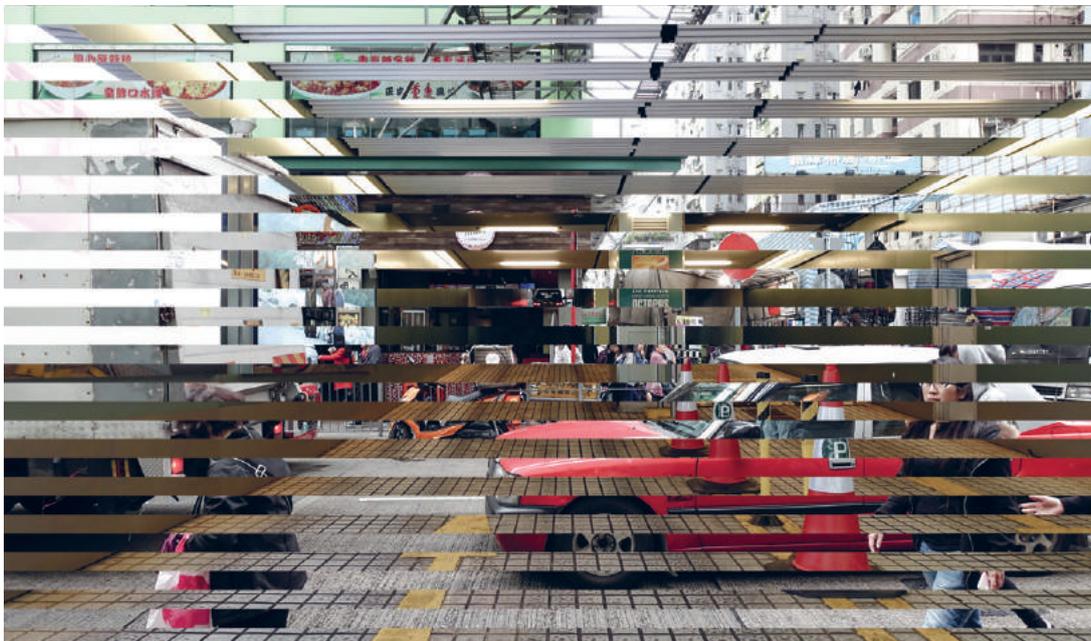
Parking is a rare intersection of infrastructure networks, land-use in metropolitan areas and technological mobilities, which embodies mutual dependencies between these elements. With this in mind, it seems logical to explore the potential of repetitive parking spaces to create a favourable context for the later development of the territories they serve. These nodes of stillness in mobility networks are meant to house an automobile — a symbol of freedom, movement, technological progress, and independence — that remains parked on average 95 percent of the time. An ability to influence movement by managing stillness is the initial starting point for entering this investigative process.

In September 2016, Uber hurriedly introduced their take on self-driving cars — a modified Volvo XC90 — in Pittsburgh, with Travis Kalanick, the CEO and founder of the company, calling the matter “existential.” Four days later, John Zimmer, co-founder of rival company Lyft, presented an idea for a transportation network based on a subscription model similar to Spotify or Netflix, which would offer an unlimited choice of vehicles. A shared autonomous fleet to serve all possible needs. Half a year earlier, fifteen major grocery store sites with vast car parks in inner London had been proposed for residential-led development. According to Estates Gazette calculations, they would be able to accommodate as many as 7,500 homes. With the introduction of the new Strategic Master Plan in June 2014, Sao Paulo became the first megacity in the developing world to eliminate minimum parking requirements citywide. In May 2014, a parking space in a residential neighbourhood on Hong Kong Island was sold for \$547 000. The market for parking barriers has been booming in Moscow with locals protecting their inner courtyards against drivers who are not used to paid street parking introduced in 2013.

While the details vary, the headlines listed above clearly illustrate links between current planning practice, parking problems, proposed reforms, and seductive technological ideas. Throughout the world, we can observe the visible complexities, ambiguities and activ-

ities of continuously overlapping strategic pursuits of different interest groups. Manifested in various forms and across a broad range of urban contexts, parking has significantly wider spatial consequences than commonly perceived. Therefore, the exploration of the topic is centred around concrete case knowledge which in the setting of this project is more valuable than predictive theories and universals. Four primary cases under investigation represent four distinctive spatial typologies in two cities — Copenhagen and Los Angeles — with different levels of mass transit services and different relationships to the automobile, the freedoms it provides and the constraints it imposes. However, when we look at the population density numbers in both metropolitan areas in 2016, there is no clear distinction. It might come as a surprise to some that the Los Angeles Metropolitan Area is even more densely inhabited — as it is contrary to the commonly perceived image of the city being an endless carpet of suburbia.

A surface parking lot, a free-standing garage, an underground parking facility and a garage for a single-family house are familiar typologies that are also the result of a regulatory framework and have a formative impact on contemporary architecture. Parking requirements along with city-wide pricing strategies determine possibility and duration of standing still; in such a way, mobility flows result from managing termination points. A current investigation illuminates these terminals, their spatial parameters, influence on a surrounding cityscape and legislation that brought them into existence. Two-way translation of a virtual text of urban planning documents into a physical space of familiar cityscapes. Abstract and predictive into visible and present.



Building Relational Spaces (in Paper Space)

This research project is about developing perspectives that support the sense of community of local communities and unearth the resources that lie hidden beneath the surface. The aim is to inspire discussions about the different conditions of different communities for organising, producing, sociality and economy. This is done through direct actions in towns, suburbs and villages — based on the idea that it is not the number of inhabitants, homes, institutions, shops, or the distance to the animals that define a place, but that it is rather events that bind people and places together.

In a time when urban and landscape planning is driven by developers and governed by market mechanisms, cohesive communities are under pressure. As towns grow, villages shrink, and suburban traffic hubs change, new strategies are required as market players and traditional planning processes have difficulties creating places that are based on a sense of community and on diversity. It is not enough to focus on cleaning up the streets and building more homes in the city, demolishing empty houses in the village — or design railway station squares with large sculptures in the suburbs. Nearness, responsiveness, presence and close dialogue with local residents are needed to enhance the diversity and identity of places and create living environments for all. In general, there is not enough time and space to reflect on the importance of what already exists and on what came into being or was initiated before the developers arrived on the scene.

Built form

My practice uses small site-specific interventions that identify local resources, make issues visible, and enhance local narratives and communities. My interventions investigate methods of supporting urban situations that are able to include people from all social classes and create lively suburbs and cohesion between villages and the surrounding landscapes. The interventions focus on relationships and boundaries between the public and

the private and between formal and informal structures. In concrete terms, we study and develop through built forms, on-site, in full scale. We do this directly in the urban spaces, in the centres of suburbs, in residential areas of detached houses, and in villages. Our on-site activities take place within different timeframes and have different types of mandates. In some cases there is no mandate at all. But they are invariably close to context.

Drawn form

A result of market-driven planning is that urban development is often communicated through predictable standard visualisations, presenting architectural objects and conceptions about 'the good life' to an in demand middle class, while abandoning real relationships and exchanges between people and places.

In my research, I address these real relationships and exchanges and investigate what they can tell us and how they can be translated and 're-presented'. I experiment with developing a mode of communication based on mapping by means of large drawings made by hand. In this way a new place with new meanings and knowledge, taken and translated from experience gained from built, on-site actions is created. The process focuses on things and relations that would otherwise not be mapped. For instance, I communicate the relations between the regulations of places, their uses and potential uses, ownership, responsibilities, maintenance, time/protocol, and municipal initiatives in relation to own initiatives.

