QUESTIONING

MATERIAL DESIGN

SPECIFIC CERAMIC GLAZED CONCRETE
DESIGN IN A BROAD PERSPECTIVE

ART DESIGN ARCHITECTURE MATERIAL AND PROCESS TECHNOLOGY

ANJA MARGRETHE BACHE

DESIGNING CERAMIC GLAZED CONCRETE TECHNOLOGY -
Based on a cross skilled approach - spanning from natural science to art.

Might materials be designed with a basis in and juxtaposition of installation art, crafts, architecture, art-research, technical scientific materials research, and process through a craftsmanship-like practice? This is what Anja Margrethe Bache suggests with the design method, Design in a Broad Perspective. This is a design method she has worked from while developing Specific Ceramic Glazed Concrete. In this book, Anja Margrethe Bache testifies to her thinking on the design method Design in a Broad Perspective and Specific Ceramic Glazed Concrete aimed at future building activities and urban spaces. It revolves around issues such as art, design, architecture, crafts, process, and material technology, as well as aesthetics and art research and is filled with Anja Margrethe Bache's art works made from specific ceramic glazed concrete with photos by photographer Ole Akhøj. The book is specifically intended for a general readership, and the reader who want to practically work with concrete, high-strength concrete, and ceramic glazed concrete.

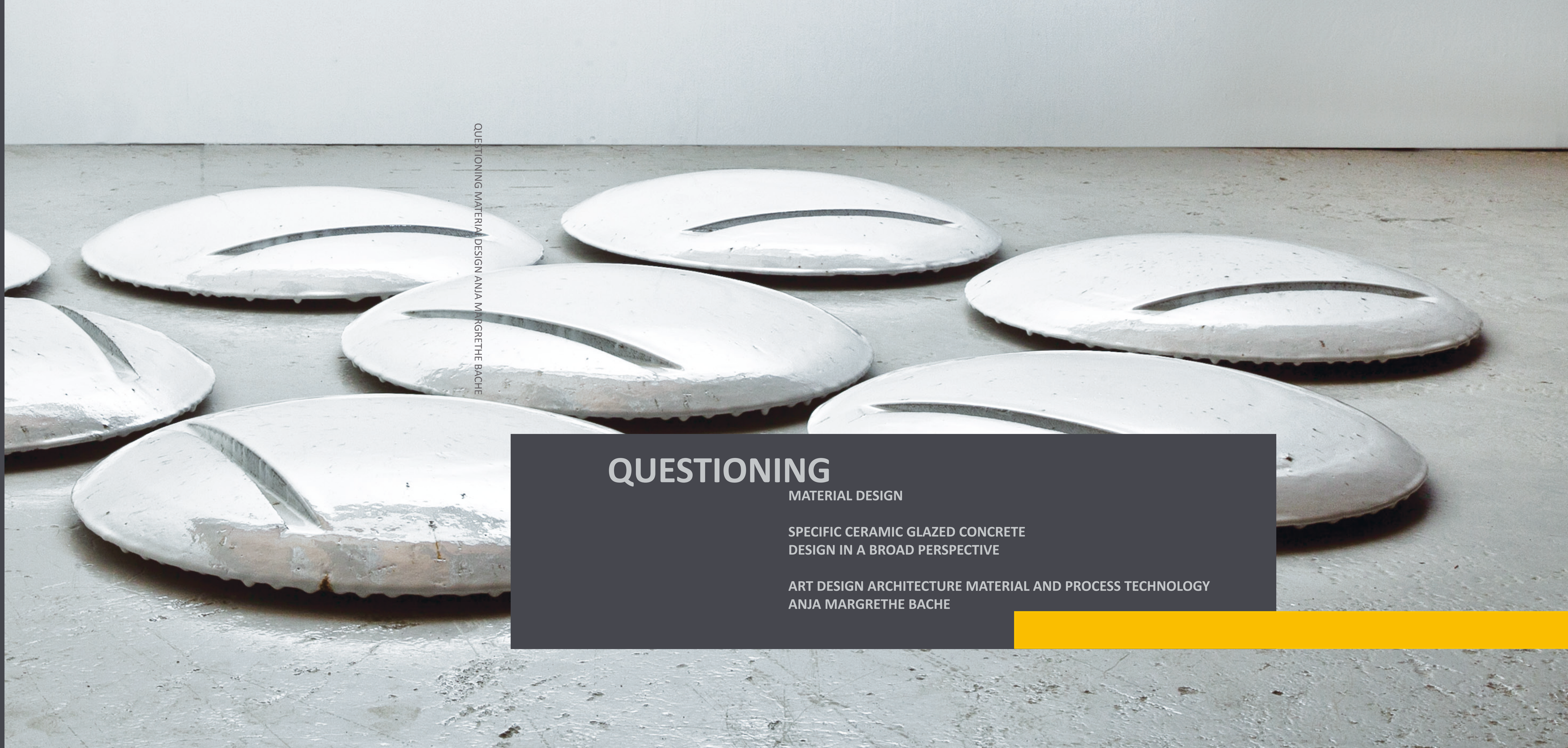
Anja Margrethe Bache is an artist, reseaercher and material designer. This book os a result of an art-technology developing project performed at the Technical University of Denmark. Anja Margrethe Bache was at that time associate professor at the Technical University of Denmark, Department of Civil Engineering, Building Design section, Master's and graduate studies.

Anja Margrethe Bache holds a degree in civil engineering from DTU's department of process technology, an MFA from The Royal Danish Academy of Fine Arts, School of Visual Arts and a PhD in Architecture from the Aarhus School of Architecture.

Anja Margrethe Bache has worked with the potential of composite materials during the course of her richly faceted education and has worked and exhibited across the whole spectrum, from engineering science investigations to architectural development and to art at national and international exhibitions.

www.anjabache.com
www.the-concrete-design-academy.

QUESTIONING MATERIAL DESIGN ANJA MARGRETHE BACHE



QUESTIONING

MATERIAL DESIGN

SPECIFIC CERAMIC GLAZED CONCRETE
DESIGN IN A BROAD PERSPECTIVE

ART DESIGN ARCHITECTURE MATERIAL AND PROCESS TECHNOLOGY
ANJA MARGRETHE BACHE

QUESTIONING Material design
Specific ceramic glazed concrete
Design in a broad perspective
By Anja Margrethe Bache

1 edition, 2014

ISBN 978-87-502-1083-2

Design and drawings: Anja Margrethe Bache
Translated from Danish to English by Morten Stinus Kristensen
Cover photo: Ole Akhøj
Editor: Pia Barnholdt Kristoffersen
Print: grafisk forum, Denmark

Printed in Denmark 2014
Dgital edition created in 2020 by the author with permission from
the publisher Polyteknisk forlag 20-08-2020

The book is published with support from
The Realdania Foundation
Dreyers Foundation

Polyteknisk Forlag
Anker Engelunds Vej 11
DK-2800 Lyngby
forlag@polyteknisk.dk
www.polyteknisk.dk

A development project told in words and pictures, completed at
The Technical University of Denmark, Department of Civil Engineering
International Ceramic Research Center, Guldagergård 2010-2011
The Danish Art Workshops, 2012 and 2013

Exhibitions at
Danish Museum of International Ceramic Art 2012
Gallery 21 Malmö 2013
Marsden Woo Gallery London 2013
Charlottenborg Spring Exhibition 2013
Crafts biennale 2013
Gallery Oxholm 2013

Development project supported by
The Realdania Foundation, 2009-2013 (main sponsor)
The Technical University of Denmark, 2009-2013 (main sponsor)

Exhibition activities and artist residences supported by
Work grant (arbejdslegat) from the Danish Government Art Fund, architectural committee, 2010,
Artist residence at Guldagergård 2010-2011
Work grant (arbejdslegat) from the Danish Government Art Fund, design and craft committee, 2011, exhibition support
Danish Arts Agency, support for London exhibition
J. L. Foghts Fond (foundation), 2011, exhibition support
Danmarks Nationalbanks Jubilæumsfond, 2011, exhibition support

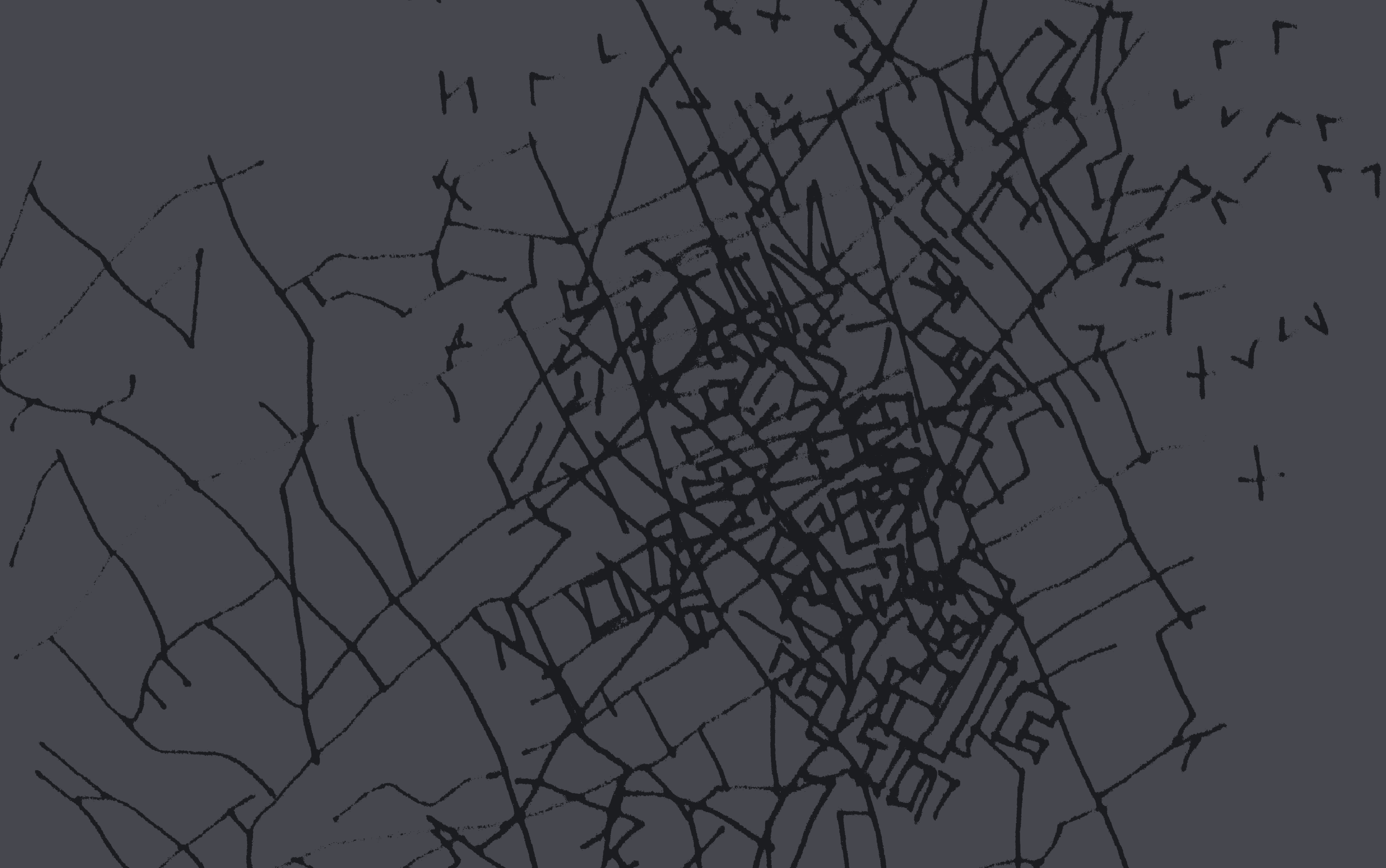
Book publication supported by
The Realdania Foundation 2014
Dreyers Foundation 2014

Some materials sponsored by Densit Aps, (www.densit.com),
Stratec (www.stratec-gmbh.de) and the Bozzetto Group, (www.bozzetto-group.com).
Primary photographer Ole Akhøj,
otherwise: photographer © Philip Sayer, courtesy of Marsden Woo Gallery,
photographer Torben Åhndal,
photographer Maja Alberte Bache,
photographer Vibeke Trolle,
photographs by Anja Margrethe Bache.

QUESTIONING
MATERIAL DESIGN

SPECIFIC CERAMIC GLAZED CONCRETE
DESIGN IN A BROAD PERSPECTIVE

ART DESIGN ARCHITECTURE MATERIAL AND PROCESS TECHNOLOGY
ANJA MARGRETHE BACHE



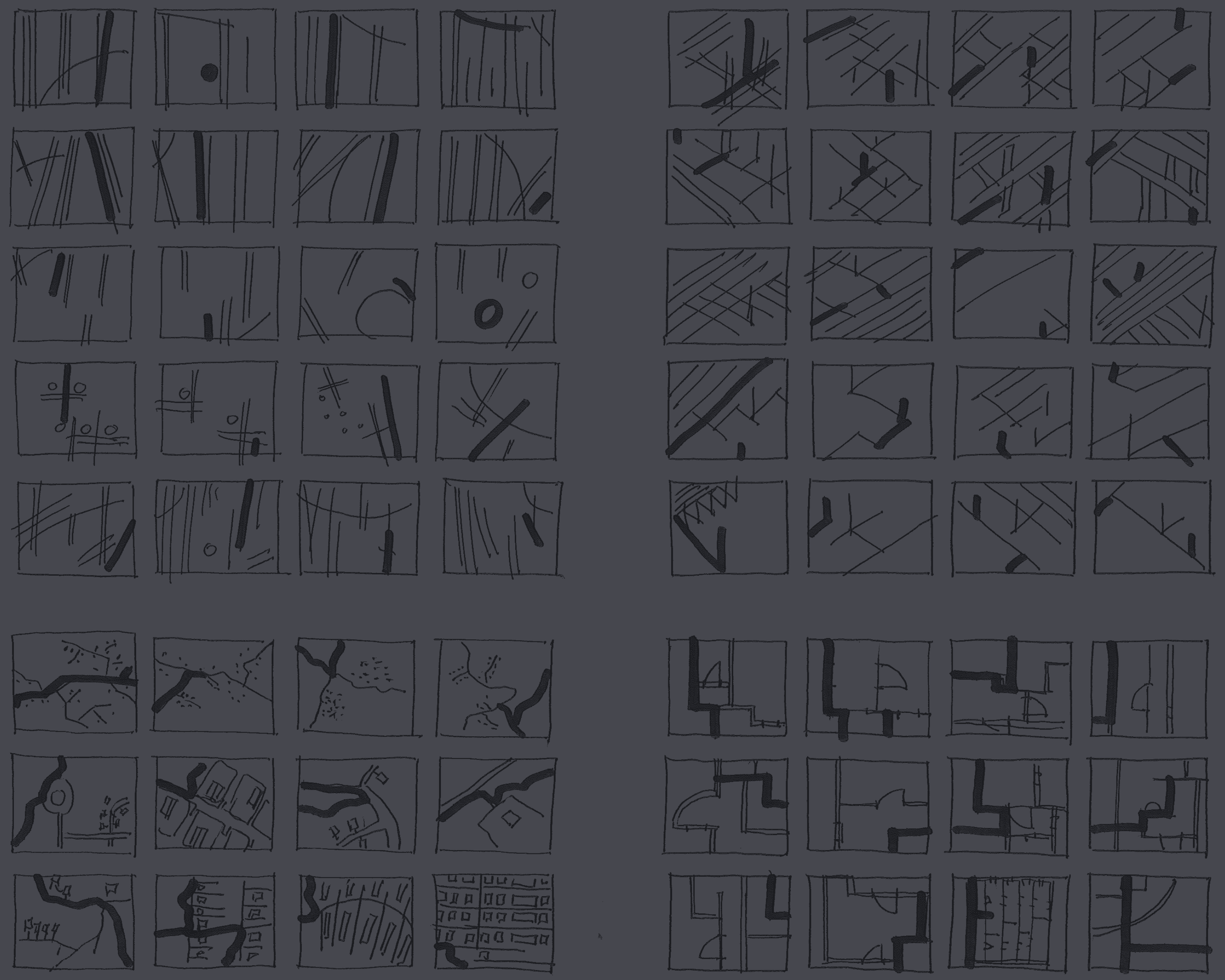
SPECIFIC CERAMIC GLAZED CONCRETE

MY DREAM IS TO DEVELOP
FLEXIBLE
LARGE-SCALE
THIN
CERAMIC
WITH
AESTHETIC MANUFACTURING
WHICH WE
WHEN IT SURROUNDS US
IN
COFFEE MUGS
ART
FACES OF BUILDINGS AND
URBAN FURNISHINGS AND COVERING
WILL KISS AND EMBRACE
FEEL OURSELVES
AS SENTIENT, EMOTIONAL BEINGS
A CERAMIC BASED IN CONCRETE.
ANJA

Thank you to my sister, Nina Jeanette Bache, my friends, Kari Skytt Andersen, Henriette Melchiorsen, and Ane-Katrine Von Bülow whose support and sparring have been indispensable. Thank you to my dear father, who inspired me, shared his research and knowledge with me, and has let me draw on his immense passion. Thank you also goes to my teenage daughter, Maja Alberte Bache, who has cried for attention and forced me out of my near-constant maniacal boundlessness of work and book writing. Thank you all you wonderful ladies, and dad too.

CONTENTS

INTRODUCTION



INTRODUCTION

The fundamental value of art is spirit
And it exists right below the surface of the art works
The spirit of the art wants to contact us, but it is invisible,
so to manifest itself
so we can see it, it uses us.
It gives us a strange desire.
A desire to create art works and a desire to view them.
(Jensen, Per Bak, 2011)

INTRODUCTION

This book was written forward, but its content was to some degree understood backwards. While writing the book, and especially while reading the literature relating to the questions that have followed it, I have continuously become aware of new ways of looking at things. It is like a Pandora's box that is impossible to close and keeps on spouting new layers of meaning.
For the third time, I've read Niels Åkerstrøm Andersen's book Diskursive analysestrategier, (Åkerstrøm Andersen, 1999), with interpretations of Foucault, Kosselleck, Laclau, and Luhmann. For the third time, new ways of comprehending this emerge. The changed meaning emerges because the terms, in relation to their context, each time unfold in a different way. It is in the reading of philosophy and of philosophic aesthetics that the terms are given new layers of meaning with historical reference to Aristotle, Plato, the Pythagorean and so on. That I can locate new meanings from the same book delights and surprises me, but also makes me despair. How can I, with what seems to still be a worm's eye's view on everything, express myself about anything when authors like Niels Åkerstrøm Andersen and his ilk have such a breadth of outlook.
While reading secondary literature, I have often felt unspeakably myopic. There is so much I do not know. This has often lead me to not want to expose my ignorance in this book. When others do not know how stupid I am, they might as well believe that I, holder of several academic degrees, am smart.
I have also thought that all I'd have to do is read more and think more smartly. But the more I read, the more I am aware of what I don't know. What I don't know is infinite. Yet, I have chosen to share what I do believe I know at this time with the vulnerability that comes along with exposing it. This I have done with a quote from Czech teacher, priest, and author Johann Amos Comenius (1592-1670), [1], in mind: Life is one long act of learning, as well as Niels Åkerstrøm Andersens's interpretation of Foucault's discourse analysis (Åkerstrøm Andersen, p. 45): When the object is verbalized it means that the object is brought into existence as a social and linguistic fact and thus can be talked of. (ibid. p. 45) I verbalize my perspective, my way of seeing certain aspects and tell of from where I establish meaning. It is my hope that this book, with its flaws and omissions and still problematic areas for example in regards to art-research, can stir discussion, criticism, and, hopefully, dialogue.

Cover photo. Specific ceramic glazed concrete objects, diameter 60 centimetres, from exhibition at the Danish Museum of International Ceramic Art, 2012. Photos: Ole Akhøj. Previous and this page, concrete bridge at Mølleøen, photos Anja.

EXCERPTS OF THOUGHT

I am a materials researcher, component designer, and artist. I develop materials with the desire to achieve new mechanical, static, chemical and/or other technical performances that can breed possibilities for future types of art, buildings, and urban spaces that do not exist today. At the same time, the materials have to move us sensuously, bodily, and emotionally, so that we want to embrace and kiss them. They must become relevant to us, so we take care of them and feel ourselves in them as reflective intellectuals, but also as beings that sense with body and spirit. Searching for such materials, I have used a holistic design method called "Design in a Broad Perspective". With this method, I invite different academic approaches to participate simultaneously, searching for a broad approach for designing materials. It consists of linking research and practice. The research is represented by technical, scientific materials research and art-research, while the practical aspect involves art, design, architecture, and crafts. Artistic crafts are also invited, but has in the design method Design in a Broad Perspective, as it has been practiced in developing specific ceramic glazed concrete, been attached to art.
By letting these distinct academic areas work together, the goal of the design method is to create a platform from where we can question materials interdisciplinarily, where both theory and practice meet, and where both quantity and quality are in play.
It is with the design method Design in a Broad Perspective, I have developed specific ceramic glazed concrete. It is not a singular material with a singular recipe, but a design concept for a group of materials. It is a concept that opens up the possibility of designing ceramic that is flexible, which can be large-scale combined with low thickness, and new appearance in terms of aesthetics, materiality, and design. This is the intended goal of specific ceramic glazed concrete in the design concept.
This book is excerpts from thoughts on the design method Design in a Broad Perspective, exemplified and concretized by selected narratives about the development of specific ceramic glazed concrete. It is about theory, but also practice, just as it has a technical as well as an artistic approach.
The book is a statement about a wide-ranging approach to designing materials that will be exposed to and work alongside urban and building contexts. It originates from years of my practical work as researcher, artist, and component designer with different materials, and it is also an introduction to specific ceramic glazed concrete. It originates from a need to communicate and share ideas including those that are yet to be complete, with the hope of discussion and dialogue. The book has a wide-ranging academic approach and encourages questioning across the boundaries of different academic disciplines.

QUESTIONING ACROSS

The Danish nursery rhyme "Spørge Jørgen" is about a little boy who will not stop asking questions. Here the questions are asked to tease, but also for Jørgen to get his parents to pay attention to him; *Dad and mom were getting fed up, everything he asked was nonsense. Often he just asked to tease - why this and why that.* (Laurents, 1966). Spørge Jørgen is put to bed and is even spanked; But one day his dad had had enough, Jørgen was spanked, and Jørgen was put to bed. But that did not end Jørgen's desire to ask questions, he kept doing it, but finally concluded that the questions he would ask in the future would no longer be silly. *I'll never again ask a silly question*. (Laurents, 1966) This book emerges from all of the questions that go unasked, which seem as if they will never be asked, and in some cases are excluded because they seem irrelevant to the context in which they are asked. Here, all questions are invited in. Here, we welcome both Spørge Jørgen's silly questions and those questions that might seem stupid. Questions can be what opens up new avenues of knowledge and make different ways of seeing things appear. When Jørgen in the song asks, *Why doesn't a cow have any fingers, why do they moo instead of woof. Why is the nail on my finger; wouldn't it be more fun if it was on my nose*, he expresses wonderment, but also courage in that he dares exposing his own ignorance. Maybe he does this because he is young and doesn't see himself as a questioner in a larger context. Jørgen asks because he can't help himself and has no anxiety of coming across as stupid. These are character traits I call for. Questions that might seem stupid in some contexts often appear as such because the frame of reference they question is different from the one the questioner finds him or herself in. Stupid questions might be stupid considered from one perspective, while they are not in another; therefore they are welcome here.
Jørgen is a little boy who has only just begun exploring a world of potential discoveries. It is the Spørge Jørgens of the world this book is directed at. Those who wonder, who can't help themselves, and those who are not afraid of exposing what they do not know and curiously explore and are challenged by the discovery.
As Peter Knoop Christensen and Anders Stahlschmidt write in their book Spørgeteknik (Christensen, Stahlschmidt, 2007), questions can inspire and liberate ideas. Including those asked by Spørge Jørgen. They can have a much more solid effect than a conclusion (ibid, preface). Questions can play a part in gathering and sharing knowledge but can also initiate dialogue and communication. Questioning is just as important as giving the right answers. (ibid., preface)
In philosophy, questions are fundamental when they are asked based on the present, but of the philosophical perspectives that reach back to antiquity. As Dorthe Jørgensen points out (Jørgensen, 2006) the philosopher does not ask to receive answers, but to become better at questioning.

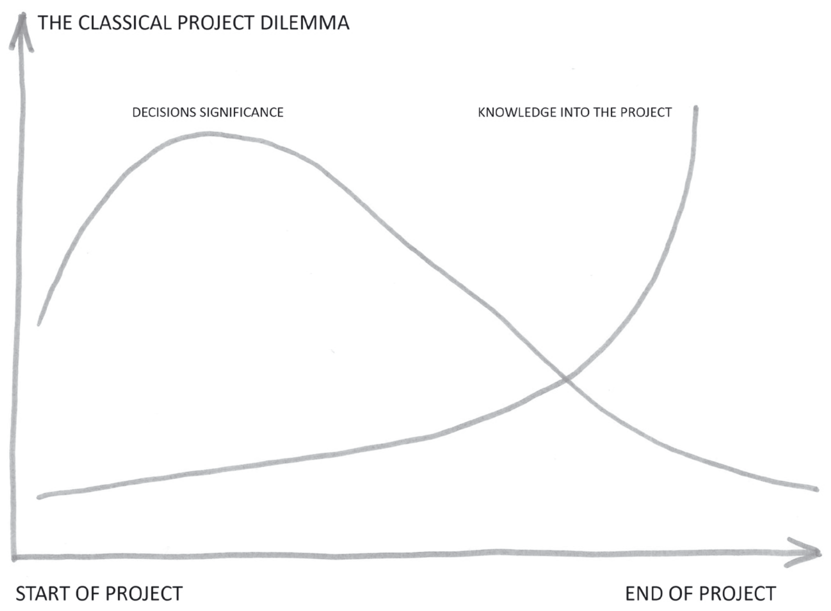
Philosophy means reframing the same basic questions that have occupied thought since the antiquity. Not in the hope of finding definitive answers, but rather in the hope of questioning better than before. (ibid. p. 193)

I ask questions. Lots of them. I have learned that that is the way to acquire knowledge. Some of the questions I ask myself, others I direct at people who I hope to engage in dialogue. People who know what I do not or can direct me to people who do. Often I have more questions than answers. And that is the impetus for writing this book; I know something but I also know that there is infinitely more that I do not know. By writing this book I demonstrate what I think I know, but simultaneously also all that I don't.
This book is written with the wish to shed light on some of the questions asked in relation to materials, hoping that questions will be asked in the future as well - including questioning across.

DESIGN IN A BROAD PERSPECTIVE

The design method, Design in a Broad Perspective, originates from research and practical work. It is the way in which I have worked with materials in various development projects. It is the content and systematics of the design of materials I have carried with me when I have talked to the materials with intellect, feeling, body, and senses. It is a design method that is not conspicuous, but rather is implicit in my work. It is what I, despite it still being flawed, attempt to verbalize in what follows. It is what I give a voice to so it can be spoken of and thusly be discussed.
The design method is aimed at designing and developing materials that will be exposed and perform in spatial contexts of buildings and urban settings. These are materials that surround us in our daily lives, which is why I believe that we must question them in relation to their technical, but just as much their artistic and aesthetic qualities. Design, development, and design of such materials still take place today, despite decades of debate about interdisciplinary approaches to the distinct steps of the process, following a relatively linear process sequence. The materials researcher develops material in the laboratory focused on material qualities such as strength, ductility, and endurance.
The craftsman producing materials to be used in for example building as prefabricated elements does so in a factory, basing the products on the materials the researcher has developed and through the processes with which she is designing them. The architect meets and demands certain things from those materials as building components and parts of the final building, while the artists, the craftsman, and the designer develop the material in their workshops for, for example, installation events, ornamentation, and outside furniture.
In this process, the materials encounter different challenges and demands often posed as questions. Sometimes the material does not live up to these demands, and it has to return to the materials researcher to be transformed, which carries major additional expenses. In other cases, the materials do not even emerge from the materials researcher's laboratory because that step seems insurmountable or its existence is never communicated to those who might have an interest in them.
Many initiatives have been made to sidestep this sluggish development sequence, yet it still seems as impractical and linear in its shape, and the communication has been made difficult by the many differences in technical language and ways of approaching the materials.
To grossly simplify, we could say that the materials researcher thinks in and observes the material from a distance, and in relation to physical and chemical theories. Through formulas and mathematical calculation tools, she examines and develops them and tests them in the laboratories. Here the materials' mechanical, static, and chemical qualities are registered and measured in controlled and well-planned tests to verify or refute her theories and hypotheses.
The architect has little physical interaction with the materials. They are represented as ideas embedded in abstract symbols in meticulous 2D and 3D Cad-Cam images followed by product descriptions. In the form of attached files, the architect receives 2D and 3D computer generated reproductions of the elements of the building from the manufacturer, which she inserts into the unified image of the building in levels, sections, and elevations. "Click - array 100 horizontal - Enter" and 100 windows are installed in a meticulous row with the desired size and spread. In this manner, the architect does not encounter the material until the actual building begins.
The architect may also choose to have close contact with the materials in the design, planning, and selection phases of building. She includes the materials as material tests and 1:1 mock-ups of the building elements and sets up study groups in relation to them in the drawing office as the basis of the architecture she intends to create. She enters into a dialogue with the manufacturer about possible changes in relation to the building task to be completed. It is the latter form of architect that is relevant here.
The artist is concerned with materials as structures that generate space and enters into a dialogue with spaces that already exist. She works with installation art and shapes the materials and influences their surfaces to achieve a dialogue with time, space, and context in the form of an artistic event. The artist questions the materials as emotion and expression and senses their manufacturing in bodily, sensuous terms. The artist acts like an explorer in her search for what story can be told by the materials in relation to her personal experience with them and in relation to the artistic event she attempts to affect with the materials.
Like the artist, the designer stays close to the materials. She, like both the architect and the artist, questions the materials' expressions of design, but like the architect also

questions function and technology. The designer operates on a smaller scale than the architect. The designer works with scale-models and makes prototypes in for example 1:1 as an explorative repetition with minor, yet important changes to detail. The designer, like the architect, may also stay in close contact with the respective manufacturers of building components and design products so process and manufacturing become part of the design process.
Patience and a loving care of the materials define the crafts artist, here a ceramic artist. She pours endless hours into attention to the materials and, to some extent, follows the directions derived from the former ceramic manufacturing. With hands and body, the craft artist questions the details of shape, colour, materialism, lustre, and texture. Inquiringly, she whispers to the ability of the material and gently prods them in new directions. This she does with cogency in glaze and material tests with an approach to testing that in many ways resembles that of the materials researcher. The focus of the ceramic artists, however, is primarily the aesthetic aspect. The crafts artist works with millennia of practical knowledge and embeds it into her work.
The same goes for the craftsman who works in the shop. She manufactures the material with craftsmanship characterized by knowledge derived from generations of experience and pulls, as if she were a magician, tricks out of her sleeves. These are secrets that only the craftsman knows and shares. With these she transforms the materials into objects of various functionalities.
It is the knowledge of and questions for the materials from different perspectives' approaches I wish to include in material design. It should not happen through the traditional, linear development process that the materials typically go through, but through a process marked by alignment, simultaneity, and active interaction as well as the sharing of knowledge between the different perspectives. This is the way I have practiced design and development of specific ceramic glazed concrete. There are many advantages to doing so by yourself as I have. It allows sharing of knowledge without being forced to explicate the tacit knowledge that defines several of the disciplines represented in the design method. On the other hand, it is also restrictive in a number of ways. Among these are slow progress, too narrow a base of knowledge, and plummeting into the depths of said knowledge. Another limitation, which I will touch upon below, is that research done with this design method may find it hard to live up to demands of objectivity and a critical approach to its object of study. This is one of the reasons why in this book, I advise that the design method Design in a Broad Perspective, is done in interdisciplinary teams consisting of several individuals.
It is advantageous to participate in sharing knowledge already in the initial phase of designing and developing materials. On Mikkelsen and Riis' curve for "The Classic Project Dilemma," which shows the coherence between the decisions made in a project process and the knowledge that it produces (Mikkelsen, Riis, 1989, p. 23) we see that the two



"Det Klassiske Projektdilemma" (Classic project dilemma) that shows the connections between the decision made during a project and the knowledge that follows it. (Mikkelsen, Riis, 1989, p. 23) The problem of projects is usually that the important decisions are made at a point in the project where the knowledge base is the smallest.

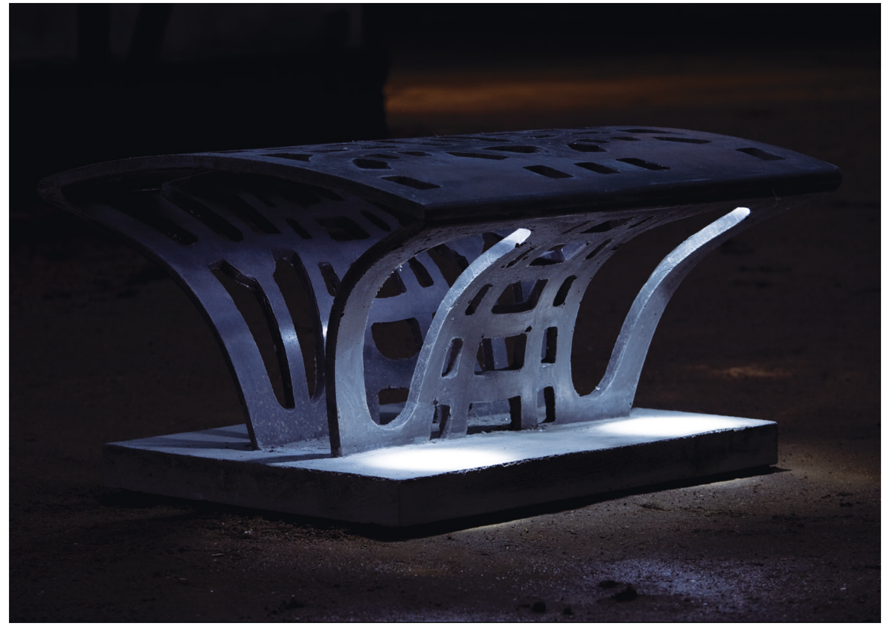
curves do not follow one another in an expedient manner. A project process is likely to be characterized by the fact that the decisions made early in the process fully determine the continued development of the project and the final product. However, what also characterizes a conventional development process is that the knowledge it produces grows exponentially and is minimal at the start of the project and maximal at the end of it. Those decisions that impact the result of the project the most, then, are made in relation to minimal knowledge of the project process. That is the tendency I seek to alter. The interdisciplinary design method, Design in a Broad Perspective, which this book revolves around, sets the scene for locating knowledge in the earliest phase of design. As such, it intends to share knowledge broadly and encourages questioning across disciplines

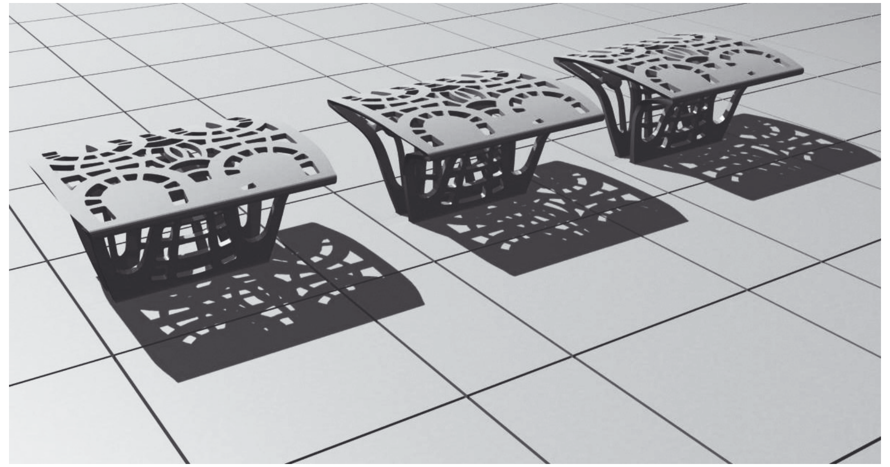
already in the earliest design phase of designing materials. To do so, it allows disciplines that are affiliated with the construction of the materials, which in traditional linear development processes are sequenced in linear succession and perform in distinct contexts, are made to participate simultaneously and alongside each other. The disciplines and their different approaches to materials must stand out and be visible. They should speak with each other, discuss demands and desires of the materials, share traditions, secrets, and learn from each others' perspective and knowledge. These are disciplines that must work together, to, in unison, develop materials using all of the knowledge they have already in the initial phase of design. This happens on a design platform that invites the materials researcher, the art-researcher, the crafts artists, the artists, the craftsman, the designer, and the architects to interact. It is this kind of platform I attempt to create with the design method, Design in a Broad Perspective. This is what I have employed when I have questioned the materials as the materials researcher in a theoretical race, as the workman in the practice of creation, as the art researcher focused on expressive and aesthetic distinctiveness, as the artist with an eye on craftsmanship and propensity for installation art, and as the building component designer with the need to cover building with all kinds of façades, in the dialogue with architecture about it.

This is the method I have used when developing specific ceramic glazed concrete. It is exactly the aforementioned disciplines I have engaged in to examine and feel out which direction specific ceramic glazed concrete should develop towards to function in urban and building contexts in the future.

It is a complex method of design. Many academically different languages are spoken at once on the same platform and the air is thick with questions. In such chaos, it might be advantageous to start from a structure that is not a rigid pattern to be followed, but as a point of departure that is open to dialogue that can lead down many different roads. That is the kind of structure I have tried to create by dividing the method of design into vertical and horizontal sequences or strings.

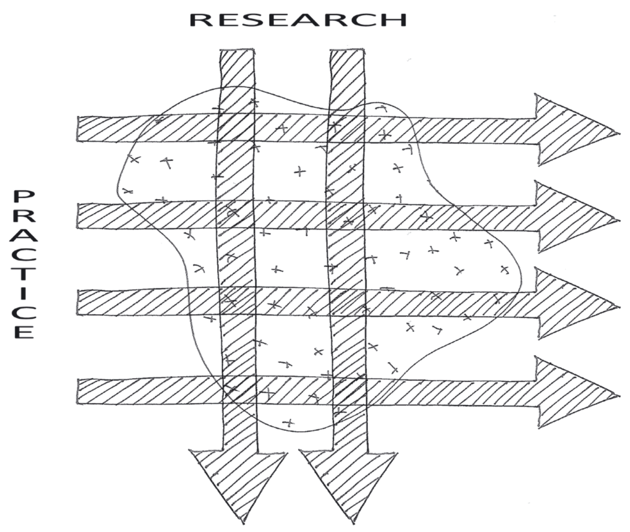
The basis of this design method is that there is an amount of different knowledge about materials in general. This is knowledge based on different disciplinary perspectives on existing materials. With the design method, Design in a Broad Perspective, the goal is to activate a large part of it for developing new materials. We achieve this by applying both





Outside concrete furniture that includes both LED lighting and a covering tile, flagstone, made from new strong and ductile concretes. The idea is that the covering tile is lowered down to the same level as the rest of urban space covering so that the furniture is not placed upon, but as part of the whole covering narrative. Design Anja Margrethe Bache. Photographer Torben Aahndal. Computer 3D rendering at the bottom right, architect, MAA, associate professor Flemming Vestergård.

vertical and horizontal strings onto the breadth of knowledge.
The vertical strings relate to research while the horizontal strings deal with practice. These might consist of the disciplines I present in this book, but also others and possibly more. In this book I choose to present the disciplinary perspective I have used when developing specific ceramic glazed concrete. With that as the starting point, the design method consists of two vertical strings and four horizontal strings.
The vertical sequences, strings of research, follow an academic framework, while the horizontal sequences follow the more or less ordered systematics of practice. The vertical and horizontal strings meet at the point that in the academic world are called cases. This is from where research draws knowledge; in relation to the focus the researchers have.
In the vertical strings, the technical, scientific researcher and art-researcher are represented. They both follow an academic framework for their process; a system of structure for research. In the model this is illustrated as a linear sequence that consists of research, analysis, hypothesis, method, case, result processing, analysis and discussion, and finally conclusion and implications. This is a common way of structuring and presenting academic work and research in written publications. However, it rarely is done in such a stringent manner. Often, iterations develop during the process, or some parts are done before or at the same time as others. As such, the graphic model is more of a guide of the content that might be part of theoretical research, and of the structure such kinds of work often flow from and presented within.
The technical, scientific materials researcher deals with applied research based on scientific theories in what is referred to as the technical, scientific field of research. While art-research, as it participates in the design method, relates more to the research structures of the humanistic and social sciences. In the design method, the central question for art-research is materials' distinct expressions and potential for aesthetic manufacturing in a given atmosphere. It is research that relies on philosophical aesthetics and applies an analytical style on art as creation and event. The two methods of research are as distinct as their areas of focus and objective.
In traditional materials research, the basis and focus often relate only to technical and scientific research.
By inviting the art-researcher to become part of the material development team, some of the questions and areas of focus she considers, and which the technical and scientifically oriented researcher normally excludes, will be able to become part of the earliest phase of material development. It is not sufficient merely developing materials that have different abilities than other materials in relation to mechanics, statics, and chemistry. Because they surround us they must also consider expression and aesthetics. As such, it is obvious that both areas of research should be represented and made to work together closely.
In the horizontal string, the artists, including the crafts artist, designer, architect, and



Principle sketch of the design method Design in a Broad Perspective. There are two vertical strings and four horizontal strings thus far in the attempt to gather and interdisciplinarily share as broad knowledge of materials as possible. Opposite page, specific ceramic glazed concrete juxtaposed with concrete object made from unfired specific ceramic glazed concrete as an exploration of space, light, and materiality. Photo: Ole Akhøj.

craftsman are represented. Here we also find the materials researcher who performs experimental tests. They follow different work methods. The installation artist operates within a complex set of parameters and constructs syntheses in a chaos of coincidences and conceptual control. She lets herself be drawn into not always planned sequences to, perhaps here, discover new openings. Similarly, the designer and the architect act within complex relations from where they create syntheses. They are wont to follow a process sequence determined by a holistic, iterative, and integrated design process. The craftsman is not herself supposed to discover what to design, but has a model and follows it to the extent the material allows during construction. These are the voices and process phases that the horizontal part of the design platform lets speak and appear visually.

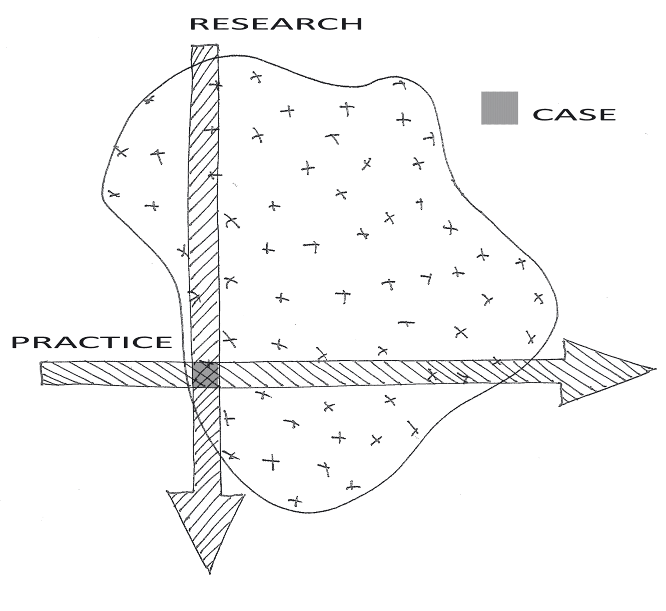
This is the knowledge that is embedded in practice, which should preferably also play an active role in designing and developing materials. In 2010-2011, I stayed at the International Ceramic Research Centre, Guldagergård, (www.ceramic.dk). This is a centre where domestic and foreign ceramic artists can apply to stay in order to seek out and develop different ceramic studies and exercises. I spent six months there working with specific ceramic glazed concrete. During my stay I met young, newly graduated ceramic artists, but also artists that had worked with clay for decades. For a material designer, finding myself in such an environment of crafts artists was a gift and dream. Here, I experienced the unique knowledge of materials that comes with the crafts artist. They know so unfathomably much of materials and continually question them. In my experience, their knowledge is not conspicuous, but rather lies within their patient work with materials for days and years on end. They contain centuries of knowledge embedded in their work with clay and glazes. Tricks upon tricks that bear witness to a deep knowledge of material and the process with which they are worked. Every material designer should be allowed to undertake such a stay. I am entirely convinced that it would raise questions that would otherwise never have crossed their minds. The most remarkable aspect of the ceramists I was able to observe was the tacit knowledge that follows them. They are able to supply answers if you ask about this knowledge, but they have little need to verbalize it, as it is fully present in their work of creating the pot, teapot, or any other artefact. It is such knowledge of artists, crafts artists, craftsmen, designers, and architects that I wish to activate and have shared in the earliest design stages of developing materials with the design method Design in a Broad Perspective.

The vertical research process gathers knowledge from the horizontal one. With narrow incisions it usurps knowledge adapted for a specific focus, and the questions that follow it, to highlight what it finds significant in the "case" stage. This is where the horizontal process phase must, for a moment, account for questions. But, as mentioned, it is not only the knowledge generated in research cases, within that narrow way of looking at things that are relevant for designing materials. It is also all the rest of the knowledge that comes with the disciplines of practice. Where they are free of the analytic eye and rigid methods of research, and can do what they do best; work with materials as they are being constructed. The horizontal practice disciplines contain knowledge that must be activated, knowledge that flows with the disciplines. And which, by making them visible, should also participate equally with research into the development of materials.

The vertical strings in the design method pose research questions aimed at the mechanic, static, and chemical qualities of the material, but also distinctiveness in their physical appearance and potential for aesthetic processing.

The horizontal sequence poses questions that relate to construction and art, design, and architecture as an event.

This is also where we find practicality in form of technical, scientific experiments. In



Principle sketch for the design method Design in a Broad Perspective. A method that by inserting vertical and horizontal strings attempts to shed light on and activate, as well as create, new knowledge of materials across disciplines. The vertical strings deal with the knowledge contained in interdisciplinary research and the horizontal strings with the knowledge that deals with practice. They meet at the point "Cases". Opposite page: concrete objects assembled via jointing made from specific ceramic glazed concrete and unfired specific ceramic glazed concrete. Photo: Ole Akhøj.

reality, these are part of materials science as its cases, and are not free in their horizontal sequence in the same way the other disciplines mentioned here are. So in reality, their extent in the vertical and horizontal sequences conform to a point located in "cases".

The material designer, or teams of material designers, that wish to utilize the design method for designing materials enter into a dialogue with this. Then the design method becomes a path to those questions that can be asked and the perspectives that can be applied to it.

In this book, the material designer is not given a guide to follow from A to Z and a promise that this will bring forth an original material. This book is excerpts from thoughts on the design method Design in a Broad Perspective that illustrate some of the perspectives that might be relevant to address in order to develop new materials for buildings and urban spaces, as well as some questions that might be asked in that context. The book, then, is excerpts from a verbalization of the design method Design in a Broad Perspective and the development of specific ceramic glazed concrete. As such, it is not a finished presentation, but rather an introduction and invitation to debate.

SPACES FOR KNOWLEDGE SHARING

When I have practiced the design method Design in a Broad Perspective, it has been possible to retain a friendly tone, understanding, and respect between the individual disciplines. That has been the case because I, as mentioned earlier, have worked with the design method by myself. However, as mentioned in the previous chapter, my hope is that this design method can function in teams with several disciplines working in close proximity developing and designing materials. This requires there to be a space for knowledge sharing. To become aware that it has to be, in my opinion, characterized by respect, receptivity, acknowledgement, and the best intentions across the disciplines represented in the design method. It is also a requirement that there is openness to differences and various ways of being. Such a social forum is where the design method, Design in a Broad perspective, is meant to prosper. It may be difficult to achieve, even with both goodwill and good intentions. For example, if knowledge sharing happens between disciplines based on cultures, methods, content, and focus areas that are are wildly different, there might be a lack of sufficient understanding for different existing ways of being. As such, the premise for a fruitful collaboration is simply not present.
An example of this is the technical university where I am employed, the Technical University of Denmark (DTU), Department of Civil Engineering, Building Design Section. Here there is an aspiration to be interdisciplinary in the form of collaboration between engineering science and architecture aimed at knowledge sharing related to both teaching and research. The discipline of architecture has been welcomed at the technical university, but under the condition that it takes its starting point in the technologies of engineering and its technical scientific approach. This is done with the best intentions and the genuine belief that this is possible. But at the same time it exposes a lack of openness and understanding of the essential premise of architecture. This rule removes the artistic nerve of the discipline and amputates its being - what is left is the discipline of architecture as a tamed dog who has forgotten how to bark. DTU's intentions are good, as they are in many other co-operations, but are simply based on a lack of knowledge and understanding.
This is not only the case at DTU, but is a well-known phenomenon in the disciplines. In research there is a sharp dividing line between humanistic sciences and natural sciences. Natural science is termed "hard science" and claims to be real science while humanistic science is called "soft" science and to some extent still struggles to claim a label of having scholarly spirit:

In the blue corner, we have the hard natural scientist that claims to hold the real science. Math and natural science is the pathway to truth. Taking its starting point in hard facts, we can explain natural phenomena with idealized (mathematical) laws and any other approach is the speculation of humanistic guesswork.
The reaction from the red corner points out that natural science makes no sense in relation to lives that are lived, and that it might even be called dangerous since natural sciences rely on a ruler's logic (nature is explained by practically being controlled by technology or through experiments). Instead, relevant intellectual work takes its starting point in concrete social practices that consider distinctiveness, differences, and is not merely passively observing, but engaging.[2]

In this book I attempt to present both "hard" and "soft" sciences as equal disciplines that might consider and utilize materials in different ways, but with their respective questions have just as much influence on how materials are designed. In a similar manner, I invite the craftsman, the artist, the designer, and the architect to partake in questioning the material from as many angles and as many frames of reference as possible.

WEARING CONCRETE

Once upon a time, I dreamed of weaving and crocheting concrete. With newly bought bicycle tubes I wound the rubber into complicated textile weaving patterns and poured into it a somewhat reluctant concrete. I wanted to make concrete clothing that would be able to bear the wearer when she or he got tired. Why, you might ask. It is uncomfortable, it is heavy, and you cannot be surprised that the person wearing it would become tired from carrying around that burden. Concrete clothes wouldn't expand either, unlike airy and light cotton fabric, which luxuriously drapes the body and follows curves and movement. The answer is curiosity and a desire to experience concrete sensuously, bodily, and emotionally.
We surround ourselves with materials in our daily lives. Some of them we come very

Opposite page: objects made from specific ceramic glazed concrete assembled with level, moulded plates with different kinds of jointings to explore the assembly methods, materiality, light, and space. Specific ceramic glazed concrete has brass-coated steel fibres that partly affect the texture and colour of the glaze severely, partly adds to the risk of the glaze running. Photo: Ole Akhøj.

close to and hide like memories of emotions. Textile meets us as clothes and warms our bodies, it watches over us when we're sleeping as bed linens, and shades our eyes from the blinding sun as curtains. We kiss ceramics with our lips when we let the hot coffee meet the taste buds on our tongue. We embrace it with our hands when we carry the jar of apples. While metal adorns our ears and necks as jewellery, or creeps around our fingers as rings. Concrete, however, we distance ourselves from. We berate it for its greyness and insistently boring mass. We walk on it as terrazzo floors in our bathrooms. But kissing it with our lips or using it to cover our bodies as bed linen or clothes goes against our bodily experience and cognition.

I hid the idea of weaved concrete away; into my box of "dream projects" along with several other "dream projects." Here was also the fashionable safety shoe I patented in the mid-eighties where the vamp was removable and could be changed as need be. This was also where you could find the sketches and initial machine drawings of a remote controlled sand castle machine; that I also had to abandon in the mid-eighties because the hydraulic pumps were too expensive. Or how about the inflatable, mobile PVC-family for the lonely traveller, which I did actually PVC-weld, but never sent on its first trip. In this project box I rediscovered my dream of ceramic glazed concrete, which would make us want to kiss it, dress ourselves, our surroundings, and buildings in the most beautiful glazed costume as an aesthetic product. Dust had fallen on the initial tests of specific ceramic glazed concrete and the yellowed paper sketches of it, but the dream was intact.

I did my first actual research into ceramic glazed concrete during my PhD project (Bache, 1998-2002). But this was far from the primary object of the project, and the dream of ceramic glazed concrete went back into storage. It was reanimated in a later artistic development project in 2006-2007. (Bache, 2006) Here, ceramic glazed concrete was to act as a light-reflecting surface to control urban spatial light in urban light furniture. But again, it was not the primary area of focus. Not until the end of 2008, many years after the dream had first been dreamt and the first tests had been developed, did I succeed in securing grants to develop ceramic glazed concrete meant for construction and façades. Finally, it was the primary area of research.

The specific glazed concrete this book revolves around emerged as an object of study in 1998, but has not found its place until a focused process from 2009 to 2012. It started with an idea, curiosity, and many questions. Some of the questions have been answered, but many more have emerged. In principle, I could keep diving into the knowledge that is part of or related to this area in infinity, perform new and further tests, and add aspects that would lead the studies and developments in new directions. Nonetheless, I have at

Opposite page and this page: Objects made from specific ceramic glazed concrete and concrete objects assembled with jointing. Photo: Ole Akhøj.

this point of the development process chosen to halt and make a fixed point by writing a book. It is about excerpts of an on-going development project and must be considered a state of the art of such; as a reflection on, and verbalization of, partly the design method, Design in a Broad perspective, and of the specific ceramic glazed concrete and the development level it is in at the moment.

SPECIFIC CERAMIC GLAZED

The theme of this book is both the design method, Design in a Broad Perspective, and specific ceramic glazed concrete. The design method speaks to the broad, disciplinary approach of designing materials, while specific glazed ceramic concrete is a narrative of the thought, the development strategies, and the way in which that group of materials has been built. The mention of specific ceramic glazed concrete in the book is a concrete example of how the design method, Design in a Broad Perspective, has been practiced. Specific ceramic glazed concrete takes its starting point in concrete.

Concrete is a material that increasingly is used in architecture, artistic works and design and new, slim, rustic solutions. With Nano-technological design, concrete has become resistant to graffiti. Corrosion technologies and retarders have brought concrete into tactile, textile solutions in its ornament.[3]. Surface technologies from other industries such as the auto industry or computer technology, alongside processes from metal industry are about to enter concrete technology. (Bache 2006, 2007), Concrete is a designer material that can be designed as desired. It provides us with new materials and possibilities for developing concrete constructions and concrete works in general. This means that engineers, artists, designers, architects and so on can request artistic solutions in concrete. Solutions that today are not available, but which we wish would be. In reality, we are only limited by our imagination.

Specific ceramic glazed concrete has its starting point in a specific group of concretes. These are concrete materials called high-strength concrete. Furthermore, they are a type of concrete that is suitable for the design strategies I work from; design of the specific ceramic glazed concrete. It is far from all kinds of concrete that can live up to this. Specific ceramic glazed concrete emerges from high-strength concretes as well as design strategies contained in the design method Design in a Broad Perspective, including material design concepts such as Densified cement ultra-fine particle-based materials, Densit, (Bache, 1970, 1971, 1973, 1981), and Compact Reinforced Composite, CRC. (Bache, 1987, 1991, 1992, 1995). Thus, the goal is to develop flexible, slim, glazed ceramic constructions originating from concrete with new expressive and aesthetic potentials. The desire is that these ceramic materials can renew both the ceramic and concrete areas and expand the possibilities of both material groups as exposed materials in building and urban spaces. Specific ceramic glazed concrete represents new material and perspectives on ceramic glazed concrete, but it is not the first concrete to be fired and glazed ceramically. The first ceramic glazed concrete I know of is mentioned in an article from 1968 by V. K. Kanaev (Kanaev, V. K., 1969) It is a porous, clay-bearing concrete, which the materials researcher attempts to surface-protect by using glaze. In the same period, Portuguese architect, Alvaro Sizas used glazed concrete in standard tiles in the entrance area of the outdoors swimming park he constructed in 1969 in Portugal. To the best of my knowledge, only the Lancashire University department of ceramics, besides myself, works with glazed concretes. Among others, the involved persons there are ceramist, PhD Alasdair Bremner, (Bremner, 2008) professor and ceramist David Binn, as well as ceramist PhD Fahad Alkandari, (Alkanadri, 2011). These are studies related to the ceramist's view on and manufacturing of the ceramic, but, in the case of Fahad Alkandari, also on ceramic glazed concrete seen in relation to the Islamic architectural tradition. [4] These years, Binn and Bremner are also focused on design of ceramic concrete wherein waste glass is included as a way to affect the aesthetic nature of the concrete and in relation to considerations of sustainability. With this, they achieve entirely original material expressions. [5]

Despite the above-mentioned initiatives, ceramic glazed concrete is yet to achieve any kind of large, practical usage, neither in art, design, nor architecture. This might be due to several factors. One is probably tradition and a general animosity towards new ways of doing things. Another more likely reason is that the ceramic glazed concrete that has been produced thus far is not markedly different from what can be achieved with traditional, clay-based ceramic. It would seem strange, then, to not simply continue using clay of which knowledge and craftsmanship has been accumulated over millennia. A third reason, which I came across when the architectural firm OMA, Hong Kong, contacted me, inquiring into the possibility for producing 5000 large-scale ceramic façade panels in specific ceramic glazed concrete for a building project in Hong Kong, is that there is a long way to go from the initial prototypes in the form of one-off productions in a university workshop to unique mass production in a factory.

Ceramic glazed concrete is, from my purview, only interesting as a reinterpretation of concrete and ceramics. They should be able to do something no other material is able to do. They must be original both as material for one-off productions and for mass-produced unique products. This is the perspective I work from in regards to specific ceramic glazed concrete. It is against this backdrop I have focused on achieving entirely novel qualities for ceramic glazed concrete while developing specific ceramic glazed concrete. It is with the desire to be able to expand the ceramic area in a pronounced way

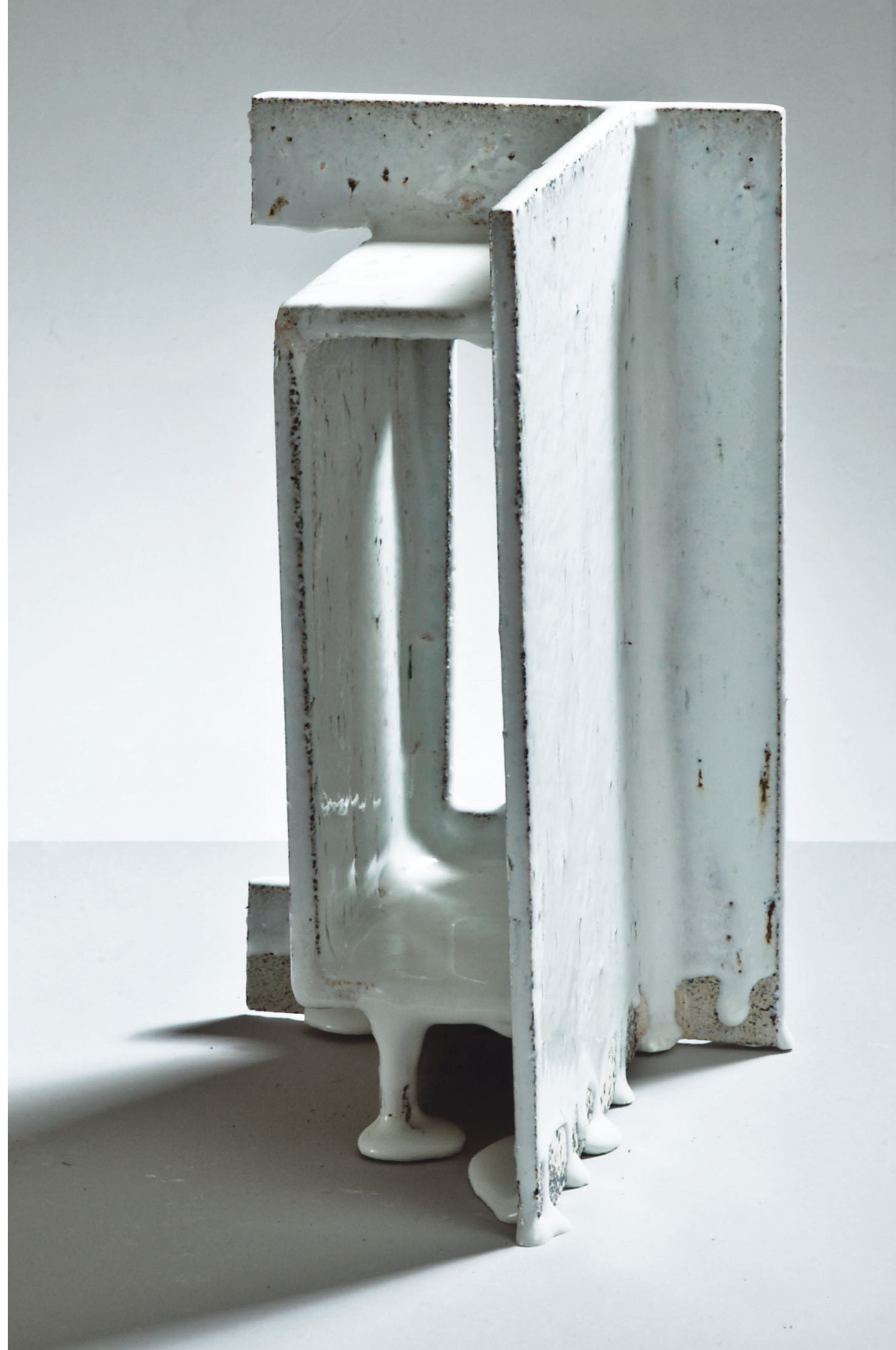
Opposite page: spatial object made from specific ceramic glazed concrete and another in concrete, juxtaposed to explore materiality, space, light, and spatial sequences. Photo: Ole Akhøj.

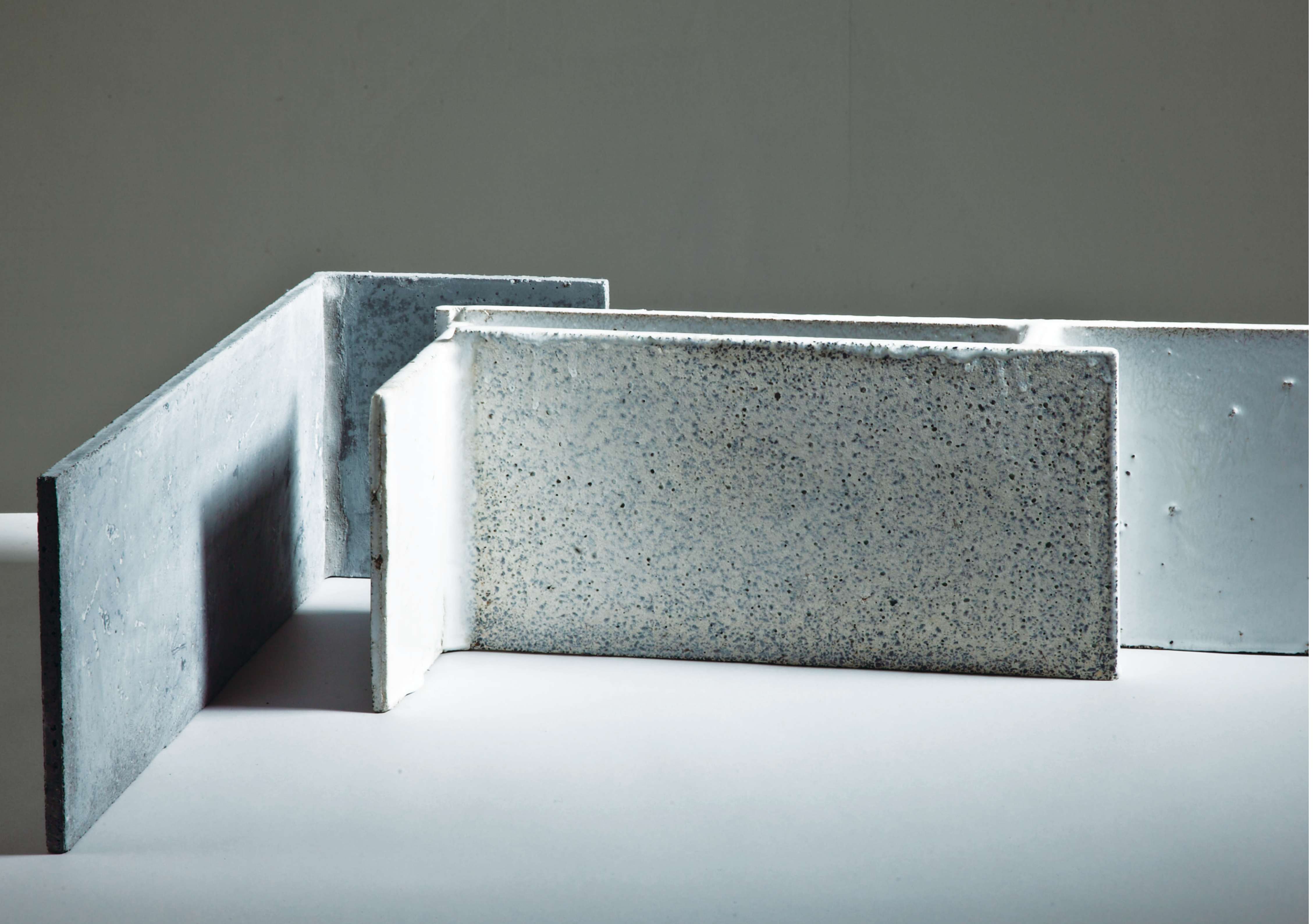
and also create new possibilities for concrete. It is with this in mind I have developed specific ceramic glazed concrete. A group of ceramic materials that prepares the ground for future flexible ceramics and thus ceramic that is less vulnerable to shocks, shears, and notches as well as abrupt changes in material thickness. It is also meant as a model for ceramic elements that can be used as large-scale ceramic components, such as façades with ultrathin material, other idioms, textures, colours, or ornamental narratives than the ones that exist today. My intention of developing specific ceramic glazed concrete has not been to replace concrete nor ceramic. Rather, it is to achieve new possibilities in both areas as well as for them to take part in a dialogue with existing materials.

THE SANDBOX

In the sandbox, the fingers point out the questions. After hours upon hours of play, we ask questions of it, test the sand with our fingers. Unfortunately with our mouth as well. During my childhood, the sandbox was a temporal and spatial retreat. Here, only the sand mattered, its consistency. Here, I moulded it into infinite amounts of non-figurative, and with sand tins figurative, sand figures over and over with no target or production in mind. I was merely engaged with the warm sand in the summer that sifted down my fingers. This was the damp, cold sand of autumn, easy to design, as well as it was the design borne from shaping tools. It was play without a sense a time; play in the now. The designs I brought forth disappeared every time I grabbed the same sand and moulded it anew. But I kept going until my parents told me to come inside; it was time for bed, dinner, or something else.
Here, I invited other kids to participate, and fought my sister for the red shovel. This was not art, design, architecture, or anything else. This was self-contained. A game about curiosity and my way of experiencing the world the way it and my contained universe existed then. It is in this context the development of specific ceramic glazed concrete should be considered. I have returned to the sandbox and today am not only playing with sand, but also with concrete, ceramic, and specific ceramic glazed concrete. In the sandbox of my childhood I designed with no goal in mind. In the sandbox I am in today, I design with a breadth of questions, a conceptual platform, theoretical knowledge, and a sensuous, bodily, and perceptual approach. I do this to obtain awareness, but also to develop materials and develop them as an artistic event. The play's perspective hopefully reaches beyond what it was in my childhood, where the strips of wood that enclosed it limited the universe of the sandbox.

Opposite page and this page: Spatial objects made from specific ceramic glazed concrete to explore materiality, space, light, and spatial sequences. Photo: Ole Akhøj.

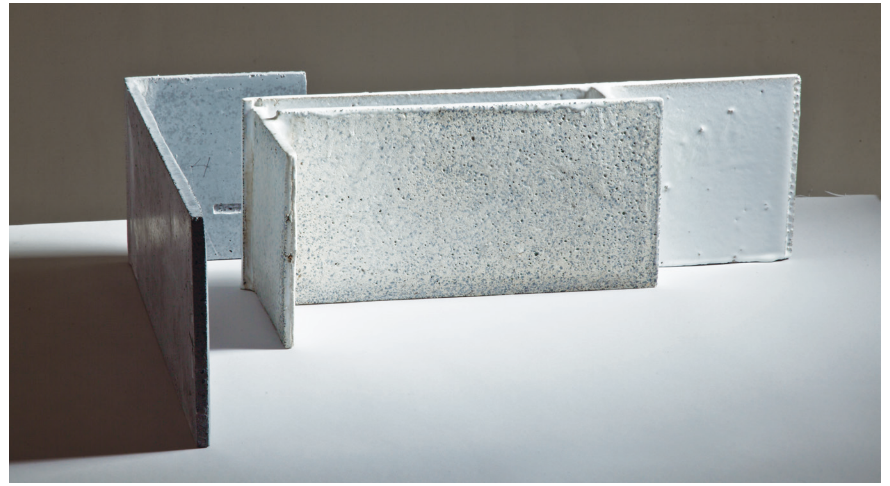




CONCRETE SPOON IN MY MOUTH

I was born with a concrete spoon, or rather a composite material spoon, in my mouth. While others are lucky to be born with a silver spoon in their mouth, mine was made of composite materials and concrete. My father, Hans Henrik Bache, who, as a single dad raised me all throughout my teenage years, was a materials researcher and invented many material technological innovations. [6] They were aimed at composite materials, but have primarily been tested in concrete as new concretes. Our home was characterized by material tests boiled in pots, baked in the oven and, in general, spread across the house. My father was passionately engrossed by physics and the development of materials. This passion he passed on to me. Already in my teenage years, he let me read the articles he was planning to publish. If I understood them, anyone would understand them. Maybe this was why he chose to let me do the illustrations for his invention, Compact Reinforced Composite, CRC, which exactly is something this project is based on. [7] I asked all the stupid questions. Cosiness, homeliness, and freshly baked buns were not abundant in our house. That I found instead with the town's ceramist, Hanne Nepper Christensen. Hanne let me visit her house where there were large ceramic jars and dishes that embraced me with their orgies of colour, ornaments, different textures and shapes. She let me spent time in the workshop while she threw and adjusted her ceramic works or loaded or unloaded the kiln. Ceramic, through Hanne, came to signify all things nice, beautiful, and warm to me.

In Denmark, Kähler ceramic is world famous. I am of the Kähler family; my great grandfather was Gustav Kähler (father of Herman Kähler) and my grandmother Margrethe Kæhler. I have always been focused on Kähler ceramic and my heart lies there, but I have no direct contact with it. But ceramic accompanied me in my upbringing and in my mind, combined with the concrete that was practically fed to me like food in my childhood home. So it was almost written in the stars that I would join concrete and ceramic. This did not happen, however, until I acquired the tools to do so. Some of them I got through my civil engineering studies, where my primary focus was to acquire a deep physical and theoretical, technically scientific understanding of materials, and knowledge of how to design them as well as test them in terms of construction, mechanical, processual, and chemical performance. Other tools, related to practice and processing as well as modelling of materials, I got from my studies at the Royal Danish Academy of Fine Arts, sculptural school, and MUR and RUM. And a PhD in architecture from the Aarhus School of Architecture, Centre for Integrated Design, CID, gave me an understanding of how to create space and building components in relation to architecture and the tools needed for this. This is the interdisciplinary approach I have used in my work as an artist, building component designer, and material designer to develop materials, and it is some of the knowledge and experience I have acquired here that I have put into the framework of the design method Design in a Broad Perspective. This is what I attempt to draw from and communicate with this book.



This and opposite page: Specific ceramic glazed concrete object juxtaposed with concrete object of unfired concrete, as an exploration of space, light, and materiality. Level plates assembled with jointing. Photo: Ole Akhøj.

THE CONTENT OF THE BOOK

The book is structured around two general themes: One, the design method, Design in a Broad Perspective, the other, the development and description of specific ceramic glazed concrete as an example of how to use the design method in practice. The book contains excerpts of thoughts on these two areas. Its goal is to communicate a perspective and initiate a conversation on the broad, interdisciplinary approach to design and development of materials and specific ceramic glazed concrete. The design method is presented by verbalizing the different theoretical approaches that are represented here. In the design method it is technical scientific research, art-research, art, including crafts, design, architecture, and craftsmanship. These are the disciplines I have included in design of specific ceramic glazed concrete. These are the ones that I talk about in relation to designing materials, in this case specific ceramic glazed concrete. This is not a research dissertation, but rather excerpts, as mentioned, from the complex thought process and the discussions that accompany the broad approach to designing materials. For this reason also, I include opinions of issues discussed. These are not meant as rules, but as topics for debate. The book alternates between narrative, opinion, and thought on the design method and specific ceramic glazed concrete. It revolves around theory and practice and touches on both technical and artistic issues. The technical chapters are written in a simple language and do not get bogged down on mathematical nit picking or physical theory. As such, the book is meant as an introduction for anyone interested in reading about the issues mentioned above, including ceramic. With its descriptions of materials and the way they are manufactured, it also is intended for the reader who him or herself wants to try working with partly conventional concrete, high-strength concrete, and partly ceramic glazed concrete.

The book is divided into technical descriptions of the materials, the chapters "Materials" and "Process/Craftsmanship" and an art-related approach in the chapters "Art Knowledge", "Research in Art", "Installation Art", and "The Art-façade".

It is possible to read the chapters separately and in any preferred order. In the appendixes there is further readings, such as for example appendix 3; a description of how a mould is manufactured. Or appendix 4; a heavily simplified analysis of an object's expressive distinctiveness in relation to art-research.

In most places, the book relies on the overall structure, but it also dives into deeper realms. It curves in and out of the intricate descriptions of material descriptions, but also lightly dances through the creation of art and the thoughts behind it. The language is tangled up with the labyrinth roads art-research with its nerdiness and quest for tidiness disappears into, while it also warms itself by the façades' reflected yellow summer sunlight, which offers itself in the mirroring of architecture. As such, dear reader, I attempt to lure you into a reading that varies in style and moves within greatly differing disciplinary approaches to working with materials.

In the first part of the book I have talked about the design method Design in a Broad Perspective, the overall structure of the book, the background of both specific ceramic glazed concrete and myself, to present the frames of reference this book is written from.

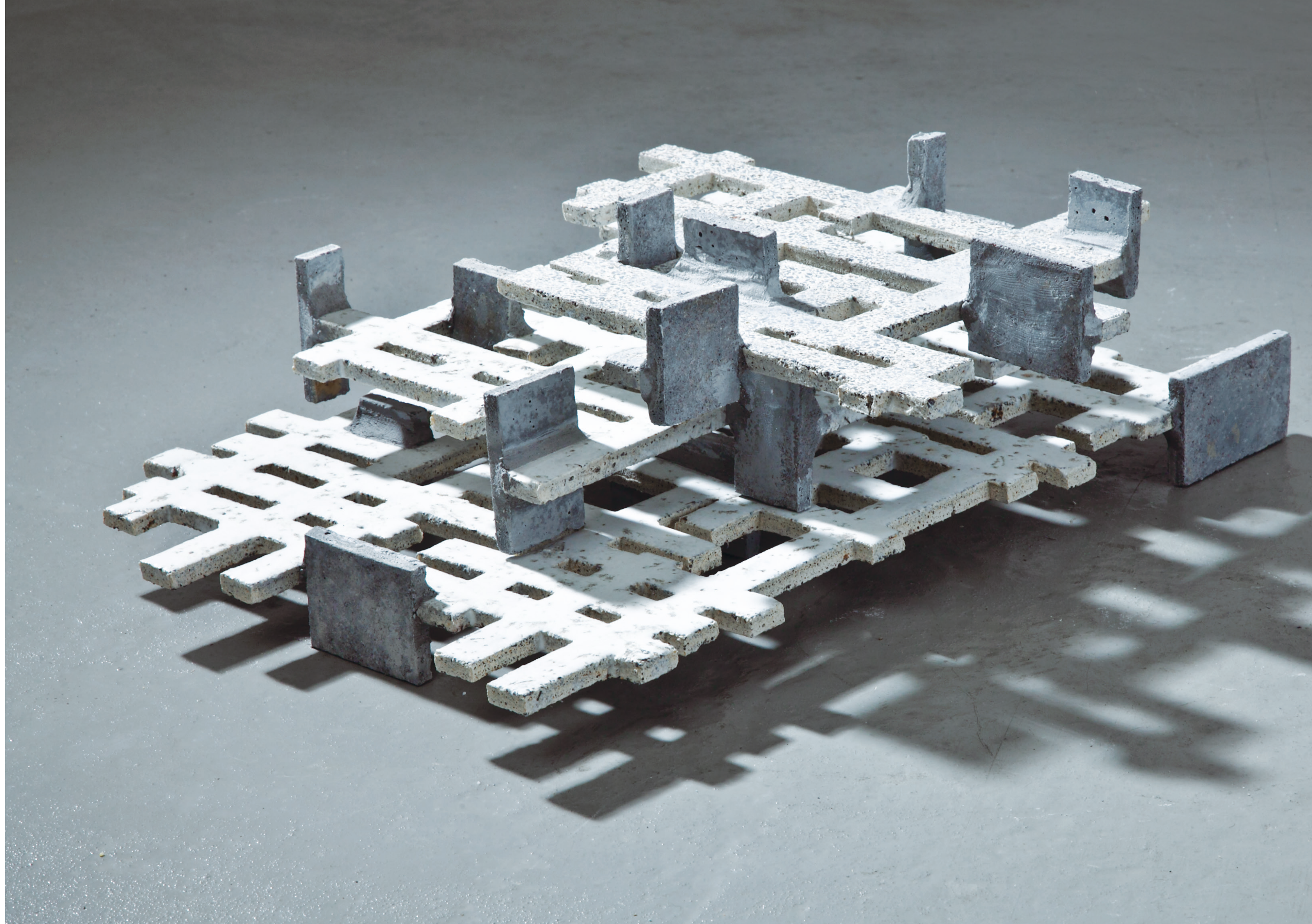
In the chapter "Art Knowledge" I introduce and discuss aspects regarding the design method in general and perhaps particularly the strings that represent the artistic approach to designing materials. In this chapter I talk about tacit knowledge, which especially accompany creative design disciplines as a spectre tripping up the process. In this chapter I also, from a perspective of philosophical aesthetics, discuss what aesthetics represent in relation to the design method Design in a Broad Perspective.

In the chapter "Materials" I talk of one of the two vertical research strings in the design method Design in a Broad Perspective. This is the one related to technical, scientific materials research. It is in this arena the materials researcher develops materials using a series of material physical, static, and chemical theories. The focus of the materials researcher in this chapter is specific ceramic glazed concrete, as well as the desire to achieve mechanical, static, and chemical performances that make her able to acquire flexible, large-scale, and thin ceramic components. The chapter is kept in a relatively simple language. Instead of rendering, for example, the mathematical, physical, and chemical formula of the theories, I describe what I actually do and what my expectations are of these actions. This means that even the reader with no technical, academic background is able to read the chapter. It also means, however, that physicists, chemists, and materials researchers or other specialists in this discipline, might be missing theories and formulas. In this chapter I talk of material design strategies, including concrete, ceramic concrete, ceramic glazed concrete, and specific ceramic glazed concrete, as well as glaze and glazing technologies.

To the readers who themselves are interested in working with concrete, high-strength concrete, and ceramic glazed concrete, I recommend reading the chapter "Materials" and after that the chapter "Process/Craftsmanship".

In the chapter "Process/Craftsmanship" the reader finds herself within a horizontal string of the design method, Design in a Broad Perspective. I talk about how conventional concrete and specific ceramic glazed concrete is manufactured and designed, including how moulds for this process are created. [8] I focus on the technical manufacturing process of the materials as practice and craftsmanship. In this chapter, I also talk about concrete mixing, casting, hardening, techniques for curing, firing, and glazing, including, as mentioned, different approaches to producing moulds. The latter is explored further in appendix 3.

In the chapter "Research with Art" I describe a vertical string of the design method Design in a Broad Perspective. This is one that has to do with art-research. I talk about and discuss art-research as the young research branch that exists today. I touch upon the problems this research entails as well as some of the forms of art-research being done today. I do this to identify the art-research I do as part of the design method Design in a Broad Perspective. This is not an exhaustive research method. This one also contains problematic areas. In this book, however, it is verbalized as proposal for on-going adjustments,



Abstract spatial object made from four component-objects with two of them appearing here. They are placed on top of each other and are made from a combination of unfired specific ceramic glazed concrete, one that has been initially fired, but not glazed and a specific ceramic glazed concrete that has been glazed with a white, glossy glaze. The concrete's aggregate and fibres are locally visible. The object can be combined in a variety of ways, thereby altering the entire expression. Photo: Ole Akhøj.

discussion, and criticism.
In the chapter "Art Installation" the vertical research string in the design methods Design in a Broad Perspective has been abandoned in favour of the horizontal practice string. This one deals with installation art. I talk about the frame of reference I speak from, including my approach to art, intentions, preferences, and the art form I practice. I also talk of three exhibitions where I have developed installation ceramic as ceramic spaces made out of specific ceramic glazed concrete. It is by relating this installation art as creation and event I illustrate which questions might appear in relation to materials.
In the final chapter of the book, "Art-façades", another horizontal string of the design method Design in a Broad Perspective is addressed. I deal with building component design in relation to architecture and building processes. The specific ceramic glazed concrete is challenged here in relation to the frame of reference called upon by large-scale ceramic façades. I wish for the specific ceramic glazed concrete as façades to enter into a dialogue with the concrete building's scale and materiality. With this in mind, I talk of concrete building, including its statics, structure, and tradition as an introduction and designation of the building technical types of façade I have developed. In the same chapter, I also discuss, using a previously published article, what happens to the narrative of a building if the mosaic tiles, glazed tiles, and flagstones that cover buildings today are replaced with ceramic elements made from specific ceramic glazed concrete. While some positive features are lost, others might be won.
In the final chapter of the book, "Conclusion", I leave behind the vertical and horizontal strings of the design method as well as specific ceramic glazed concrete to provide a wide-ranging perspective as a way of wrapping up the book.
In appendix 1 of the book, I specify recipes for concrete, high-strength concrete, and ceramic concrete to be glazed. Here I also specify mixing procedure. Please note that the recipes listed here are for materials sold in the marketplace that are ready to be mixed. As such, they are suited to be refined in relation to the specified concept I talk about in relation to specific ceramic glazed concrete. These are not the recipes I have discovered until now. The reason that they are not is to further stress that specific ceramic glazed concrete is merely a concept and not a fully developed recipe.
In appendix 2 the individual glaze recipes are specified, including firing procedure for the chosen ceramic concrete. Please note that this is not a recipe for specific ceramic glazed concrete, but a proposal for ceramic glazed concrete wherefrom the reader might take her starting point.
In appendix 3, I describe how different kinds of moulds for concrete casting might be manufactured.
In appendix 4, I lay out a heavily simplified analysis of the expressive distinctiveness of an object.
Notes and bibliography are found at the end of the book.
This book is an invitation to follow along with some of the thought processes, ideas and opinions on, as well as underlying intentions of research and practice in the design method Design in a Broad Perspective and specific ceramic glazed concrete.
I hope that this book with its transparency can foster discussion and prompt questions across disciplines.
It is my attempt to do so, written from my current point of view. This is what I happily share and discuss with the reader.

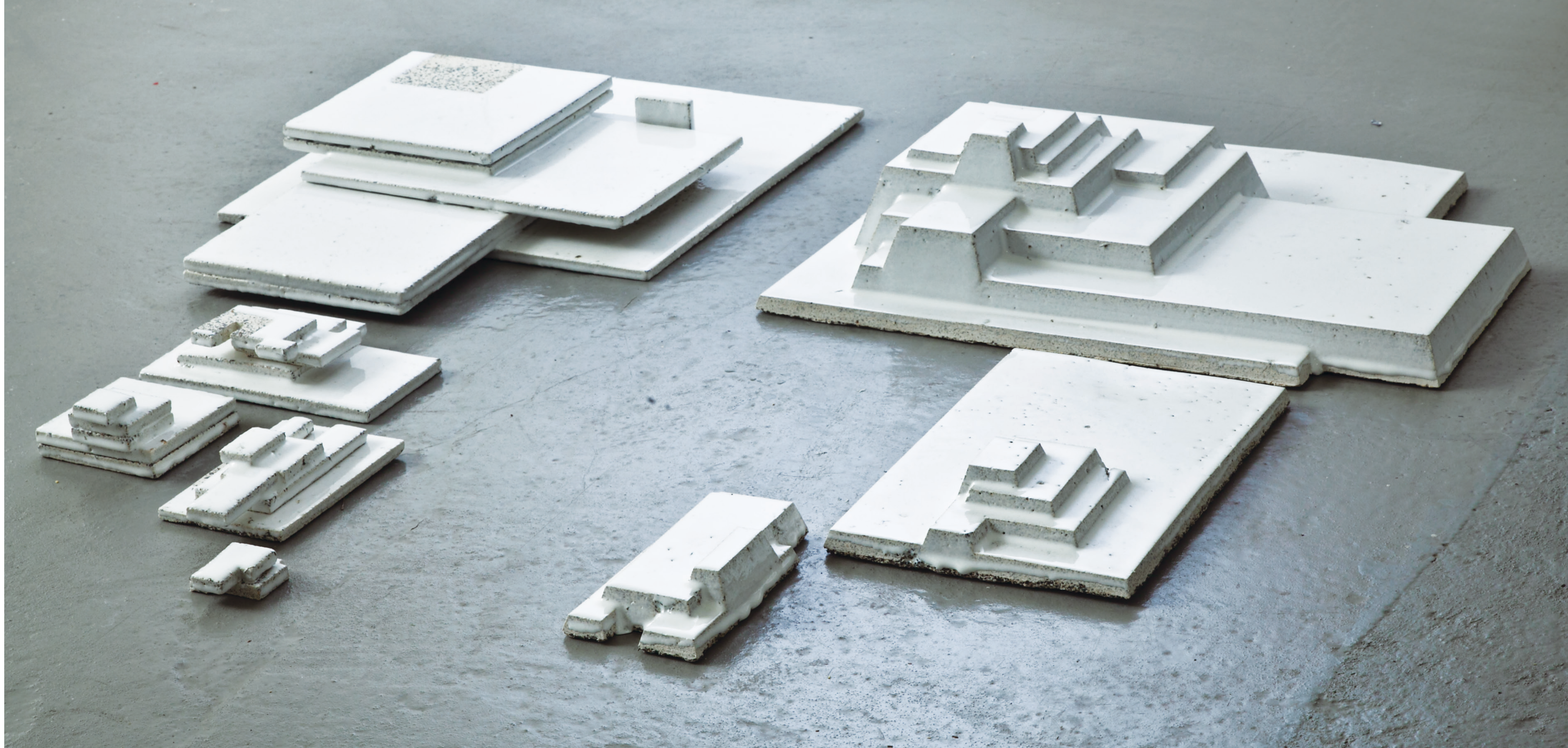
Opposite page: spatial, abstract object assembled with level plates made from specific ceramic glazed concrete with jointing. During firing the object writhed. Exploration of shape stability, light, space, materiality, and assembly techniques in specific ceramic glazed concrete. Photo: Ole Akhøj.