Exchanges between practice and research

The themes of research are made clear by practice. For practice develops a responsiveness to the meanings that are created in a work process characterised by curiosity, a quest for the human in situations, and by questions about how things are connected — power structures, the strange, and how it feels to be a stranger. On-site actions in built form raise questions for research, visualise and elucidate these questions through mappings in drawings and texts that reinforce and carry on the local narratives of the selected places and merge elements across time and space.

In overall terms, the project unfolds questions about how and to what extent we can keep architecture open to the community. Social conventions, organisational principles and deliberations about form and configurations are illustrated by transforming already existing and invisible contexts and relations that others can build on.



Transformation on abandonment

A new critical practice

At the moment the rural population is abandoning their home villages and moving into the cities. Thus, the economic and social inequality between the urban and rural populations is increasing. The implications for rural villages are conspicuous and exemplified by a rapidly increasing number of decaying abandoned buildings. Thus, the physical appearance, as well as the identity of the rural villages, will undergo fundamental changes in the coming years. Abandoned buildings in the Danish rural villages are the crux of the research behind the exhibited artefacts.

Today, the Danish government attempts to address the problematic presence of ruins in the rural village-scape through large-scale state-funded demolition projects. Despite good intentions, these demolition efforts emphasize the fast eradication of local history, identity, and community cohesion under the guise of state-authorized clean-up projects. The question remains whether something is irrevocably lost when buildings are demolished overnight and replaced with lawns. Therefore, there is an urgent need to enable public discourse with a more nuanced view on abandoned rural houses.

This research has been conducted as a counter-practice of radical preservation. It seeks to reveal and activate the endangered intrinsic qualities through implementing a series of transformations of abandoned buildings prototyped at full scale in various rural village settings. Each of the transformations serves two purposes. First, they represent implemented prototypes of different strategies on the inevitable future transformation of the rural village-scape. Second, the transformations act as catalysts of the locally rooted debate as an attempt to influence public discourse. The residents' responses are considered a significant impact indicator, supplementary to the physical transformations themselves. The exhibited artefacts represent a minor sample of these transformations.

Biopsies of the abandoned (2015) originate from a vernacular farmhouse in the village of Ydby, dated 1780. Despite being listed as worthy of preservation, the farmhouse and the intact barn complex were condemned

to demolition. This bleak prognosis allowed destructive interventions to the pig stable. Similar to pathological preparations, fragments were cut out as biopsies. These were aligned with the forage trough, which originally separated man from animal.

The biopsies covered a broad range of historical events over the entire lifespan of the building as well as the spatial dimensions of the pig stable. Apart from exposing the revealed material history and spatiality of the 235 year old pig stable, the biopsies exposed the building's previously hidden sub-nature, such as a revealed drainpipe. Similar to a medical dissection, the relations between internal and external were emphasized.

The spatial experience of the pig stable was re-established based on the biopsies, as a compressed spatial sequence within a new context. In this case, the new environment was an exhibition. More important than meeting the demand of the exhibition space was an attempt to test the preservation of space, materiality and even ambiance through a minimal reconstruction of a building detached completely from its original context. The reinterpreted spatial sequence also raises a discussion on how to preserve endangered buildings worthy of preservation. Although the method may seem radical, the only remaining outcome of the abandoned farmhouse was demolition.

The reverse biopsy (2016) originates from an abandoned confectionary located in the pedestrianized zone of the main road in the rural small-town Hurup. As part of a research prototype, the confectionary was reopened for a two-month period before it was demolished. An attempt was made to catalyze an exchange of narratives of the building and the place into the collective memory, thus preserving the building immaterially.

A horizontal cut-out within the dimensions of the fridge in the private kitchen reopened an old connection from the bakery shop to the bakery in the back building – through the kitchen. This intervention was undertaken in a similar manner to a horizontal reverse biopsy, cutting its way through three states of privacy. This allowed the beholder to look through the entire building from one specific position on the pedestrian street outside the storefront.

The physical extent of the biopsy began at the inner wall of the public bakery shop that was visible from the pedestrian street. The penetration of this inner wall made of plaster first revealed a closed doorway, including the encased door leaf at the back of a fridge. The intervention then continued on the opposite side of the fridge door in the private kitchen. Here it cut lengthwise through the kitchen table, the cupboards, the dishwasher, the zinc, and the top cupboards. It then penetrated the tiled brick wall at the end of the kitchen by creating an opening towards the scullery. From here, two tiled brick walls were opened, the latter of which joined the intervention with the bakery space by cutting through a porcelain zinc. The intervention terminated once it reached the outside by cutting through a workbench and the tiled end wall of the building.



Processing Imperfection

Exploring creative possibilities in the digital architectural drawing process

Thresholds for technological inventions have been a vehicle for novel artistic practice. One example is the advent of the abstract art movement just after 1900, following significant technological advancements in society during The Technological Revolution (1870–1914). Art historian Mel Gooding explains: “From the early years of the twentieth century painters and sculptors in the European traditions of art, more than any time since the Renaissance, consciously sought radically new ways to represent their experience of that world.”¹ According to Gooding, abstract art emerged as an attempt to encompass the fundamental changes taking place. Technologies destabilised the common understanding of the world and consequently influenced traditional ways of working within artistic practices.

Inspired by the simultaneity of technological advancements and developments within artistic practices, the research focuses on opportunities for artistic design processes within architecture, using new, although established, digital technologies. The computer has rationalised the architectural design process, and even though it can be questioned whether digital technologies have fundamentally changed the core of the architectural drawing, the computer inevitably offers changes to the architect’s available work methods and thereby expands the premise for drawing architecture. Furthermore, along with the integration of digital fabrication during the last 40 years, the drawing’s premise expanded from graphical representation to also include instructions for digitally driven material processing.

The PhD research is triggered by the interpretations that are necessary in the digital design process between the drawing and fabrication of physical models. For instance, a drawing for fabrication directs digital tool operations with mathematical precision. However, the same drawing can also embody the ephemeral and not yet decided. In reverse, fabrication informs the drawing with material constraints and physical concepts. Consequently, it is a premise in the digital design process that just as the drawing informs fabrication, fabrication must inform the drawing.

The research mode of the presented PhD project is research by design. The reasoning is produced through practising architectural design, and the practice-based work is used as the research’s empiric material.² Using research by design almost inevitably requires a creating I, i.e., *I am the maker of the study’s empiric material*. I was in dialogue with the material during the making, and I reflected on these studies afterwards. Consequently, the present PhD project encompasses two types of operation. One is to design by probing into the inquiry field by creating architectural drawings and models (creating knowledge in dialogue with the material). The other is the textual framing (creating knowledge by reflecting on the design studies), which is an attempt to establish a written context for the observations of the work processes and their central themes.