ACKNOWLEDGEMENTS

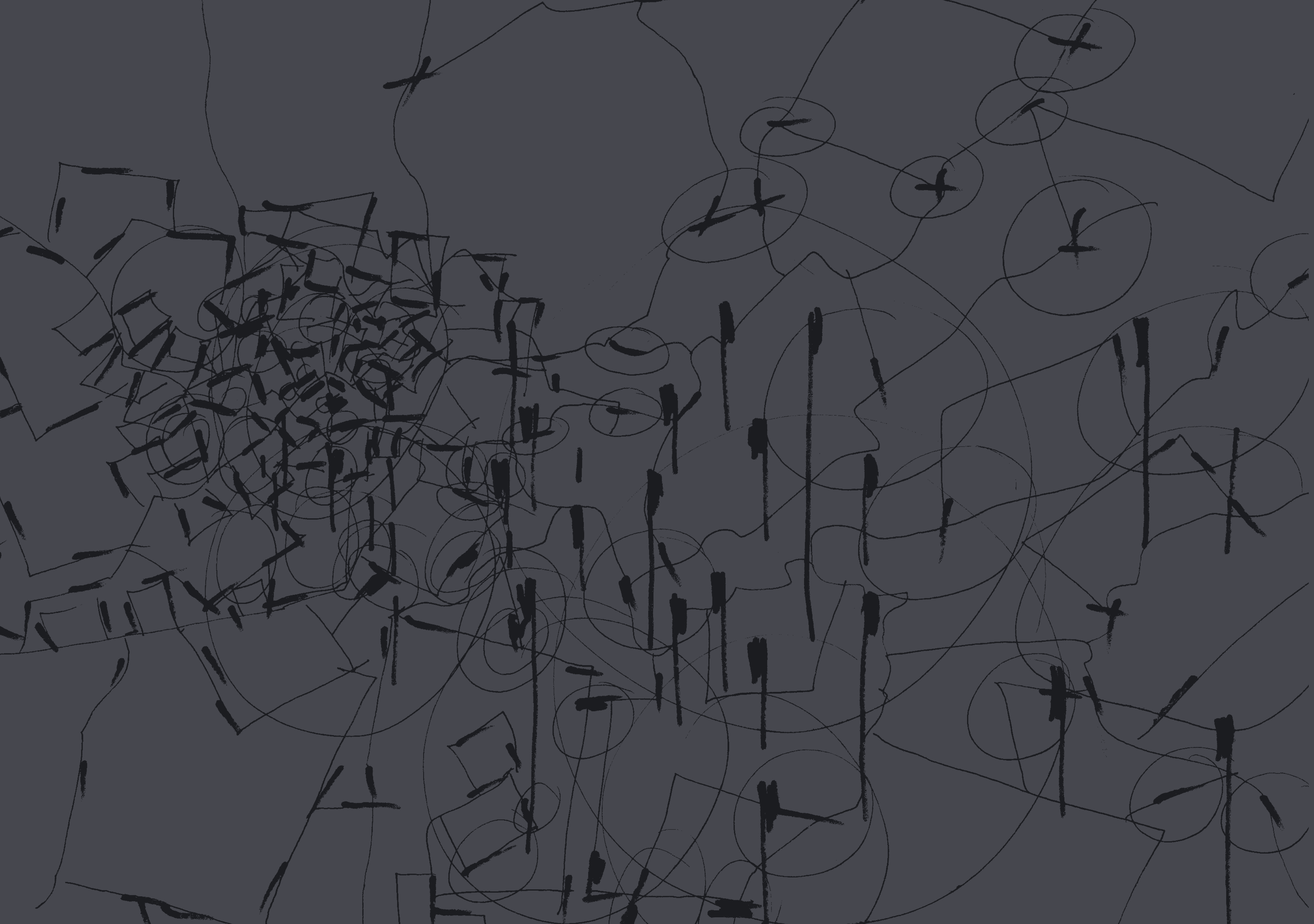
The Realdania Foundation has been the main sponsor of the development project of developing specific ceramic glazed concrete, but also together with the Dreyers Foundation the making of this book. Without the support from the Realdania Foundation neither specific ceramic glazed concrete or this book would have become a reality. I therefore express my deepest gratitude for the support they have given me. I hereby also thanks Dreyers Foundation for together with the Realdania Foundation to make this book possible.
The Technical University of Denmark, Civil Engineering Department, Building Design section has let me complete this project despite the fact that it in many ways strays from the research done there. DTU has also supported the writing of this book. It has not at all been possible for me to find a place where my interdisciplinary approach to material design has been realizable. As such, I am deeply grateful, also, for the patience and receptiveness I have received from DTU.
I have done three artist residencies related to developing and artistically investigating specific ceramic glazed concrete, partly to encounter other environments, but also because there were good ceramic workshops there. These were at the International Ceramic Research Centre, Guldagergård in 2010-2011 and the Danish Art Workshops in 2012 and 2013. I am extremely grateful that these two places happily welcomed me into their warmth, and gave me access to kiln facilities despite this project being one that is interdisciplinary and deals with a new kind of ceramic. I was awarded a stay at the convent in San Cataldo, Italy to begin work on this book. For that I express thanks also. During this process, I have had exhibitions of specific ceramic glazed concrete in several

places, both as installation art and crafts. These include selected exhibitions at Charlottenborgs Forårsudstilling (Charlottenborg Spring Exhibition) 2013 and the Crafts Biennale in 2013. Furthermore, I have been given the opportunity to exhibit installation art in 2012 at the Danish Museum of International Ceramic Art, Grimmershus with the concept "Forskydninger - Ceramic Spaces," at Gallery 21 in Malmö, Sweden with the concept "Ceramic on Tour", at Gallery Oxholm in Copenhagen, 2013, with the concept "Ornamental Play" as well as at the Marsden Woo Gallery in London, 2013 with the concept "Signs and The Signed". It can be difficult to gain access to galleries when you, like me, has taken a yearlong break from exhibiting. I give thanks to these exhibition spaces for letting me display artistically here. I have received financial support for these exhibitions and artist residencies from the Danish Government Art Fund, Architectural committee, 2010, the Danish Government Art Fund, Design and craft committee, 2011, the Danish Arts Agency, 2013, Danmarks Nationalbanks Jubilæumsfond, 2011 and J. L. Foghts Fond, 2011. I as mentioned also received financial support for this book from The Realdania Foundation and Dreyers Foundation. Once more, I express my deep gratitude for this support.
The companies Densit Aps. and Bozzetto Group as well as Stratec have donated some of the materials. This was amazing, thank you. During the project, architect, MAA, partner at C.F. Møllers Tegnestue, Lone Wiggers, architect, MAA, partner at Gottlieb Paludan Arkitekter, Kristian Hageman, ceramist Ane-Katrine von Bülow, designer Henriette Melchiorsen, conservator and graphical designer at Oslo National Museum, Kari Skytt Andersen, colleague architect, MAA Flemming Vestergård, my sister, head nurse and bachelor of management and psychology, Nina Jeanette Bache, and several of my colleagues at DTU have made themselves available for sparring. Thank you ever so much. Thanks also goes to laboratory leader at DTU, Jørgen Bjørnbak and assisting engineer Jens Martin Dandanell for having established a workshop for my development project in the middle of its run at DTU. Photographer Ole Akhøj has patiently photographed my works from the very first spatial drafts in specific ceramic glazed concrete, to installation art and finally the sketches for large-scale façades. Selections from his work are included in this book. Thank you, dear Ole. Thank you to everybody.

Objects made from specific ceramic glazed concrete. On the left, the objects consist of level surfaces held together by glaze, while the objects on the right are moulded spatially and glazed. Exploration of manufacturing techniques and expressions, materiality, as well as light/shadow play. They are made from specific ceramic glazed concrete. Photo: Ole Akhøj.

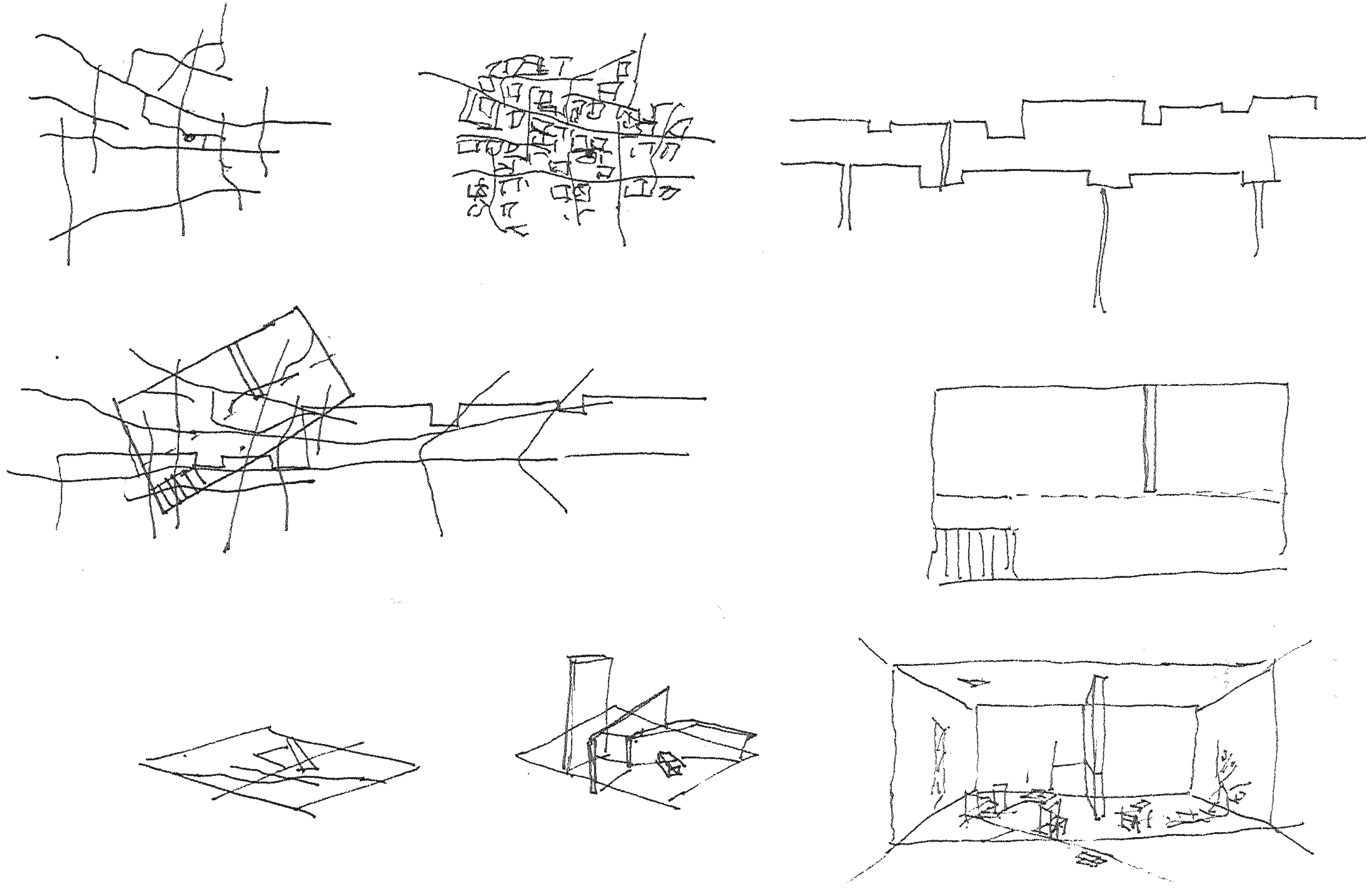


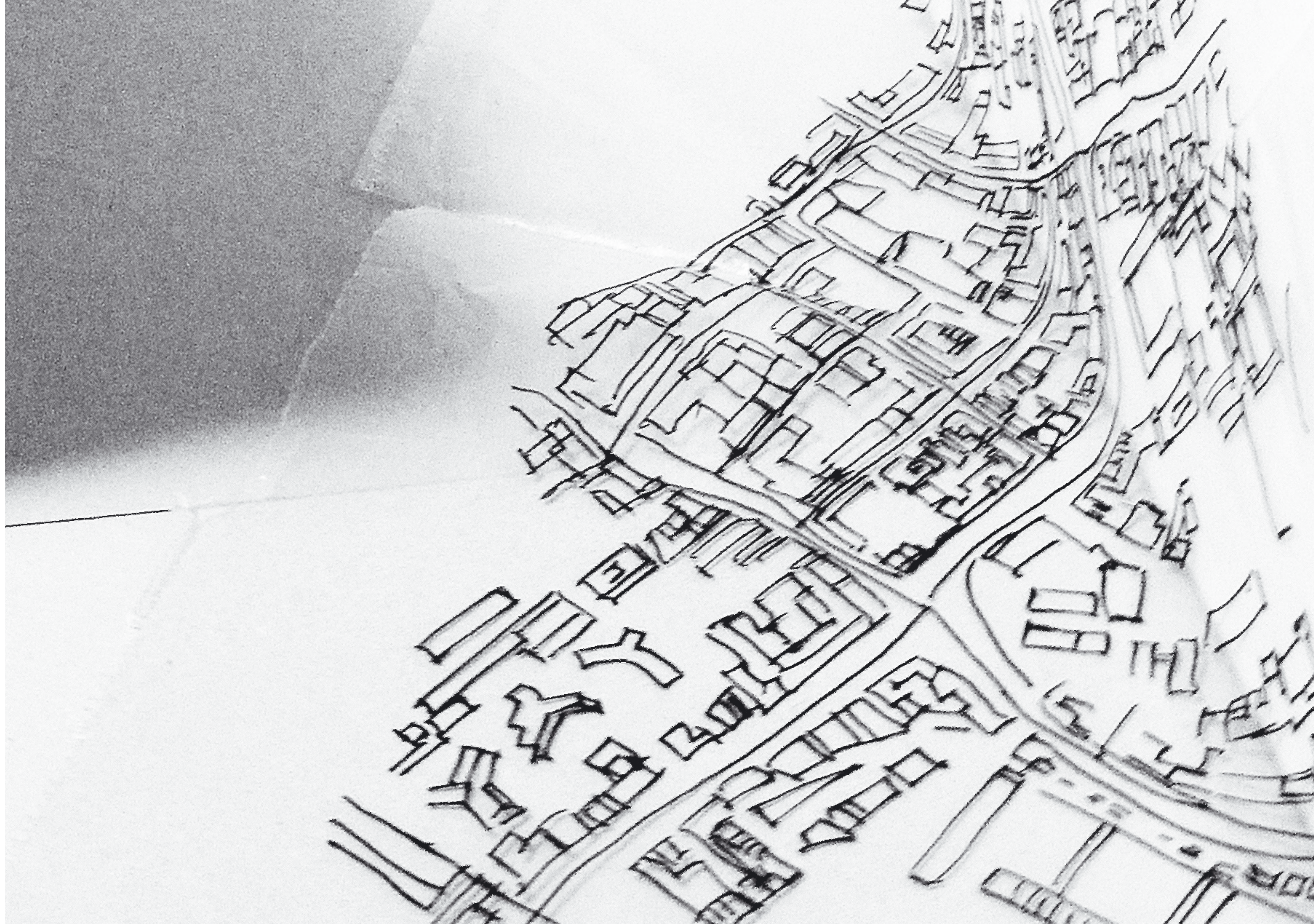
ART KNOWLEDGE



ART KNOWLEDGE

Art is not a result of knowledge
but a way of gaining it
(Ørskov, 1992)





ART KNOWLEDGE

All sensuous experiences emerge from patterns of experience and memory related to sensations, moods, emotions that cannot be controlled or explained with semantic understanding of words, but are also expressed in idioms. (Lorenzer, Alferd, 1984, p. 23).

The knowledge of art is complex and contains tacit knowledge. In this book, it relies on philosophical aesthetics as a mouthpiece. It is the tacit knowledge and philosophical aesthetics this chapter is about. This is meant to be an introduction to the succeeding chapters "Research with Art", "Installation," and "Art-façade" in this book.
Materials surround us like our everyday. They speak to us, posture, not just to be seen but also to be heard, tasted; to give off sound and reverberate as bodily sensation with layers of meaning hidden with emotions, memories, and experience. As the resonance of a tuning fork, vibrating around ourselves as being in the world, they greet us in the form of shapes, textures, colour, surface, structures, and constructions in different contexts and at different times as events. [9] They present themselves to us as intellectual and physical statements stretched across temporal space.
I want to design materials that are distinctive and different from the ones that already exist. They must contain different mechanical, static, and chemical qualities, but also have different physical appearances and aesthetic effects.
These materials must affect us so we feel them like physical, sensing beings that exist in the world. That is why I employ different perspectives to the design of materials.
The first perspective is what the first chapter "Materials" is about. This is what in the vertical string of the design method has to do with technical, scientific research; the theory packet of the materials researcher. The other perspective is unfolded in the three chapters of the book that deal with art. Here I attempt to employ art-research from one vertical string of the design method as well as two horizontal strings, those dealing with installation art and design of large-scale ceramic glazed façades in buildings, to question among other things what deals with the qualitative aspect of expressions and aesthetic manufacturing.
These are chapters I've always wanted to communicate in writing, but once and again have left un-verbalized, because much of the knowledge contained here is tacit knowledge.

TACIT KNOWLEDGE

Art and art research are accompanied by knowledge that besides explicit knowledge is coupled with knowledge that appears as bodily and sensuously embedded experience that resides within the very act of doing. This is knowledge that only to some degree can be verbalized and which the authors Birgitte and Steen Wackerhausen (Wackerhausen, 1999), based on Michael Polanyi, dub "tacit knowledge," or "tavs viden" in Danish.

Historically, M. Polanyi is one of the first people to seriously market the term "tacit knowledge" (Danish: "tavs viden"). A term that refers to the condition where people might have knowledge even if this knowledge cannot be put into words. Based in several psychological studies as well as more anecdotal events, Polanyi, very persuasively, attempts to provide proof that tacit knowledge exists. But also Merleau-Ponty, Husserl, Heidegger et al deal with similar ideas. A long list of scientific surveys, furthermore, point to this being the case (for example Dixon (1971, 1981), Benner (1984), Schön (1983) et al). Man seems to posses knowledge that does not exist in terms of language, and man seems to be able to perform acts, professionally and competently, without their actions and skills being based in rules. (Wackerhausen, 1999).

According to these two authors, several kinds of knowledge exist. This is the knowledge that exists outside of ourselves and which is the knowledge that generally is acknowledged to be the real knowledge and the one practiced by us researchers in particular in the scientific and technical universities:

For something to be knowledge it must fulfil (at the least) the following conditions: (1) first and foremost, it must be explicit, (2) it must be expressed in writing, (3) it must be true, (4) it must be soundly reasoned why it is true. Closely connected to this - and thus part of the dogma in a wider sense - is the idea that knowledge can be externalised in relation to man. Meaning that knowledge is not tied to one person, but can exist independently, outside of any persons. (Wackerhausen, 1999)

Then, according to the two authors, there is tacit knowledge, which is related to practice, hands-on and is more of a personal kind of knowledge. This is a knowledge they divide into present tacit knowledge, which can be verbalized, but which has not been so yet and knowledge they then dub principled tacit knowledge, which is knowledge in a more fundamental sense and is outside the boundaries of exact language.

The term "the silent dimensions" is well-suited to be an umbrella term for those aspects of human competency, skill, knowledge, etc., that fall outside the (present or principled) boundaries of explicit language, outside the domain of exact rules and procedure. Tacit knowledge can be divided - although not incisively so - into respectively present tacit knowledge and principled tacit knowledge. Present tacit knowledge here includes knowledge that man has but has not been verbalized, but in principle could be verbalized in an exhaustive manner. Principle tacit knowledge is knowledge that in a more principled sense lies outside the boundaries of exact language. That is to say, knowledge that cannot exhaustively be "externalized" and is given independent character, being knowledge that cannot exhaustively be made clear through sentences, and, consequently, where knowledge of sentences alone is not sufficient knowledge. (Wackerhausen 1999)

In the design method "Design in a Broad Perspective" the wish is to actively include all kinds of knowledge areas mentioned above in designing materials. As designer Helle Hove writes, [10] material understanding is not acquired only as theoretical knowledge, but also through testing it by hand.

Understanding material is a combination of theoretical knowledge and the testing by hand. Whether it is dyeing yarn to be weaved into a piece of textile, steam bending wood for a chair, pleating fabric for a future collection, plaster moulds for casting porcelain, plastic vacuum suction for a computer case, or new software in a virtual game. All of the above are processes through which the student gains experience to better master and thus challenge the material. Understanding material thusly is linked to knowledge of production that also benefits the designer both in terms of interacting with the world around him or her, but also to a large extent in terms of developing the product. Here, understanding the material is closely linked with the possibilities and limits of a preferred shape, both in terms of the quality of the product and the financial aspects. (Hove, 2010)

This is also the knowledge we acquire through practical work with materials in general and as such something we all carry with us. It could for that matter also be a tool for

Previous pages. Details of Daniel Libeskind's Jewish Museum in Berlin on the left, as well as Santiago Calatrava's train station in Lisbon on the right. Photos: Anja. Previous pages on the left principle sketch that shows how the exhibition at Marsden Woo Gallery London started from registering different structures related to the exhibition space and its surroundings. Previous page on the right, sketch of housing stock and infrastructure surrounding the gallery made into a folio with spatial distribution for the exhibition. This page: details, specific ceramic glazed concrete and wood as spatial installation. Marsden Woo Gallery, London, 2013, Sign and the Signed, Between presentation and representation. Photo: Ole Akhøj.

acknowledgment, which we can use not only in manufacturing design objects, but also in our everyday life when we respond to reality. Architect and associate professor at Aarhus School of Architecture, PhD Anders Gammelgård Nielsen in his PhD dissertation writes, relying on the article "inzinerte Materialitet," (Böhme 1995) by German philosopher Gernot Böhme, about how we as children through play build up relationships to materials and preserve it as experience:

According to Böhme, through work relations we build up a sensuous relation to the materials. This relation involves a basic acknowledgement of the qualities of the materials; its physical capacity. We work with the materials and thereby become aware of their inner structure, their elasticity, tensile strength, thermal conductivity and so on. Our earliest sense experiences are made through this work relation. As we "meet the world" we establish a relationship to our closest surroundings and thereby create a close relationship to the materials. In childhood, work is replaced by play. Through play we "test" our surroundings as the child builds up familiarity with the materials - the stick breaking when it is bent beyond its tensile fracturing point, the flint that shatters against the granite, the clay dissolving in water and so on. Similarly, the artist as well as the craftsman builds up a basic familiarity with materials through the work relation. Familiarity that will later become the bedrock of free and intuitive shaping of the material - knowing the material means knowing its possibilities. The artist becomes one with the material - the material becomes the extension of the artist. As we greet the material with open senses, through perception we establish a coherently sensuous image of them. (Gammelgård Nielsen, 2002 p. 40)

When I teach the course Building Component Design at the Technical University of Denmark, building design section, I always begin the course by asking the students to taste design. They must learn to acknowledge and utilize their senses, their bodies, and their emotions as design tools along with the explicit knowledge and tools they have otherwise acquired during their studies to become an engineer. It is not the intention for them to be able to explain everything in speech or writing. They must learn to feel, to use what they carry with them as experiences, as they simultaneously pin down, describe, and contextualize their subject. They must acknowledge that they as sensuous beings with a body that can be touched sensuously and emotionally also contain knowledge that cannot be verbalized, but can be questioned through "doing."

Details ceramic as spatial installation. Marsden Woo Gallery, London, 2013. Sign and the Signed, Between presentation and representation. Made from conventional concrete, wooden pegs, and specific ceramic glazed concrete. The floor objects are 14 x 14 x 5-7 centimetres, the boxes 40 x 40 x 40 centimetres, the panel 160 x 50 x 1-2 centimetres. Photo: Ole Akhøj.

The silent space has no coolness or sense of breadth of outlook. It is like a dance where body, music, and scenery form a harmonious whole. Suddenly, the work "silent" sounds empty because it has absolutely nothing to do with emptiness, but rather with "ladenness" if such a work even exists? In reality, it is so meaningful that it is even a space, which I sometimes, in the midst of a busy day filled with errands, dreads that I will not be able to locate and enter because this is where I most strongly feel alive. This is where I am replenished, where I catch up to myself, where everything around me becomes whole and alive and where I might be a compounded part of a wholeness. This wholeness, which is what I am doing, my body and movements and surroundings, materials and answers. (Hansen, 2012)

The students must locate the silent space that Professor PhD Finn Thorbjørn Hansen (Hansen, 2012) describes above and feel its ladenness. They must do so not only to fulfil an assignment to locate the solution to the building component I'm asking them to design, but also because I want them to, once more, become aware of that they actually know, but which they no longer know that they know. They no longer probe as deeply as they did at the beginning of their studies, as the dreaming, yet-to-be-fully-formed kids they used to be. Now, instead, they use their fully developed logical and rational thinking with which they feel secure and master in every respect. Using senses, body, and emotion as a design tool is a way to incorporate and question as well as work with the aesthetics and the qualitative. It is something students of artistic, creative studies learn through their education.

When design students learn to work with aesthetic mechanisms such as shape or colour, it often happens through project courses, in the workshop, or through experiments upon experiments. "What happens if I make this line wider, if this shape becomes more pointed, this colour more saturated?" Through repeated attempts and dialogue with the teacher about concrete cases, they acquire understanding of basic tools of design. Understanding that partly is accumulated as know-how or tacit knowledge. (Hove 2010)

In this book's chapters on art-research, art creation, and art events, I will attempt to verbalize the explicitly communicable knowledge, present knowledge that in principle should be possible to verbalize, while tacit knowledge must remain tacit, but perhaps appears in the description of doing and in the extensive photo material this book is filled with.

AESTHETICS - THE AESTHETIC

As we touch materials, the materials touch us. Beneath the touch, we sense the surrounding material, but simultaneously learn how we (our own flesh and blood) are touched by our surroundings. In the meeting with materials, then, we sense ourselves. (Böhme, 1995)

Philosopher Søren Kierkegaard's quote, which I mentioned in the beginning, about how life must be understood backwards, but lived forwards (Thilst, 1994) can be reused here where it is apt for this chapter and to several aspects of the book in general. It is as if the pieces of the complex puzzle that both the design method and the development of specific ceramic glazed concrete consist of, by reading among other things philosophy, particularly philosophical aesthetics, as well as writing this book, begin to fall into place. However, this does not mean that the complete view yet emerges, but some of the outline is becoming clearer. The writing of this chapter has been a struggle, exactly because it tackles tacit knowledge. This is knowledge that has accompanied me through several years of working with materials within art and research, as well as development. Not pronounced or specific, but intuitively with a sense of certainty. As Professor and philosopher Dorthe Jørgensen (Jørgensen 2008) writes here, philosophy can be helpful.

With aesthetic experience you perceive something you feel certain about, but don't fully understand, which you might also have a difficult time expressing. Philosophical aesthetics, however, offers devices and terms that make it possible to be absorbed in thoughts on experience and express yourself sensibly about it without losing a sense of context or significance. (Jørgensen, 2008, p. 320)

Dorthe Jørgensen's body of work (Jørgensen, 1997, 2003, 2006, 2008) has meant a lot to my approach and reading of philosophical aesthetics, and so have other contemporary Danish and international philosophers' books and articles. Without them and several other philosophers' work, as well as their interpretations of other and earlier philosophers' work, I would never have been able to write this chapter of the book. Despite a kind of clarification in what I have read and my own research and practice, I still find it difficult to write about. As mentioned earlier, it has become ingrained within me as a sensuous and bodily experience and as a feeling, without being immediately conspicuous or particularly communicable. The wit I, at a PhD seminar on philosophy at Aarhus School of Architecture, 1998, felt like a pressure of expectation from philosopher Jørgen Dehs, like in my assignment then, which also today is present in the desire to acquire clarity and a certain kind of overview, is absent yet. An absence which by the way during the PhD seminar led to a, read by me in his facial features, marked disappointment in Jørgen Dehs, who probably had excepted partly wit, but perhaps to an even larger extent artistic ferocity. Even the "ferocity of art" with its desire for liberty has been sent out of the room. Aesthetics as a philosophical discipline has been a road in the search for a wider understanding. The following chapters of the book are not meant to be the end point of my adventure into philosophical aesthetics. It is a journey that has only just begun and will continue. This is a discipline that passionately takes hold of me with its explanatory perspectives, for example with its existentialism, but also to me represents all the things I don't know of and must discover. It is a central realm in both my artistic works and in art-research, but also in the design method Design in a Broad Perspective, including design of materials. As such, it cannot be omitted.
Reading philosopher Gernot Böhme's teachings on epistemological aesthetics (Böhme 1995, 2006, 2010, 2012) particularly his atmosphere concept as well as architect Peter Zumthor's works (Zumthor 2005) about how he in his works uses the atmosphere concept in practice, has left me with tangible delineations for explanatory models.
Why, you might ask, are questions of aesthetics and the aesthetic even questions I find are important to ask? This is partly in relation to the desire that the materials I wish to design lead to an aesthetic and sensuous feeling in the ones who encounter them, but also and even more so, because it is one of several tools for us as individuals to use in order to find our way in a fragmented and vast reality. A world, philosopher Carsten Friberg (Friberg, 2007) writes, where many of us find ourselves in a crisis of orientation. In a state of chaos and lack of control we must create and narrate our life story as we run after the rapidly galloping inconstancy. These are the conditions of life. This is a world that Morten Kyndrup (Kyndrup, 2008) tells us can only be told 1:1.

The world cannot be told, at least not in any other measurement than 1:1, as the painstaking reproduction of the mediating shifts between unplaceable memories and the unfathomable present of our stream of consciousness. This is the way it is, this is the way it feels. It is true but cannot be addressed, it becomes hermetic, oppressively stifling - lonely and displaced, each of us is contained within and by our own narration of ourselves. There are no other possible narrators. (Kyndrup 2008, p. 132)

In such a perspective on life, aesthetics and the aesthetic in the present analysis as theory on sensing and bodily awareness where also emotions are incurred as well as beauty as the aesthetic sublime, are a way to feel. With aesthetics and the aesthetic as a part of our bundle of experience and awareness we are able to find our way and act with closeness and care. When I earlier wrote that I want to develop materials with aesthetic functions that make the viewer of the art event, who is also a part thereof, want to embrace and kiss the materials, this is not say that this in itself is the goal. To a much larger extent, the goal is to make us see ourselves and recognise ourselves as sensuous, bodily, and feeling beings and that exactly the experiences we acquire from this are just as meaningful in

our search for perspectives on life and finding our way, as our logical, rational intellectual thinking is.
In the following I only include distillates of these many philosophical considerations. These are the approaches to philosophical aesthetics that I feel are relevant to and reflect what I sense, match my work, as well as what is best suited for my artistic work, research, and the design methods as practised. As such, these are perspectives on philosophical aesthetics that are relevant to the theme of the book.
Aesthetics and in particular the aesthetic as a processual design tool, as manufactured and accented event, as well as in form of bodily and sensuous feelings, which are perceived and stored via experience as awareness, are central to the design method Design in a Broad Perspective's artistic expression. Here, the aesthetic is related to sensing and sensuous approaches to awareness and manufacturing (Baumgarten, 1750, Seel 200, Schusterman 1997, and Böhme 2006, Kyndrup 2007) as well as beauty understood as the aesthetic sublime (Gadamer 1984).
Etymologically, aesthetics is defined as what the body senses. It is derived from the Greek aisthetikos, which means sensing, in turn derived from aisthanesthai, which means to sense or to feel. (Jørgensen Angkjær 2007). The term aesthetic originally appeared in an Ancient Greek context and emerged as a philosophical discipline in the middle of the 18th century with the publication of German philosopher Alexander Gottlieb Baumgarten's book Aesthetica, 1750, 1758 (Baumgarten, 1750).
In the Ancient Greek as well as in Baumgarten's version the theme of aesthetics is sensuous epistemology. In Baumgarten, aesthetics is a discipline that in itself has nothing to do with sensuous epistemology, but rather is the doctrine of sensing. Baumgarten thusly dissociates himself from metaphysics. Furthermore, he stresses that philosophical aesthetics can be an epistemological supplement to logic. (Jørgensen 2003).
Aesthetics as epistemology was, however, immediately replaced by a marriage to art, an approach that has dominated for centuries and not until recently have started to become less rigidly applied. Aesthetics referencing Baumgarten's theme have been dug out of its hideaway and been polished off to better fit the present. So has phenomenology from Husserl (Husserl, 2001) to Merley Ponty (Brandt 2002). This is not to say, however, that art and aesthetics now are inter-connected, but rather that the term aesthetics and its theme no longer only deals with art hereunder the beauty of art, but several different aspects also. It is so widespread that philosopher Jørgen Dehs (Dehs 1984) writes:

Details, ceramic as spatial installation, Marsden Woo Gallery, London, 2013, Sign and the Signed, Between presentation and representation. Made from wooden pegs, conventional concrete and specific ceramic glazed concrete. The panel is 160 cm x 50 cm x 1 cm. Photo: Ole Akhøj.

The chance of acquiring a simple, fundamental model of orientation for aesthetics is no more obvious than acquiring one for example social studies, psychoanalysis, or linguistics. (Dehs, 1984, p. 9)

While philosophers Ulrik Bisgaard and Carsten Friberg (Bisgaard, Friberg, 2006) go as far as to claim that aesthetics today concern all life conditions. As such, it is not surprising that Danish film director, Morten Balling in a newspaper article in Politiken (Balling 2012) points out that the term aesthetics means nothing, that it is "a bag of hot air." Author Torben Sangild (Sangild, 2012) remarks, however, that this is a wrongful interpretation. The concept of aesthetics means many things, but that does not intimate that it has no meaning. Thus, according to Sangild, aesthetics are (Sangild, 2012):

A. The theory of sensing and a sensuous approach to the world
B. The theory of the beautiful (and the sublime and the hideous)
C. The theory of art and its devices (all types of art)
D. The aspect of art that deals with the sensuous and with regards to structure
E. Creation of shape, sensuous expression.

It is quite possible that other overviews point to different approaches to the concept of aesthetics. But what is relevant here and what I respond to is what Sangild in the following labels as points A and B. It is aesthetics as the theory of sensing and a sensuous approach to the world as well as aesthetics as the theory of the beautiful (and the sublime and the hideous). It is philosophical aesthetics that here, besides art, deals with all life conditions. (Bisgaard, Friberg, 2007) Carsten Friberg (Friberg, 2006) writes that the sensuous operates and stirs emotions such as joy, disgust, and loathing:

The sensuous operates. It evokes many feelings, including pleasure and joy, disgust and loathing. It attracts attention by capturing it, holding it, leading it, and diverting it; it affects by addressing and repelling, fascinating, and irritating. (Friberg, 2006, p. 35)

In the reality in which we move and manifest ourselves, sensing is an essential tool. Not

On this page details ceramic as spatial installation Ceramic Glazed Concrete and wooden pegs. Photo Ole Akhøj. Opposite page. Details, ceramic as spatial installation, Marsden Woo Gallery, London, 2013, Sign and the Signed, Between presentation and representation. Made from conventional concrete, wooden pegs, and specific ceramic glazed concrete. Photo © Philip Sayer, courtesy of Marsden Woo Gallery.

just for causing joy or disgust, but because it is through our senses we are impacted with impressions from our surroundings. Many associate senses with the five classic senses. These are hearing, sight, taste, smell, and touch. But the movements of the body, position, weight, and power also provide the brain with sense stimuli through muscles, tendons, and joints. This is called kinaesthetic sense. Further, the sense of balance is a seventh sense. [11] If you look up senses in the Brittany Medical encyclopaedia these are defined as stimuli the brain receives via the sensing of the body. [12] Then the list gets more specific and also includes sense of movement, sense of colour, sense of body, sense of light, sense of pain, sense of position, sense of pressure, sense of space, and so on. [13] Generally, however, they are within the seven senses mentioned above. It is this holistic approach to sensing I refer to in the following when I describe sensing. These are the five classic senses, as well as the kinaesthetic and sense of balance.
Everything that is observed through senses can be observed aesthetically, according to philosopher Martin Seel (Seel, Martin, 2000). But that does not mean, Seel continues, that all situations are aesthetic and certainly that far from all of them are aesthetically relevant. Not all sense impressions remain in us as aesthetic experiences. The aesthetic, however, is emphasized by Seel as something that deserves independent attention. (Friberg, 2007, p. 225) According to philosopher Nelson Goodman (Goodman, 1984, p. 10), this is achieved when the observation is conditioned on emotions. With the emotionally conditioned observation, it becomes aesthetic experience. (Degh 1984, 10) Philosopher Hans Georg Gadamer points out that the aesthetic experience is acquired in the encounter with beauty. Beauty is experienced to be purely formal, but besides that also as a faint container of spirituality, which leads to something otherwise non-existent. (Jørgensen, 2006, p. 192) This is what Gadamer terms the aesthetic sublime. This is where the aesthetic observation becomes aesthetic experience. This is, according to Heidegger, what makes us move closer to being and, according to Gadamer (Jørgensen, 2006, p. 192) changes us forever.

A work of art thusly puts its spectator into a state where he or she both experiences beauty that is purely formal, and faintly senses meaning, which is spiritual. The element of faint meaning constitutes an aesthetic "sublime" in the work, which makes the aesthetic experience exceed itself and become experience. (Jørgensen, 2006, p. 192)

On this page and the opposite details ceramic as spatial installation. Marsden Woo Gallery, London, 2013. Sign and the Signed, Between presentation and representation. Made from conventional concrete, wooden pegs, and specific ceramic glazed concrete. The floor objects are 14 x 14 x 5-7 centimetres, the boxes 40 x 40 x 40 centimetres, the panel 160 x 50 x 1-2 centimetres. Photo: Ole Akhøj.

The sense impressions that make themselves known as aesthetic experiences thusly affect, according to the philosophical considerations above, our being in a way that transforms us. What plays a role in the sensing leading to this are emotions and beauty, which form an aesthetic sublime. Beauty works, Gadamer writes, as an agent of change in that the one who experiences beauty changes. According to Dorthe Jørgensen (Jørgensen, 2006, p. 54) this is not to be taken completely literally.

Since I am not a wholly different person after listening to the music of Bach than I was before. ..But the music did give me a different perspective on the world that I would otherwise have had, if I had not heard it. (Jørgensen, 2006, p. 54)

Beauty, here, is not bound up with the term "beautiful" which to a much larger extent refers to socially constructed taste preferences. Beauty surpasses the beautiful by not only arousing desire, but also stimulating the intellect. (Dorthe 52, beauty) Beauty can, as Torben Sangild (Sangild 2012) already set the stage for, deal with what is hideous, but also, according to Goodman (Goodman, 1984), delight, joy, disgust, and loathing. Beauty does not represent a cosmic order principle, a divine whole, or the doctrine of classic taste formation, the sublime, nor the elevated spirit of genius. Beauty here refers to the aesthetic sublime as an epistemological concern.
The materials I design must somehow move us as individuals closer to ourselves as sensing beings, body, and emotions, and thus achieve awarenesss that provide us with tools for orientations. Goodman (Goodman, 1984) mentions disgust and loathing as some of the feelings aesthetics can create in us. This, however, is not what I have in mind, not what I seek in my dialogue with neither the materials nor what I wish to awaken in those who encounter them. That is, on the other hand, emotions that bring delight, joy, attraction, and other similar reactions. The intention is for the materials in the event to breed desire to embrace and kiss them. You are unlikely to do that if they are repellent or they disgust you. Absorbing beauty as the aesthetic sublime requires that you, as an individual, are ready to do so and have the tools to do it. It demands openness:

The artwork is no spick and span unit facing a passive spectator. The perception of the

On this page, ink drawing on transparent foil mounted on wall and wooden pegs as abstract fabulation on the Clerkenwell area's infrastructure surrounding the gallery. Opposite page: installation detail made from unfired concrete, wooden pegs, specific ceramic glazed concrete, wooden plates, and drawn materials. Marsden Woo Gallery, London, 2013, Sign and the Signed, Between presentation and representation. Photo: Ole Akhøj.

work plays a role in putting it and its context of ways of understanding and linguistic devices into play. Then another kind of dialogue emerges when and if the subject is able to devote itself to the work, which functions in relation to its sensuous surplus and idioms. Taking delight in art has no end goal, but rather is an event that makes linear time fall off its hinges and makes strategic preferential theories expire. You must be ready to capture the event; you must be worthy of it. The conditions for this dialogical exchange are that the visiting, sensitive, and sentient subject is capable of minimizing the noise and preceding expectations they bring themselves. (Lassen, 2005)

It also demands sensitivity, philosopher Steen Nepper Lassen (Lassen, 2005) writes. This is the sensitivity and closeness I believe that we in our everyday lives, in our dealings with others and our being, must risk much more. If we abandon the aesthetic sublime, we do not sense the emotional reverberation within ourselves, but are reduced to frozen rigidity, incorporated into the darkness of logic if these are the only steps we follow. Beauty here is not an objective thing, a characteristic of the object alone. Nor is it understanding something that merely exists in the subject as the ability to adjust our imaginary powers to reason and intellect. (Kant 1790) Beauty here behaves quasi-objectively, between subject and object as a loaded atmosphere where the aesthetic sublime makes you affected by it on an emotional level. (Friberg, 2006, p. 234). The quasi-objective equals the relationship between the qualities of the surrounding objects and the condition of the observant subject where both are co-constituents. An atmosphere relates to both the subject in a reception aesthetical perspective and the object in a production aesthetical perspective. (Böhme) This is what fills a room with a mood that affects us emotionally. (Ibid. p. 234)

The character of an atmosphere is the way in which it communicates a feeling to us as participating subjects. (Böhme, 2012, p.2).
All the same, can one really make atmospheres? The term making refers to the manipulating of material conditions, of things, apparatus, sound and light. But atmosphere itself is not a thing; it is rather a floating in-between, something between things and the perceiving subjects. The making of atmospheres is therefore confined to setting the conditions in which the atmosphere appears. We refer to these conditions as generators. (Böhme, 2012, p.3)

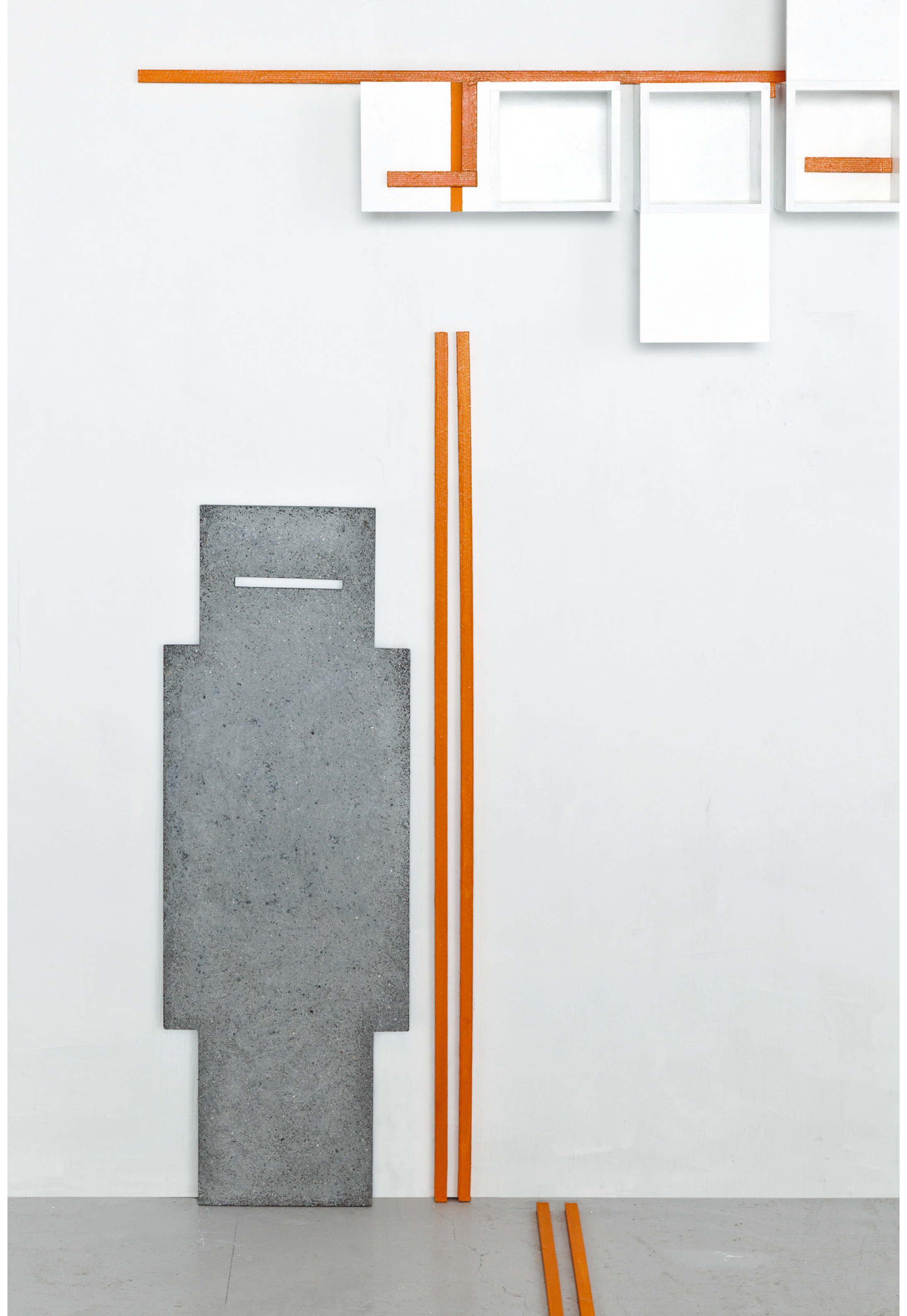
This and opposite page: installation details from Marsden Woo Gallery, London, 2013, Sign and the Signed, Between presentation and representation. Made from conventional concrete, wooden pegs, ink drawing on transparent foil mounted on wall and specific ceramic glazed concrete. Photo: Ole Akhøj.

An aesthetic atmosphere is an atmosphere that with the help of what Böhme calls “Generators” is “tuned up”. It is like a theatre stage that does not let the audience stay outside. That which goes on on a stage, but, for example with lighting, sound, and more captures the theatregoer with a mood that embraces and affects him or her.

In scenography, therefore, we have an art form which is now directed explicitly, in its concrete activity, towards the generation of imaginative representations in the subjects, here the audience. It does not want to shape objects, but rather to create phenomena. The manipulation of objects serves only to establish conditions in which these phenomena can emerge. But that is not achieved without the active contribution of the subject, the onlooker.....................................
It becomes clear that what is at issue is not really visual spectacles - as was perhaps believed by practitioners of the old scenography - but the creation of “tuned” spaces, that is to say, atmospheres. The making, as long as it concerns a shaping and establishing of the geometrical space and its contents, cannot therefore relate to the concrete qualities possessed by the space and the things within it. Or, more precisely: it does not relate to the determinations of things, but to the way in which they radiate outwards into space, to their output as generators of atmospheres. Instead of properties, therefore, I speak of ekstases - that is, ways of stepping-outside-oneself. The difference between properties and ekstases can be clarified by the antithesis between convex and concave: a surface which, in relation to the body it encloses, is convex, is concave in relation to the surrounding space. (Böhme, 2012, p.3).

Now the question is which generators are to be used and how they must be tuned to achieve precisely the desired atmosphere. There is no definitive answer to this. Danish architect Jan Gehl tunes urban spaces across the globe with delicate awareness of how man acts in urban spaces. Danish artist Olafur Eliasson regulated an atmosphere at an exhibition at Tate Modern, London, with an artificial sun and architect Peter Zumthor practices regulation of atmospheres by shaping spaces, both those of the buildings and those of the urban spaces, through a careful approach and use of materials. A magnificent example of this is the Thermic Baths in Vals Graubunden where Zumthor lets nature in the form of water and light crowd through cracks in the building, which as a geometrically compact and simply structured cavern wraps itself around you with its materiality and almost archetypical appearance as if being close to nature. Raw concrete moulded on site with impressions of the formwork plates here meets the gneiss of the surrounding mountains as manufactured oblong natural stones, stacked from floor to ceiling like a textile pattern made with ornamental repetition and the still water as the floor. Zumthor is a master of making materials speak together and regulates the atmosphere in the way it stands out and is manufactured as well as structured and speaks with what surrounds it, in this case water and light, but also mountains and the reigning climate. In the book Atmosphere, Zumthor (Zumthor, 2005) speaks about how he is inspired by atmospheres reproduced in paintings, photos, experiences places, and spaces, as well as music and even sentences. When he experiences a regulated atmosphere, he asks himself if he would be able to recreate it. It is not the place, buildings, urban spaces, cafes, or the fixtures or persons present. But it is the mood, the atmosphere he seeks to recreate, interpreted anew through his architecture. Peter Zumthor collects regulated atmospheres for inspiration. He is happy to hang photos or any of the other objects mentioned on the display board at the drawing office when a new building job is begun. They indicate the desired regulated atmosphere. This is what he would like to see recreated and unfolded in the architectural solution. Not in the same way, but in relation to a new solution of it; new architecture. (Zumthor, 2005)

On this page wooden pegs and boxes. Opposite page: installation detail made from unfired concrete and wooden pegs and boxes mounted on wall. Marsden Woo Gallery, London, 2013, Sign and the Signed, Between presentation and representation. Photo: Ole Akhøj.



Quality Architecture to me is when a building manage to move me. What on earth is that moves me? How can I get it into my own work? How could I design something like the room in that photograph? A building I have never seen, in fact I think it no longer exist – a building. I just love looking at. How do people design things with such a beautiful natural presence. Things that move me every single time. One word for it is atmosphere. I enter a building, see a room, and in the fraction of a second – have this feeling about it. (Zumthor, 2005, p. 10.)

In this book, Zumthor talks of some of the “markers” he uses to design and plan generated atmospheres and architecture. These are the ones I draw from and use as the potential markers, which in Böhme’s terminology are called generators. It is with these as the types of question to be asked in the artistic job and, as will become clear in a later chapter, are used also in art-research, that atmospheres are sought to be regulated and manufactured aesthetically. It is this collection of terms, (Zumthor, 2005):

”The Body of Architecture”,
”Material Compatibility”
”The Sound of Space”
”The Temperature of Space”

”Surrounding Objects”
”Between Composure and Seduction”
”Tension between Interior and Exterior”
”Levels of Intimacy” and
”The Light on Things”

For more on these elements as Zumthor calls them, I refer to the book Atmosphere, (Zumthor, 2005) and will not delve deeper into it here. In the chapter on art research I have taken the liberty to relate the term correlations to questions of how materials are manufactured. I use them as such in the design method Design in a Broad Perspective as questions the art-researcher can benefit from. I will return to this later.
That the term correlations are listed as they are above should not make it seem as if this is a stringent sequence to be followed. Similarly, these are not term correlations with which I can guarantee that following them will make it possible to regulate atmospheres as aesthetically sublimely as Zumthor does. This demands artistic insight and talent equivalent to his. When I mention it here and go as far as to point to Zumthor’s term correlations as markers, it is partly because it fits so well with Böhme’s epistemology on the aesthetic and partly because it hits the nail on the head for precisely what many form-creating artists focused on spatial manufacturing work from. It is just rare for shape-creating artists to express and verbalize it as clearly as Zumthor with the help of his editor and interviewer Brigitte Labs Ehlert does in the book Atmospheres.
Until now, these are the markers I have come across in my research that fit best with the relationship I seek to uncover. That is why I use them in art-research related to the aesthetic. Zumthor’s list can be used as a shopping list of the questions that can be asked of the search and creation of an aesthetically regulated atmosphere, an atmosphere where we are touched sensuously, bodily, and emotionally to such an extent that we feel ourselves and our being in the world. It can also be helpful in art-research that is put to the difficult task of relating to what it is about materials that makes them participate in aesthetically regulating an atmosphere when being a part of an event.
The aesthetic appears in three different positions in the design method Design in a Broad Perspective. As part of a practice in the creation of art, including specifically choice of materials, in manufacturing and shaping these, as well as structuring and compositionally organizing them. It is in the intentional manufacturing of the art event. Here, the aest-

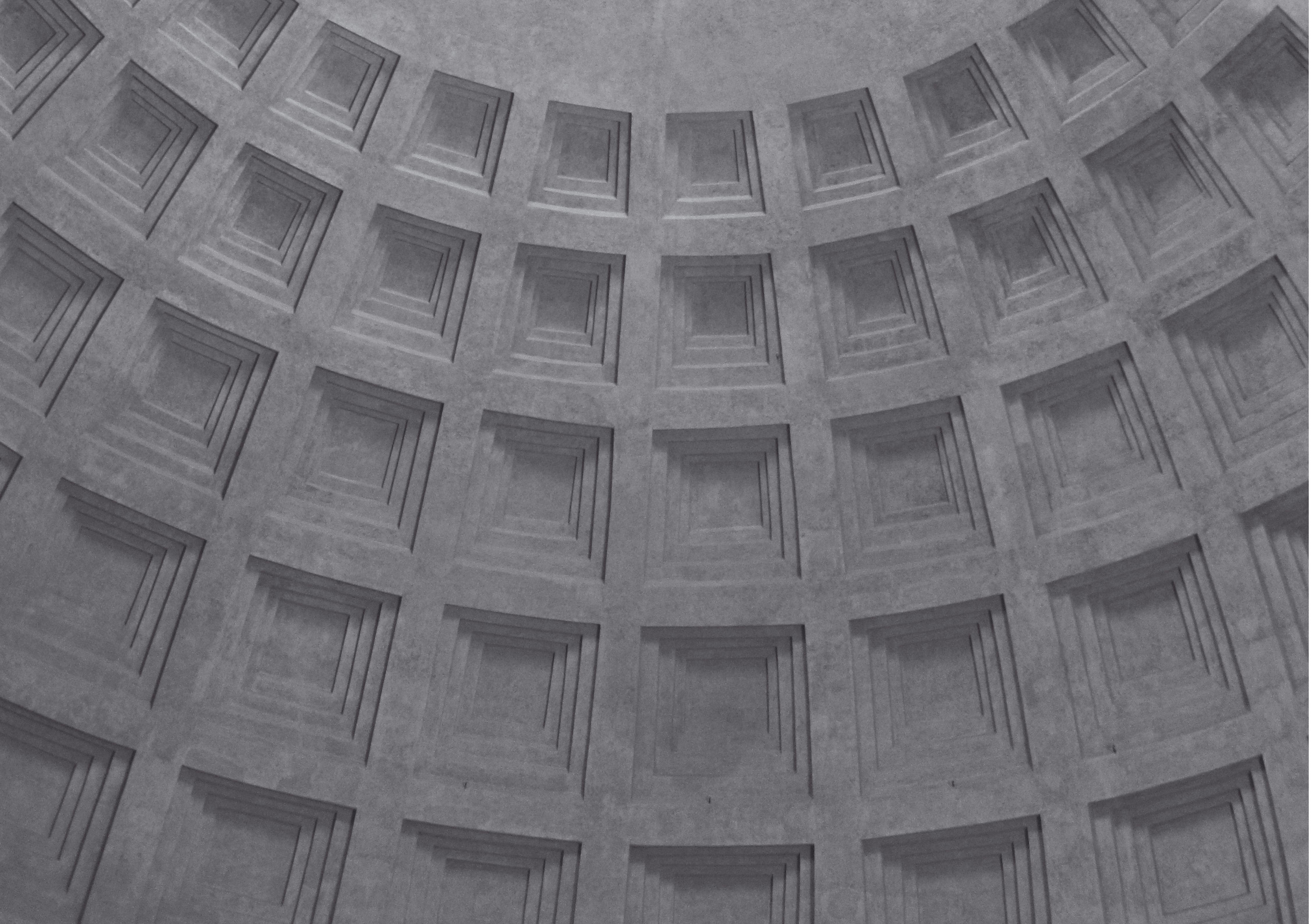
This and opposite page: installation details from Marsden Woo Gallery, London, 2013, Sign and the Signed, Between presentation and representation. Made from conventional concrete, wooden pegs and boxes, ink drawing on transparent foil mounted on wall and specific ceramic glazed concrete. Photo: Ole Akhøj.

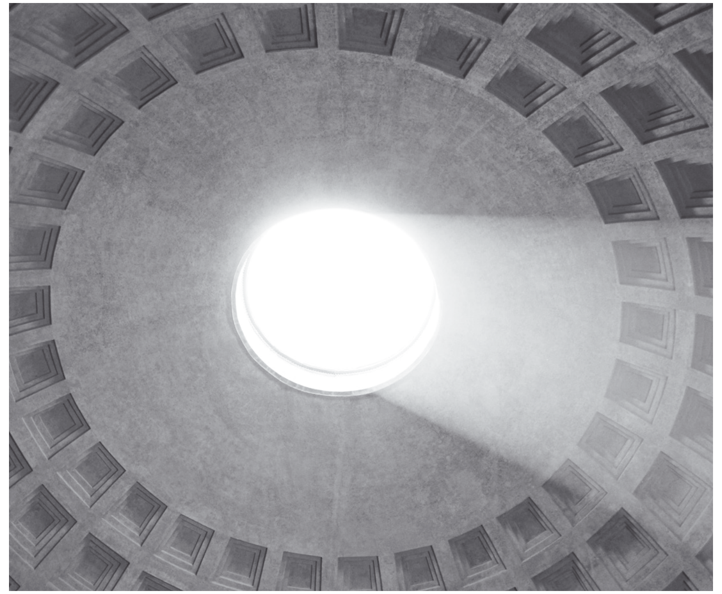
hetics are related to what for the artist is a subjective, sensuous, bodily, and emotional experience and awareness. It is also related to the subject's feeling and expectation of the event the artist is planning to execute, and the atmosphere that will reign therein as well as the idea of how this will affect the spectator of the event.

Furthermore, the aesthetic appears in the design method as modelled manufacturing of materials, objects, artefacts, and even as intentionally regulated to the individual spectator when she is part of it. The event is orchestrated, manufactured, and shaped to produce communicated meaning and mood for the recipient and her experience of it, as well as affect her experience of her own self as part of the event. The aesthetic is here located in-between the object-state and the subject-state within the event, a quasi-object which is an aesthetic relation, a regulated atmosphere.

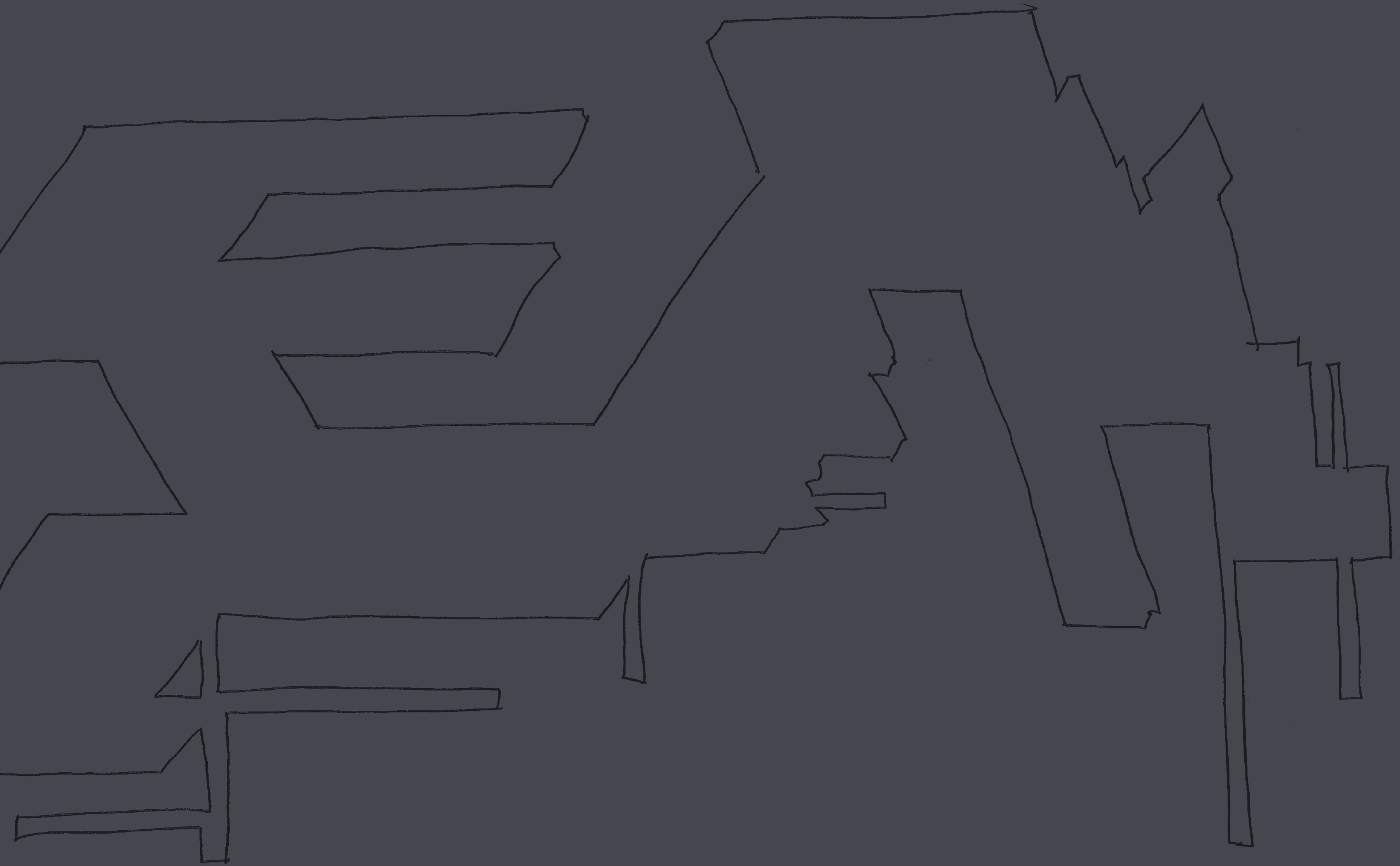
The final position of the aesthetic is when the subject, the artist, the researcher, and the spectator within and outside of the event and in relation to the artefacts and the intentional manufacturing experience and question the aesthetics and hereby, if it works, locate aesthetic awareness and experience about it. All three positions of the aesthetic are relevant to the design method as ways to acquire awareness, which can be used to design materials.

Opposite page and this page: Details, spatial installation, Marsden Woo Gallery, London, 2013, Sign and the Signed, Between presentation and representation. Made from painted wooden pegs and boxes, concrete and ceramic glazed concrete. Photo: Ole Akhøj.





MATERIALS



MATERIALS

Science is not just a collection of laws, a catalogue of unrelated facts. It is a creation of the human mind, with its freely invented ideas and concepts. Physical theories try to form a picture of reality and to establish its connection with the wide world of sense impressions. Thus the only justification for our mental structures is whether and in what way our theories form such a link. (Einstein & Infeld, 1938)

MATERIALS - CONTENT

Part of the design method, Design in a Broad Perspective's vertical string is the technical scientific materials research. That is what this chapter is about. Technical scientific research is applied research based in the theories of natural science. Natural science is characterized by being the first order's observations of nature and the world. Based on approximately precise observations of parts of nature and the world, natural sciences articulate theories about this cohesion and behaviour. In technical scientific research, these observations are sought to be transformed into something that can be used, for example, in a car, computer, or, as in this case, building. It is also within the technical scientific research materials science and design and development of materials are located.
When designing materials, theories such as plasticity theory, elasticity theory, fracture mechanics, material physics, capillary theory, thermodynamics, chemistry, and so on can be relevant. They are relevant also when we deal with research in ceramic, be that technical ceramics, or, as in this case, construction ceramics. Here also thermo-related theories are important.
The mechanical, static, and chemical behaviour of the materials depend on under which temperatures they are observed. To specific ceramic glazed concrete the behaviour of the materials in regards to temperature play a role both in terms of manufacturing the ceramic constructions, but also subsequently, for example, as an integrated part of buildings where fire and safety matter.
The chapter is introduced with some considerations on material design within the normal-temperature zone to then move into material development in the high-temperature zone. The materials are studied as closely as possible, down to the micron level, but also observed on the large scale. The chapter deals with concrete, ceramic glazed concrete, and specific ceramic glazed concrete, as well as glazes and glazing technology. It implicitly contains the mentioned theories, including packing theories, material physics, fracture mechanics, and chemistry. The chapter is kept in a simple language and describes what is bred by the theories in terms of materials.
To the reader who works with concrete, high-strength concrete, or ceramic glazed concrete, it might be beneficial to read this chapter, the following chapter "Process/Craftsmanship" as well as appendixes 1, 2, and 3.

MATERIALS

I have designed specific ceramic glazed concrete aimed towards flexible ceramic, large-scale components combined with low material thicknesses. These are concretes I have orientated towards new performances in the ceramic area. I have followed the previously mentioned design method "Design in a Broad Perspective". In this chapter, I move up close to the technological part, including specific design of composite materials, concrete, and glazes. Here, I combine, as something new, theories, newer composite technologies such as Densit and Compact Reinforced Composite with, among other things, ceramic and glaze technologies and as such acquire specific ceramic glazed concrete aimed towards new mechanical, static, and chemical performances. In this chapter, I consider the concrete in relation to packing materials densely in order to achieve high strength, designing them in relation to fracture mechanical design so they can be bent and are less vulnerable to fissures and shocks, as well as the fact that they move from being hydraulically chemical bonding in the concrete to being a ceramic bonding structure in specific ceramic glazed concrete. Furthermore, I consider the glazes in relation to strengths, durability, and interaction, as well as the visual narrative about the concretes. Finally, I conclude on the collected data, which are the selection criteria for the ingredients to be included in specific ceramic glazed concrete to achieve the best possible performance.

CONCRETE - A DESIGNER MATERIAL

The qualities I require from concretes did not exist when I started this project. As such, it has been necessary to develop the materials. This is the entrance point of materials science and with it tools for design of materials.
In the 1960s, materials science emerged as a distinct academic discipline. With it came devices for measuring, understanding, but also designing new materials.

Materials science, the study of materials as a whole, rather than in their special chemical, physical and engineering aspects, is a fairly recent development. Indeed it has only lately become respectable… Naturally the first task was one of understanding the observed phenomena, why solids in general, and especially the familiar materials, behave in the way they do. Though there are still a good many loose ends, this stage can broadly be said to be accomplished. The problem now facing materials scientists is what to make use of their knowledge. The ambitious will want to apply materials science in radical ways, either by making substantial changes in the older materials, or else by inventing new and perhaps better ones. J.E. Gordon. 1984.(Gordon, 1984).

Previous pages. Pantheon Rome, Concrete and light details. Photos Anja. Explorations of light, materiality, and ornamental expressions of specific ceramic glazed concrete when juxtaposed with unfired concrete. Photo: Ole Akhøj.

Explorations of light, space, materiality, and construction details in specific ceramic glazed concrete. Spatial, abstract façade object, self-supporting with exposed armament bar and locally unglazed, but fired so that aggregate and fibres are exposed. Photo: Ole Akhøj.

It is based on this materials science that we today are presented to a host of new materials. The theory on composite materials is included in materials science. A composite is a material made up of two or more solid materials, which thereby acquires qualities that the distinct materials do not contain by themselves. (Holliday 1996)
Concrete is a composite and basically consists of solid materials such as cement, sand, and rocks as well as water, but other ingredients can be mixed in as well. There is virtually an infinite amount different concrete mixtures. However, they are all characterized by their hydraulic, chemical binding.
Materials science provided us with theoretical calculation and test devices, as well as tools for designing concrete for, among other things, mechanic, static, and dynamic performances. Therefore it is important to know that what exists can be questioned, and that it is possible to dream and to change what exists today.
As I see it, it is insufficient to, as architect Louis Khan does (Khan, 1973), ask a brick what it wants.

If you think of a brick, and you are consulting the orders, you consider the nature of brick, you say to brick "What do you want brick?" Brick says "I like an arch". If you say to brick "Arches are expensive and I can use concrete lintel over an opening. What do you think of that brick? Brick says "I like an arch" :it is important that you honor the materials you use, you don´t bandy it about as though to say "Well, we have a lot of material, we can do it one way, we can do it another way". It is not true. You must honor and glorify the brick instead of shortchanging it and giving it an inferior job to do in which it loses its character, as for example, when you use it as an infill material, which I have done and you have done. Using brick so makes it feel though it is servant, and brick is a beautiful material. Khan, Louis I, 1973.(Khan, 1973)

Such a question demands that a brick has a practically ontological will based in a specific behaviour. With composite technology and the tools it brought, we, on the other hand, are able to demand, or at least enter into a dialogue with the material to reach different mechanical, static, dynamic, or fracture mechanical performances.
A dialogue with a brick, therefore, can be politely started by asking the question Louis Khan asks, but then can turn into something more challenging: "Dear Material, what do you want?" When the brick then answers that it wants to do what it has always done, the question can be changed to a more insistent approach: "Dear material, I want you to behave in the manner I desire, how can we do that together?" Then the questioner moves into the composite thinking.
The concrete binders, [14] I have used exist in the industrial context. They have been developed to meet the requirements demanded there. When I transfer them into other functional areas, they encounter new demands. I gather the materials, concrete binders from industry where they are used as heat insulating materials, and bring them to the artistic area, aimed towards art, design, and architecture, as for example building materials. In industry, parameters such as heat insulation are vital. The materials here are used in thick layers as insulation for heat moulding containers made from, for example, steel. By transporting these materials to the aforementioned areas, demands arise that are related to construction design, such as strength, fatigue, durability, and fire safety. In building, there will also be demands related to comfort and function.
Materials in a building context must make it comfortable to be in whichever space they surround and border on. This goes both for internal spaces, but also for external, urban spaces. In this respect, the materials must not only fulfil static, building technical dimensions, but also be nice to be around. They must be safe to move within and be of a quality that makes maintenance as smooth as possible.
Materials used in disciplines like art, design, and architecture must also live up to demands of aesthetic performance, and an experience thereof thought up by the designer. It is, then, something that has to do with shape, surface conditions, its texture, tactility, visual expression, colour, ornamentation, as well as how it relates to its surroundings.
As such, the concrete binders I gather from industry encounter completely novel demands. Besides this, I demand that the building elements can be bent and that they are manufactured as large-scale constructions with low thickness. Finally, the materials must also be designed in relation to sustainability, resource use, and cradle-to-cradle considerations. This is why materials used in one context, in this case for industrial heat moulding processes, cannot be directly transferred to other contexts (in this case art, crafts, design, and architecture). It is necessary to redesign and develop the materials in relation to the context they are going to be part of. In the following, I will point to some of the material technical areas I have focused on when designing specific ceramic glazed concrete such as strength, ductility, and durability.

CONCRETE - CERAMIC - CERAMIC CONCRETE

The word ceramic comes from the Greek word "keramos," which means clay. Famous Danish ceramist Finn Lyngård (Lyngård, 1976) defines ceramic as clay products, such as earthenware, stoneware, and porcelain. This is what ceramic usually is thought to be. There are, however, other and broader definitions of ceramic. For example, Daniel

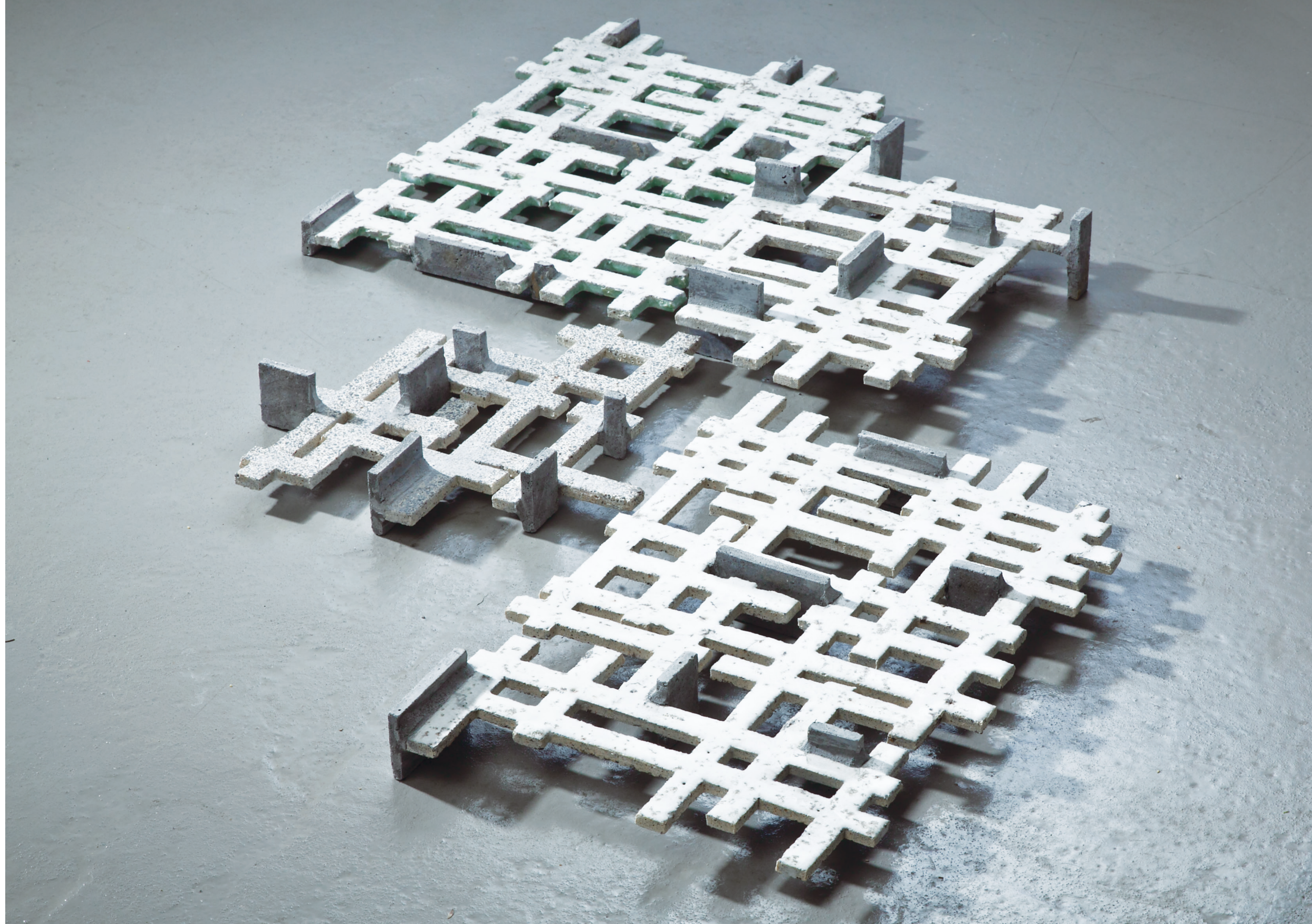
Rhodes (Rhodes, 1968) defines ceramic as usable objects made by heat treating earth products, including, besides clay, cement.

Ceramics may be defined as the art of making objects of usefulness and/or by the heat treatment of earthy raw materials. Ceramics includes not only pottery, but also glass, brick and tile and other structural clay products, refractories and fire brick, laboratory porcelain, sanitary wares of all sorts, dielectric porcelains, CEMENTS, plaster, lime, and virtuous enamels on metal. (Rhodes, 1968)

Portland cement consists of clay and chalk mixed and heated to 1400-1500 C° in up to 160-meter-long rotary kilns. Here, clinker are produced that via cooling are grinded into cement. Cement is the foundation of hydraulic concrete. That the concrete is hydraulic means that it hardens, finds its strength via a chemical reaction with water. Does that mean concrete is ceramic? No, cement is, but not concrete if we go by Daniel Rhodes' definition of ceramic. It's not as if we heat-treat conventional concrete to acquire usable objects. Concretes have the quality that they hydrate and find their strength at room temperature. Heating it to temperatures of 1000 C° - 1300 C° as we know it from clay products will destroy the concretes. Bazant (Bazant, 1996) thusly mentions that Portland cement melts at 900-1000 C°. Therefore, the concretes I use in this project are not conventional and I allow myself to call them ceramic. It is, on the other hand, concretes that are based on cement types more heat resistant than, for example, Portland cement. These are cement types like aluminate cement. Aluminate cement consists of chalk and bauxite or of corundum. (Neville 1975) It is manufactured by being pre-processed in long rotary kilns of temperatures up to 1600 C°. In this process, clinker are produced, which are then crushed and made into aluminate cement. Aluminate cement is manufactured with different percentages of aluminate oxide and calcium. The types of aluminate cement I work with contain a relatively large percentage of aluminate oxide in proportion to the chalk content. These are cement types that are heat resistant at higher temperatures than Portland cement.
High-temperature concretes, HT concretes, are according to Bazant (Bazant 1996) concretes that are constant until 1000 C° and above. While refractory materials, including refractory concrete, according to Peder Hald (Hald, 1958) are those that do not melt at 1580 C° and above. The concrete binders I take my starting point from are heat resistant until 1000 degrees Celsius and are described as HT materials.
HT materials and refractory materials might consist of aluminate cement, but also of other kinds of binders consisting of for example magnetite, dolomite, or chrome. These are not concrete binders or types that normally are used in today's building for load-bearing constructions. They are, however, used as lining and insulation in large industrial facilities. These might be nuclear power plants, boiler furnaces, cement, glass, or soda kilns, porcelain kilns, cupola kilns, and different kinds of metal melting kilns. (Rhodes, 1968)
High-temperature concretes and refractory concretes hydrate as conventional concrete. Cement, aggregates, and, potentially, other ingredients are mixed with water. Specific ceramic glazed concrete consists of aluminate cement and other contained ingredients, such as, for example, dispersal agents, micro silica, corundum aggregates, fibres, and water. The mixture is cast and put away to harden (in a damp environment) at temperatures above 0 C°, usually room temperature at about 18-25 C°. Thus, the cement's hydration process is begun, wherein the cement grains through a chemical process are partly transformed into cement gel. It can be observed as the cement grains expand and partly fill up the cavities between the constituent parts, but also inwards.
By heating high-temperature concrete and refractory concrete first, the free water, located in-between the cavities between particles and cavities of the cement gel, will evaporate. By continued rise in the temperature, the chemical, hydraulically bound water of the cement gel and any potentially contained particles and aggregate will evaporate. After this, the cement gel, the chemical binding, which gave the concrete its strength, will break down and a vitrification process will begin. This is when the concrete gradually is transformed from being concrete bound by chemical bindings in the cement gel, to being ceramic concrete bound by the ceramic binding, the vitrification. Vitrification means partial amalgamation. There are many different levels of vitrification processes. A light vitrification, for example, could be that the surface borders of particles fuse, but the particles themselves remain intact and do not melt. It could also be when less refractory component parts melt entirely and surround and retain other more refractory component parts. This is a vitrification process that seems to take place in the HT concrete binders I work with at sufficiently high temperatures. The chemical binding of the cement gel partly melts and binds the rest together as ceramic binder. The outer limit of the vitrification process is when all the component parts melt. Then it is no longer vitrification, but melting.

DESIGN TOWARDS STRENGTH

Not all concrete binders can be used as basic materials for designing specific ceramic



Abstract spatial object consisting of four component-objects with all of them displayed here. They are placed one after another and are made from a combination of unfired specific ceramic glazed concrete, one that has been initially fired, but not glazed and a specific ceramic glazed concrete that has been glazed with a white, glossy glaze. The concrete's aggregate and fibres are locally visible. The object can be combined in a variety of ways, thereby altering the entire expression. Photo: Ole Akhøj.

glazed concrete, when it must be flexible and be used in construction with low thickness. The basic materials must be dense, high-strength concrete binders and must have an aptitude towards being packed even more densely and with other ingredients, while maintaining their ultra-dense packing.
Conventional concrete binders do not meet these requirements, nor do those based on aluminate cement or other cement binders. Their packing structures are too open; there is too much air between the ingredients. Furthermore, the particles in these kinds of concrete, conventional concretes, are locked in an open structure so it is impossible to fill out the cavities between the ingredients with smaller particles.
The dense packing is partly achieved through use of super dispersal agents, partly by including particles, which in geometry and size fit the cavities between the cement grains and the other ingredients that are part of the mixture. They, however, also must live up to other demands such as being related to mechanic and static performance.

DESIGN TOWARDS THE LARGE SCALE

The most optimal method is to design materials related to the construction contexts of which they will be part, specifically in relation to the sizes of the constructions, as well as the loads they absorb and safely bring to the ground. Here, I initially consider design of materials related to constructions affected by pressure, pull, and bending.
The larger a construction, the heavier it will be. The thinner it is, or the less thickness it has, the smaller the sectional area that will bear the weight of the construction.
This was something philosopher, physicist, and astronomer Galileo Galilei called attention to already in 1638 in the treatise Two New Sciences (Galilei, 1954) where he exemplifies the conundrum by enlarging, scaling up, a human bone. By scaling up human bones to those of a giant, the giant, if the material stays the same, collapses under its own weight. All the giant can do to avoid collapsing, Galileo Galilei writes, is to replace the material used for human bones with stronger materials for the giant.

Clearly then if one wishes to maintain in a great giant the same proportions of limb as that found in an ordinary man he must either find a harder and stronger material for making the bones, or he must admit a diminution of strength comparison with men of medium stature: For if his height be increased inordinately he will fall and be crushed under his own weight. (Galileo Galilei, 1638).

If a construction is scaled up, its weight, the net weight, will grow proportionally to the volume with a factor of three, n^3, while the load capacity of the construction only grows proportionally with the sectional area of the construction with a factor of two, n^2. This means that to a certain upscaling, the construction immediately will collapse under its own weight.
Specific ceramic glazed concrete is designed for constructions with low thickness. Here the object is enlarged, but the thickness is not. This means that the larger the element gets, the more the net weight will increase by a factor of n^2, while the sectional area only grows by a factor of n. So the problem remains the same. At some point, enlarging the surface area in specific ceramic glazed concrete will mean that it collapses under its own weight. As such, as a baseline, we select high-strength binders, as well as have the additional mixed-in ingredients be of high strength also.
When designing materials, my starting point has been Densit technology. (Bache 1978) This among other things deals with packing materials densely by choosing component materials that correlate in relation to size, geometry, and mechanical conditions, in order to acquire high strengths in the concrete binders. Densit binders based on this can be packed markedly more densely than conventional concrete and therefore achieve higher strengths. (Bache, 1978) The particles that are part of this are chosen, furthermore, from whether they are very stiff, because they in the Densit binders become important to the final qualities of the concrete, which is not the case with conventional concrete. High strength concretes are often characterized by, unlike the conventional concrete, not being locked in the open, porous structure. Here, surface forces are minimized or eliminated with dispersal agents and super dispersal agents. This is a kind of soap that lays down on the surface of the component ingredients so they repel each other. Think of two magnetic north poles sought to be brought together. They will repel each other. The same thing happens with the particles through the super dispersal agents on the surface. In this way, freedom to package materials and acquire high strengths is obtained.
Concrete binders packed with Densit technology might have markedly higher packing densities than conventional concrete binders (Bache, 1986, Bache 2002). This high packing density is advantageous in regards to strengths and elasticity modules. But as we shall see later, this is also a condition for designing materials against ductility.
In conventional concrete, compression strength is indicated in water-cement relationship v/c. (The weight of water required in a mixture compared to the weight of the cement) This is not the case with materials based in Densit technology. Here the compression strength is directly proportional to the strengths of the component parts. (Bache, 1986) It

Opposite page, detail from exhibition "Ornamental Play, The Meeting as Ceramic Sketch, Ceramic Spaces " at Gallery Oxholm, 2013. Specific ceramic glazed concrete and painted wood. The exhibition contribution is like a sketching phase, away from the function of the factual façade towards the installation ceramic's play in space with an exploration of the aesthetic, spatial, textual, and colour scheme. It is like an examination of the ornamental structures and textile play with the diffusion of light. Photo: Ole Akhøj.

Detail from "Ornamental Play, The Meeting as Ceramic Sketch, Ceramic Spaces " at Gallery Oxholm, 2013. Specific ceramic glazed concrete and painted wood. Photo: Ole Akhøj.

is important to maintain the high compression strength even after firing.
Since the purpose of HT products and refractory materials in general is insulation and thermal protection of industrial facilities, the mechanical qualities necessary to know for this project's design phase targeted at building elements often are not available. Manufacturers mainly supply information of durability, insulating qualities, and sometime pre-firing compression strengths. While information on post-firing compression strengths are not provided. Bazant (Bazant, 1996) in the book High Temperature Concretes points out that the strength of refractory concretes when they are hydrated and subsequently transformed into ceramic, often is equal or higher when the firings have been of 800 C° or above. (Bazant, 1986)
In the concrete binders I use, the cavities between the aluminate cement are partly packed with the one hundred times smaller round micro silica particle and thus has achieved dense packing. If this binder is combined with strong corundum aggregate before firing you can achieve concrete with strengths three to five times greater than conventional concrete. It is possible to pack the binder even more densely and include more micro silica and other strong ingredients with the proper temperature constancy, geometry, and scale. This is what I work with to achieve strong materials to develop specific ceramic glazed concrete elements.