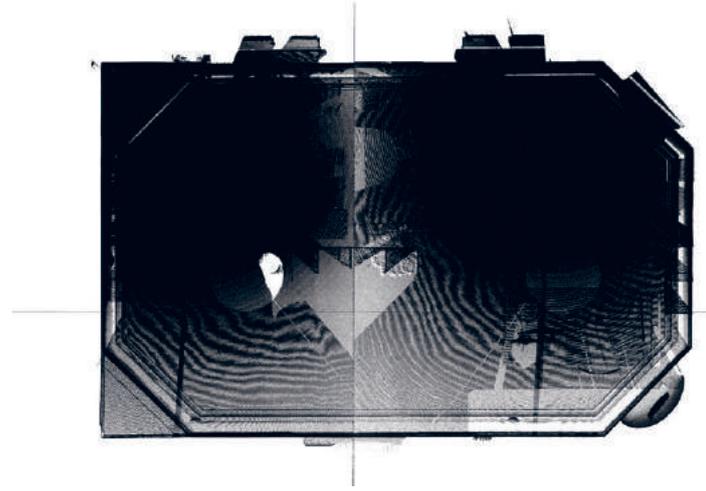
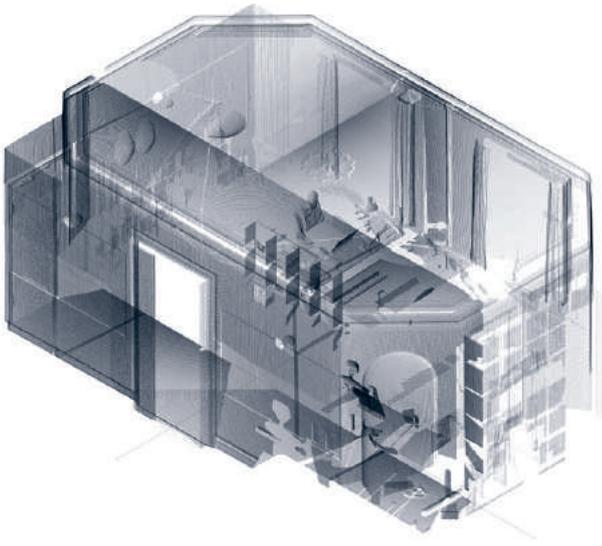
The research inquiry probes into the design process of nine design projects with the purpose of exploring frictions and destabilisations as a vehicle for creative exploration. On the one hand, the digital design process can be seen solely as an instructive method, operated by the predefined system of the computer. However, on the contrary, the design projects show that the frictions enable the coalescence of the ephemeral and the quantifiable. Furthermore, the frictions lead to unexpected opportunities for engaging with imperfection.

The digital design process consists of design choices available in a fluctuating transfer between data [input] and information [output] in an often multi-peaked discontinuous design space. The formatting operation of data and the extraction of information are transfers that need an interpretation. For the interpretation processes, different carriers are used to bring data and information across the dividing line when making the design decisions. The carriers are transcription and translation. In their seminal book, *Architectural Representation and the Perspective Hinge*³ from 1997, Alberto Pérez-Gómez and Louise Pelletier underline the difference between a mechanical transcription to a translation that needs reflective attentiveness. Applied to music they remind us that: “It is a historical misunderstanding to imagine the interpreter as a mechanical operator that always produces the same results.” They continue by explaining that: “The music is made by humans, in the vivid present, and it is always different; this is its quality, its meaning, rather than defect.” The carriers for the interpretation processes in the design project made during the PhD studies can be both (and simultaneously) mechanical transcription and intuitive translation. Therefore, the research presents the view that seen as a spectrum, mechanical transcription and intuitive translation of digital information create precisely that interpretation, which implies a distance and leaves tiny cracks in the otherwise predefined digital system for the imagination (and design exploration) to enter.

1 Gooding, Mel. 2001. *Abstract art*. London: Tate Publishing. 6

2 Verbeke, Johan, *This is Research by Design* in Fraser, Professor Murray. 2013. *Design Research in Architecture: An Overview*. Ashgate Publishing, Ltd. 145–150. Derudover er forståelsen for RbD og hvordan metoden er operationel for nærværende studier blevet udviklet igennem diskussioner med Johan Verbeke.

3 Pérez Gómez, Alberto, Pelletier, Louise, 1997. *Architectural Representation and the Perspective Hinge*. Massachusetts Institute of Technology, Cambridge. 382



Tectonic patterns

The initial focus of my research at the PhD school at Aarhus School of Architecture was to explore how computational methods could help to expand the scope of possibilities for formal and tectonic expression in architecture. Whereas the architectural profession has fully embraced the digital formats and tools that became available with the proliferation of computer technology, an interest in completely new design methods that incorporates computation as such has been relatively absent until recently. A need for users of 3D modelling software, particularly within the animation movie industry, to be able to customise their digital design tools has made software providers expand their products with interfaces that allow users to add functionality through short pieces of computer codes. This makes it possible for architects to use form generation methods developed for fields outside architecture, such as biological simulation, physics or computer science; I have been working on developing and demonstrating these principles in my PhD project. During the project, I became occupied with ways of combining digital form generation with fabrication methods. Digital production technologies have been used in many industries related to building construction and through bespoke digital design logics. It is possible to integrate fabrication constraints in the initial design, thereby ensuring that even advanced design solutions match the following realisation process without major redesign of components, which is otherwise often the case.

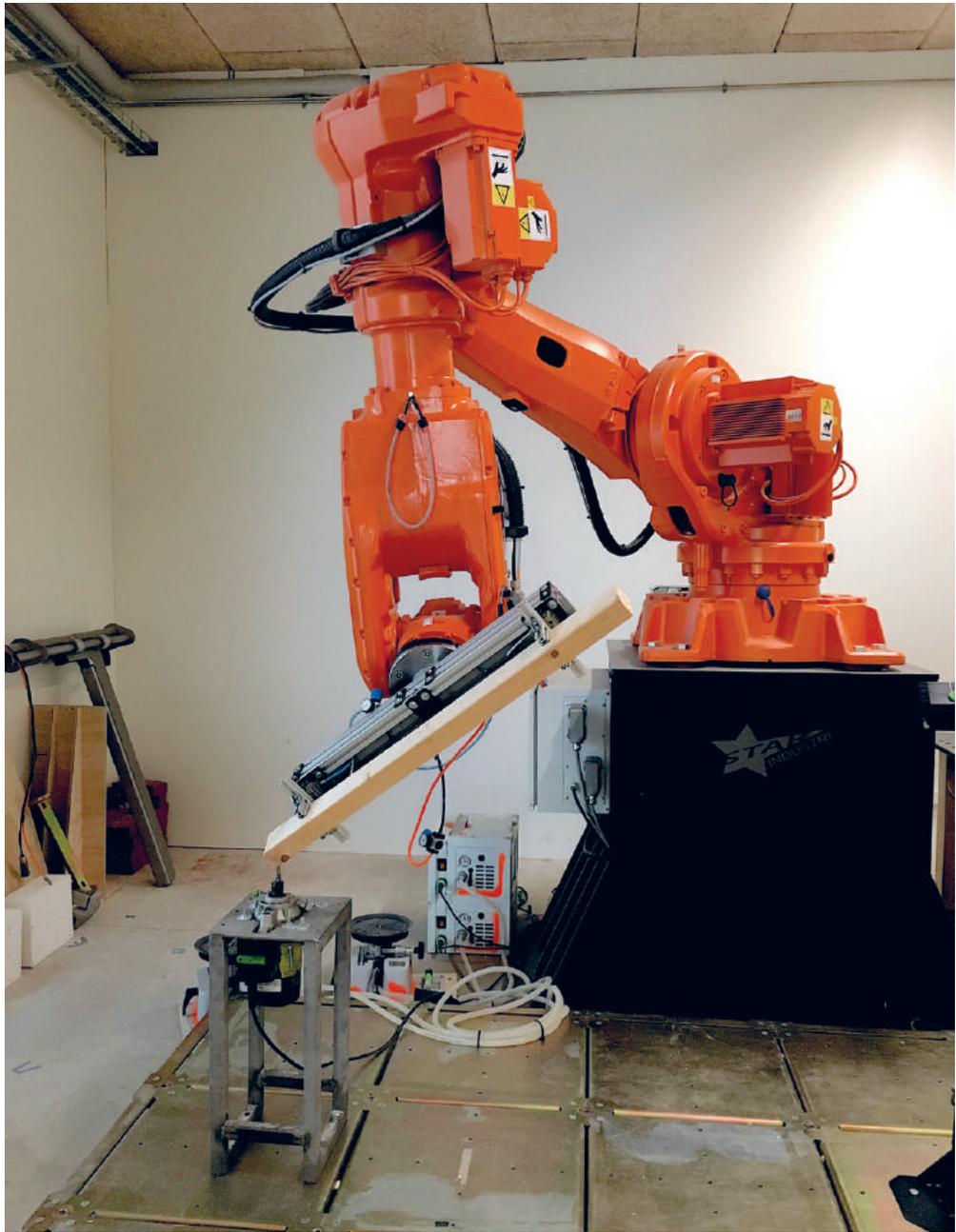
In the project *Timber Curtain*, it was a challenge to develop a digital form generation method that could work both as a design tool and a simulation tool and could also generate the geometric information necessary for digital fabrication on a 5-axis CNC router. The idea was to benefit from pinewood's capacity of bending in order to allow a larger field of geometric freedom with a relatively low amount of wood. The shape of the lattice was formed with guiding curves, supplemented by a number of variable parameters for the number of subdivisions and the dimensions of the S-shaped cross section. As part of the form generation, information about the fab-

rication logic was embedded. Including limitations for length, which needed to fit the router platform grid. Due to the underlying mathematical logic, each joint could be precisely shaped to allow adjacent components to meet perfectly. The structure, when mounted, consisted of bent members, but had to be produced from straight timber. Therefore, the analysis of the fabrication constraints was related to the straight version of the component, while the overall design could be evaluated based on visualisations of the structure when mounted. The simulation would give warnings about potential problems as messages, but also by visualising the actual fabricated member in its position. So rather than showing how the result is *expected* to look, the system would show how the result actually *will* look as a result of the relevant fabrication constraints. This made it possible to adjust parameters and guiding curves until the simulation looked harmonious.

Under the umbrella of the research project *Material Imagination*, supported by the Independent Research Fund Denmark, I am currently working in collaboration with assistant professor Anders Kruse Aagaard on a part project focusing on wood as a building material. The project is about using material properties as a starting point for the development of fabrication, construction and design principles through the lens of digital technology, i.e. CT scanning, laser scanning, CNC milling and robotic fabrication. Currently, the goal is to investigate how robotic processing with, for instance, a chainsaw can make way for construction logics based on wood that has not been pre-processed into box-shaped standard dimensions. The fabrication is linked with digital simulation and analysis to establish a holistic workflow that can work both as a design tool and a way of controlling construction and fabrication logics.

In a larger perspective, the research attempts to support the idea of architects regaining a deeper knowledge and understanding of material capacities and fabrication technology. A situation reminiscent of how architects worked in the past when architects had a more direct dialogue with craftsmen before and during the design and construction process. As such, the research can be seen as a change of perspective on architectural design where factors such as material, fabrication and construction logics regain a central role through the use of digital technology.

The projects are carried out based on a *research by design* approach, understood as being developed through means that are inherent in the professional practice, rather than a historical or analytical approach. Often, a broad hypothesis is formulated and then explored through the development of new methods and techniques, which themselves become the central research contribution. This is parallel to the way architectural projects are developed in general, with the difference that in the research, the method has higher priority than the final result itself. In several of the projects, the physical production clearly is a crucial part of the development process and has a major role in the research. The approach is perhaps comparable to research within engineering science or computer science, where new methods or principles are also developed through the research that is carried out.



Rethinking Tourism in a Coastal City

Design intervention as a method for understanding, reframing and redesigning

Can you go via Pomme Frites Strasse to Fabriksvej, or is it a dead end? Can you both drink beer and rosé on the bench at the harbor? Can you wear a shirt and tie under the coverall, and is there room for the seal, the dredger and a bath guest in Hvide Sande harbour?

Tourism is a significant and growing economic sector and a primary transformative driver. Tourism transforms cities, landscapes, and cultures, for better and for worse. We want to ensure the first and understand the latter. This project aims to investigate, map and describe how *places* ensure a broader positive impact from *tourism*, and how *tourism* engages with *places* in a more meaningful way. This is done using a series of site-specific design experiments. In the creative process of defining, designing, co-creating, using and discussing the design-experiments, the project enrolls and interacts with numerous actors, thus enabling a more nuanced mapping of opinions, competencies, and interests.

The project is situated in the paradoxical situation of Ringkøbing Skjern's coastal territory. Here we experience two opposing trends. 1: A stagnating economy and loss of population and workplaces as a result of the ongoing general polarization in Denmark where people move towards the major cities. In this context, the territory is often described as Udkantsdanmark ('Peripheral Denmark'). 2: A large and increasing interest in the coastal territory as a tourist destination, hence a substantial seasonal exposure of local culture and landscape, and a temporary manifold increase of population (3.3 mio. annual tourists in Ringkøbing Skjern Municipality. In this context, the territory is often described as Vandkantsdanmark ('Shoreline Denmark'). This reciprocal growth trend gives a substantial significance to the tourist sector in the region. Hence, we find it relevant to ask: What do we want from tourism?

In the middle of this, we find Hvide Sande. An active

port city developed around a lock and a dam as a link between Vesterhavet and Ringkøbing Fjord. With a stagnating population of around 3,000 people, a fishing industry undergoing a gradual rationalization and an increasing focus on port facilities servicing off-shore wind farming, Hvide Sande is simultaneously sandwiched in between thousands of summer houses on the west coast and visited by large numbers of tourists every year.

At present, in Hvide Sande, the driving transformative forces of development are tourism-related investments and the continued, but changed, industrial use of the natural resources (wind farming and fishing). Often these two driving forces are perceived to conflict. An example is off-shore windmill farms changing the horizon and view from the beach and the summer houses. The interest and outset of the research project, however, is to investigate positions beyond this dichotomy. By transgressing existing categories like tourist and local, urban and rural, natural and industrial, but looking into the restructuring processes of the physical territory, the project is looking deeper into the potential based *on* and not *in spite of* this entanglement. Hence we want to question the easy dichotomy often used in both planning discussions and in stereotypical tourist-oriented presentations of places.

Instead of focusing on creating better destinations in an attempt to give tourists what they demand, the focus should be on creating better cities for people — residents as well as visitors. It is essential to be aware of concepts such as part-time local and part-time tourist. This emphasizes a more nuanced approach to planning that engages more with places and which engages more deeply with the small-scale design of places, and subsequently uses local experience to inform and qualify large-scale, top-down planning.

The physical design-experiments have sought to investigate the performative potentials of various places, people and elements found in Hvide Sande. This is done using straightforward design actions such as rearranging, adding or subtracting existing elements in Hvide Sande to create new situations that activate well-known sites in new ways. Actions that help to amplify or stage certain potentials and gazes and, hence, generate debate.

Through the various 1:1 design-experiments conducted in Hvide Sande, some preliminary conclusions take shape. 1.1: Design-experiments can function as catalysts for site-specific debates that help articulate conflicts and potentials. 1.2: Design experiments can be used to investigate and activate the inherent possible actions of a place. 1.3: Design experiments can engage new local participants in developing places, to supplement and qualify the prevalent developer-driven strategy for tourism. Suddenly the local dock worker is helping to develop the tourism of Hvide Sande.



Architectural probes of the infraordinary



Social coexistence through everyday spaces

The infraordinary city

Architects are known for spectacular buildings and visionary urban spaces. But what facilitates the social coexistence within the city on an everyday basis? This research project investigates the *infraordinary* as a condition and catalyst for social coexistence and interaction. The term *infraordinary* is used to describe what is worn invisible by daily use and as an opposite to the extraordinary. Take, for instance, kiosks, apartments, laundries, hot-dog kiosks, stairways. These spaces are vital for the interaction between the inhabitants of the city on a daily basis — yet we hardly notice them. In an era of explosive growth of our cities, it is crucial to critically examine the everyday social dimension, if our cities are to be liveable in the future. Here, the research contributes with critical perspectives to inform future building practices and urban planning.