DESIGN AND FRACTURE MECHANICS

The way in which constructions, and as such a construction material, fracture is important to building. Human lives are at stake. Load-bearing constructions, for example, cannot suddenly fracture or collapse. If that happened, the users would be unable to escape. It is necessary due to safety concerns that a load-bearing construction yields to overloading without fracturing. It must have so-called elastic deformation followed by a long plastic deformation before ultimately fracturing. Then we have time to detect the problem and either relieve the pressure on the construction or replace the construction.
For constructions, be they sculptures, façade elements, or anything else, materials are designed with the large scale and ductile tensile behaviour in mind.
Many think that the way a material fractures is a material property, quality. A glass of water fractures when we drop it on a stone floor so the material of glass is brittle. Elastics do not fracture if we pull them so the material is ductile. Fracturing conditions, however, is not a fixed material quality. The larger and stronger the construction, the larger the risk of it fracturing in, in the case of building, unacceptable ways: the brittle fractures.

Two extremities can describe the way a construction fractures. The brittle fracture is what is characterized by only elastic deformation and no plastic deformation. It fractures, then, without us observing any prior deformations. While the ductile fracture is defined by plastic buoyancy before the fracture. Normally, fractures will have both an elastic and a plastic sequence. Load-bearing constructions, then, must always have plastic deformations before fracturing; that is, be characterized by ductile fracturing.
Mode of fracturing depends on material qualities such as the elasticity module, E (N/m2), fracture energy, G, (N/m), and strength, στ, (N/m2) , but also on a form parameter; size of the constructions, L. This is expressed in the brittleness module B, which is a model law that can be used as a general guideline for fracture mechanic design of materials. (Bache 1986) [15]

$B = \sigma_t^2 L \;/\; EG$

where
B = brittleness module
σ_t = pull strength, (N/mm^2)
L = size, (m)
E = elasticity module (N/mm^2)
G = fracture energy (N/m)

The model law is an expression of the relationship between elastic energy and plastic energy:
B = elastic energy/plastic energy. The smaller B is, the more ductile the fracture, which is exactly what we want from a load-bearing construction.
From the brittleness module, we see that the stronger a material is, the larger the risk of a brittle fracture and the same in regards to the larger the constructions are.
That this is the case can be seen in for example steel. Steel wires, used in for example suspension bridges can be used with strengths up to 2000 MPa when the dimensions of the wires are relatively small, while the allowable strength for load-bearing steel constructions of much larger dimensions is about a quarter of the strength, around 550 MPa.
Glass is often brittle in large dimensions, but seems tactile in smaller dimensions, such as glass fibres.
But if we return to the brittleness module B, we also see that the larger the elasticity module, E, and fracture energy, G, the smaller the risk of a brittle fracture.
This is where design of materials again enters the picture. We saw before that it was possible to designate material strength by choosing strong component parts and dense packing. Similarly, we can choose ingredients with high E-modules. Furthermore, it is possible to increase the fracture energy G considerably. High fracture energies G can be

achieved with fracture mechanical design of material like it has been done in the fracture mechanical design concept Compact Reinforced Composite. (Bache 1986) The abovementioned brittleness module is part of several design guides in CRC-technology, which Hans Henrik Bache invented in 1986 when he was senior researcher at the cement and concrete laboratory at CBL, Aalborg Portland A/S, Denmark. (Bache 1986) Through CRC, Bache acquired ultra strong and fracture ductile large concrete constructions, despite the starting point being the extremely strong, but in this scale very brittle Densit binder. Thus, the Densit binders cracked during their own hardening as we see it in clay products drying out. (Bache 1986) CRC is a fracture mechanic design concept not just for design of concretes, but also for plastic material, metals, and should be also for ceramic materials. The details of the CRC concept will not be explored here, instead I refer to the bibliography under Bache, Hans Henrik, for further reading on the subject.[6,16]

DESIGN FIBRES AND PRINCIPAL REINFORCEMENT

Concrete is generally characterized as being able to only absorb pressure loads. The reason that despite this, it is possible to use concrete constructions for beams and plates exposed to bending and thus both pressure, pull, and displacement impacts, is that other materials in the concrete absorb the pull and displacement impacts that occur here. This is often a combination of fibres and principal reinforcements done in materials able to absorb tensile and shear loads. Fibres make the local pull strength of the small and the principal reinforcement absorb the global pull strength for the entire construction. In conventional concrete it is not possible to mix in high volume percentages of fibres and principal reinforcement. Furthermore, the concrete binders in conventional concrete are not packed so densely that embedding fibres would have much effect.

By contrast, in newer high-strength concrete characterized by and built from, for example, Densit and CRC or similar technologies, such as Reactive Powder Concrete, high volume percentages of fibres and principal reinforcements can be embedded. Here, the binders and concrete are packed so densely they have great impact on the fracture energy and thus the ductile performance of the constructions. These concretes are characterized by having mechanic behaviour that is very similar to steel, only with half the weight. They are also able to yield considerably and can handle bending and fatigue with no visible crack formation. (Bache 1992) Here, however, it is important to stress and emphasize once more that the concretes designed with the CRC technology and similar technologies, not only centre on stuffing more fibres and principal reinforcements into the concretes. The technologies consist of designing materials from the micrometre-sized particles, including to macro meter, relating to the scale of the constructions.

The misunderstanding I often encounter in concrete peoples, materials researchers, and others who work with concrete and materials in general, probably arise because the technology often is simplified to be communicated more effectively. As such, there are fragments of the technology that go unrepresented in the articles. This is so the reader can comprehend it all. I use a similar form of communication here. I hope, however, that with the emphasis above, to have made it clear that what I describe herein is only the tip of the iceberg of this technology, which has emerged as a conglomerate of and synthesis between physics, chemistry, capillary theory, fracture mechanics, and several other physical and chemical theories. It is much more complex.

There are several ways for a fibre to add to the fracture energy when it is part of a material. For example, it can break or be pulled out of the matrix. The matrix, in this case, is the concrete. It has turned out that fibres add most fracture energy when they are pulled out. (Bache 1991, 2004) The fibres selected must therefore partly be strong, partly be able to withstand the high temperatures and firing curves they are exposed to when glazed. They must also have a strength and length/diameter ratio that make them able to be pulled without breaking, as well as contribute to a long fracture process. The latter means that the fibres must be visibly moved in the localized area before being pulled to its final point. As such, the highest possible fracture energy is achieved. Simultaneously, it is important that the concrete binder is densely packed. In this way, it is better able to maintain the fibre and counter its pull. In this manner, even higher fracture energy is achieved. (Bache 1991, 2004)

If the concrete matrix is porous and has the open structure known from conventional concrete bonding it with fibres will be a relatively bad idea. Then, not much power is needed to pull out the fibres and the fracture energy achieved in this manner, as such, will be relatively small. That is why fibres in conventional concrete do not have much effect, yes, even to such an extent that it destroys the composition and inner structure of the concrete.

When fibres are used in concrete at normal temperature intervals they are often made from steel. Steel fibres have the advantage that they are stiff with large E-modules and are available in the desired dimensions. As such, they have, combined with their strength and stiffness, a length/diameter ratio that make them able to be pulled without fracturing, as well as having a fracture process so long that it contributes a certain amount of fracture energy.

The strength of many types of steel, however, plummets drastically at around 900 C°. Furthermore, the coefficient of thermal expansion in many types of steel is somewhat higher than in concrete matrixes at higher temperatures. This means that during heating, the steel expands more than the concrete matrix and consequently initiates cracks in the matrix. It might also, if the fibres are not equally distributed in the specific ceramic glazed concrete object entail that it writhes during firing and thus produces an undesired deformation and change to the expression.

Opposite page: Detail from "Ornamental Play, The Meeting as Ceramic Sketch, Ceramic Spaces " at Gallery Oxholm, 2013. Specific ceramic glazed concrete and painted wood. Photo: Ole Akhøj.

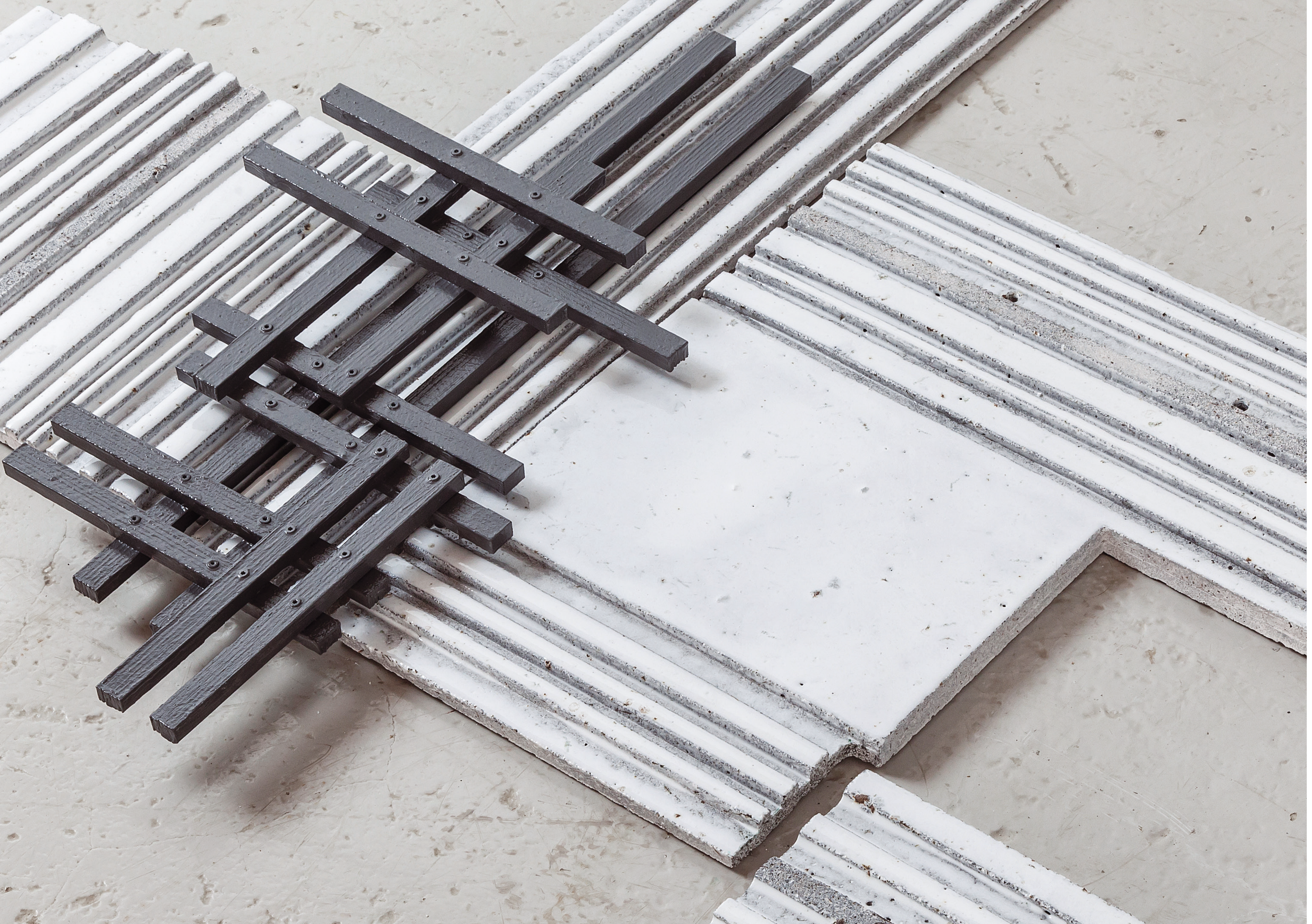
I have tried many different kinds of metal fibres and in most cases been able to observe problems of heating during firing. Besides differentiated degrees of heat expansion, the problem is that the fibres and for that matter the reinforcement bars I have tested lose their ductility as well as their strength. The characteristics of the metals are easily dependent on partly the heating temperature, but particularly the cooling curves, that is to say how quickly and how the metals are cooled down.

In many of the fibre types I have tested, a porous layer appeared around them during firing. This layer could be crumbled away after cooling. This layer would work against the good bonding of the concrete to the fibres and reinforcement so these would have no effect on the fracture energy. The porous layer partly is generated through incineration when carbon within steel is fired, but can also happen when the metal undergoes a change in structure during cooling and thus is locally destroyed. However, special steel fibres are manufactured that maintain strength and partial ductility after having been exposed to such high temperatures, as well as the cooling curves specific ceramic glazed concrete goes through. What I have discovered, seemingly, does not form these kinds of destructive porous layers during cooling. These are specific high temperature fibres developed especially for these temperature intervals, which are moulded fibres.

Pulling a long steel wire and cutting it according to need and desire of the fibre lengths is the way most fibres within the metals used for concrete constructions in building at the normal temperature area are acquired. But by moulding the fibres, you achieve a much better control of its qualities adapted for the high temperatures and cooling curves that it must be able to resist.

An alternative to steel fibres is fibres produced from heat resistant glass products, aluminate oxide and silica with various kinds of metal oxides. They are able to withstand high temperatures. They are, however, mostly produced with very small dimensions within the micrometre-scope. In principle, they alone will not be able to add the desired fracture energy, as the fracture process is relatively short. But it might be advantageous to embed these kinds of fibres when designing in the micrometre scale, the smallest scale for local fracture behaviour, if it is combined also with larger fibres. If these fibres are enlarged so they are adjusted to the desired dimensions and also in order to acquire a longer pull process for the fibre, they will, however, as mentioned earlier make the ductile performance transform into brittle fracture performance. Then the fibre will not deliver the desired fracture energy.

My experiences with these tiny fibres are that they are very difficult to mix into concrete during the mixing process. They come in form of cotton-like wads. During the mixing pro-



cess, they amass in small clusters and therefore are unequally distributed. As such, the effect of the fibres is destruction of the concrete matrix. Furthermore, and for the same reason, it is difficult to achieve large volume percentages of fibre addition.
Therefore, I have for now chosen not to include these kinds of fibres in specific ceramic glazed concrete. However, they might be used when specific ceramic glazed concrete is manufactured with powder technology and powder pressings. Then it will be easier to distribute the fibres equally and arrange them correctly.
Conventional glass fibres, which are quite a bit cheaper and are available in the desired scale and strength as well as in rope and textile form, are not suitable. They melt at 900 C° or even lower temperatures and polymer and plastic fibres in general are also unusable in this context for that reason.
Fibres provide as mentioned local fracture energy and furthermore prevent cracks from forming in the construction. In larger constructions that must absorb both pull and bending, it is advantageous to also include the global reinforcement, principal armament. Thusly it is ensured that the construction, once the fibres have been pulled and the crack has moved beyond the fibres, is still unbroken. The principal armament is an reinforcement that runs through the entirety of the construction. This might be in the shape of reinforcement bars or textiles. Principal armament ensures the global fracture energy and prevents cracks from spreading and ultimately fracturing the entire construction. Principal armament might, as fibres, be chosen from different temperature-constant materials. The ceramic textiles are in this context interesting. They are able to withstand temperatures up to 1200 C° and sometimes even more and are relatively strong in regards to pull. They are flexible and can be bend at will without much effort and work in two directions. The company 3M has developed textiles that should be usable. They, however, have been developed for the NASA space shuttle and are so expensive that not even testing them for this context has been possible within my development project.
With armament bars and textiles made from metals and steel, similar problems arise as those I have mentioned in regards to steel fibres. At the present time, it has not been possible to locate any steel or metal armament that live up to the demands of this project within its economic scope. Therefore, when designing objects where principal armament is desired, I have planned it so that the armament is not embedded until after specific ceramic glazed concrete has gone through various firings.
Either that or I design the specific ceramic glazed concrete objects so that a crack will find it difficult to spread across the entire panel due to, for example, the pattern I choose to emboss in the panels. I will return to this issue in the chapter "Art-façades". My search for principal armament fit for the conditions of specific ceramic glazed concrete is not over yet - I am still looking. This is the reality that many researchers encounter. They have a theory and a dream, which cannot be fully verified and tested until years later.
This was the case with materials researcher Hans Henrik Bache who already in the early 1970s had developed the Densit theory. Not until about eight years later did he, at a conference within a completely different discipline, encounter the exact ingredient he had been waiting for that could prove his theory. Similarly, I hope to stumble on a principal armament that might live up to my demands and the firing curves they are exposed to in specific ceramic glazed concrete that is also financially viable.

Opposite page detail from "Ornamental Play, The Meeting as Ceramic Sketch, Ceramic Spaces " at Gallery Oxholm, 2013. Specific ceramic glazed concrete and painted wood. Photo Ole Akhøj.

HIGH-TEMPERATURE CEMENT - BUILDING

Concrete people with knowledge of aluminate-based concrete and its history in building will be wary of reintroducing it to building. Aluminate-based concrete hardens quickly and achieves about 80% of its strength already a day after being cast. This is why aluminate-based concretes became such popular building materials during the housing shortage of the 1960s forwards. It was possible to build housing much more rapidly than before with concrete based on aluminate cement rather than concrete based on Portland cement. Years later, however, it turned out that some of them collapsed while others were close to doing so. Aluminate-based concrete can, if exposed to temperatures above 30 degrees Celsius as well as high humidity, change its basic structure of the aluminate oxide's hydraulic, chemical binding to calcium. It might transform from being hexagonally unstable to having a cubically more stabile structure. The cubic composition takes up less space than the hexagonal one and therefore with the change in structure causes a severe decline of the strength of the concrete. This is called conversion of the material. Aluminate cement was therefore banned from building in several countries during the 1970s or had its scope of use limited to only being allowed in non-load-bearing constructions in building. In France, however, it remains permitted.
When I choose to bring back aluminate-based concrete to building despite this, it is because it is in a fundamentally different form. It now exists as ceramic; specific ceramic glazed concrete. As previously mentioned in this chapter, it is concrete that is markedly different from conventional concretes, including the conventional aluminate-based concrete that was banned back then. Their water/cement ratio is much smaller, 0.18-0.20, compared to the 0.40-0.50 of back then. They are much more densely packed, in some cases so much so that water finds it difficult to penetrate from outside. [17] They are either entirely or locally glazed, which also to some degree prevents external water penetration. Furthermore, they contain aluminate cement with the amount of aluminate oxide about four times larger than the amount of calcium, so that the amount of calcium

to be converted is minimized. Furthermore, I do not use the concrete until it has been fired. I fire at relatively high temperatures to make sure that the original hydraulic binding, which was what was banned and what gave the concrete its strength, is transformed into ceramic bindings during vitrification. Then, it is the ceramic binding and not the hydraulic binding that holds them together and gives it its strength. Finally, I developed and designed specific ceramic glazed concrete to be used in building, but also, for example, in mounted or self-supporting constructions, such as façades. The bearing of the building, then, is independent of it. If specific ceramic glazed concrete must be used as the primary load-bearing construction it can, as today, be used as permanent shuttering as I talk more about in the chapter "Art-façades" where it is rear-cast with conventional or high-strength concrete. Then, it will not be the specific ceramic glazed concrete that bears the construction, but the rear-cast. To the reader who plans to use specific ceramic glazed concrete as a primary load-bearing construction in building there are, however, a series of standardized tests that must be completed to verify my presumptions above before it can be considered safe to do so.

DEVELOPING GLAZES

When you first begin developing glazes, you quickly become aware that it is a field with an infinite amount of possibilities. Many use their entire lives developing new glazes, without ever being able to say that they now know everything there is to know. Of course, that is what makes this field so exciting; that you will never finish. (Hansen, 2001)

Ceramic glazed surfaces can be strong, resistant to weather, highly durable, and beautiful expressions rich in colour and texture. Most people know them from bathroom environments, swimming facilities, but also from building surfaces where they cover large areas in the forms of mosaics, tiles, or in some cases larger elements. They adorn these surfaces as they simultaneously protect them. They are easy to clean and maintain. These are the qualities I want to transfer to concrete. With ceramic glazed concrete I do not want to replace concrete, but rather develop dialogue between concrete and glaze that tells of the presence and qualities of both and as such adds wholly new visual and aesthetic expressions. I have also wanted to achieve surfaces that through use and over time remain as they were initially and are easy to maintain.
Glaze is glass with added materials that ensure:

- High viscosity so the glaze does not run off the body when it melts
- Lower melting point and
- Synergy with the body (in this case, the fired concrete object)

Glaze is non-crystalline. [18] Its main ingredient is silica, which creates the glass phase. Aluminate oxide ensures high viscosity for the glaze so that it does not run off the body, while other basic oxides, such as Li_2O, Na_2O, and K_2O make sure the melting temperature is lowered. (Hald, 1958) Silica aluminate oxides and the bases are available, as with clay and cement, as earthen products. These might be in the form of mixtures of feldspar, kaolin, chalk, pipe clay, quartz, and nepheline syenite. The materials are bought separately as powders at the dealer, for example in bags of 100 grams, 2 kilo, 5 kilo, or in even larger quantities. Prefabricated glazes are also available. During the development of glazes, I have mostly mixed the glazes myself, as the manufacturers mostly do not provide information of the ingredients in ready-mixed and sold products. Furthermore, they are rarely suited for the selected concretes and must therefore be readjusted. By knowing the recipes, it is possible to adjust and tailor them. However, it must be mentioned that during a few of the stages of the project I chose a purchased glaze because those stages were not aimed at examining glazes, but other issues.
Manufacturing glaze requires patience. First, materials are weighed in the form of dry powders, then they are selected and mixed from different recipes. I have mostly worked from Emannuel Cooper's glaze recipes (Cooper 2004), but there are many books on this area also. (Linnet, 1996) (Muffit, 2002), (Hamer 2004).
Different kinds of dry powders are mixed and then carefully strewn into water, carefully and at a pace to make them not clump together. (As you do with plaster) The mixture is mixed and then strained with a relatively finely meshed sieve with a mesh of 60-200 (the larger the number the closer the wires are) to make sure the glaze blend is homogenous and not clumpy.
Now the glaze is ready for the raw object or the fired one, the body. This is the biscuit firing. It is advantageous, both in regard to energy and finances, that the glazed concrete surface can be achieved already at the biscuit firing. This was achieved with a few glazes, but most of the glazes required the concrete to be fired once more. This is because the porosity of the selected concretes is very low pre-firing. After firing, it becomes sufficiently large for the glaze to bond. Here, one of the many contradictions of developing materials emerges.
I choose to fire the concrete object once more to make the glaze bond well while the object is glaze fired, but at the same time I make it more porous as its strength declines. The next focus of the project will be to develop even more glazes that function already at the biscuit firing. However, it must be mentioned that the selected concretes require a very slow heating during firing to make sure they do not fracture. [19] This is not always an

Detail from "Ornamental Play, The Meeting as Ceramic Sketch, Ceramic Spaces " at Gallery Oxholm, 2013. Specific ceramic glazed concrete and painted wood. Photo Ole Akhøj.

advantage to the glazes.
Glazes can be transparent, translucent, opaque, or wholly covering. If they are wholly covering, the body could in principle be made out of clay or any other material. It won't be visible through the glaze anyway. If, on the other hand, the glazes are transparent, translucent, or opaque they might enter into a visual dialogue with the body, its aggregate, and any visible fibres that might be present. It can create expression and narrative of the colour and texture of the glaze, but also about the material the glaze is working with. It is no secret that I find the latter possibility the most interesting because this would lead to the possibility of developing new visual expressions and a specific distinctiveness for the synergy between glaze and concrete. But I have tested both the covering, transparent, translucent, and opaque glazed.
There are many ways of colouring and decorating ceramic objects. These might be

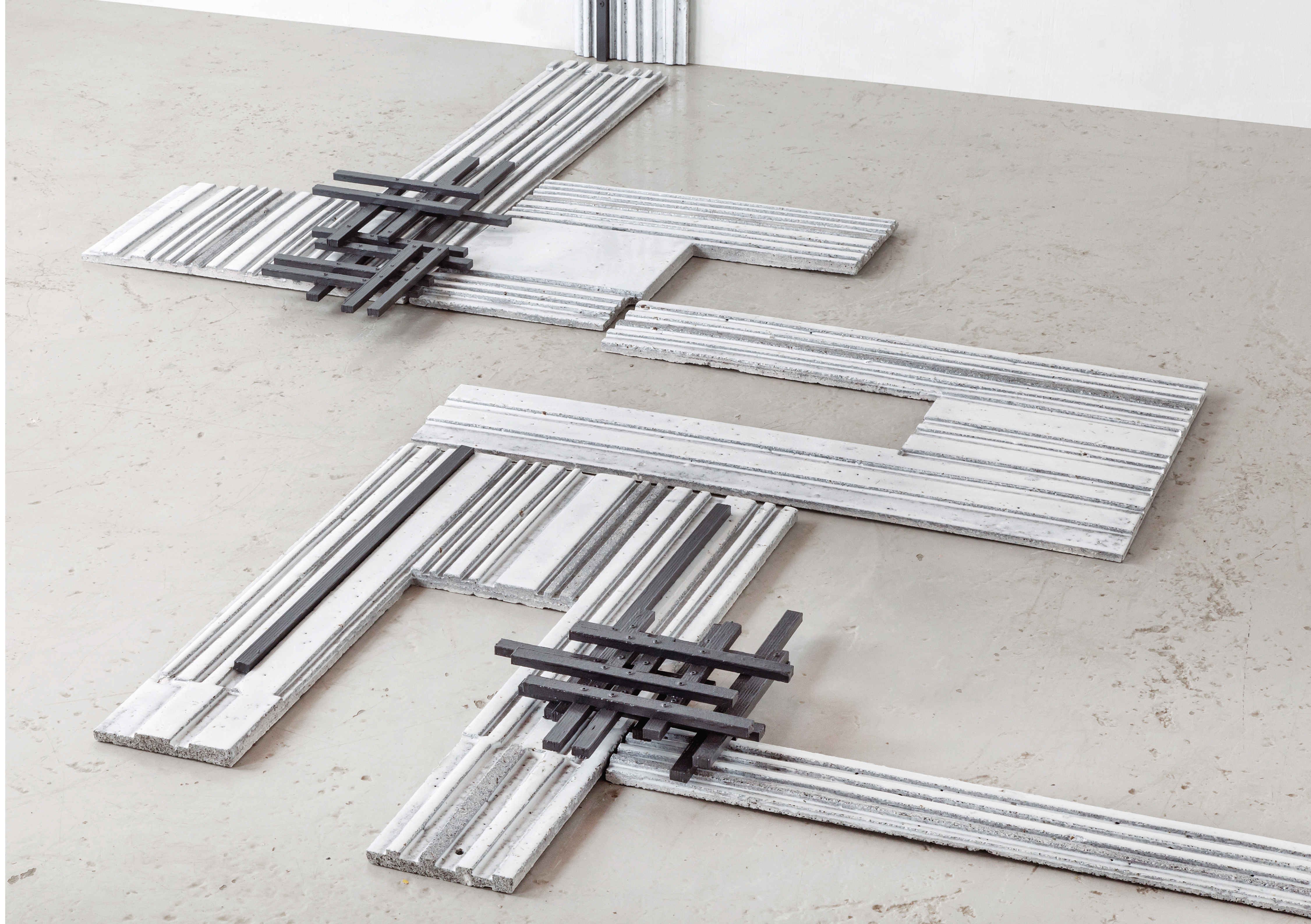
- Metal fritters that are metal oxides, fired and pulverized.
- Under-glaze colours that are applied to the raw or fired object before clear glaze is poured on it
- Over-glaze colours where the glaze is applied first, body with glaze is fired, and colours then are painted followed by another firing of the unit.
- Coloured glazes that are acquired by mixing in metal oxides or metal fritters.
- Gilding and
- Coloured substances, engobed clay, and clay colours.

Of these, over-glaze colours and gilding have not been used, while all others have been tested.
Over-glaze colours are not expedient, partly because they require no more than three firings, partly because the colours they use are toxic and come in direct contact with its surroundings, risking pollution of these.
Under-glaze colours have been tested as engobes, which before they are fired are dipped into clear glazes.
Gilding has not been financially viable for these constructions. They are too expensive and therefore have not been tested.
The glaze can be applied to the body by dipping the body, pouring the glaze on it, or via spray glazing. Glaze can also be painted on with a brush. I have used the application techniques of brushing, dipping, pouring, and spraying as they all are suitable for these constructions. Often the glaze does not behave as wanted: they do not work with the body, the glaze is filled with holes, it peels off, has not acquired the desired colour, is mat where it was supposed to be glossy, and so on. Then it is necessary to alter the glaze. Other minerals must be added, the ratio of minerals contained might be changed, or others can replace some of the existing ones. This requires several glaze tests. This is a completely normal process to the ceramist trying to determine the composition of the clay products, glazes, and firing forms. It demands methodology, order, and repeated registration of tests and results so it is possible to revise or recreate the tests subsequently. This is when the ceramist proves to be a patient soul which I have also tried to be in this project. In this connection, I'd like to recommend the book Ceramic Faults and their Remedies (Fraser, Harry, 2005) as a guide to detecting glaze issues that also offers possible solutions to such.
A glaze firing can take place in an oxidizing kiln environment. That means where there is air, oxygen, but also in a reductive; where there is none. There will usually be differences in terms of colour and texture between the two types of firing. The firings can be done in electric kilns, gas kilns, or other types of kilns. The kind of kiln also has an effect of the expression of the glaze. In this project, I work with electric kilns because they are available at the Technological University of Denmark, but also because they are the easiest to control in terms of firing curve, maximal temperature, and soaking times. Some of the concrete elements for the installation exhibit at the Danish Museum of International Ceramic Art, however, were fired at Tommerup Ceramics Workshop in gas kilns. So this is possible also.
If the same result needs to be repeated several times, the firing must follow the same firing type and firing curve. Firing curve indicates the speed with which the temperature rises and falls, as well as maximum temperature and soaking times, meaning stages, where the temperature remains the same. It is normal to keep the soaking time at maximum temperature for 10-30 minutes.
But this is something that must be determined with tests for separate glazes in the same way as rates of temperature increases and drops also must be determined via testing.
The glazes I have developed are made with the wish that they are able to:

- Add a palette of colours and textures also in the large scale
- Work with concretes, including aggregates and fibres.
- Be durable both inside and outside
- Furthermore they cannot be unhealthy
- They must be easy to maintain and repair

Pretty much all the glazes are able to deliver pretty colours and textures, also on the large scale. It also turns out that some glazes can work with concretes, including the selected

Opposite page, Detail from "Ornamental Play, The Meeting as Ceramic Sketch, Ceramic Spaces " at Gallery Oxholm, 2013. Specific ceramic glazed concrete and painted wood. Photo: Ole Akhøj.



ones, while not all glazes are durable, resistant to scratches, or suitable for an outside environment where they can be exposed to acid, shocks, and frost.

There are many kinds of glaze. Some require low temperatures to melt, while other melt at high temperatures. Earthenware vitrifies at low temperatures, which is why the earthenware glazes similarly are fired at low temperatures, 900-1100 C°. Stoneware clay vitrifies at higher temperatures, which makes it necessary for stoneware glazes to be fired at higher temperatures, 1200-1400 C°. (Andersen, Møller, Sten, 1946) Earthenware glazes used to be the most used glazes in Denmark. The low firing temperature was achieved by adding lead and red oxide, which today are banned in many countries, including Denmark. Lead and red oxide are toxic and they are also released after the completion of the glaze firing where the object has been used. (Lyngaard, 1976) Other materials have since then replaced the toxic component in earthenware glazes, so today it is legal and possible to use them. But low-fired glazes, including earthenware glazes, are not resistant to scratches or outside climate. Furthermore, the mechanic bond they make with the body is relatively weak. The glaze melts into the upper cavity of the body, which by solidification functions as barbs. Either these are broken or else, as is often the case with earthenware, the porous and not very strongly vitrified clay mass breaks easily. (Matthes, 1990)

Stoneware glazes, on the other hand, have a strong bond to the body. Then the glaze melts at the high temperatures, the surface of the object is also vitrified and a strong middle layer, a fusion between the glaze and the parts of the body that are vitrified, emerges.

This is why stoneware glazes and high-fired glazes have been preferred in relation to specific ceramic glazed concrete. Besides the ones mentioned above there are glazes that are fired at even higher temperatures than stoneware glazes. These have not been included in this project because the ceramic concretes I work with are not stable at such high temperatures. Another reason is that I want to keep the temperatures as low as possible because of energy resources and sustainability considerations.

When I, despite this, have tested earthenware glazes, it is to find out whether they are able to work with the concretes. It is also to point to a host of possibilities with other scopes of products than the one I have directed specific ceramic glazed concrete towards.

Stoneware glazes can be divided into a long list of types, such as alkali glazes, ash glazes, crazed glazes, salt glazes, feldspar glazes, and crystal glazes. In general, I have selected a few of these because they create colours and textures I've wanted to test. This is also because I believe they can be relevant for further usage, and because I am curious as to whether they are able to function with the selected concretes. These are alkali glazes, ash glazes, and feldspar glazes. Furthermore, stoneware engobes and a few earthenware glazes have been tested. Out of these selected glazes, only the feldspar glazes are obvious to be used in industrial production. The others have, apart from the splendid colours and textures, a few disadvantages in relation to, for example, scratch resistance or uniformity in relation to production and durability. Stoneware glazes, due to the higher firing temperature, also produce more mat colours than earthenware glazes. Alkali glazes, however, are an exception. They provide very clear and pure colours although they are not very scratch resistant and have easily cracked surfaces. Therefore, they are mostly used for decorating, which also is the reason that they have been selected. Ash glazes are powerful and have colours and surface qualities that resemble tree bark. Their expression depends on the ash used. Ash glazes' expressions can be difficult to control in mass production where the exact same colour is wanted. The ash glaze expression can, even if it is from the same tree type, vary depending on where the tree has grown, its age, and which part of the tree is being used. It has been used here, however, because its colours and textures are different from the other glazes and because there might be context, building-wise, where its varied nature is appreciated. Feldspar glazes are, according to Finn Lynggard (Lynggaaard, 1976) an umbrella term for the kinds of glazes that are usually used in stoneware manufacturing. They are, he continues, very strong and dependable. By adding other basic metal oxide, you create the basis for an infinite amount of glazes with wildly differing colours, expressions, and characters. (Finn Lynggaaard, 1976) In appendix 2 I have listed glaze recipes for different alkali, ash and feldspar glazes.

Opposite page detail from "Ornamental Play, The Meeting as Ceramic Sketch, Ceramic Spaces " at Gallery Oxholm, 2013. Specific ceramic glazed concrete and painted wood. Photo: Ole Akhøj.

Stoneware engobes are not glazes, but do produce many different colour and surface characteristics. The possibility of using engobes makes up a large part of the area of investigation in relation to achieving different colours and textures. Engobes are a simple method of decoration that consists of coating a formed clay object with a thin layer of clay in a different colour. (Hald, 1956) Normally, engobes are used in leather-hard, clay objects that have not yet been fired, but it is very difficult to apply to fired objects. As such, Peder Hald (Hald 1956) suggests that this as a general rule is to be avoided.

Tests with engobes on the concretes I have designed, however, demonstrate that these are different conditions. In this case, it has still not been possible to make the engobes work together with the unfired objects, while rather nice results have emerged with pre-fired concrete objects. The engobes become relatively mat, and as such, if a glossy surface is desired, this requires that they be coated with a glossy glaze. Both engobe and glaze are applied before "Glaze firing" and as such do not require a third firing. I have tested decorating with engobes on unfired objects, fired objects, with and without glaze.

The ingredients in the concrete, including especially the fibres added independent of which fibres are used, affect the appearance of the glaze. Steel fibres, therefore, appear as graphic, black lines in the relatively white concrete body after firing and are also visible

in the glazes. If concrete is glazed, they will usually come through as black or darker markings. The steel fibres can also make the glazes end up with completely different colours and textures than if they were not there. The steel fibres can also affect the glazes so that they obtain a completely different colour and texture than they otherwise had had. Grinding the object down to half aggregate, however, can minimize the effect of the fibres on the glazes, as they will then be visible as small points in the object and only partially affect the glaze.
If the object is grinded, and a transparent or translucent glaze is selected, the variegated, lively lambency, as we know it from terrazzo, will enter into a dialogue with the glaze, and as such tell of the body that is bearing it.

GLAZES AND DURABILITY

Glazes are usually very durable and the weathering usually happens with little visual change. But not everything lasts forever. So despite designing with goals of large durability in mind, both in terms of body and glaze, regular use will occasion different changes and possibly also damage.
The glazed surfaces hopefully maintain their colour and texture to a large extent.
It should be possible to wash them, as we do, for example, the walls and floor of a bathroom. However, this requires closed and smooth glaze surfaces, whereas more coarse and rough glazes will not have similar potential for being cleaned. The glazed surfaces are expected to withstand frost, acid, and shocks. If large-scale, glazed concrete constructions are used and they fracture entirely or partly, it must be possible to alter or repair them. It might be difficult to repair glazed surfaces. In that case, they must be dismounted, and undergo a repair process and another firing.
Another solution is to set up a personal kind of ecosystem with super-targeted mind set.

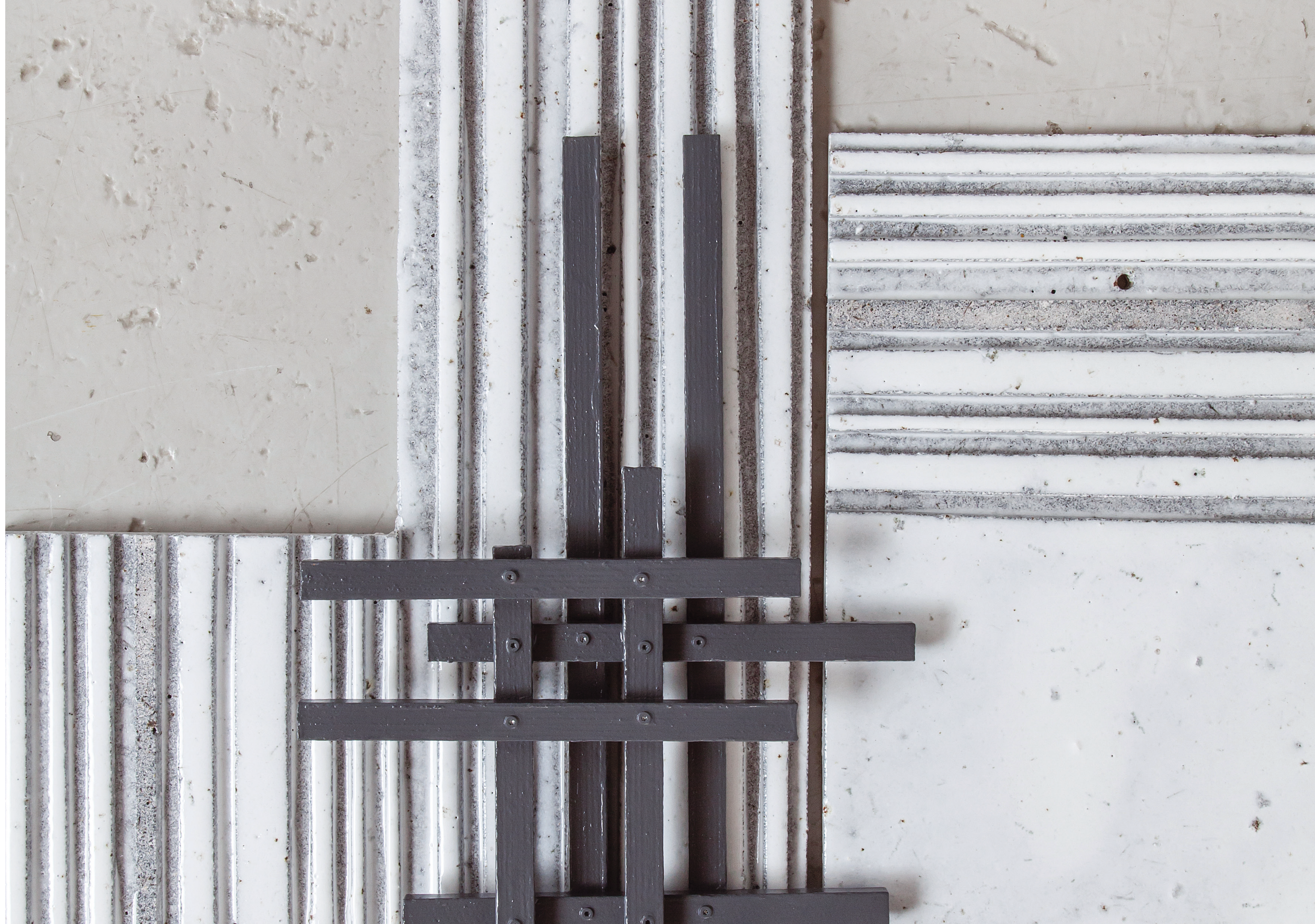
SELECTING INGREDIENTS

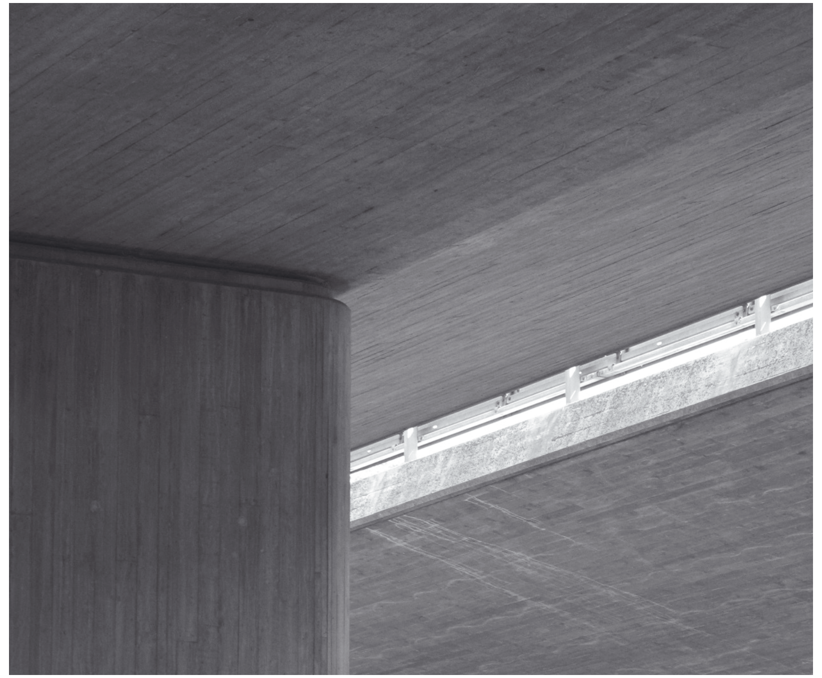
Based on the theory and experiences described above, a guide for designing specific ceramic glazed concrete might look as the following:
The concrete binder consists of, among other things, aluminate cement. It must have a high aluminate oxide percentage in relation to calcium to safeguard against conversion of the internal structure. I work with 70%-80% as a starting point. In the concrete binder, there is generally also contained micro silica as well as super dispersal agents that both ensure high packing density and good bonding for the fibres. Aluminate cement is characterized by being angular and about 100 times larger than micro silica that is likely to be round. The densely packed ingredients characterize the concrete binder with micro silica generally being packed into cavities between aluminate cement particles. It might be advantageous to pack other ingredients into the mixture that with scale and geometry make it more densely packed.
These ingredients must:

- Fit mutually in terms of size and scale
- Fit mutually in terms of geometry
- Be heat resistant or improve vitrification
- Be strong and have a high E-Module
- Fit mutually in terms of thermal expansion degrees
- Fit mutually in terms of structure and mecahnical properties at different firings

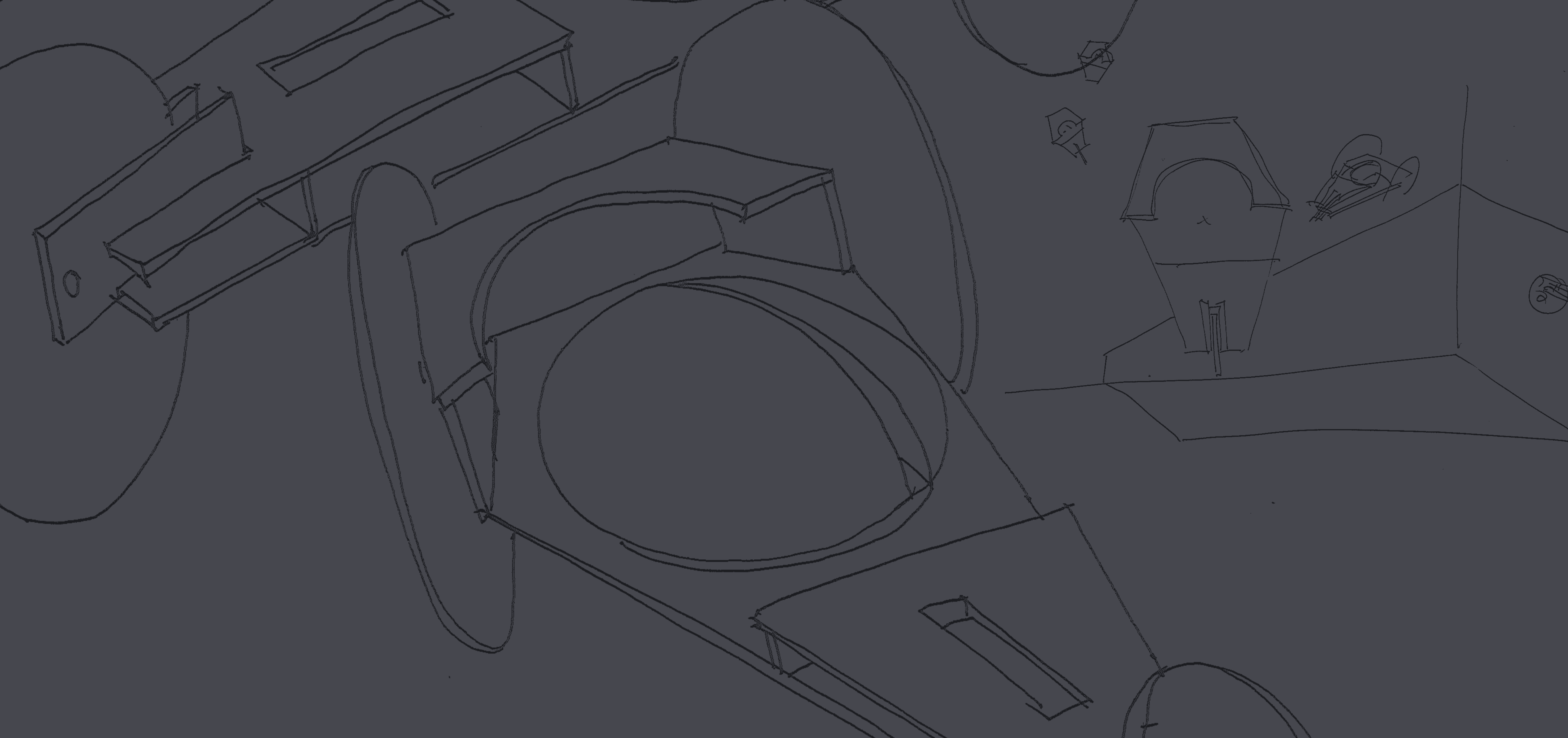
The fibres I use are made of steel. They are moulded and are refractory at relatively high temperatures. Their length/diameter ratios are about 40, which is adjusted to strength and ensures their being pulled entirely from the matrix rather than fracture. In regards to fibres, reinforcement bars, or textiles added to specific ceramic glazed concrete, they also must live up to points one through six.