My grandmother's Danish tabac

When I was a child, I occasionally stayed at my grandparents' grocery store. At the time, it was a completely ordinary shop, similar to what today would be referred to as a kiosk, a Danish version of the 'tabac'. This space was a true anchor point — a social vertex — in the local community. Not only did it supply the neighbourhood with basic goods: high and low met there for an informal chat, regulars would be offered a cup of coffee from the backroom and others would hang around to drink after-work beers in the storage basement.

One day it was over: the road outside was redirected and a shopping mall was built a few hundred metres away. The shop front was patched up with bricks. Although my grandmother's tobacco shop existed for more than 23 years, not even a single photograph exists. Maybe it was so common — a background for everything else to unfold — that no one gave it much thought?

The infraordinary

Infraordinary literally means *below ordinary*. *Ordinary* is usually not meant in a positive way. If you follow the OxfordThesaurus, one soon arrives at words such as *banal, uneventful, uninteresting, dull, boring, uninspiring, non-essential, insubstantial* that have rather negative connotations. Conversely, *out-of-the-ordinary* is often understood as something to strive for in all aspects of modern society. This also goes for architects and decision-makers. And rightly so, because this is what architecture can do: give us experiences previously unimagined. However, the city should be built on social interaction and correlation on a daily basis. And it is not, necessarily, the grand gestures and spectacular design that contribute most to this, but rather the backdrop of everyday life.

At a distance from the well-known

The *infraordinary*, and the everyday, is hard to see because we are engulfed within it. Often, we take it for granted and only see it when it is gone or broken. To enquire into the everyday topography a tactical research methodology is deployed in order to get at a distance of the familiar and by-pass the usual hierarchies of perception to gain new knowledge. Consider it similar to switching one's shoes — mounting the right shoe on the left foot — in order to rediscover the feeling of walking. These critical spatial practices span an interdisciplinary territory for *seeing different* and *making the familiar strange* using literary devices, photographic apparatuses, architectural representations, moving pictures and interactive installations. The research is structured around seven *urban biopsies* — a sort of tissue samples of the city and its lived life. Together, these produce new perspectives on the *infraordinary* — beyond the city understood in numbers, diagrams and from a bird's-eye view. Ultimately, this research project contributes with a range of possible routes to understanding the everyday topog-



raphy and our social coexistence within it, through an alternative and more nuanced prospect.

Three urban biopsies

Excerpts from three of the urban biopsies are displayed at this exhibition:

The Danish tabac: A visual-acoustic installation conserving the history and qualities of my grandmother's kiosk.

The hot-dog kiosk: The diversity and social encounters at a hot-dog kiosk in Aarhus are explored through a two-fold interactive installation. At the hot-dog kiosk, the installation captures images of the feet of the visitors. At this exhibition, a continuous receipt displays the incoming photographs, mixed with the history of the hot-dog kiosks, facts and statistics. This re-choreographs the banal and contextualizes its latent qualities and potentials.

The stairway and the apartment: My apartment is old and porous. The other inhabitants of the block are present within my home: their conversations seep through the radiator pipes, their footfalls echo in the stairway and the neighbour's alarm clock wakes me up through the wall. The social coexistence and correlation between the inhabitants within my apartment building are explored and mapped, by using my own experienced lifeworld, 3D scanning and an alternative photographic apparatus in combination.



Wilding and weaving

A relational design practice

This doctoral research study is embedded in and developed through the architectural practice Helen & Hard.

The practice's experience, through engaging in many projects, is that the current discourse on sustainable architecture tends to focus much on energy efficiency, CO2 calculations, and new technologies but often neglects the more intrinsic ecological potential of architecture, which lies in the relational, experiential and poetic nature of space. This research explores and articulates this potential in the context of Helen & Hards relational design mode. Furthermore, it investigates the relationship between an individual's creative access to this embodied knowledge and the systemic frameworks which can help to bring it forth in the collective endeavours and complex processes of building architecture.

H&H's overall approach to design is relational, caring how all parts of a project affect each other and work as a whole within the specific situation it is embedded in. It aspires to enable coherence between multiple parameters and concerns and thereby provides a more ecological outcome. It explores how spatial/aesthetic languages can be conceived of as growth forms which allow processes of feedback and adaptation throughout the design process.

The research focuses on the experiential qualities and properties of a relational architecture and how H&H organize as a practice to make relational architecture. What interests me are on one side to explicate the capacities we as architects perform to handle relational design processes, and on the other side the different levels and qualities of design which are supporting these kinds of development processes.

The potential is to bring increased understanding to how architectures can respond to social/environmental challenges with spatial, experiential, aesthetic qualities.

Research by design has enabled me to reveal and explicate tacit levels of the relational design practice of H&H. The research started with a mapping of H&H as an evolving system over 20 years, drawing the different epochs of development around its changing habitat, activi-

ties and projects. At a certain point the drawing act itself came into focus and the research took an unexpected direction into the creative act of hand drawing itself.

The drawing work revealed how embodied spatial history, linked to Norwegian coastal landscapes, is a resource for form finding and aesthetic expression, through wilding and weaving lines. It has given access to a language, available while and through drawing — which is more poetic, narrating around the creative processes of making and sense making.

Further, the act of drawing produces a real time aesthetic experience, as a forecast, of the qualities/properties of the final architecture. Finally, the drawing can weave together invisible potential synergistic relationships between different design levels. The study of drawing also resulted in a specific method of redrawing.

The mapping of H&H's different epochs has given a new understanding of the practice itself as a specific forming field — a rich habitat for projects and ourselves to grow from. It continuously rearranges and adapts itself according to external forces and its own purpose. This systemic coherence of the practice, a kind of self-knowing and self-creation, is a relational capacity and a relational design in itself. The epoch mapping was tested as a heuristic tool for the development of a new project and the redrawing of ongoing projects to bring to the surface potential spatial, aesthetic experiential languages.

It is clear that the research has foregrounded and helped make explicit different relational design capacities:

1. The capacity of wilding and weaving, linked to the interest in and capability for balancing emergence and design;
2. A spatial, aesthetic language, conceived of as a relational growth form which anticipates, prepares for, even invites iterations, feedback, adaptations and more collective development processes;
3. The practice as a whole working to support relational design processes.

On one level, this research explores drawing as a method to reveal personal embodied knowledge of spatial aesthetic capacity, on another level, it connects this understanding to the pragmatic field of an architectural practice and the conditions and frameworks which may care for and enhance this core professional capacity.

The relational design practice of H&H can be understood as a dynamic between the following capacities: a sensitivity and respect for the singular, a nurturing of inclusive and emergent design development and a systemic agency. With these capacities and interests, making architecture for H&H means at the same time producing and being supported by designs which can allow for development and behaviour where multiple feedback is welcomed and valued. The research adds articulation and knowledge to these spatial, aesthetic capacities, which supports relational developments in the practice of H&H.

Experiment R / Opticut

In collaboration with Odico Formwork Robotics, Hicon A/S, Aarhus Tech, Søren Jensen Consulting Engineers A/S and Brunsgaard Scaffolding A/S and TU Delft, Aarhus School of Architecture has developed a new fabrication method, in which a robotically controlled, heated wire can cut advanced concrete formwork at unprecedented speeds. The design freedom of the method enable us to realize optimized structures, which use less material, energy and emits less CO₂ than conventional structures. The project is part of the Ph.D research project 'Computed Morphologies — Digital Construction Methods for Topology Optimized Architectural Structures' which explores the architectural potential of the method.