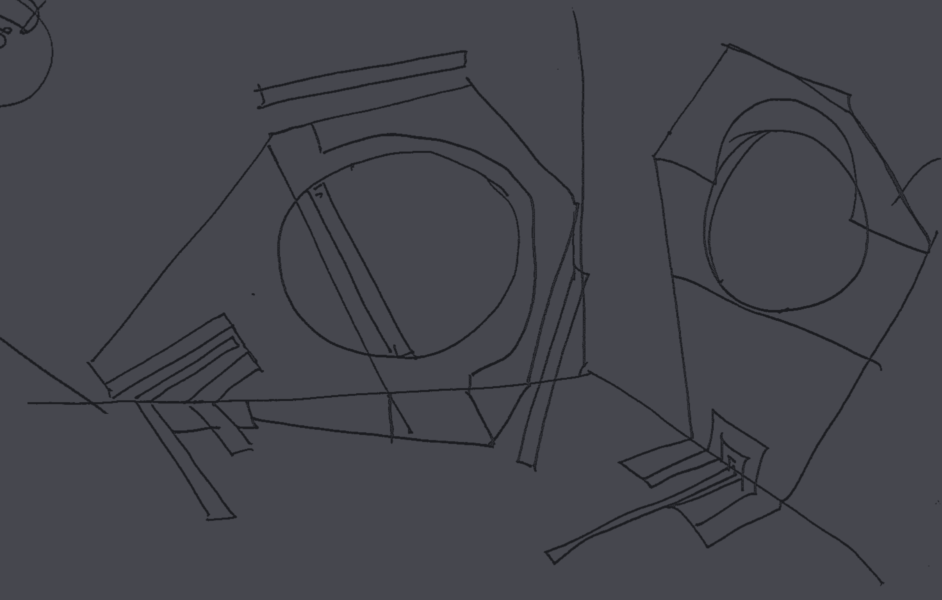
Opposite page detail from "Ornamental Play, The Meeting as Ceramic Sketch, Ceramic Spaces " at Gallery Oxholm, 2013. Specific ceramic glazed concrete and painted wood. Photo: Ole Akhøj.





RESEARCH WITH ART





RESEARCH WITH ART

Art does not emerge from the rules of conceptual thinking,
but from other sides and the way the spirit functions as conception and imagination.
They must not be seen as random or foolish,
but as the work of the spirit before it narrowly restrains
itself in scientific work.
(Ørskov, 1999)

RESEARCH WITH ART

Art-research is part of the design method Design in a Broad Perspective in the vertical string. It runs parallel to the research the materials researcher does in technical, scientific materials research's string, but the questions, the content, and the results of the two strings of research differ greatly. These are two strings I have practiced simultaneously in the design method Design in a Broad Perspective and in designing and developing specific ceramic glazed concrete. It is my hope, however, that it can be practised as if by a team made up of different disciplinary approaches.

Those that are part of this must cooperate and thereby benefit from their very different research approaches to research, manufacture, and design of materials.

Art-research, as it is represented here, still has tensions and flaws in its structural make-up. These are tensions that seem to accompany art-research in general, as the relatively young discipline it is.

In this chapter, I discuss art-research to then point out the way it takes part in the design method Design in a Broad Perspective. Here as well as in the following chapter, I will also discuss the problems that accompany it.

Art-research in the design method Design in a Broad Perspective is a way for me to extract knowledge from the creation of art and art as an event, with art here refering to both installation art, including crafts, design, and architecture. It is knowledge that is related to the expressions of materials as distinct and aesthetic effects. It is questions relating to this that art-research seeks to ask by being the operational tool material designers can use when designing materials. The work of art-research, then, is to gather knowledge and transform it into an operational, dynamic tool; a platform consisting of specifically developed questions similar to the "descriptive markers," generators, (Böhme, 2012, p. 3) but also an emphasis of the materials' distinct expressions.

Art research and artistic research are not identical. The two terms are different.

Art research examines the existence of art and its purpose is to prove and examine the possibilities of art and critique its conditions. It explains art, making it easily digestible for us. (Kirkkopelto, 2008) This is not the purpose of art-research in the design method Design in a Broad Perspective. Artistic research is based on the idea that the existence of art is a given and presumes that nature, the world, reality, and society, in this case the materials, can be studied by relying on art and its creation. (Kirkkopelto, 2008) It is the latter definition of art-research that is relevant to the design method, Design in a Broad Perspective. It is this approach to art-research I use. Art-research establishes an "analytical incision" across art with a specific aim, an area of research that aims to gather knowledge about materials' expression and aesthetic effect. Art and artistic research are related in the design method Design in a Broad Perspective, but are in principle separate in terms of methodology, content, and results.

According to associate professor Per Galle (Galle, 2003), art-research can be divided into three categories: rejection strategy, limitation strategy, and expansion theory.

The rejection strategy simply entails rejecting any attempt at scientification, for example by referring to how this threatens the artistic core of the disciplines, as I mentioned just before.

The limitation strategy entails isolating the scientification by limiting the research of the disciplines to a few auxiliary disciplines that have already established themselves as sciences, but do not deal with the very creation of art; the actual act of designing. These auxiliary disciplines might be energy and environment technology, materials theory, construction theory, and ergonomics, which have obvious practical-instrumental value to design disciplines such as architecture, furniture art, and industrial design. Other auxiliary disciplines such as art history, cultural studies, and cultural sociology have a much more indirect usage by offering the designer a general background to understanding the artefacts she or he designs.

The expansion strategy entails expanding the definition of science so that it absorbs art while keeping it intact. Since science is done through research, one simply defines science broadly enough for it to include practising art; for example in a so-called "artistic development work." (Galle, 2003, p. 83)

The artistic research I include in the design method Design in a Broad Perspective follows the strategy Galle calls the limitation strategy. It utilizes several auxiliary disciplines. Galle mentions materials theory. Materials theory is part of the design method Design in a Broad Perspective, but it is not part of art-research. Materials theory is part of materials research. Philosophy, however, is the auxiliary discipline I let art-research lean against. With philosophical aesthetics as the auxiliary discipline, art-research questions art. Art creation similarly is part of the design method, but making it independent of art-research has been a goal. It is independent as it develops from the artist's own principles, artistic intensions, and preferences. Art-research has no influence on art, which merely is the object being observed. It does require, however, that art as a means, not an end, aims to have an aesthetic effect. Art-research pulls knowledge from the art from "Cases," as they

Previous pages: Details of concrete bridge at Mølleøen, photos Anja. Opposite page: Section of the exhibition Ceramic on Tour, Gallery 21, Malmö, installation ceramic, specific ceramic glazed concrete, diameter 60 cm, red glazed casting loam, height 5 cm, and wooden cart made from painted MDF wood, 130 cm, 2013. Photo: Ole Akhøj.

are called in the design method. In reality, art-research explores the art through different points of its creation, as well as of art as an event. The object of study for art-research is art, in this case meant as installation art, crafts, design, and architecture. Art's knowledge is explicitly communicable, but also accompanied by tacit knowledge. The focus of art-research is to pinpoint the distinctive expression and aesthetic function of materials. This might be problematic, as science must live up to several normative rules to be acknowledged as scientific. One of these is that it must be objective. If the research is objective it is traditionally considered to be scientific. (Chalmers, 1995, p. 27) Objective knowledge must be acquired through strict methods deduced from data gathered via observations and experiments. (Chalmers, 1995) But as Chalmers also points out, even the strictest methods are not always sufficient as the observation is dependent on the observer:

There is much evidence that the experience of an observer when he sees an object merely is decided by the information that in the shape of light rays penetrates the eye of the observer or the images created on the observer's retina. Two observers seeing normally, observing the same object from the same place under the same physical conditions do not necessarily experience the same sight even though the images on their retinas easily could be identical. (Chalmers, 1995, p. 55)

The commonly accepted notion within established academia, however, is that if the science is objective its results are independent of who is doing the observing the subject. And as such, it is considered to be of universal validity and repeatable. The distinctive expression of materials to some extent can be singled out through comparative studies, as we will see in the next chapter. It is when basing it on this as such being only partially possible to point out whether a material contains distinct expressions as one of its material qualities. On the other hand, it is not possible to provide objective answers to the aesthetic effect of materials. It is not possible because in this case we are not looking at a material quality. As we see in the chapter on aesthetics, the aesthetic relates to an aesthetically regulated "atmosphere". An aesthetic atmosphere is created from a collaboration between objects, time, place, context, observer, and the event wherein the art event is unfolding. Materials' aesthetic manufacturing, as such, is only one aspect of this process. The art-researcher with art-research questions the aesthetic effect of materials, receives answers that are tied to one person; the person being asked. Therefore, they are

Section of the exhibition Ceramic on Tour, Gallery 21, Malmö, installation ceramic, detail from floor and wall elements made from respectively red glazed casting loam, diameter 30 cm, and painted MDF wood, length 40-60 cm, as well as round felt mats, 2013. Photo: Ole Akhøj.

generally not objective and might vary from person to person. This might, if the research is to be scientific, then not be what art-research intends its result to be.
The art-researcher instead might try to complete a user-survey in the pursuit of objectivity. The more people that are asked, the more universal, and thus objective, the answer will become. This is an approach that especially social sciences utilize.
In social sciences, it might be relevant because in its very statement of purpose it is focused on specifically selected segments of the population. Then, this group will be questioned and this might also be the segment to which possible instructions, advice, or solutions are directed. In art-research, this can also be pertinent if the materials are being developed for a particular segment of the population. This, however, as I see it is not a particularly feasible road to go down in the case of the art-research we are dealing with here. This is because the response obtained by the art-researcher, even when based on numerous answers, often will be characterized by evaluations based on taste, which are irrelevant in research that seeks to be objective.
In Kant's perspective on the aesthetic, an evaluation based on taste, aesthetic conviction, can be made objective because in his eyes it is a faculty of cognition located between the sense of the subject and imagination. The objective emerges because this faculty of cognition according to Kant is relevant to everybody because it is universal. (Kant, 1790)
If we went with Kant's approach to the aesthetic then this might be the solution for art-research. The evaluation based on taste is via Kant made into an objective conviction. But Kant's approach to the aesthetic, however, is also that the aesthetic solely relates to the faculty of cognition, while the materials are irrelevant to the evaluation based on taste and as such do not influence it. As an art researcher that examines the aesthetic manufacturing of materials when they partake in various events, there is therefore little benefit in Kant's perspective on the aesthetics. In his approach to the aesthetic and the regulated atmosphere as part of it, Böhme, on the other hand, does include manufacture of materials, but also design and advertisements. I talk more of this in the chapter on aesthetics.
In the design method Design in a Broad Perspective, the art-researcher's concern is not to enounce the evaluations based on taste regarding the aesthetic effect of art, but to locate the questions that can be used to inquire further. The results of art-research are partly, in comparative studies, to pinpoint the distinct expressions of materials, partly specifically developed questions relating to the aesthetics.
The distinctive expressions of materials are related to their potential for producing expressions in the shape of, for example, form, scale, proportions, figure, texture, materiality, implicit ornamentation, colour, and gloss. While the focus of the specifically developed questions are the quality and aesthetic effects of the materials. The latter, as such, relies on philosophy, which also centres on questions.

Philosophy consists of reframing the same basic questions thinkers have dealt with since antiquity, not with the expectation of locating the ultimate answer, but rather with the hope of asking better questions than have ever been asked before. (Jørgensen, 2006, p. 193)

The objectivity of science is not acquired in relation to aesthetics from quantifiable measurements, falsification/verification, or a large amount of questionnaires. It is acquired by following stringent methods that rely on and borrow approaches from philosophical aesthetics. Art-research in this manner is structured with an academic framework in mind. It is achieved by observing what it sees as an object outside of itself in the same way as it relates critically to its area of inquiry.
The art-researcher, then, provides a tool for the material designer. The art-researcher delivers knowledge about art by emphasizing the qualities and by being an operational tool in the form of questions the material designer can employ when designing materials. The questions developed by the art-researcher are closely related to the circumstances wherein the materials are meant to be used. So it is not only the questions that are interesting to the materials designer, but also the path, factors, and parameters that are part of it as well as the reasoning that accompanies it. It is these questions, but also the background that has made the research able to come up with them, that make up the basis of the materials designers' design of materials. In the design method Design in a Broad Perspective, the art-researcher uses transparency in research, reasoning, and method.
Art-research is a relatively new branch of research. Its form, content, and methodology are still being debated both within the art-research environment, but also in relation to other academic disciplines. As researcher Floris Solleveld (Solleveld, 2012) reminds us, today, despite thousands of PhDs having been earned by art-researchers across the world and twenty years of debate, there is still not a satisfactory answer to what art-research is.

Still after twenty years of debate, there is as yet no satisfactory answer as to what artistic research is. (Solleveld, 2012)

The discussions revolve, among other things, around whether art-research should be more closely linked to the content, methods, and forms of communication in the art or whether it should adhere to a more traditional formula, which is what generally happens in universities. I have chosen the latter, but am still open to the first one in the design method Design in a Broad Perspective. That is the one that more fully absorbs art:

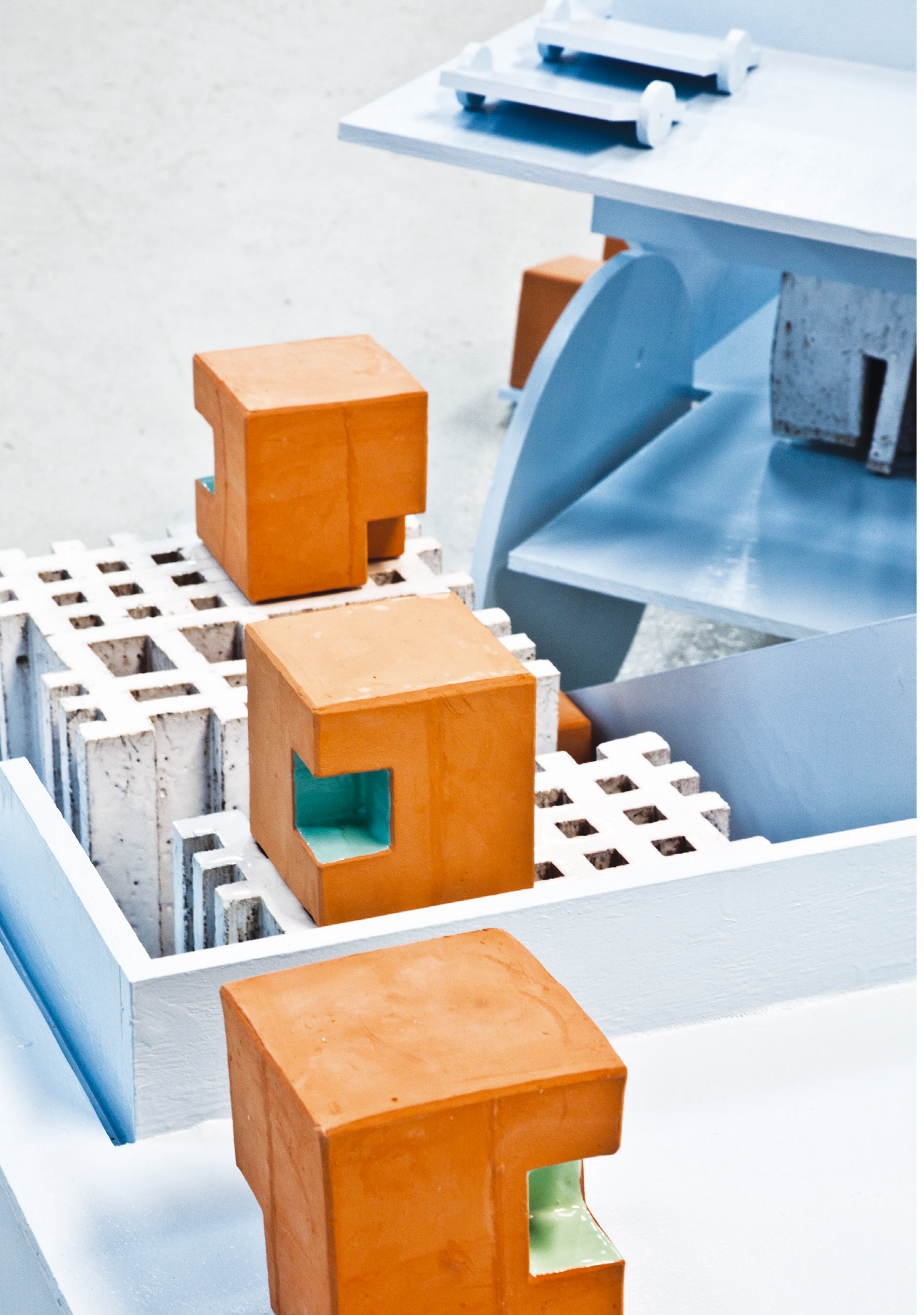
The expansion strategy entails expanding the definition of science so that it absorbs art while keeping it intact. Since science is done through research, one simply defines science broadly enough for it to include practising art; for example in a so-called "artistic development work." (Galle, 2003, p. 83)

Here the art must be kept intact. Whether that happens in the design method Design in a Broad Perspective might be disputed since it requires an aesthetic manufacturing as expressive device.
I have not chosen the expansion strategy because it on the surface seems to cause problems in relation to the scientific spirit, but also to the usability of the research results. As it appears in the Danish Ministry of Culture's definition of artistic development activities, which is also included in the expansion strategy and which is equal to a PhD at graduate schools, the final product can be a written dissertation, but this is no requirement;

"Systematic development activity aimed at gathering new knowledge about the creation of art. The development is based on a combination of stringent, registering methods, sensing, and artistic insight. The work is finalized through a conclusive process of reflection that can be communicated and in that way adds to the disciplines' methodology and epistemology." (Danish Ministry of Culture, 2009)

What is distinct about research in the form of artistic development work when compared to other research disciplines is that it includes both sensing and artistic insight in methodology, as well as the way in which communication is encouraged, though it does not have to be in the form of a written dissertation. As I see it, that sensing and artistic insight is included is an important step in the development of art research's distinctive nature. It is also, as I see it, a step in the right direction for art-research to acknowledge that the results of its research can take a different form than the written one, because it as such sets the stage for an acknowledgement of tacit knowledge. At the same time, though, this is also the weakness of this kind of art-research. Art-research in the form of artistic development work might find it difficult to be recognized by other academic disciplines because it both in terms of its content and results seem indeterminate and because the knowledge acquired is not communicated with clarity and focus. Furthermore, artistic development work might seem less distinct compared to art practice. They are quite similar at the face of it. Many artists, including myself, ask questions of and with the art and construct art through stringent methods. They register and critically reflect with their artwork and in relation to employing art as an event. As artists, they include sensing and artistic insight and communicate results with the art itself, but also as articles in catalogues and sometimes art journals. Is the practice of these artists, then, really artistic development activities and should be considered equal to a PhD and research by the prevailing definition of this?

Detail from exhibition Ceramic on Tour, Gallery 21, Malmö, installation ceramic, specific ceramic glazed concrete, red glazed casting loam, and painted MDF wood, 2013. Photo: Ole Akhøj.



I find it hard to see the difference. The crux of the problem might be that the articles communicated by the artists are not necessarily addressed to or recognized as academic journals and that the artists therefore do not, as former research chief at the Danish Design School, Thomas Schiødt Rasmussen, (Rasmussen, 2003) points out, let their communication "circulate in a scientific community." (Rasmussen, 2003):

Research in design must be focused on the process - not the artistic process - but the process from hypothesis to conclusion. The experiment that is done - and which possibly could result in something that is characterized as a work - is merely a step in that process. The written publication is of the utmost importance. It might be correct that a picture says more than a thousand words and that a model says more than a million words, but not until the words are committed to paper and published they are able to circulate in a scientific community. (Rasmussen, 2003)

I tend towards considering the written dissertation to be the principal way to communicate art-research results. Because this is where I first see art-research being distinct from the art activities, but also due to its results. But at the same time, I do not think that the written dissertation is able to stand alone but that it should be backed up and complemented with photos, sketch materials, art objects, physical objects from the manufacturing and examination, and therefore I emphasize a combination of both approaches mentioned above. For that reason, art-research and art as creation and event are part of the design method Design in a Broad Perspective. This is precisely done in order to consider that both artistic insight and sensing are represented in the methods, but also so that the products become the written dissertations as well as the art as event. I merely choose to generally separate art-research and art in the design method, which means that art-research in this perspective primarily follows what Galle calls the limitation strategy. At the same time, there is the bind for art that it must aim to have aesthetic manufacturing be its means, not its end. If this is not the case and if art's approach to the aesthetic is for example the loathed, which the interpretation of aesthetics might also be, then this is not art that art-research can utilize.
According to French philosopher Bachelard, science does not know what to do with what is qualitative. The person, he goes on, who begins examining the qualitative structures of being excludes himself from science. (Bundgård, 2004, p. 136)

Section of the exhibition Ceramic on Tour, Gallery 21, Malmö, installation ceramic, details made in specific ceramic glazed concrete, "boxes", height 40 cm, red, partially glazed casting loam, "cubes", length 15 cm, and painted MDF wood "cart", length, 120 cm, 2013. Photo: Ole Akhøj.

Natural sciences came into being centuries ago, art-research is still relatively new. A discussion that accompanies it in seeking a scientific standpoint and potential belonging, which recognizes the distinctiveness and quality of art-research, might provide us with answers in the long term if we continue to ask these questions. I have objectivity in mind as a researcher in art-research, but I also seek to include sensing and artistic insight in the art, both are part of the design method Design in a Broad Perspective as ways of generating knowledge about the materials to the benefit of the material designer.

ARTISTIC RESEARCH

To expand on the chapter on art-research above, I will now look closer at its structure, content, and methodology and how it is part of the design method Design in a Broad Perspective. I do this by, among other things, considering art-research in relation to the development of specific ceramic glazed concrete.

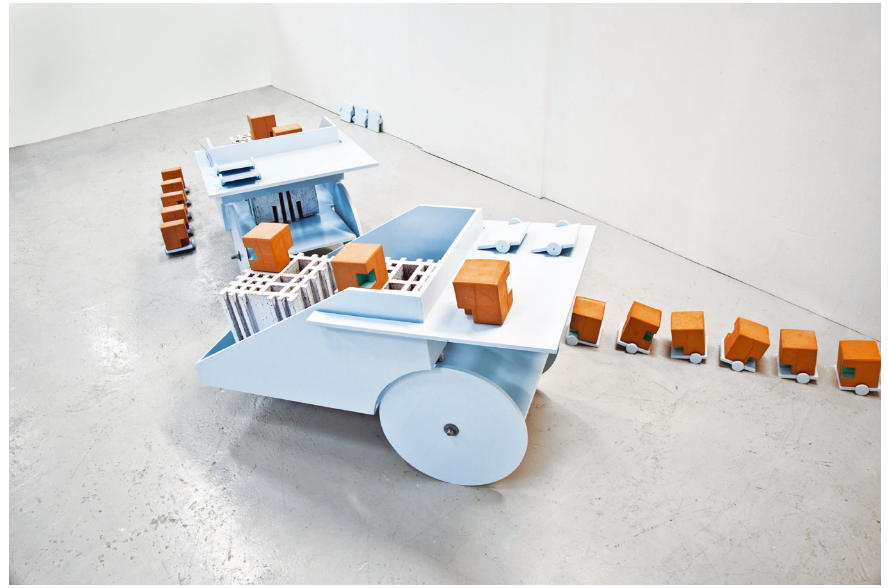
We are still in the vertical string of the design method, art-research, and here view the horizontal strings that include art, crafts, design, and architecture as practice. The art-researcher is located at an appropriate distance from what she sees as an object of her observations. Art-research as it occurs in the design method Design in a Broad Perspective and the way I present it in this book is based on the fact that the art it observes is aesthetically manufactured and that this art is to be considered an event. The art that enters into the purview of art-research should not be considered as a singular artwork, a building, an artefact, or design in the classical sense. It consists of physical objects, a context, as well as one or more spectators/visitors. It is the whole of art as an event that is the object of study in art-research. With its analytical devices, art research extracts knowledge from art both as an event, but also from its creation. The object of art research, thusly, is also the creation of art. The art researcher basically asks four questions. Two of them deal with the distinctive expression of the materials, while the last two deal with the aesthetic manufacturing of the materials. In the following, I begin by identifying the questions that deal with the distinctive expressions of materials.

In relation to the distinctive expressions of the materials, the art-researcher asks the following two questions:

A. If the materials have a distinct expression, what is it?

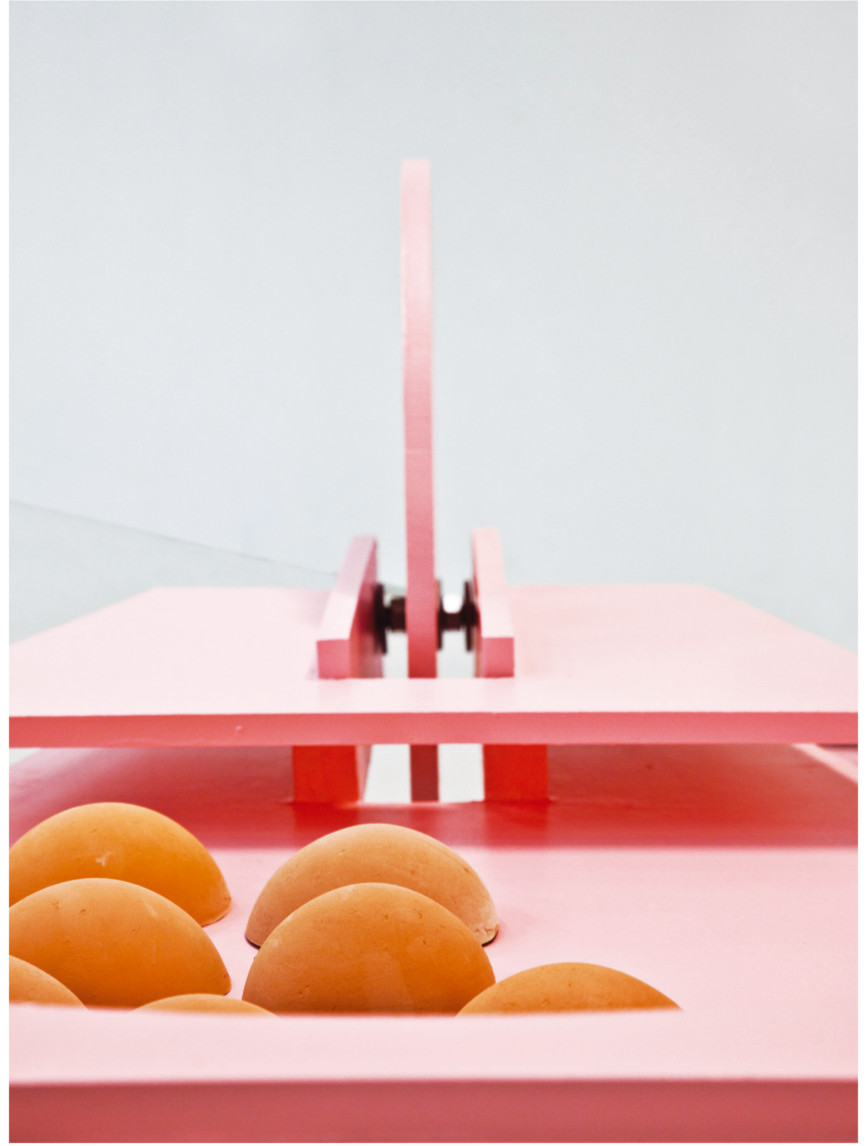
B. How is the distinctiveness of the materials attained?

Section of the exhibition Ceramic on Tour, Gallery 21, Malmö, installation ceramic, details made from specific ceramic glazed concrete, "boxes", height 40 cm, red, partially glazed casting loam, "cubes", length 15 cm, and painted MDF wood "cart", length, 120 cm, 2013. Photo: Ole Akhøj.



The first question is answered by observing the art event, while the other has to do with the art creation. The questions breed descriptive registration and gathering of data. Questions A and B are open questions and as such can contribute to their descriptions lacking clarity. This is why the art-researcher chooses to add details to the questions, wanting more specific answers. Answers that are independent of who provides them. Those I have used here are based on Willy Ørskov's theories on developing and reading abstract objects. (Ørskov, 1999)

- FORM CATEGORY including figure, composition, directions, proportions, volumes, figure meetings, size
- SURFACE CATEGORY including colours, patterns, textures, gloss, materiality,
- FORM CHARACTERISTIC including shell/mass, arbitrariness/precision, geometric/non-geometric, open/closed, bearing/borne, heavy/light, light/shadow
- ARRANGEMENTS including stretch, composition, spread, stabling, ..
- POSITIONS including standing, lying, suspended, etc.
- RELATIONS including against, from outside, on top of, below, inside, etc.



This list of terms can be expanded or simplified as need be. [20] The questions are asked in relation to the materials and the way they are displayed and placed in the event. The answers suggest a characteristic of the materials, but do not point out the distinctive expressions of the materials, which is what the materials researcher is requesting. But by producing comparative studies, this can be achieved. The question that follows this list of terms is then if it might be possible to arrive at the same answer by using other materials. Initially, the comparative studies relate to the materials that are connected to the material being studied. In relation to examining and developing specific ceramic glazed concrete the comparisons are to ceramic in the traditional sense (clay-based), ceramic glazed concrete, and conventional concrete. The comparative aspect is then comparing the observed materials to the others in relation to how these materials would look if they pursued the same expression. The objects being analysed are then not actually made from these materials, but rather point towards the research on them and their development over time. These are what the art-researcher does comparative studies of.

The art-researcher pinpoints and compares and based on this, sets up sub-conclusions that together form the conclusion and perspective of the research. I choose not to do that here. [21]

In art-research, the assumption is that this registration is objective. To accomplish this, the art-researcher's questions must be specified more clearly. There is still a risk of person-dependency due to the art-researcher's proposal: the questions being asked. The verbal description, choice of words, the way the object is observed might as it stands depend on the person, his or her angle of perception, distance etc., and also whether he or she is having a day where the words flow freely while other days they are harder to grasp. In comparative studies where approximate objectivity in the answers is sought, these aspects must be excluded to the largest possible extent. The question is whether this can be fully done, I doubt it, but we might, by more clearly defining the conditions under which the questioning is done, as well as further detailing the questions, arrive at a better framework for approximate objective answers.

The art researcher's questions about the distinctive expression of the materials are accompanied by the questions of how this distinctiveness has been realized. These are, as mentioned, questions that deal with the creation of art. Based on this, the art-researcher has used analytical devices to point to characteristics that might be unique to the examined material. He or she, on the other hand, is also able to use the analysis to demon-

This and opposite page: Details of installation ceramic from the exhibition Ceramic on Tour, Gallery 21, Malmö, made from specific ceramic glazed concrete, diameter 60 cm, red casting loam, diameter 10 cm, and painted MDF wood "cart" 10 cm, 2013. Photo: Ole Akhøj.

strate that the material in this manner is not distinct from other materials and so, in this respect, is not unique.
Consequently, the material designer has the possibility of designing his or her materials so the characteristics shown to be unique are examined to be variants thereof. This might be whether or not more expressions with similar characteristics can be present or whether they through potential design can be strengthened.
The next question the art-researcher asks is the one that deals with the aesthetic effect of the materials:

B; what aesthetic effect do the materials have?

As we can see in the section on aesthetics in the previous chapter, what the art-researcher questions is whether the materials help regulate an atmosphere in the event in order to affect the spectator aesthetically.
Based on this, the situation the art-researcher questions is much more complex. Partly because it is not only the materials and their manufacturing that affect the aesthetic mood of an atmosphere, but also whether the recipient actually sees it as such. This includes sensing, bodily sensation, and emotions that are characterized by being personal, subjective, and thus neither objective nor universal.
The art-researcher, as was the case in philosophy, chooses not to formulate answers to this because that is actually impossible. Instead, she presents discussing perspectives to this, and tries to identify and define this complexity.
Wishing to provide the material designer with a tool to use in the design of materials that partly relates to the art-researcher's knowledge of the distinctive expressions of the materials, partly to their potential aesthetic effects, the art-researcher tries, in relation to aesthetics, to provide specifically developed questions. These are questions based on the art-researcher's analytical approach to and perspective on the aesthetically regulated atmosphere and the effect caused by the materials to it. As such, the products of the research are these specifically developed questions. They are not statements bound up on specific persons like evaluations based on taste, but are inscribed in a kind of discourse, open to criticism, discussion, and modification. They are, in terms of their reasoning and starting point, transparent.
When developing specific ceramic glazed concrete I have been artist, spectator, and art-

Details of the exhibition Ceramic on Tour, Gallery 21, Malmö, installation ceramic, specific ceramic glazed concrete, red casting loam, and "cart" made from MDF plates. Also wall sections where specific ceramic glazed concrete and over fired red casting loam with a diameter of 20-30 cm and MDF plates with lengths of 30-60 cm. 2013. Photo: Ole Akhøj.

researcher. This has given me the opportunity to work in a broad, interdisciplinary manner in relation to designing materials. As such, I have been able to rely on my intellect, my analytical skills, and my bodily processual experience as well as my sensing and experience of this sensing. But considered in relation to art-research, this is a weakness in the research method because it jeopardizes the objectivity and integrity contained in processing and gathering data based on observations from the outside or afar. As architect, PhD, Katrine Lotz writes in her article "Transparens, originalitet og gyldighed", ("Transparency, originality, and validity,") (Lotz, 2003) there will be blind spots. The solution according to the article is making transparency into a criterion and a viable stringent research framework where transparency of the research makes it to possible to repeat the research process independent of whoever is doing it.

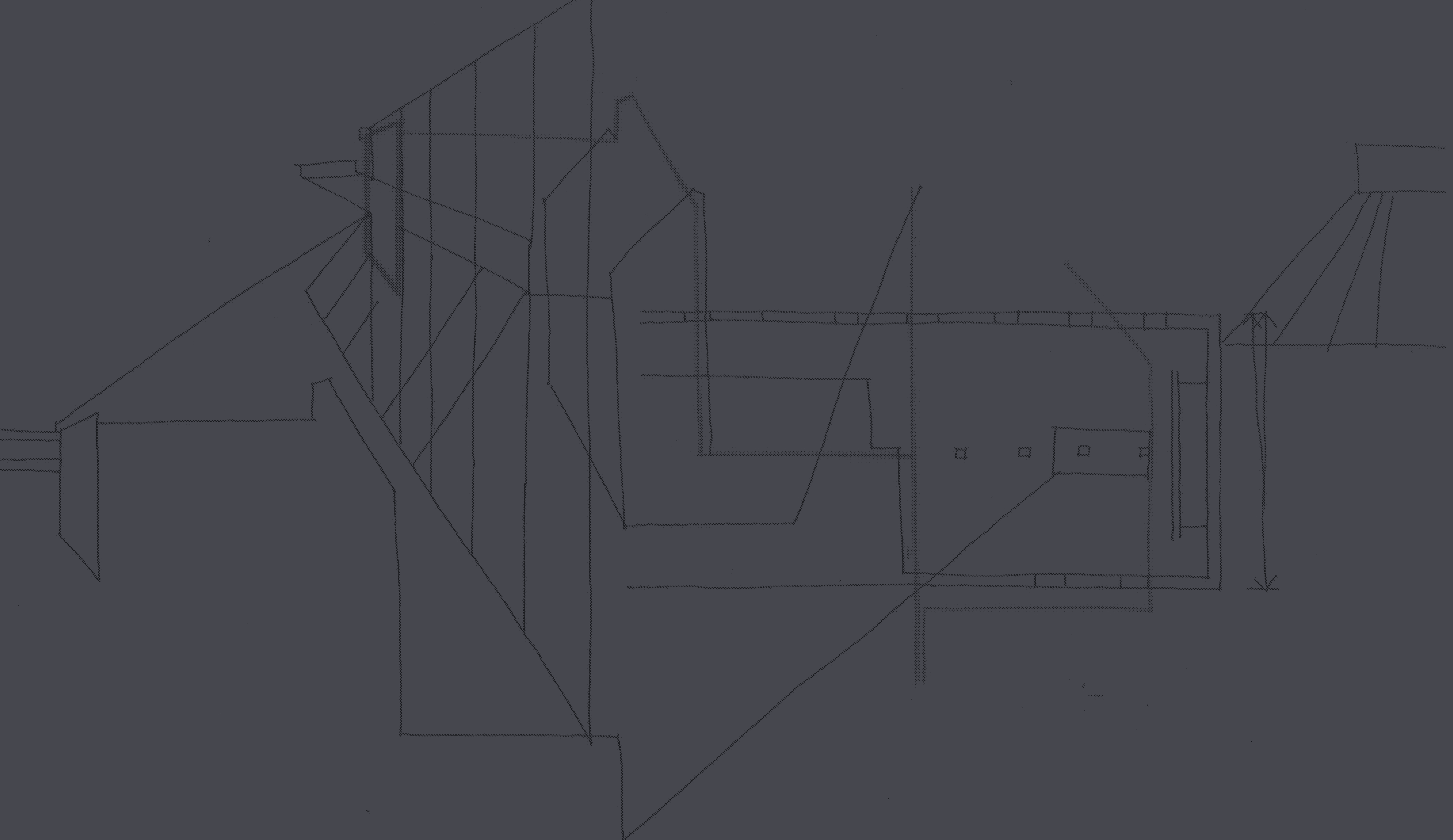
The transparency criterion is the basic scientific demand that we are able to see what has happened in an examination and can be considered to be an adjusted, elaborated response to Karl Popper's Falsifiability and or refutability criterion that demands that a statement and its principles for explanation must somehow be possible to test.
(Lotz, 2003)

This is what I strive for in research: to describe the framework of the knowledge acquired as well as explain it. This is hopefully also what makes it able to function as a tool for designing materials, as a kind of design platform, because the material designer can enter into a dialogue with the statements of the design platform. What I look for as art-researcher is therefore not initially a Popperish falsifiability or verification of statements, but the statements themselves inscribed in a discourse open to discussion. These are what I as researcher seek to systematize in relation to analyses and to transform them into the operational design tools for designing materials that function as descriptive, variable "markers", as questions.
The research strategy of the art-research is still being developed in the design method. Therefore, it has initially taken its starting point in philosophical aesthetics as mentioned earlier, including Böhme's term atmosphere, but also Zumthor's descriptions of his use and manufacture of regulated atmospheres and architecture in general. The questions the art-researcher asks at the stage of development, art-research finds itself in at this moment of the design method have been borrowed from Zumthor's book Atmosphere, (Zumthor, 2005) These are the markers the materials designer can use in relation to the aesthetic production and design of the materials. In the following, I lay out a short account of the meaning I, as mentioned earlier, has taken the liberty of providing them with. I also speak on how the material designer might use them. The main question is how to relate to the connections of the provided terms in relation to regulating an atmosphere aesthetically? The questions, based on Zumthor's term correlation and adjusted for the material designer, for now are as follows:How do you approach "**the body of architecture**": how do you approach materials as the constructive skeleton of your object, here in relation to the way in which they affect you aesthetically. How do you approach "**Material Compatibility**"?: How do you approach the juxtaposition and collaboration of materials?. How do you approach "**Levels of Intimacy**" ?: How do you approach the materials' scale, size, proportion, and distance of observation in relation to the body and feeling of intimacy? How do you approach "**The Sound of Space**"?: How do you approach the way materials affect the transmission of sound?. How do you approach "**The temperature of space**"?: How do you approach the ways in which materials react to its surroundings in relation to temperatures?. How do you approach "**The Light on Things**"? : How do you approach the way the materials affect the transmission of light with reflection, absorption, but also in terms of light/shadow and nuances, as well as its own separate narrative about materiality? How do you approach "**Surrounding objects**" ?: How do you approach the materials as manufactured objects relating to an event? How do you approach "**Between Composure and seduction**"? : how do you approach materials as composited material, structuring, placement, and manufacturing in relation to its narrative and seductive power? How do you approach "**Tension between interior and Exterior**"? How do you approach the materials as what creates a compartment/shielding and those that are seen as such from the outside? How do you approach "**Architecture as Surroundings"**?: How do you approach the materials' dialogue not only with other materials in the art object, building, or artefact, but also with those that appear in its surroundings? How do you approach "**Coherence**"?: How do you approach the cohesion of materials in relation to all the other things that take place in the events you plan for the materials to exist in? How do you approach "**The Beautiful form**"? ¬: How do you approach the beauty of the materials as the aesthetic sublime in all of the questions above? These are as they stand operational to both the artist, designer, architect, but also the materials researcher and materials designer. It is the case with all creative disciplines that the answers are individual, and that the artistic statements and the materials designed with these in mind will also emerge from personal, and as such differing, approaches to this. The developed questions of the art-researcher, then, do not guarantee an aestheti cally regulated atmosphere. These are the conditions under which the artist, designer, and architect work. They use themselves as sensing, feeling, and bodily "measurers" of the aesthetic aspect of their work, but do not know and are unable to guarantee that this is also how the recipient sees and experiences it. This is a discussion the art-resear cher absorbs into her research, but only as a starting point of discussion, not as an answer. This is where the art-researcher's work in many ways is similar to that of the philosopher. The work of the art researcher then, besides pointing out the distinctive expressions of materials, is to discuss the role materials have in aesthetically affecting the atmosphere of an event as well as, based on this, develop specific questions the material

designer can employ when designing materials.
The research method presented above and in this book related to the design method Design in a Broad Perspective is still being developed and refined.