Experiment R / Opticut deploys RAWC for manufacturing of topologically optimized concrete structures and hereby aim to significantly lower the cost of constructing advanced concrete structures and buildings. The project is implemented through a full scale demonstration prototype, which accentuates the relation between architecture, technology and statics.

The prototype is jointly developed by the consortium, while the EPS formwork is produced in collaboration between Aarhus School of Architecture and Odico Formwork Robotics.

The new method is applicable within construction and restoration of concrete structures, where it enables new, unique design possibilities that are simultaneously cost-competitive in comparison with current manufacturing methods, but most importantly enables significant reductions of material consumption.

The over-arching aim of the project is to explore the architectural potential of this method in practice through the realization of an experimental, topologically optimized prototype structure in Ultra High-Performance Concrete, which will be erected in 2018 on Tangkrogen in Aarhus. Through the realization of this full scale prototype, the project seeks to contribute to the public and architectural discussion about the artistic possibilities in construction robotics. This contribution encompasses three themes:

1. The sculptural and architectural design potential which — based on the constraints and possibilities of the new manufacturing method — can be cost-effectively realized through digitally controlled robotic production, and hereby outline a new direction for the future of concrete construction.
2. A questioning of the conventional distinction between architecture and engineering, in which both structural and aesthetic conditions are mediated through autonomous, digital processes, and results in a design which is mutually determined by gravity, design intent and the constraints of the manufacturing method.
3. A financial perspective, which outlines a new potential for realizing geometrically complex designs with unprecedented cost-efficiency, and hereby opens up for a vast diversification of architectural practice.

The scientific scope of Experiment R / Opticut is the coupling of two technologies: topology optimization of concrete structures; and robotic wire-cutting of formwork systems in Expanded Polystyrene (EPS, also popularly known as 'Flamingo'). Topology optimization (TO) of concrete structures was investigated by Aarhus School of Architecture in the Danish National Advanced Technology Foundation project 'Unikabeton (2007–2009)'. The project concluded that TO can result in significant reductions in material consumption of up to 70%; but at the same time, the challenges of realizing the advanced designs through existing technology — by far out-weigh the financial savings achieved through reduced material consumption.

On the background of this project, the consortium behind *Experiment R / Opticut* has developed a new manufacturing method. Robotic abrasive wire-sawing (RAWC) of EPS formwork for concrete casting, and geometric rationalization methods for producing designs which can be cut using this technology. Comparative tests indicate that the method is significantly faster than existing technologies, with an up to 126 times increase in production speed.

The exhibited concrete object represents the first element of the prototype structure, A1, which will be assembled with the remaining six elements at Tangkrogen in Aarhus. Further, a 3d-print of the full prototype design can be seen, along with robotically cut formwork samples in Expanded Polystyrene



When the water comes!

When we talk about climate adaptation to more water, it is also about time we question our settlement patterns, urban development, and planning. More rainwater can cause flooding — and many of the places we build increase the flood risk. When we discuss increased amounts of rainwater, it is not always the water itself that is the problem.

In Denmark, climate adaptation is very much concerned with how we adapt our built environment to sea rise, groundwater rise, and to more frequent cloudbursts. Freshwater is a resource in itself; yet large amounts of rainwater often cause problems. The reason is not just the water, but the way we settle and inhabit the land. Climate change combined with an increased urbanisation



tion means we have to adapt our urban landscapes to new and more unpredictable situations. Increased precipitation and more frequent cloudbursts raise questions about the way we plan, build, and settle.

Water and the subterranean / building on wetlands

In particular since the late 1800s we have become accustomed to being able to control the water in underground systems such as drainage pipes and sewers. This technological conquest has allowed us to reclaim land. It has allowed us to extend our urban areas and settle in places that were previously unsuited for habitation. It became possible to build on the wet meadows, drained marshes and in blue-green passages. One of the functions of these places was to lead water to large meadow lakes, into the bay, or they made it possible for the water to infiltrate.

The Dry City — urban development and control

When water was brought under control, planning, urban development, the parcelling out of land, the location of buildings, and the use of building materials created a perception of the city as 'The Dry City' (Den Tørre By). In The Dry City, the physical environment supports the interests of humans. Primary roads were created to facilitate mobility, such as commuting, supplying goods, and allowing access to emergency services when needed.

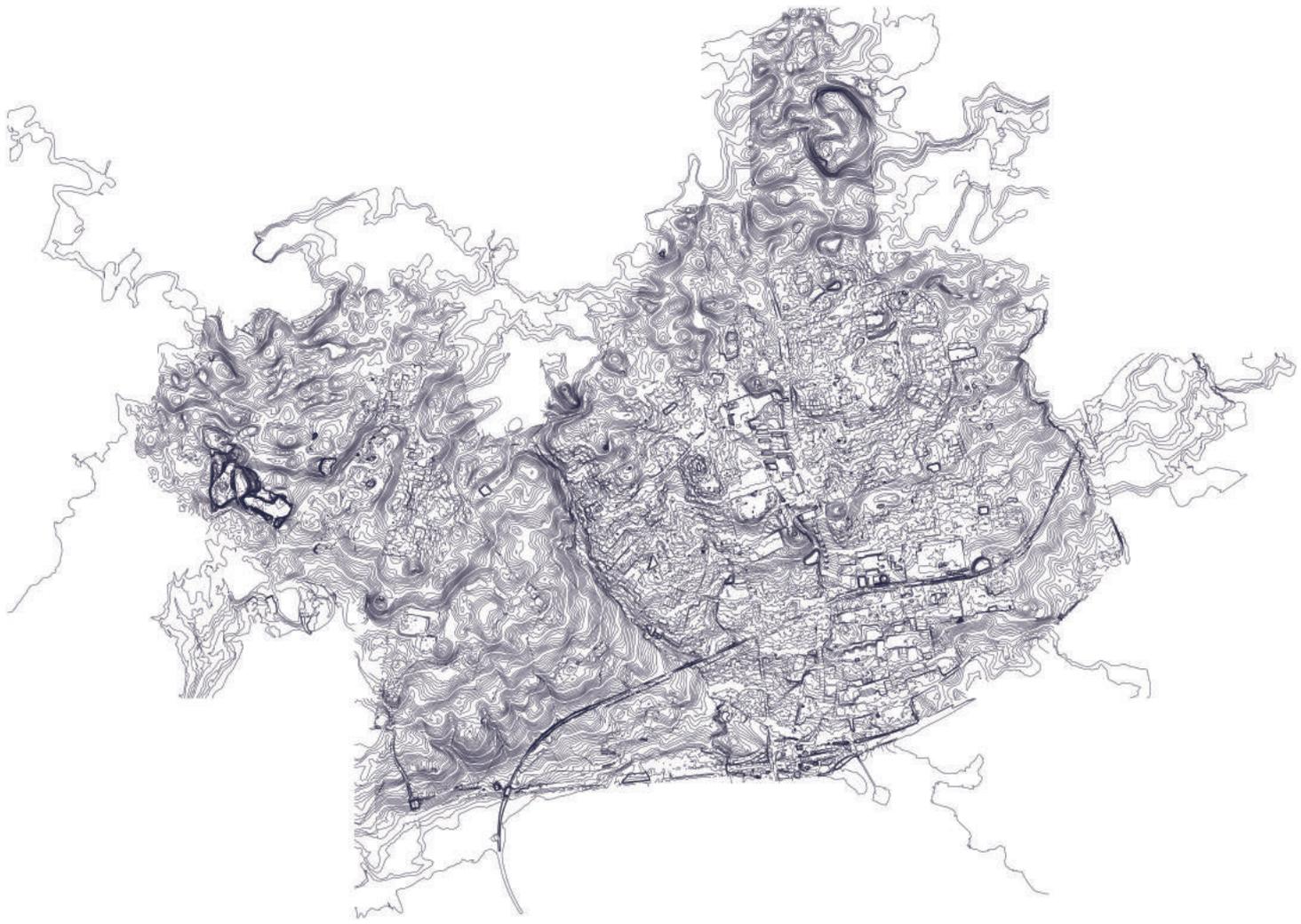
The Wet City — water crosses boundaries

Groundwater rise, sea rise, and increased amounts of rainwater, however, change the conditions of our urban landscape and challenge our understanding of the landscapes of the city. Rainwater no longer stays in pipes underground; and when rainwater moves over the surface, it respects neither property rights, local planning, nor financial interests.

When the cloudbursts occur, 'The Wet City' comes to the surface, questioning our perception of city vs. landscape and nature vs. the manmade. In the event of a cloudburst, the vast landforms of the ice age emerge. Below the asphalt and tiles of the urban landscapes, terrains and soil conditions awaken, which for 11,000 years have been optimised to lead water on, downwards, towards the sea.

The city's landscapes — access roads or river beds

When cloudbursts occur, water crosses administrative, economic and functional boundaries, revealing major landscape features that interact with man-made landscapes, such as roads and buildings. The access road, the sealed surfaces of the front garden, the company headquarters and its parking space create new routes for the water. During cloudburst, the roads obey the rules of the water: becoming river beds that convey the water, while the basement and the pretty foyer are transformed into water reservoirs and mirror ponds. In many cases this has consequences for human interests in the urban landscapes.



Place names that tell a tale about water
— hydrotoponyms

When the water comes is based on the research project 'Waterscapes of Value' — which used the suburb of Lystrup as a case study. In 2012 Lystrup was hit by a cloudburst which resulted in the flooding of both roads and buildings. By comparing historical maps, contemporary maps and flood maps, a pattern emerged: the flood-threatened residential areas were located in former wetlands. Today's street names make this even more visible with their nature-romantic references to the (wet) landscape features of the past. Street names that include hydrotoponyms, such as, e.g. Åvangen (river meadow), Mosevangen (marsh meadow) and Ellebrinken (alderbrink), speak the language of water. The case study points to the unresolved relationship between the

Dry and the Wet City. By marking Lystrup's existing 'hydrotoponyms,' a picture is drawn of the everyday urban landscape, The Dry City, that we take for granted. When Lystrup's hydrotoponyms are juxtaposed with historical wetlands and future flood maps, new relations emerge. When the cloudbursts occur, the water takes over and the ice age landscape emerges. The Wet City awakens.

The research project is based on methods from research by design, including 'mappings' that combines hard and soft facts, the measurable and the sensual, the past, the present, and the (likely) future. These methods have provided opportunities for examining climate adaptation and habitation based on the premises of water. They also indicate potentials for the urban development of the future, in which water is turned into a resource. In The Dry City as well as in The Wet City.

Biographies

Anders Kruse

Aagaard

Anders Kruse Aagaard is an architect who holds a PhD and is an assistant professor at The Aarhus School of Architecture. Anders takes part in the three-year research project 'Material Imagination', where he combines knowledge about and examination of material properties of wood with high-tech fabrication processes. The research field of Anders stems from a broad interest in materials and the diverse properties — a topic that was also explored in his PhD dissertation.



Anne Mette Boye

Urban designer and landscape architect. Focuses sharply on strategies for urban transformation, urban spaces and landscape. Founded the architectural office *Metopos by og landskab* with Trine Skammelsen and Ellen Braae. Jumped into the academic world in 2012 and established the architectural office SecondCity on the side in 2014. Anne Mette began her PhD in April 2016 on part-time. It was made possible through funding from *Fremtidens Byfornyelse*.



Charlotte Bundgaard

Charlotte Bundgaard is MArch and PhD in architecture, associate professor, and Head of Research at Aarhus School of Architecture. She was awarded a PhD degree in 2006. Her dissertation has been published in Danish and English under the title *Montage Revisited — rethinking industrialised architecture*. For several years she has been doing research in the fields of industrialisation, tectonics and transformation. From 2010 to 2014 she was Prorector at Aarhus School of Architecture and responsible for the school's collaboration with architectural practice.



Polina Chebotareva

Polina Chebotareva works at the intersection of psychology, art and architecture. Currently she is a PhD fellow at Aarhus School of Architecture. Her research by design project is titled 'Architectural aesthetics as catalyst of social change' and explores how the multisensory aspect of the built environment influences how one acts and what one perceives. Furthermore, the research investigates how architectural design can shift one's attention to stimulate new ways of seeing and doing. A central part of the research is two installations made in collaboration with architects. Outside of her research, in 2016, Polina co-founded the design studio Between Architecture and People (BAP Projects) where she applies her research to a psychology-based design practice on projects in architecture, interior design and urban installations. Prior to the PhD research, between 2012 and 2016, Polina worked at Studio Olafur Eliasson with concept and design development. In 2015 Polina received a Master of Science in Psychology from University of Copenhagen. Her research and design work is strongly inspired by her previous work experience and studies in the fields of psychology and art.



Elizabeth Donovan

Elizabeth moved to Europe from New Zealand after completing her Bachelors of Architecture. Following this, in Sweden at Chalmers University of Technology, she completed a dual Masters in architecture and sustainability and worked in a small architecture office. She is currently finalising her PhD at Aarhus School of Architecture specifically focusing on the relationship between sustainable architectural discourse and practice.



Jon Krähling Engholt

Semi-German, volleyball player, Jute, architect, drone pilot, coffee lover, PhD student. After several years as a university student in physics and the history of science, in 2008 I fell in love with the school of architecture. The study expanded my interest in technology and materials — most notably in digital tools for complex form finding and fabrication. As an architect, I have worked with these subjects in local practices for a few years, before sitting down behind my desk in the PhD school in September 2017.



Udo Garritzmann

60

Udo Garritzmann is an architect, researcher and teacher of architecture based in Rotterdam, currently PhD fellow at Aarhus School of Architecture where he researches on theories of tectonics and brick architecture. Before fully committing his time to academia he gained long-standing experience in professional practice (Garritzmann Architecture, De Architekten Cie., OMA/Rem Koolhaas). He has taught at various schools of architecture (TU Delft, AvB Amsterdam, AvB Rotterdam, Riseba FAD Riga and msa Münster), has published academic essays in books and professional journals and was a member of the editorial board of architectural journal OASE. Udo Garritzmann graduated with honours from TU Delft and received the Master in Design Studies (MDesS) from Harvard University.



Angela Gigliotti

Angela Gigliotti is an architect, educator and researcher. She is currently a PhD fellow at Aarhus School of Architecture, Denmark; an external lecturer at DIS Copenhagen; and a visiting PhD candidate at the AA London, UK. She has researched and taught since 2010. She is co-founder of OFFICE U67 ApS, an architectural practice whose works have been awarded, exhibited and published in international contexts. In 2017 it was listed as the Danish standard-bearer among the 20 most talented practices worldwide by Wallpaper* magazine.



Karianne Halse

Karianne Halse holds a Master of Art in Architecture (Aarhus School of Architecture, 2012). She has been practicing as an architect with an emphasis upon landscape at SLA (Copenhagen), SLETH (Aarhus) and James Corner Field Operations (NYC). Besides a number of publications and exhibitions, Karianne has been teaching at Aarhus School of Architecture since 2012. The PhD project is funded by the Danish Council of Independent Research.