Ceramic on Tour, Gallery 21, Malmö, installation ceramic, red casting loam, length 20 cm, painted MDF wooden shelf, length 130 cm, and wooden pegs, 100 cm, 2013. Photo: Ole Akhøj.

PROCESS/CRAFTSMANSHIP



PROCESS/ CRAFTSMANSHIP

DISPLACEMENTS AND COHESION
Displacement is more than matter.
It is balance of art on the edge of physics and science.
It is calculated proportions in any sense of space.
Ceramic glazing is reflective, still deep almost coagulated
And frozen with aggregate
In temperature and mode of time,
With gravel, sand and cement.
These works are practice Scientifics,
They are matter to be identified beyond, over and above syntax.
They are will of independence
expressed and digested in matter, considered in ceramic Spaces.
(Wedebrunn,2012)

PROCESS/ CRAFTSMANSHIP

The materials researcher's considerations of the structure of materials in relation to theory are abandoned in this chapter. Instead we move into the workshop of the craftsman. This is what in the design method Design in a Broad Perspective corresponds to a horizontal string. This is where the material is questioned while being manufactured. As also emerges from the other two chapters of the book, the stringent division of the design methods into strings that I introduce is less stringent than it is presented. For example, the craft of the ceramist was part of the narrative on glazes in the chapter "Materials." So when I present these as separated strings in the book, this is not to be taken completely literal. It is only in trying to create a kind of overview that the knowledge areas surrounding materials are separated in the indicated structure and follows the general principles of order.
In the craftsman's workshop, the material encounters different questions than the ones put forth by the materials researcher as well as new challenges to live up to. These are the questions and challenges the materials are designed with in mind in relation to the design method Design in a Broad Perspective. This is what I present in this chapter. It is when the components of concrete are weighed, mixed, cast, hardened, and made into spatial form. It is here, and in appendix 3, that preparation and manufacture of moulds have an impact on the way materials are designed. I also touch upon glaze and firing techniques and some of the conditions and challenges that present themselves here.
The craftsman works, as she is presented here, from a specified design proposal. I have positioned the idea generation, concept development, sketching phase and whatever else leads to the design proposal in the horizontal strings dealing with installation art and

This page. Mixing specific ceramic glazed concrete with a paddle mixer in the concrete laboratory. Notice gloves, mask, and ear protectors as well as exhaustion that all are necessary for health reasons. Protectionglasses should also be used. Photo Maja Alberte Bache. Opposite page: casting specific ceramic glazed concrete in a horizontal, open mould in the DTU concrete laboratory. The concrete is cast into a wooden mould with foam board inserted to form, with vibrations in the 70 Hz zone on a vibration table. Photo: Maja Alberte Bache.

design and development of large-scale ceramic façades. Those are not addressed here. This is not to say that this is not part of the craftsman's work. This is simply due to structural concerns and a way to simplify the narrative in order to provide an overview.

THE LENGTHY PROCESS ROAD

It takes minutes to create a watercolour painting, but months to produce a ceramic object. Characteristic to both is that neither can be changed. Once the pigment has let go of the marten hairbrush and made its mark on the white, slightly damp watercolour paper it is eternal. Similarly, a ceramic object is eternal after it has been fired. One always opens the door to a kiln nervously after a firing. It can be a horrible sensation where everything collapses to the ground and points to months of additional work. It can also be a feeling of relief, even deliverance, when one succeeds. (Bache, 2012).
Creating something in practice usually follows a long sequence of process steps. These might differ from person to person and discipline to discipline. In the following, I sketch the process sequence I work from when I manufacture and mould concrete and thereby create spatial phenomena from both concrete and specific ceramic glazed concrete.

CASTING

There are many ways to form concrete. The most utilized is casting concrete, but powder pressure, extrusion, filling, and spray casting are other possibilities. 3D printing has also entered the world of concrete.
I would have liked to do much more work with powder press and 3D print in relation to developing specific ceramic glazed concrete. Powder press has distinct advantages, such as control of material packing, implementation of fibres, and orientating them, as well as determining and controlling thickness. This is a method that has had large impact on technical ceramic on the large scale, but today also makes it possible to produce ceramic elements on the large scale. These, however, are usually ultra-brittle. Powder press, on the other hand, has not yet been used much in relation to concrete. Furthermore, the shaping freedom I desire is not possible with powder press. 3D printing concrete is also relatively novel and would require very specific development initiatives in my project. This would redirect the project in a manner I was not interested in.
Therefore, I have chosen the most commonly used processes in the concrete industry, casting and filling. These are processes that also any small business, artist, craft artist, or any other interested party might use. I talk here of casting and filling.

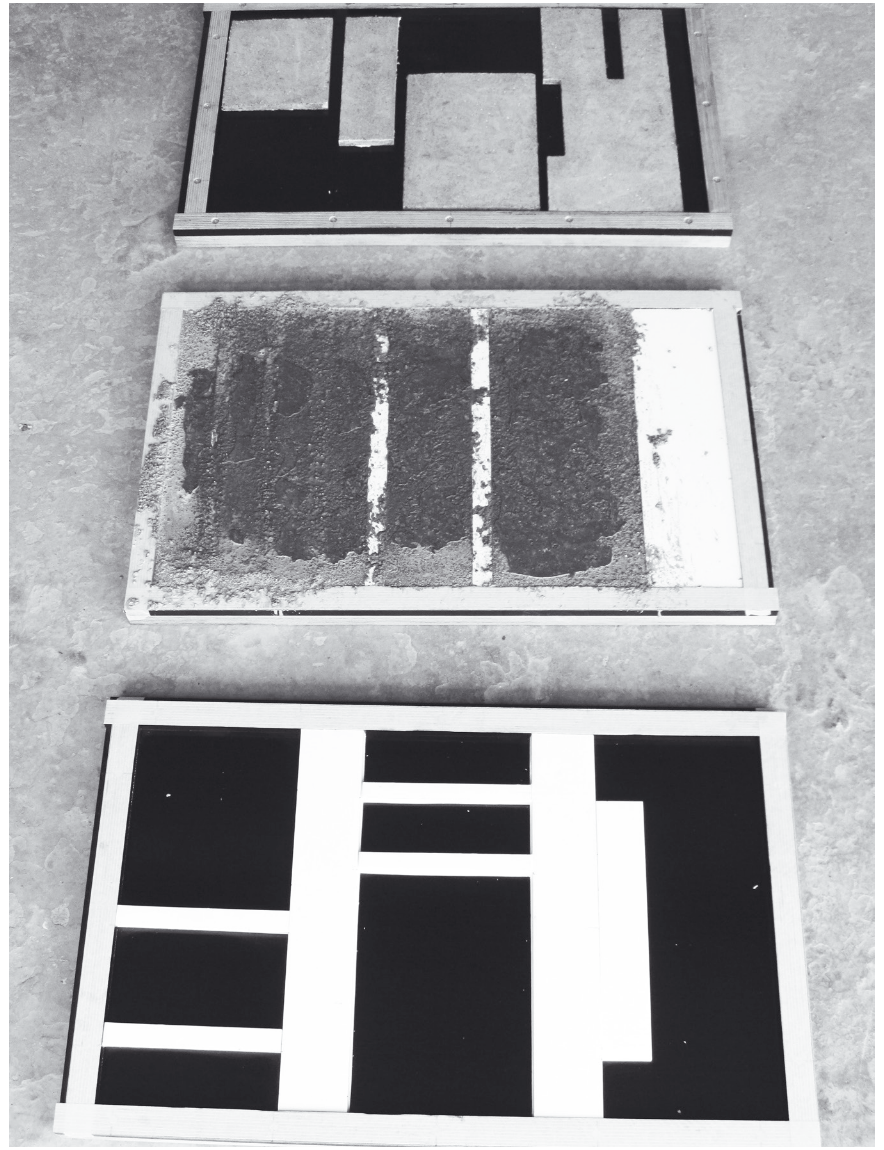
HORIZONTAL-VERTICAL CASTING

When concrete is cast it can happen in a variety of ways. The concrete can be cast horizo-

ntally and level when level plates are desired. These can then subsequently be assembled with jointing and thusly be transformed into spatial objects. It is, however, also possible to make a mould that when it is de-moulded produces the desired spatial object without utilizing jointing. There are advantages and disadvantages to both methods. Which method to use depends much on the form and expression the object is meant to have.
In the following I go over both methods.
There are many advantages to casting into a level, horizontal open mould, which can be seen on the opposite page. The casting can be visually monitored and as such be controlled as to whether or not it is being processed as desired.
The homogenous, level surface that makes up the bottom of the mould ensures that the vibration of the mould is homogenous and distributed evenly and as such that the concrete is equally spread across the surface. But with a horizontal mould, the side of the mould, the side from where the concrete is poured into the mould that is, becomes uneven.In the case of vertical casting into the narrow channels of a spatial mould, for example those displayed on page 122 and 123 where we see wooden moulds, both sides of the concrete object will have a nice, smooth surface. This kind of casting might be difficult to control, however, because the cast cycle for large elements is long and the moulding plates provide resistance to the concrete flowing into the narrow channels. If moulding plywood or a similarly non-transparent material is used for the mould, it is not possible in the vertical mould either to tell if the cast has happened satisfactorily or has flowed into all corners. Whether the mould has casted properly will not be discovered until the concrete has hardened. It might be difficult to make sure that the vibration is homogenous and that the vibration from the vibrating table reaches across the whole casting compound. On the other hand, the spatial mould, at least if the casting goes as planned, produces even sides and corners and the glazing might also be easier to control. I will return to this latter aspect later in the chapter.

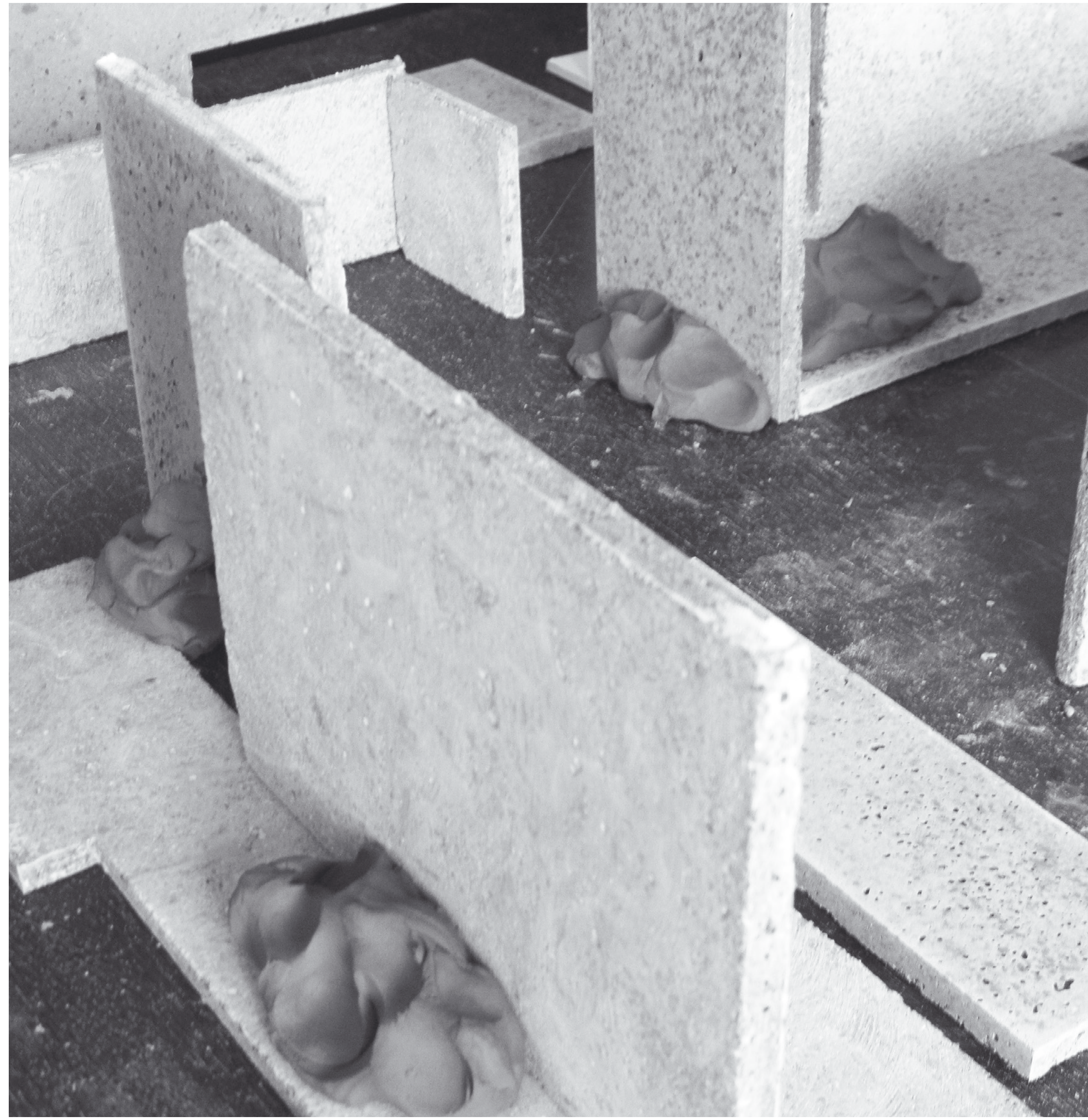
CONCRETE TRIMMING - PROCESS

Concretes can be designed with a specific casting process in mind. The concrete used for extrusion is not identical to what is used in 3D printing. The type of concrete being cast in large quantities for high thicknesses are not identical to those being used for constructions of very small thicknesses. They must be adjusted for the processes they are part of as well as with the desired ultimate design in mind. The densely packed concrete may seem sluggish when being cast even with vibration. Therefore, it might be tempting, for example, to improve the flow when casting in narrow channels by feeding the concrete large quantities of super dispersal agents, more water, or both. It might also be tempting to change the frequency of the vibration during casting.
If further super dispersal agents are implemented in the concretes, this might help



improve the flow somewhat. There is, however, a distinct risk of destroying viscosity, cohesion, and the structure of the concrete. It is also important to point out that super dispersal agents often delay the hardening process of the concrete, in some cases to a relatively large degree. I have taken advantage of this fact by making ornaments in the concrete while is was solid but not yet fully hardened several days after having cast the specific ceramic glazed concrete. But to many, a hardening period of a month or maybe even more is not preferable. So including extra super dispersal agents must be done with care and I recommend doing several small-scale tests beforehand.
To conventional concrete, the solution is adding more water, which lessens, however, the strength of the concrete. But often, concrete binders, which are fabricated with super dispersal agents, will break when extra water is added. Furthermore, in specific ceramic glazed concrete more water will be disadvantageous because it makes the concrete more porous after being fired and thus less strong. It will also cause less effective binding of fibres and thereby reduces the fracture energy. A problem might also arise from the added water in specific ceramic glazed concrete because it might cause separation of the concrete when casting with vibrations. The heavier ingredients such as the aggregate and fibres will tend to situate itself against the bottom of the mould where it meets the vibration table, while the concrete paste, having no larger particles, will end up on the top of mould, the casting side. The fracture mechanical design will in this kind of casting only function locally in the object. Furthermore, the firings will cause cracks to form locally in the part of the concrete that has no fibres or aggregate, the concrete paste. The firings will also cause those elements that previous to firing were level to bend. The unequal distribution of the fibres, aggregates, and concrete paste makes one side of the object expand while the other is squeezed together during the firings. Adding extra water to specific ceramic glazed concrete to create an easier flow, then, is generally inadvisable.
The frequency of the vibrations to the concrete has significance to the casting. To those concretes with several size graduations in their particles, aggregate, and other ingredients it is advantageous to work with as high a frequency as possible. Doing so will ensure that the vibrations spread to all of the ingredients rather than only the largest ones. This can be observed in the fact that the densely packed concretes, with 3-7 size graduations in their particles, aggregate, and fibres, flow more easily into the mould the higher the frequency. The conventionally used frequency in industry vibrator tables is 50 Hz or even lower. I have cast specific ceramic glazed concrete at frequencies around 70-100 Hz and adjusted the materials accordingly to this process.

Opposite page, wooden mould assembled with foam board *and ready for horizontal moulding process, concrete casted into a mould, and casted concrete panels when taken out of the mould. On this page concrete objects assembled with jointing before firing and glazing, made from specific ceramic concrete. Photo: Anja.*

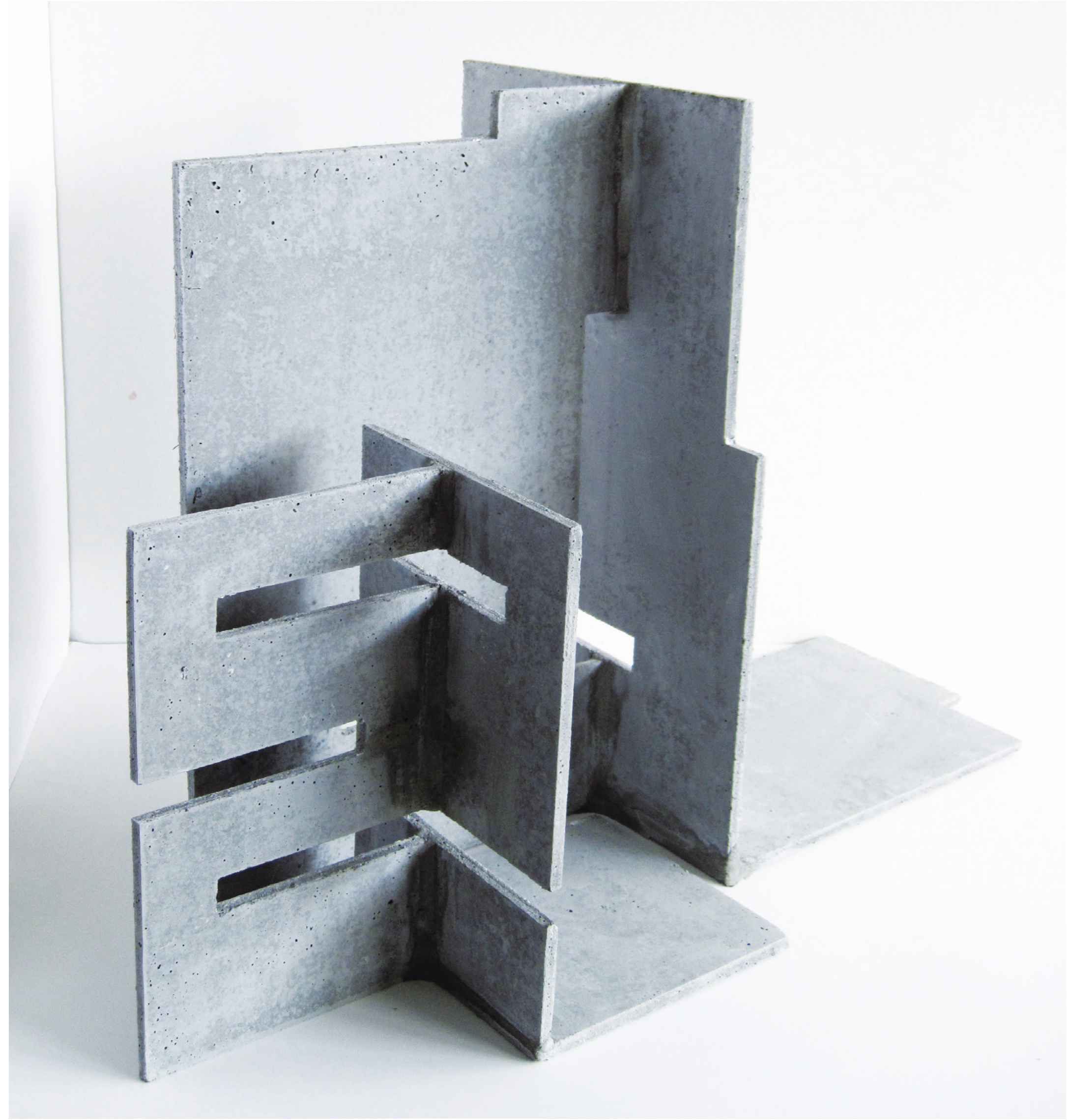


CONCRETE CASTING PROCESS

The process for manufacturing specific ceramic glazed concrete to some extent follows the general one of casting concrete objects. This means that the processes I describe at the normal temperature zone can be done with the concrete mentioned in the appendix, conventional concrete, high-strength concrete, and ceramic concrete.
It must be stressed, however, that only ceramic concrete can be fired in the way described. When working with concrete, it is important to take several precautions. Cement, micro silica, fly ash, small-scale ceramic fibres and so on are dangerous to the eyes, skin, and especially the lungs. That is why it is so important to have exhaustion or a different kind of ventilation when working with concrete. It is also necessary to wear a dust mask and gloves and because of the noise of the mixer and vibration table, even hearing protectors. They must be worn during measuring and mixing as well as casting. Cement, sand, rock aggregate, water, fibres, and so on are measured according to a recipe. The densely packed concrete binder and high-strength concrete in some cases require strong concrete mixers with excellent blades, preferably four or more, to produce the most homogenous mix possible. Conventional concrete mixers might have problems in that respect.
The concretes are mixed according to mixing procedure that vary much depending on which kind of concrete is being mixed. It is of the utmost importance that concretes with super dispersal agents are mixed by carefully following the directions provided by the dealer because they behave completely different than when mixing conventional concretes. During the initial phase of mixing, they may seem very dry. Not until after several minutes of mixing the concrete will it change from being dry to being more wet and having completely different flow behaviour.
Once the concrete has been mixed, it is cast. The mould has been placed on the vibration table beforehand and has been greased with mould oil making it glisten, but not wet no matter if the mould is made from silicone rubber, wood, or metal.
When casting in horizontal, level moulds, I prefer to begin by casting at a low vibrating table frequency, about 30-35 Hz, as I pour the concrete from the mixer into the mould. Once the mass of concrete has been distributed evenly in the entire mould, I vibrate it at maximum frequency, mostly for no more than a few minutes until no air bubbles can be detected in the surface of the concrete mass. In spatial moulds, on the other hand, I choose to cast at the highest frequency throughout the entire casting process. Most aluminate based concrete sets relatively quickly and might already change into a more sluggish and solid mass as it is being cast. In conventional concrete, this is remedied by pouring in extra chalk, but since that is exactly the ingredient that increases the conversion that happens in aluminate-based concrete, which we want to avoid, that is not a possibility in this case. Casting them therefore might quickly become difficult. The casting must be relatively fast and, for the specific ceramic glazed concrete I work with preferably not take more than half an hour. In the case of normal-temperature concretes, partly the high-strength concretes and the conventional ones, casting time can be longer. By having them vibrate for too long during casting, bleeding might occur. This means that the concrete separates. This can be seen from a watery, lighter mass appearing in the margins of the mould. If this happens, the vibration must be stopped even if air bubbles are still appearing. After finishing the cast, the cast with mould is placed in a damp environment. Placing the casts under close-fitting plastic sheets might accomblish this. You should be careful that the sheets do not sink into the concrete mass as this will change its surface quality. By placing it in a damp environment, the concrete hardens and finds its strength before drying out. If the concrete is not placed in a damp environment as it hardens, the water meant to bring out the chemical binding of the concrete will evaporate during hardening and the concrete will be ruined. I usually let the concrete objects I have cast from specific ceramic glazed concrete harden for 48 hours, while I let conventional concrete harden for at least five and preferably seven days before moving them on to curing.

CONCRETE CURING

Concrete can be cured in a variety of ways. I have mainly relied on grinding and drilling. Grinding concretes can be done with grinding cups. If we are dealing with high-strength concrete or specific ceramic glazed concrete we are dealing with relatively abrasion-proof materials, and it is necessary to use diamond grinding cups. With other types of concrete, grinding cups of hard metal can be used. The grinding is not done until after hardening, but usually before firing because it is difficult to produce the level grinding surface after firing. Grinding can happen while the objects are in the mould, but also after they have been removed.
I have used both methods. To the large, slim objects, for example the large-scale, thin façades I have manufactured using specific ceramic glazed concrete, it might be helpful to have them buttressed by the mould. On the other hand, it might often be necessary to also grind the objects after they have been removed from the mould, for example to refine edges or remove some unwanted imprecisions from the cast.
It should be noted, however, that grinding removes the outer layer of concrete, the thin paste, and thereby exposes the concrete's aggregates. This might cause a terrazzo effect, but of course might also be unwanted if the goal is a level, homogenously grey paste colour. Grinding causes changes to texture, patterns, gloss, and colour scheme.
Once the hardening is complete and potential grinding has been done, the elements are ready to move onto the next phase of the process, the ceramic process. Before I describe the ceramic process, however, I will talk briefly about the manufacturing of moulds and how to use jointing to assemble level surfaces cast in a horizontal mould.



DESIGN - HORIZONTAL MOULD

In the following, I will look closer on what manufacturing a horizontal, level mould entails as well as the manufacture of the more spatially complex mould. I will also consider advantages and disadvantages. Both areas are briefly touched upon here, but are given more detail in appendix three.
Moulds can be made from many different materials. I have primarily made them from moulding plywood, foam board, silicone rubber, combined with plaster and other types of wood. They can be made from plastic and are widely made from steel and other metals in industry. Both silicone rubber moulds and steel mould are expensive, but recommended when many identical objects must be manufactured.
It is relatively simple to manufacture moulds for horizontal, level casting. However, assembling the level objects into a spatial construction at the eventual jointing is more difficult. I will return to this later. Moulds can be done in level, open boxes made from moulding plywood. The edges of the box must be demountable or must have slip for removing the concretes after hardening. For example, the edges might be screwed onto a bottom plate from the top, making it possible to mount and demount them and in that way remove the moulded object from the mould. The mould having slip means that the vertical edges must have angular deviation from the vertical one of a few degrees (2-5 degrees). In that way, the mould can simply be turned over once the concrete hardens and the object taken out without removing the sides of the moulding box. The level horizontal mould, to acquire detailing and sense of relief, must be made from a combination of an outer mould made of wood wherein is inserted foam board, silicone rubber mould, or a combination of wood, plaster, and silicone rubber. This is described in more detail in appendix 3.
It is possible to glue the foam board to the moulding plywood with a glue gun, while wood glue is not recommended. The latter is wont to not let go of the wooden mould and as such is difficult to remove. It is important to note that the thickness of both the foam board and silicone rubber should not exceed 10 mm if concrete is to be cast on top of it. With higher thickness it might be difficult to distribute the vibrations from the vibration table to the moulding mass during casting.
With horizontal moulds, level surfaces of concrete and specific ceramic glazed concrete can be produced.

Concrete objects assembled with jointing before firing and glazing, made from specific ceramic concrete, height 40-60 cm, and thickness of 1 cm. Photo: Anja.

DESIGN - VERTICAL MOULD

The vertical mould is three-dimensional and spatial. It is likely to be much more complex than the horizontal one, and there are several problems within the casting process itself. On the other hand, the vertical mould is well suited for shaping objects, if the shape is to have accurate details both in general and in terms of the smaller ones.
In case of the vertical mould, the large amount of work is in developing, devising, and realizing the mould and the casting process as well as devising how to remove the concrete object from the mould after it has hardened.
The mould must be designed so the concrete reaches all of its corners during casting.
It must also ensure that the vibration is equally distributed across the mould so neither bleeding nor local separation of the concrete mass occur.
As opposed to the horizontal, level mould described before, this can be difficult to control in this mould during the casting phase. Furthermore, casting in the vertical mould often happens through narrow channels so the mass being cast does not give off the same mass pressure as when the casting is done into a horizontal, level mould.
If the mould becomes to complex for it to be demounted afterwards, it is possible, if it is made from wood, to burn off the wood after the biscuit firing. I did this with some of the ceramic installation objects I made for the exhibition at the Danish Museum of International Ceramic Art. However, this is not advisable to constantly do as it is a polluting waste of resources and might make the work even more complicated and expensive as the moulds obviously will not be able to be reused.
An advantage of the vertical, spatial casting is that the cast becomes smooth on both sides of the surfaces, or is impressed with the mould on both sides and as such does not necessarily require curing such as grinding. On the other hand, narrow casting channels, abrupt edges in the mould, and long casting paths may make the casting sluggish and sometimes impossible.
If the mould is made from a combination of silicone rubber of for example wood or plaster, as I detail in appendix three, this must be pulled over a positive reproduction of the desired object. This too can be made from wood. With its complex design, this in itself can be much work.
In appendix 3, I show how to make this spatial mould when it is made from wood or a combination of wood and silicone rubber, or wood and foam board.
Devising a mould that creates the desired shape of the object in concrete or specific ceramic glazed concrete requires good planning, but in some cases also several detailed tests.

Opposite page, wooden mould assembled and ready for horizontal moulding process. This page wooden forms being assembled where the many wooden pieces are arranged and ordered to maintain control during the assembly process. Photos: Anja.

The mould must, due to the experiences made here, often be adjusted and improved. Designing a mould is as important to do in the most initial design phase as sketching and designing an object made from concrete and specific ceramic glazed concrete already.

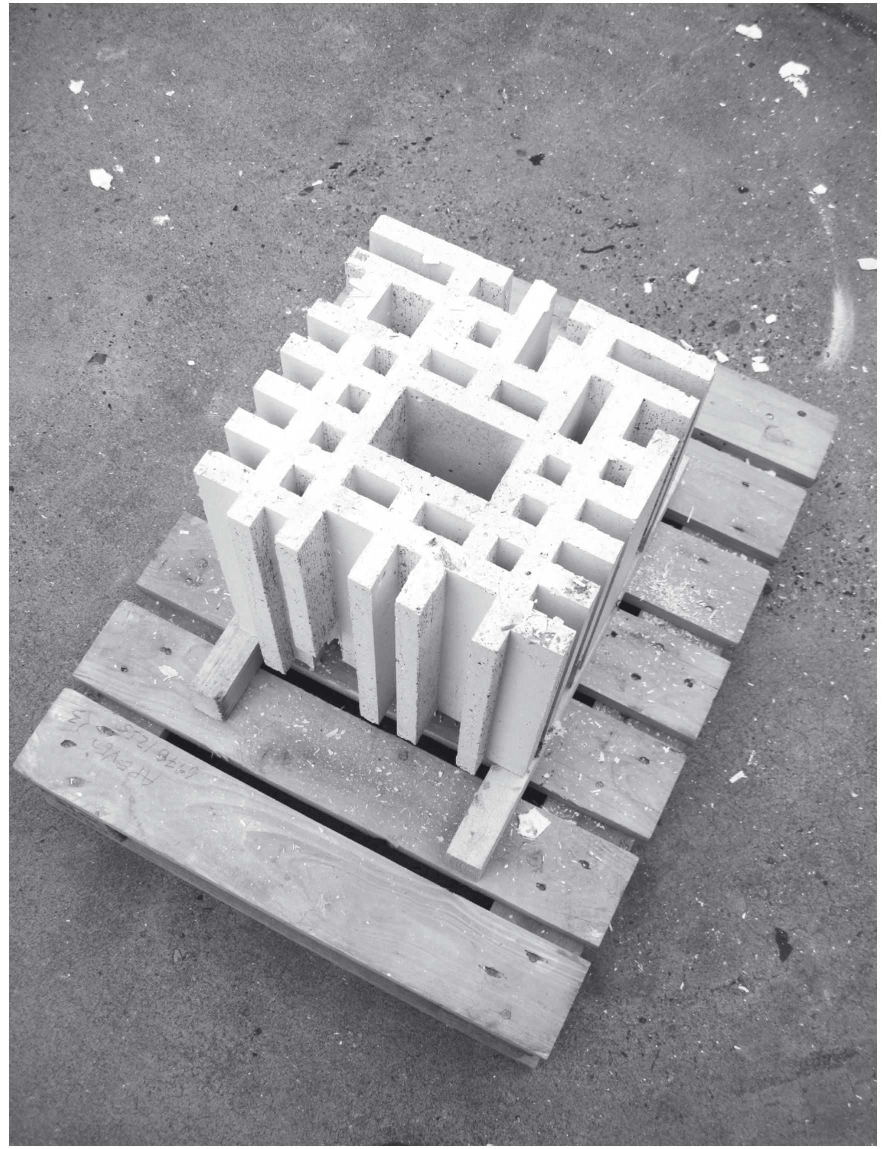
JOINTING LEVEL SURFACES

The level plates made in the horizontal, open, level mould can be assembled through jointing and produce spatial objects.
The jointing can be done before firing, but also after the plates have been produced and glazed. Whether it is done one way or the other has large influence on the final visual expression.
In a conventional jointing of concrete elements, steel armament is likely to take part in order to acquire strong and ductile mechanical bonding between the component elements being assembled. Unfortunately, no strong and ductile armaments that can handle the firings specific ceramic glazed concrete goes through to be glazed have been discovered yet. They either ruin the concrete matrix or they are fired so that they have no strength or ductile effect. That is why it might be advantageous for the large elements in specific ceramic glazed concrete to not be assembled until after the plates have undergone firing and have been glazed. The assembly can be completed by having the plates made from specific ceramic glazed concrete made with specific fittings for this assembly, such as holes for the metal armament to connect the plates mechanically when combined with the joint filler being used. For smaller objects it is possible to accomplish assembly of plates with jointing without using steel armament. This means that it can be done prior to the firings.
The visual result of the jointing will differ according to whether it is done before or after the firings. If it is done prior to the firings, it will be possible to glaze both plates and joints. Then the spatial object will appear as having one continuous glaze across its entire surface.
If the assembly is done after the firings and with steel armament combined with conventional concrete that does not have to be fired, the joints, obviously, will not be glazed. The joint in the concrete, then, will be exposed and will appear visually in the colour of the used concrete, most often grey or white, and a mat and slightly rough texture. The texture, however, might also be smooth if the casting is done on entirely level surfaces, made for example from plastic.
The assembly of specific ceramic glazed concrete plates must therefore be part of the whole visual design of the object. If one needs the level surface on both level sides to be made from specific ceramic glazed concrete, it is desirable for the jointing to be done prior to firing. In this manner, the levels can be placed upright during firing and can therefore be glazed on both sides.

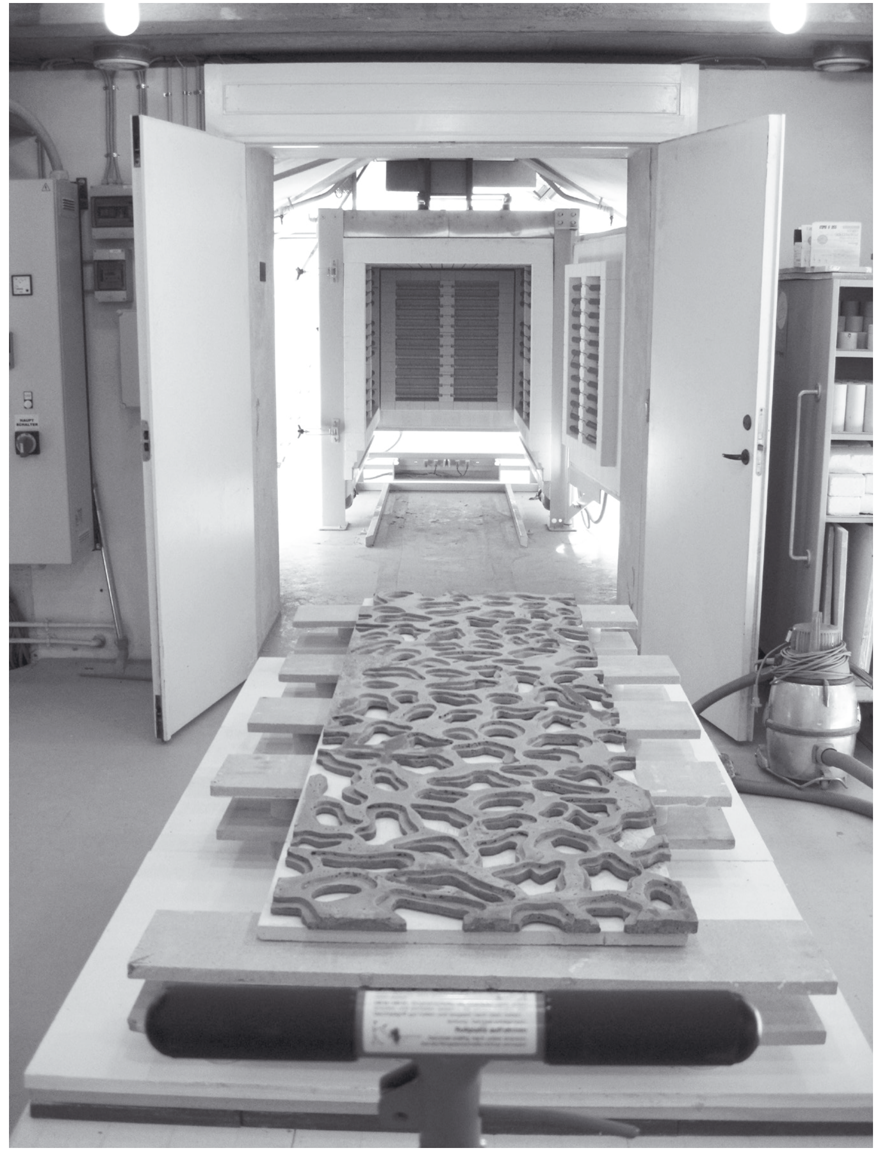
If the jointing happens after the level plates have been glaze fired and there is still need to fire them on both sides, it gets a little more complicated. In these cases, specifically designed systems for glaze firing the plates must be made so that they can stand upright in the kiln and be glazed on both sides. Another solution might be to do two glaze firings and leave the plates lying level on the kiln plates. Then the initial glaze firing must be done at a high temperature followed by another glaze firing that can be done at a lower temperature. This, however, requires three firings all-in-all which is expensive.
In the following I describe jointing prior to firing. It is done with a spatula of joint filler that is able to withstand high temperatures. Links for dealers of such joint filler as well as details on how to mix and fire it are listed in appendix 2.
The joint filler is filled on with wood and steel tools and with the hands (gloved, since concrete can cause extreme eczema). First, it is applied to the one surface area that has been shaped unevenly for this step, and then the other surface, which also has a locally uneven surface, is pressed down upon it and kept in place. It is important that both surfaces are damp, but not wet before the joint filler is applied. The surplus filler is removed. Examples of plates assembled with joint filler prior to firing can be seen on pages, 20-33.
A stronger bond between the two plates is achieved if the jointing has not only been made where the two plates meet, but also around that area. The jointing therefore often causes rounded, soft assembly transitions between the two plates, or assembly corners that break with the mutual angle ratio of the two plates. With such a jointing, it might be difficult to control the precision and achieve sharp, well-defined angled assembly marks.
The jointing must, if it is done with ceramic concrete joint filler equal to what I indicate in appendix 2 harden for 24-48 hours in a damp environment.

PROCESS - FIRING

After the concrete has hardened, it is removed from the mould and possibly cured via grinding,and fired for the first time. This is only the case, however, with specific ceramic glazed concrete. In appendix 2 I have listed those concretes that do not need to be fired. These are intended for the normal temperature zone.
As mentioned in the part on glazes in the chapter “Materials” I fire specific ceramic glazed concrete twice. The first one is the biscuit firing, while the other one is the glaze firing. At the biscuit firing, it is important to note that specific ceramic glazed concrete must go through a relatively slow rise in temperature until it reaches maximum tem-



Opposite page, specific ceramic concrete cast in wooden mould shown on previous pages. The outer sides of the moulds have been removed before firing. On this page, the cast specific ceramic concrete after the biscuit firing with the mould having been burned off, placed on a pallet. Photos: Anja.



perature, which in my case is in the high range. This is necessary because the specific ceramic glazed concrete I use is densely packed. With a slow rise in temperature, 50 C°/H, I ensure that free water bound within the other ingredients can be released without the risk of explosion. In densely packed concrete, the water might have a difficult time being released from the concrete.

If the object made from specific ceramic glazed concrete, on the other hand, has been fired beforehand there generally is no risk of explosion. Here the glaze firing can stick to what is ideal for the glaze. For the glazes I have used, this has been with temperature increases of between 80 C°/H and 100C°/H.

Glazes and how they are applied have been addressed in a previous chapter where I also referred to ceramic literature that most excellently guides and describes how to do this. For refractory materials and the high-temperature materials sold, these products usually provide information on firing curves for the biscuit firing. In appendix 2 I have listed the recommended firing curves for the ceramic concrete recipes I have indicated. But, as mentioned, you should note that this might differ if the product stems from another dealer.