Rasmus Hjortshøj

38 years old. PhD student at Aarhus School of Architecture conducting the research project *SEACHANGE – Territorial Entanglements in the Coastal Territories of the Anthropocene*. I was born in Skagen and have been brought up in close relation to the sea and thereby the state of ephemerality that governs the coastal landscapes, which is also my primary topic of interest. I graduated as an architect from Aarhus School of Architecture in 2008 and now live in Copenhagen, from where I have eight years of experience in architectural design working in both the building and planning scale. Recently, I have transitioned into the field of research where I am mainly engaging in the built environment and the context in which it is inscribed through photography – primarily focusing on the coastal territories. In my practice COAST Studio, I combine the medium of the visual representation with architectural theory through both my architectural and photographic practice and through the research environment at Aarhus School of Architecture.



Masha Hupalo

Masha Hupalo is trained as an architect, with degrees from Saint-Petersburg State University of Architecture and Civil Engineering (MSc) and University of Applied Arts, Vienna (MA). She is currently pursuing a doctoral degree on urban territories, new technologies and networked infrastructures at Aarhus School of Architecture, Denmark. In her research project, she is investigating the potential of parking policies and requirements to influence urban configurations and the speculative nature of planning documentation. Besides working for three years in architecture practices in Vienna, she has taken part in several group exhibitions in Europe and Asia.



Gitte Juul

Research fellow at Aarhus School of Architecture & University of Ljubljana, Faculty of Architecture, associate teaching professor at the School of Architecture, The Royal Danish Academy of Fine Arts, Copenhagen. Artistic leader of The Office for Art in Town in Ballerup since 2011. Recent publications and exhibitions: *Inhabitation* 2016/2017, KADK, 2018, *Det foreløbige Kontoret for Kunst i Byen kompendie*, Ballerup Municipality, 2017, *East West River*, Arbejdermuseet, Copenhagen, 2016



Mo Michelsen

Stochholm Krag

Mo Michelsen Stochholm Krag is an architect, educator and researcher born in Aarhus, Denmark in 1975. He is assistant professor at the Aarhus School of Architecture, Denmark. He holds a PhD in Architecture. He has 17 years of experience in the private sector as a building architect. He was co-founder of architectural office Krag de Ridder ApS in 2006. He teaches and researches in the areas of transformation of depopulating rural villages, radical preservation, and experimental practice research since 2010. He reviews new architecture at the Danish architectural trade journal "Arkitekten" since 2014.



Maya Lahmy

Maya Lahmy combines her professional practice in architecture with teaching and research. She is currently enrolled as a PhD fellow at Aarhus School of Architecture. Her research is triggered by the interpretations that must take place between digital drawing processes and the digital processing of physical materials. The inquiry probes into and uses digital means as a vehicle for creative exploration.



Niels Martin

Larsen

Niels Martin Larsen is an architect and an associate professor at Aarhus School of Architecture in Denmark. He holds a PhD in the field of digital design and fabrication, a Master of Arts in Architecture and a Bachelor of Architecture, and he is educated as a programmer. Niels Martin Larsen has been practicing and lecturing as an architect since 1998. He has undertaken private practice as well as projects for 3XN Architects, C.F. Møller, Chris Thurlbourne and EMBT. He has been teaching at the Bachelor and Master programmes at Aarhus School of Architecture. As a member of the research lab Technology and Building Culture, he is taking on research in digital form generation and digital fabrication methods. Currently, Niels Martin Larsen is working on the research project Material Imagination, supported by the Independent Research Fund Denmark.



Mathias Meldgaard

I am more interested in discussing what architecture *does* rather than how it *looks*. I pose questions and enter into dialogue through design and find that discussions are most fertile when they take their starting point in the tangible. I am curious about how we interact with each other and our surroundings and how design inspires to consider things more nuanced. My research is situated at the intersection of understanding of place, urban design and planning focusing on how the first qualify the last.



Espen Lunde Nielsen

Practitioner and independent researcher working in the intersection between art, architecture and technology. He holds a PhD degree (2017) and a Master of Art in Architecture (2012) from Aarhus School of Architecture. In 2014 he was a visiting research student at Bartlett School of Architecture. His experience includes SLETH (2012) and Studio Christian Wassmann (2010). In 2017 he founded NO38 Architecture+Research.



Claus Peder Pedersen

Claus Peder Pedersen is an architect and an associate professor at the Aarhus School of Architecture where he is head of the PhD School. He has been active in promoting design and practice-led research through networks and associations such as ADAPT-r and CA²RE. He was a founding partner of the architectural offices TRANSFORM and Blankspace.



Siv Helene Stangeland

Siv Helene Stangeland is an architect and researcher based in Stavanger, Norway. She studied at ETSAB Barcelona and Oslo School of Architecture. Together with Reinhard Kropf, she founded the architectural office Helen & Hard in 1996. They have won numerous awards and prizes for their sustainable practices and their timber architecture. In 2017 she received a PhD in Architecture from Aarhus School of Architecture on H&H's relational design approach.



Asbjørn Søndergaard

Asbjørn Søndergaard is PhD fellow at Aarhus School of Architecture, and co-founder and Chief Development Officer at Odico Formwork Robotics, where he heads the industrial research and development within the same. This work entails several high-profile research efforts to develop novel fabrication technologies within the architectural construction, such as Robotic Hot-Blade cutting, Augmented Reality Interfaces for robotic production programming; and automation of non-repetitive robotic manufacturing. A trained architect and research fellow at Aarhus School of Architecture, Asbjørns research synthesizes an interest in topology optimization and robotic fabrication as constitutive instruments of architectural design, an interest that is being investigated over several collaborations among others with Gramazio Kohler Research, ETH Zürich, and Israel Institute of Technology, Haifa.



Katrina Marstrand Wiberg

Katrina Marstrand Wiberg is a PhD fellow at Aarhus School of Architecture. Her project is entitled *Water-scapes of Value – value creation through climate adaptation in everyday landscapes*. It focuses on climate adaptation for 'the common good' in everyday urban landscapes. Katrina is currently employed as an assistant professor in landscape architecture at Aarhus School of Architecture. She is also project manager at Gustin Landskab, where her responsibilities relate to landscape analysis, strategy, climate adaptation, water, and value creation.



Colophon



Exhibition Catalogue

Curator:	Karen Kjaergaard, Head of Exhibitions, Aarhus School of Architecture
Catalogue design:	Mathias Skafté, Architect MAA
Cover design:	Casper Riis Jensen, OddFischlein
Translation and English proof reading:	Thomas Falkenberg Svendsen
Editors:	Charlotte Bundgaard, Head of Research and Claus Peder Pedersen, Head of the PhD School
Print production:	Martin Høgsgaard, WeProduce
Portraits:	Selfies
Paper:	Munken Print White 120g and Glossy Glossy 150g
Typeface:	Univers 55 Roman
Run:	250 (DK) + 250 (UK)



Charlotte Bundgaard Claus
Peder Pedersen Anders Kruse
Aagaard Anne Mette Boye Polina
Chebotareva Elizabeth Donovan Jon
Krähling Engholt Udo Garritzmann
Angela Gigliotti Karianne Halse
Rasmus Hjortshøj Masha Hupalo
Gitte Juul Mo Michelsen Stochholm
Krag Niels Martin Larsen Maya
Lahmy Mathias Meldgaard
Espen Lunde Nielsen Siv Helene
Stangeland Asbjørn Søndergaard
Katrina Marstrand Wiberg



ISBN: 978-87-90979-74-4

ARKITEKTSKOLEN AARHUS | NØRREPORT 20 | DK-8000 AARHUS C | DENMARK | AARCH.DK