DESIGN - FIRING

The firing process has a lot of influence on the design of specific ceramic glazed concrete. Specific ceramic glazed concrete demands that the objects are level throughout the firings so they do not writhe. Objects having such heavily corbelled surfaces with no support might cause the objects to writhe locally and do not maintain their form stability. In several cases, I have built external support devices for the firing processes or designed the objects to have more stability also during firing.

In the case of the more complex spatial objects, it can be difficult to achieve equal distribution of heat in the kiln. For example, the sides of the object closest to the kiln shell will be impacted by higher temperatures than the sides farther away from the kiln shell. Consequently, temperature differences within the objects might occur during firing.

It is possible to incorporate that the heat must be distributed evenly into the design and placement of objects in relation to each other in kiln can also be done with considerations of this aspect.

I have previously mentioned how when casting the concrete, bleeding and separation of the concrete might occur. This might lead to the objects writhing or locally cracking

This page: Concrete panels in specific ceramic concrete put on a trolley for large-scale kiln, ready for biscuit firing at the Danish State Art Workshops, 2012. Photo: Anja. Opposite page, façade panels being glazed with spray glazing in large-scale glazing booth at Danish State Art Workshops, 2012, photo: Vibeke Trolle

during firing. Therefore it is advisable to make the concrete homogenous to avoid this. During testing, it has also been revealed that too large of a scale variation in the sizes of the particles in the concrete might cause large cracks to form when large-scale objects are developed. This happens, for example, if a binder has a cement grain larger than 100 micrometres so only aggregates of about 1-3 millimetres are part of the mix. Then the paste between the aggregate will crack during firing, risking expansion throughout the glaze firing and ultimately ruining the ceramic object. Therefore it is important to have more continual jumps in grain size of the ingredients. As mentioned earlier, this is also important in relation to the packing density. As can be seen from several of the spatial objects I present in this book, the lowest edge that meets the kiln plate is unglazed. This is to make sure that the object does not melt to the kiln plate.

PROCESS DESIGN - TRANSPORTATION

In this particular case transportation entails moving the objects made from specific ceramic glazed concrete before firing, after biscuit firing, when it is glazed before glaze firing, after it has been glaze fired, and once it is finished and is transported to the context where it is to be used, for example a building site. Here transportation might also entail lifting and mounting it at the site as well as demounting and transporting the object to dispose it.

If these transportation steps are considered early on in the design process it might affect the design and make it easier to control the final product. For example, it can be necessary to incorporate part-elements or shape it so a crane can lift the object. It is also possible that the element is to be glazed locally, but not where it is touched when it is lifted to the kiln. I will not go through the different transportation phases here. In the chapter on art-façades, I will briefly talk about mounting and fitting and how design relates to these aspects. Obviously, also this has an effect on how the object is to be designed and the process with which it is manufactured. It also influences design of moulds and materials.

SELECTING INGREDIENTS

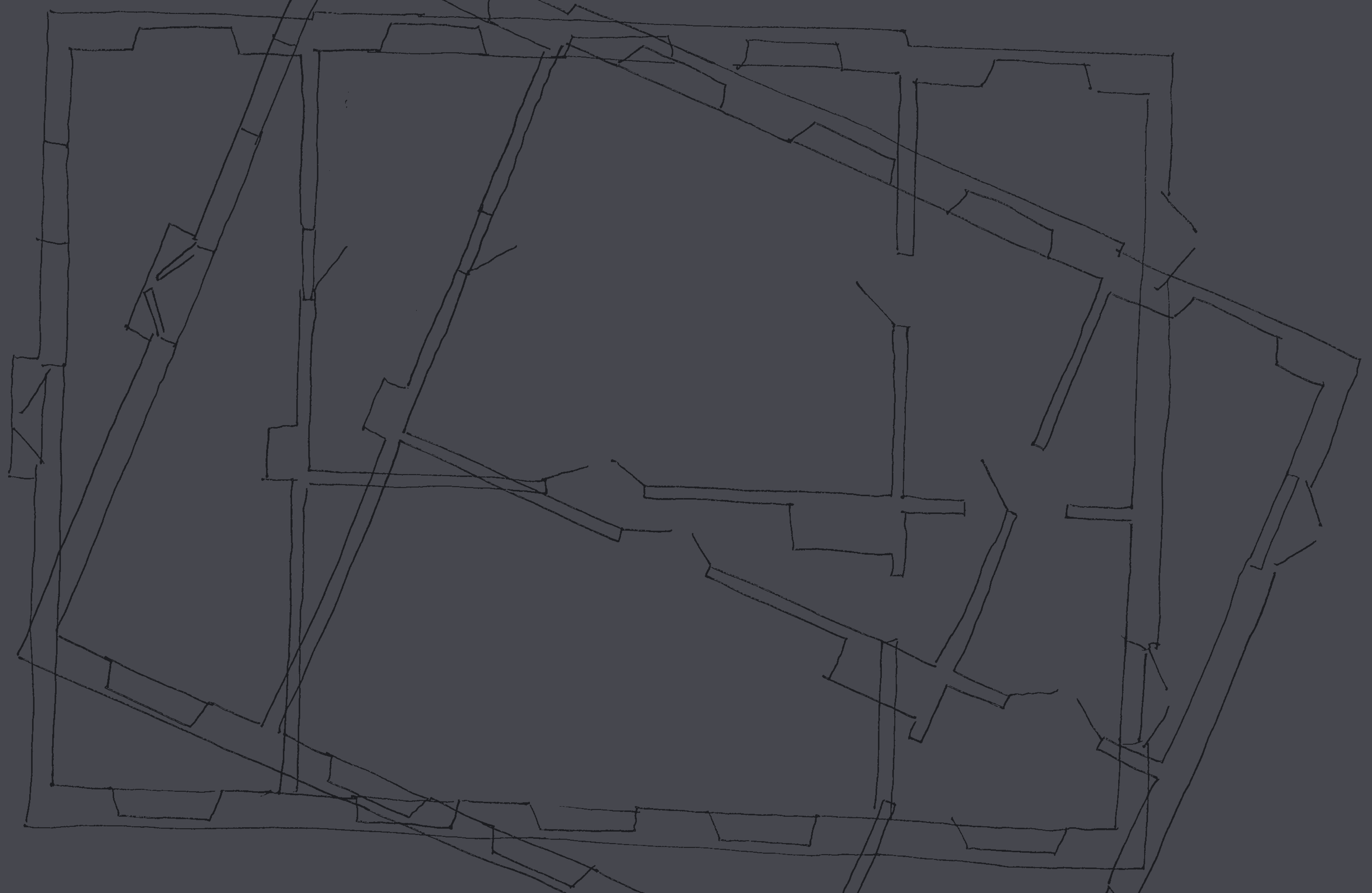
Based on the experiences described above, a guide for designing specific ceramic glazed concrete in relation to the aforementioned steps in the process might look as follows:

Opposite page: washing off glaze locally on façade panels made from specific ceramic glazed concrete before glaze firing. Photo: Vibeke Trolle. Next page: clay workshop at Danish State Art Workshops, where I in 2012 and 2013 developed panels of a size that fit their large electrical kiln with a length of 160 cm. Photo: Anja.

- Dispersal agents. Adding extra super dispersal agents to make the concrete flow better or into narrow channels might be an advantage. It does, however, lengthen the hardening period severely and might destroy the structure if done with large quantities. Adding extra water might be a good idea when dealing with relatively small amounts, but otherwise is not advisable. It can ruin the structure and cause cracks and writhing when fired.
- Aggregate in relation to firing. There should preferably be aggregates of several different size graduations to avoid local crack formation. Similarly, the ingredients selected should all have similar heat expansion degrees.
- Aggregate and thickness. The maximum size of the aggregates must be adjusted to the desired thickness of the object being manufactured.
  If the thickness, for example, is 2 cm without principal armament, the size of aggregate can, for example, be up to 5 millimetres. While if there is principal armament taking up some of the space of the thickness or the thickness is no more than 8-10 millimetres, the aggregates must at most be 3 millimetres. Obviously, if an object has a thickness of more than 2 centimetres, the aggregate cannot exceed 2.2 centimetres because then the concrete mass would not be able to flow into the mould. If ornaments are part of the desired concrete object as reliefs, the size of the aggregate must also be considered in relation to these. In that case, they must be small enough for the concrete mass to flow into the relief patterns of the mould.
- Aggregate and construction scale. In large-scale constructions it is preferable to include several size graduations of rock and sand, as well as using rocks as large as possible. This is because the fracture energy increases, as does its strength if the aggregates are strong. (pressure). Large aggregates might also improve the distribution of vibrations throughout the concrete mass.
- The shape of ingredients. It is also important, however, that the aggregate and the ingredients chosen in relation to the mentioned aspects are shaped so they ensure a good cast. Round particles and aggregates, therefore, are preferable over angular ones because it eases the cast.

Once more, it is important to stress that before the final desired project is cast and designed, doing tests is advisable. With prior testing it is possible to revise the concrete compound and the working conditions if they are not successful. Prior testing can be done on a smaller scale or through tests that only test details of what is being designed.

INSTALLATION ART



INSTALLATION ART

Art articulates new opportunities,
shapes, relations, and differences - of the cultural continuum
that characterizes the entropy state of our time.
(Olsen, 1992)

INSTALLATION ART

When thought moves around artistic material, in terms of concepts it happens in a qualitatively different manner than in philosophical or scientific problems. But art and philosophy do share the fact that they are both determined to be levels of thought that add consistency to infinity, while science on the other hand must abandon considering the infinite. (Madsen, 2002, p. 295)

Installation art is part of the design method Design in a Broad Perspective as a horizontal, practical string. Included here are also crafts. In this chapter, I extend an invitation to attend he workshop and art events and talk of my artistic work with materials. I do this to thereby verbalize the demands and wishes, but perhaps in particular the questions I use to challenge the materials. This narrative deals with three different art installation exhibitions based on specific ceramic glazed concrete. These are:

- *Ceramic Spaces, Forskydninger, 2012, Danmarks Keramikmuseum (Danish Museum of International Ceramic Art), Grimmerhus, Middelfart, (Bache, 2012).* [22]
- *Ceramic on Tour, 2013, Gallery 21, Malmö, (Bache, 2013).* [23]
- *Signs and the Signed, 2013, Marsden Woo Gallery London, (Bache, 2013).* [24]

These are all presented in the book with photographs by photographer Ole Akhøj and from Marsden Woo Gallery photographer Philip Seyer. [25] They should, precisely to underline the site-specific nature of the installation, have been taken at the museum and galleries including spectators, since they were events. But for several reasons that will be explored in this chapter, I have chosen primarily to present them as they are recorded in the photo room and as they are presented in the catalogues and articles that have been published about them. (Bache, 2012, Wirnfeld, 2012).
The primary focus of addressing the installation art in relation to the three exhibitions have primarily been put on the initial one, which took place at the Danish Museum of International Ceramic Art. These were exhibitions created independently of the art-research. They were all site-specific and related to the context, in this case museums and galleries, they took place within. They also related to the audience as an integrated part of the art event.
Installation art consists of an event where site-specific objects interact with the exhibition space and its audience making the experience of it different, transforming it.

Installation art can be defined as an artistic genre of site-specific, three-dimensional works designed to transform the perception of a space. [26]

Installation art, then, is not a singular work but must be considered an event. The installation art I displayed at the three exhibitions were primarily based in one material, specific ceramic glazed concrete. My artistic examination consisted of examining what kind of dialogue of form and expression as well as space I could accomplish with ceramics. This is an approach that is based on the materials and is reminiscent more of the crafts artist's approach than that of the installation artist. The craft artist, in this case the ceramist, often starts from one material and how to display it, the clay. While the installation artist,

Previous pages: Sections of concrete bridge near Lundtofte, Denmark. Photo: Anja. This and opposite page, installation "Round juxtaposition with direction" ("Rund sammenstilling med retningsangivelse") from the exhibition at the Danish Museum of International Ceramic Art, 2012. All in all, ten circular elements were placed on the floor. Diameter 60 cm. White, glossy glaze with markings of steel fibres and mixed, mat glaze mix. Specific ceramic glazed concrete. Photos: Ole Akhøj.

referencing the traditions of fine arts, rarely devotes herself to one material, its perfections, and production. Installation art is, as it is presented here, a conflation of installation art referencing the traditions of fine arts and the crafts represented in ceramic.
This is also the reason I have allowed myself to join installation art with crafts in the design method Design in a Broad Perspective. These are usually two very different disciplines, but have been linked here because that is how I have utilized them in the design method and when developing specific ceramic glazed concrete.
It is also because the installation art I displayed at the three exhibitions were meant to be explorations of the relationship between ceramic as craft and ceramic as installation art based on the traditions of fine arts. With the ceramic installation art I have tried to comment on ceramic based in crafts. Ceramic art within the crafts tradition, especially conceptual art, is likely to refer to its own practice, expression, and usage or maintains a classic conception of art as being a singular work. This means that the ceramic sculpture in any urban space is displayed as a work in the classic sense, with no reference to the space that surrounds it. It can also be observed in ceramic ornamentation when it is architecturally applied as decoration on the building that relates neither to the overall concept, tectonics, or functions of the building nor to the urban space that surrounds it. This is a shame because that same ceramic art could acquire much greater meaning if it entered into a dialogue with what surrounds it. It is also a shame because the ceramists holds the key to greatly enriching our surroundings physically and materially with a quality that otherwise is severely lacking. [27] Ceramists has incredibly deep and manifold knowledge about the materials and the way they are produced. I am not a ceramist, but I have much respect for the discipline and those who do it. For that reason and the love I hold for the discipline, I allow myself to, somewhat provokingly, push and animate ceramists to gain a much broader perspective on ceramics.
The installation art I have displayed made from specific ceramic glazed concrete was meant to comment on ceramic as craft based in the traditions of fine arts. It pointed towards architecture and responded to the places in which the ceramic was to perform. It invited the audience to participate as part thereof, as an art event.
The installation art was directed towards a museum, the main building of the Danish Museum of International Ceramic Art and three galleries, Gallery 21, Malmö, Sweden, Marsden Woo Gallery, London, UK, and finally Gallery Oxholm in Copenhagen. These are all places that let me display installation art as a conflation of art and crafts. I am very grateful to them for this.
Museum inspector at the Danish Museum of International Ceramic Art, Pia Wirnfeld, even wrote a great article on the exhibition I did there, which was published in Ceramic Art And Perception. (Wirnfeld, 2012).
Despite this, I believe that my choice to display my installation art made from specific ceramic glazed concrete at the Danish Museum of International Ceramic Art was not very wise. This is because my exploration within installation art made from specific ceramic glazed concrete primarily was planned as an encounter between it and conventional concrete and concrete buildings. The main building at the Danish Museum of International Ceramic Art is a red-plastered brick villa with ornamented end walls and an interior richly influenced by historicism's references to the Dutch renascence. This is a ceramic museum. When I thought it would be interesting to exhibit there it was because the Danish Museum of International Ceramic Art precisely represented the traditional opinion of ceramic referencing crafts that I wanted to comment upon. I will later return to how this turned out to be a difficult task as I, while setting up the exhibition, was forbidden to mount anything on the walls. [28]

This, opposite and next two pages installation “Round juxtaposition with direction” from the exhibition at the Danish Museum of International Ceramic Art, 2012. All in all, ten circular elements were placed on the floor. Diameter 60 cm. White, glossy glaze with markings of steel fibres and mixed, mat glaze. Specific ceramic glazed concrete. Photos: Ole Akhøj.

When I did the exhibition for Gallery 21, Malmö, it was directed towards rooms with concrete floors and white walls and a raw floor. This was the gallery space Gallery 21 was meant to move into shortly before the opening of the exhibition. But the move never happened, which meant that the installation art instead encountered an intensely yellow wooden floor. The installation art as an encounter between the specific ceramic glazed concrete and conventional concrete had yet to materialize. Unfortunately, the expression of the exhibition suffered from maladjustment.
Not until the exhibition at Marsden Woo Gallery, London, did it succeed. This is a gallery open to experimental ceramic, they allow for the exhibition spaces to be tampered with and the gallery is made up of simple, well-defined rooms with alkyd grey, painted concrete floors.
The exhibition at Gallery Oxholm, Copenhagen, has similar boundary conditions as the one at Marsden Woo Gallery. It is a gallery that usually exhibits fine art and is also open to spatial interference in the gallery. The exhibition, however, is taking place as this book is undergoing its final edit. Therefore I will not talk more of it, although it is visually represented in the book with photos.
Installation art as art creation and art event challenges materials with a complex questioning taking its starting point in site-specificity, working with the materials, including manufacturing the moulds, transportation, mounting, and several other aspects. In installation art, the materials encounter the real without the bind of design and architecture that also have to fulfil a function.
Installation art is part of the design method Design in a Broad Perspective for designing materials because the methods the artist uses, the focus and content the art revolves around, and the results achieved are different from the both the research in the design method, but from the other practical disciplines as well. The artist questions the materials in practice with her fingers in the materials and not, like the art-research, through a theoretical analysis done from afar. The artist demands that the materials can behave like structures and constructions, but does not, like the materials researcher, examine the mechanical, static, and chemical qualities of the materials. Furthermore, the artist lets herself flow into the non-systematic examination types that often are much different from the systematics that generally define research and science.

In the existing urban spaces and building plans I find spaces, lines, sequences, colours and surfaces that I attack. I turn them upside down, insert levels, turn them inside out and pull details or let them become wholes or the other way around. I let the ceramically glazed concrete enter into a dialogue with other building materials' materiality, gaps and transitions and engage the gentle meetings and tensions as shouting, whispering, roaring or dominating voice. I develop structures, scale them up, out of and as repetitions with its own rhythm, steadiness or chaos. And then, after having been inside the material, being wedged in the layered outer wall, having kicked the function plan and slept in the urban space, the large scale relational sculptures in public space are crystallized and relates to and makes its mark in a spatial context. The relational sculptures are expected to point inward, toward themselves in the abstract conceptual universe, but to also point outward in the search of a place to belong. The function is not habitation, but to acknowledge spatial conditions. Neither is it to refer to the architecture, but to explore what architecture as the foundation of sculpture design can teach art and how this on the other hand can move architecture and urban space. (Bache, 2010). [29]

The product of the art is the installation art while the product of research is dissertations or articles, while it might, for the materials researcher, become materials with new qualities as well.
As opposed to both design and architecture, art is a free art form. It is not bound by function. The task of art is to transform experiences, demonstrate other perspectives and/or move us sensuously, emotionally, and bodily. It is not to manufacture artefacts or usable buildings.
As mentioned earlier, I have practiced the design method as an individual. This means that as an artist, I have created the art meant for the art-researcher to observe and analyse in relation to her focus. Art in the design method is meant to be free of research. That is the case because it does not play the role of being cases for the experimental exploration of art-research, subject to the methodology and primary focus of this discipline. Art must perform under its own set of conditions and with its own methodology and thus display of the art must be free of the systems and thinking that exist in research and science and, for that matter, the other strings of the design method. This is where it can provide new approaches to the materials.
Once more, I must mention that in practice I have been unable to maintain such stringent a division between, for example, art and research. Invariably, I will carry the knowledge I acquire from the different approaches to the materials with me throughout the strings of the design method. As such, art will also be affected by and be based on the knowledge of, as well as the questions to, specific ceramic glazed concrete I have acquired and asked in, for example, materials research. To art, these blurred boundaries might be less of a problem as long as it is free from the framework and methodology of art research. Oppositely, it might be a problem for art-research that strives for objectivity, scientific nature, and a distance to what is being observed. I will not talk more about that here, but will do so in the chapter on art-research.
Practice of art is an intellectual and bodily, physical activity. With the intellect, idea complexes are set up and reflected upon during the process, while the body is used as a tool for arranging the materials, but also for dialoguing with them. It is with the body and its close relation to the materials as I create art, I sense whether what is being brought

forth touches me sensuously. It is from this quiet, wordless dialogue that my answers of direction and method for working with materials emerge.

With art I step into a sphere of chaos, as a springboard to the "other" that exists outside of logic and rationale. As a bodily feeling of non-verbalized, to some degree known knowledge, the work with the material is settled as fossilized sensing tracks. These are paths, road, and wide tree-lined boulevards where I feel the world and feel myself being in the world. Knowledge that I am not yet able to put into writing. (Bache, 2012). [30]

To many that do not work in the art field, it will often seem strange to let the body work as tool, as a kind of mouthpiece or guide to what you are doing. But if it is compared to the experience of the music of the violinist, it might make more sense. If the violinist plays excruciatingly false and fills the room with dissonance, it hurts the body. It is not the ears that hurt, but the dissonance spreads and causes a physical, bodily, emotional reaction. If the violinist, finally learning to locate the right tones, fills the room with pleasantly sounding music we feel as if it touches us directly. We physically experience our inner mood being elevated. It is as though the music forms a direct sounding board for our feelings. In Design in a Broad Perspective, I create intentional art with an implicit desire to create this harmonious sounding board, to cause direct effect to both feeling and intellect. I do this by striving for the aesthetical in art, not as its primary goal but as part of how it is communicated.
Starting with artistic intention, I create objects that are based in the material, in its materiality, colour, texture, and shape, but also registration of the context/art scene and considerations of the spectator. To me, it is in the meeting and spaces-in-between that art as an event becomes relevant. I consider art as what enters into a dialogue and relation with the world that surrounds it. To me, what is of primary importance to art is that it relates to and is intentional in relation to its content and its devices. The installation art I have displayed, thusly, has used objects to accentuate and emphasize certain areas and make them cooperate to add new layers of meaning and experiences of those. At the Danish Museum of International Ceramic Art I was disturbed by the voluptuous figurations and stucco patterns applied to walls and ceilings according to the style in which the museum

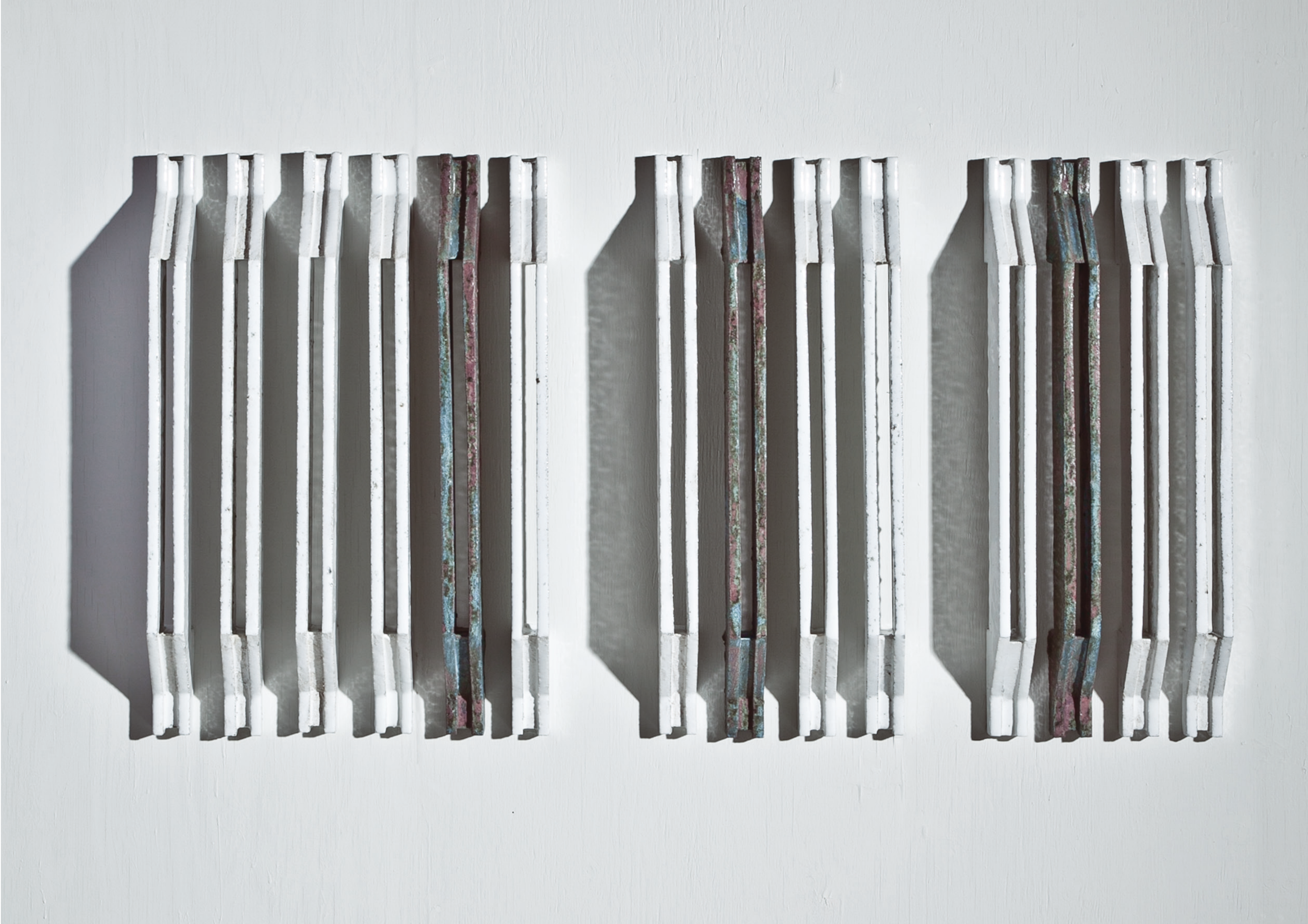
This page and the two following. Wall object with the title "Mounted tact" (Ophængt takt) from the exhibition at the Danish Museum of International Ceramic Art, "Displacements" (Forskydning), 2012, made up of fourteen bars. Each bar measures: L: 85 cm, W: 7 cm, H: 8 cm. White, glossy glaze as well as mixed, mat. Specific ceramic glazed concrete. Photos: Ole Akhøj.

was built. At the same time, I was preoccupied with the dynamic play of light and shadow that flowed through the large window sections and could be seen in, among other things, the radiator ribs as well as in the round, quiet silence of their thermostats. I experienced them as geometrically abstract, simple, and yet taut in shape, and I wanted to make them speak. Therefore, I created objects from specific ceramic glazed concrete that divided the light into vertical measured stripes of light and shadow. By doing this, I struck a note with the natural light and a geometrical harmony with the ornamental narrative of the radiators. As such, they, the objects, were striking up a minuet. My intention was for the spectator to experience the objects made from specific ceramic glazed concrete, here especially the way the light was divided among them, and see the similar play of light in the radiators and experience them as an interaction. In this way, the entire exhibition space containing the objects was to be activated as part of the art event. Once the visitors to the museum entered the room, they would change the play of light. In some places the light was broken up, so the rhythm that had before been measured and functioned as a dialogue between objects and the radiators, now was being locally changed into new, different rhythms. The visitor, the objects, the light, and the exhibition space were all meant to join together in making the art an event.

Generally, my reason for making art is that it is a forum where I can artistically materialize and test my ideas. But it is also because in art I can use the visual, the perceptual, and the broadly sensuous to acquire other and often surprising experiences and awareness, I am not able to acquire through linear, logical, and rational thinking. Art and working with the materials, working through process as well as the experience of the art event both expand and narrow my sense of the world, and acts like a tool for dialogue with it, and the materials.

In art, I take my starting point in the avant-garde art of the past that removed the plinth from the sculpture, the minimalistic art that removed the figuration and land art that operated on the large scale. I include conceptual art that provided the idea-based art and the primary research on the premises of art itself and connects it to art as “an event”. It is beyond the scope of this book to define art, a mission that seems impossible anyways as the definition of art changes constantly and depends on who provides it. The important thing, it seems to me, is that the artist always questions the existence, character and efforts of art, but also relates to the surrounding world. This is a basic condition for art, which only the intentional artist is able to fulfil.

This and opposite page: Wall objects with the title “Mounted tact” from the exhibition at the Danish Museum of International Ceramic Art, Forskydning (“Displacements”), 2012, made up of fourteen bars. Each bar measures: L: 85 cm, W: 7 cm, H: 8 cm. White, glossy glaze as well as mixed, mat. Specific ceramic glazed concrete. Photos: Ole Akhøj.



Are the ceramic vase and artist Marcel Duchamp's readymade urinal from 1921 made from porcelain both ceramic art? The ceramic pot is usually described as craft. But when artist Peter Brandes displays three pieces of pots of about six metres and erects them in Roskilde, Denmark, the pots referencing the sculptural tradition, it might even be said that they nearly due to their scale can be seen as buildings and containers. At the same time, the pots are placed in a square, on a plinth that, unlike the square, remains horizontal and breaks up the measured ornamentation and spread of the tiling as if it was growing out of the ground. The pots on plinths designate a kind of local infrastructure to those that pass by them. As spectators we can walk up to them and touch them, but we can also move away from them and around them. Furthermore, we can, if we are tired, lean on them and their plinth. Whether it is art or something completely else holds no importance. I, personally, am not a great fan of them if I must evaluate them in relation to my taste in and attitude towards art. On the other hand, I am fascinated by their simultaneously strange expression, scale, and fullness in the urban space, as well as the way they move beyond the boundaries of craft. The plinth whereupon the pots have been placed, in terms of its expression falls somewhere between a new interpretation of the pedestal and a locally raised surface. Those who pass by the pots notice them, change their patterns of movement and many indicate fascination. The pots, in this manner, with the plinth played a part in producing new layers of meaning and helped experiences of the urban space to emerge.

Duchamps' readymade from the 1920s, the "Urinal" has been widely praised and is famous art that has had a large influence on today's art. Duchamp's method was removing the object from its original context being a pee bowl and moving it into the art institution, the museum, as art. In that way, he problematized art and its boundaries and made the art spectators consider a connection that had not previously been questioned. With the readymades he exhibited Duchamp contemplated a wholly new approach of how to consider art and the art museum. Art, in this manner, is about messages and attitudes.

In many cases, it is not about creating beautiful things, but instead about moving us as human beings, so that we experience the world that surrounds us, intellectually, but also spiritually, sensuously, emotionally, and bodily.

But what about the porcelain toilet that has still not been removed from the brown, cardboard transport packaging that partly envelops it, which is placed in the lobby of the educational institution where I work. This is a readymade as well and demanded attention. Furthermore, it had a relevant aesthetically expressive effect in its interaction with the space. But was it art? It was not meant to; there was merely a need in the building to replace a toilet on the first floor.

But precisely because art provides us with new ways of viewing our daily lives even this randomly placed object can be seen as possessing artistic value. This is what art is able to do; it can enter our daily lives and provide us with new perspectives on it.

It is not possible to provide an answer to whether the wrapped toilet in the lobby is art or what art is, but it opens up a discussion and a conceptual and visual isolation of the area that should continually follow the discipline in its development and relation to the surrounding world.

I work with site-specific art. This is an art form that not merely works inwards, but also takes hold of the lines, sequences, narratives, meetings and rhythms within the spaces. These are the ones that strike the chord that makes everything make a sound, so that we as human beings might relate to them.

I saw how a snowball with a diameter of one meter placed across my running path demanded that I ran around it as it simultaneously made me think. Was it stabile, would it keep on rolling, how had it been produced? Its shape was markedly different from the surrounding snow that had fallen during the night. It had been borne from human action and those people must have been up very early because I ran at 7 in the morning and there was no snow the night before. A static snowball with its shape, tracks in the snow and location, becomes dynamic in the shape of the thought process it ignites. It becomes relevant; at least as part of the rest of the run. In a similar way, art can become relevant by approaching a place, but also as an experience that rouses our curiosity or reverberates throughout our experience package.

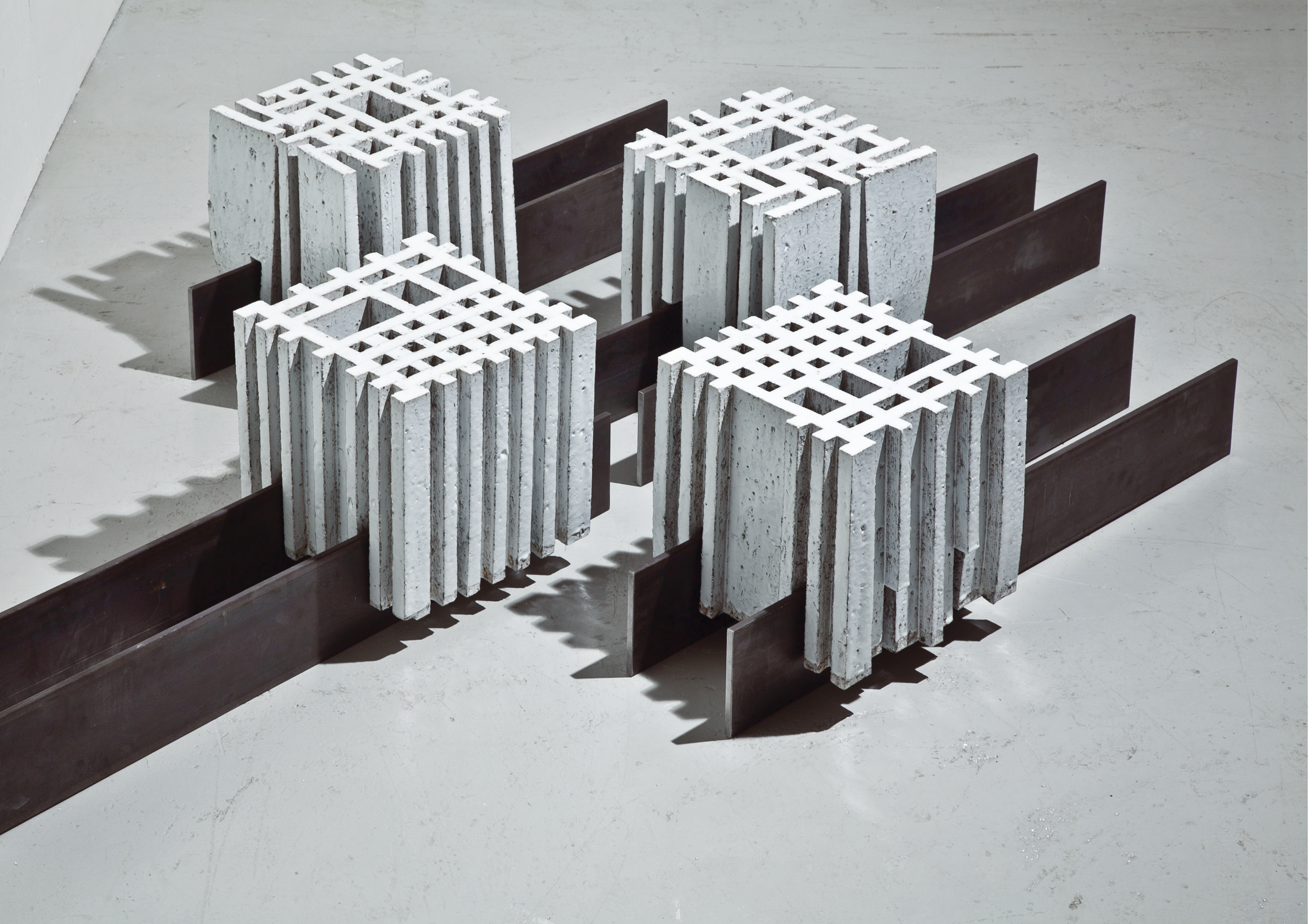
In Gallery 21, Malmö, at the exhibition "Ceramic on Tour", I strayed from my regular approach to art. Normally I work with abstract objects. In Malmö, I chose to bring together abstract objects with abstractions over recognisable figurations. I shipped the ceramic across Øresund and the bridge that connects Denmark and Sweden, Øresundbroen, in soapbox cars made from high-coloured wood. At the exhibition at Gallery 21 in Malmö they stopped as if they had arrived at a picnic area, tent camp, or garage. One of the soapbox cars had lost a wheel - this was an element of the installation art.

What does ceramic have to do with soapbox cars and vice versa, and why was some of the ceramic made from specific ceramic glazed concrete and other from red casting loam? Of course, there are many different reasons for this, but one of them was that with the exhibition, I tried to manufacture spaces for remembering. This was memory of the way we played when we were children, when our hands were buried deep in the clay, making crocodiles, hares, or a small man. This was also the memory that transported our minds back to when we as children had built one soapbox car after another, one more raggedy than the next, and with loud sounds and butterflies in our tummy raced down

Opposite page: Wall objects with the title "Mounted tact" from the exhibition at the Danish Museum of International Ceramic Art, Forskydning ("Displacements"), 2012, made up of fourteen bars. Each bar measures: L: 85 cm, W: 7 cm, H: 8 cm. White, glossy glaze as well as mixed, mat. Specific ceramic glazed concrete. Photos: Ole Akhøj.

the hills.
At Gallery 21, Malmö, the intent was to invite the spectator inside the room of play as memory with wordplays in the catalogue, the colours of the soapbox cars, as well as the ceramic presented in the gallery. The ceramic, soapbox cars, their structure and relative placement were arranged in such a manner that the gallery space could play a role in the event. The memory was meant to initiate a present, but hopefully also be a different perspective to the future. At my opening at Gallery 21, Malmö, the first visitor was an elderly lady who had expected to experience traditional ceramic. As soon as she walked through the door, she turned back around with a near-horrified look on her face. This was, she told me in plain Swedish, certainly no way to treat ceramic. Luckily others were more open to what was happening here and dared enter the gallery.
This is the lot of the artist. The exhibition is intentional with a desire to move the spectator. But the artist rarely knows if she succeeds. In Malmö, I moved the first spectator. Even to such a degree that she did not want to see the rest of the exhibition. That wasn't quite the intention.
The art crawled down off its pedestal in the early 20th century. Pedestals are still, however, used in many artistic contexts both in traditional art but also particularly in crafts. Pedestals should, exactly because they reference a classic art tradition and art as singular work, which points about 100 years back into the art history referencing art salons, only be invited inside if they are part of the whole narrative. That means that not only must the object be shaped, but the pedestal it stands on must as well. In these cases, the pedestal must relate in terms of shape, material, space and so on, to the encounter with the object and the encounter with the floor as well as what surrounds it. In installation art, it is not the art object as the singular, class work that is being dealt with, but rather the event with its complexity of component elements.
The objects of installation art might with benefit meet the gallery's floor, corners, ceiling, doors, windows, radiators, ducts, outlets and relate to them. I would like for the sculptures in urban spaces to enter into a dialogue with the floor of the urban space, its coverings, the colours and shadow play of the trees, the cars driving by, the busses, and the people perched on the benches. Similarly, I'd like to see ceramic art act as an integrated part of buildings, speaking to the building's tectonic, construction system, history, place-

The two pages before and this page: Installation ceramics from the exhibition at Danish Museum of International Ceramic Art, 2012 with the title "Mounted forward and to the side" ("Monteret fremad og til siden"). Six "boxes" made from specific ceramic glazed concrete. White, glossy glaze and mat green-grey with markings of the component parts of the concrete, mounted on steel bars. Each box arrangement measure H: 40-50 cm, L: 100 cm, W: 35 cm. Photos: Ole Akhøj.



ment in relation to other buildings, and infrastructure along with a host of other aspects. Art should belong to help make its mark and acquire meaning.
As I wrote this book, my protected artists' house in Rådvad from 1780 underwent external renovation. I live in the middle of a park-like forest, Dyrehaven, which King Christian V of Denmark (1646-1699) established as his par force hunting grounds. This was also where royal physician Johann Friederich Struensee (1737-1772) and his lover, Queen Caroline Mathilde (1751-1775) rode about as lovers. There is a lake here and a small river that in its path from Furesøen out to Øresund runs under the Mathilde Bridge (Mathilde-broen) named for the queen. Here, nature sets the stage for the event with the change of the seasons. During winter, the dark, weathered branches of the trees surround us as an enclosure, and the low angle of the sun sends downs of weak, grey, light tones. The snow lays down a silent blanket and we encounter only the whisper of the cold. While spring greets us with light green as sounds of the birds and the frogs mix with the swishy sounds of leaves in the wind. The smells sneak up on us with the news of what is coming, spring and summer. This year, I missed out on spring. The renovation of my house consisted of a façade restoration where the plaster of the walls was removed. Scaffolding, encircling white plastic tarps with blue plastic covering directly attached the windows, hermetically sealed off the building. From inside my house there was no way to look outside, the windows could not be opened, and the little amount of light that entered the room projected blue light onto the walls, floors, and ceiling. I found myself in a "blue water-filled aquarium" and could, as when I dive with no oxygen bottle for a longer period of time, not breathe. It could have been an artistic enterprise, an installation where the spectator as a visitor in my home was to experience difficulty breathing and perhaps subsequently be more aware of his or her existence outside in the surrounding nature.
My art, which at the exhibitions have primarily been displayed with specific ceramic glazed concrete, has not been about creating claustrophobic, low-oxygen rooms, but have been characterized by an underlying intention to create ceramic spaces with an aesthetic effect to make the event be experienced sensuously, bodily, and emotionally in a positive manner. The aesthetic, as mentioned earlier, is not the ends of my art, but rather the means to make art be experienced more directly and immediately like the harmonious sounds of the violin player from before. When something must be communicated, the way it is communicated is of the utmost importance to the recipient's understanding.

Opposite site: Installation ceramics from the exhibition at Danish Museum of International Ceramic Art, 2012 with the title "Mounted forward and to the side" ("Monteret fremad og til siden"). Four "boxes" made from specific ceramic glazed concrete. White, glossy glaze with markings of the component parts of the concrete, mounted on steel bars. Each box arrangement measure H: 40-40 cm, L: 100 cm, W: 35 cm. Photos: Ole Akhøj.

If the message, for example, is delivered with an angry shout often only the anger is registered, while the message itself is overlooked. The aesthetic is partly a device for observation in my work with art, partly a way to communicate it. Hopefully, it is with the help of the aesthetic we become aware of ourselves as sensing, bodily, sensitive beings and act accordingly.
In the following I will move closer to the creation of art, installation art as event, as well as finish up the chapter with a short summary of how art can contribute to designing materials.

ART - PROCESS

An artist`s process depends on the artist, but also on the kind of art she does.
The process I have followed leading up to the cited installation art exhibits are relatively extensive and include many process stages.
The process I describe has been created from installation art based on specific ceramic glazed concrete. It begins with an initial concept development and the writing of an application to exhibit at an exhibition space. After this comes registration of the exhibition space and the surroundings as well as gathering data about its history, infrastructures leading to and away from it, as well as many other kinds of data. Based on this, I make information posters with drawings, photos, text, and whatever else is relevant as well as a scale exhibition model. Then I sketch, in two steps, with hand sketching and sketching in physical models. In these sketching steps, the design of the objects and their expressions relate to a complex set of questions. After this, I draw what I have thought up in 2D AutoCAD computer sketches, including intersection levels, for the cutting of wood for the moulds. After this I develop the objects. I test them in a photo room I build. There I take photos of the setups to present to the photographer. Photographer Ole Akhøj then takes pictures of my works. With them I make catalogues, press releases, invitations, and presentations for the museum's website. After this, I produce transportation cases, pack up the exhibition, and have it transported to the exhibition space. Here, I unpack it and set up the exhibition. The exhibition takes place. At Gallery 21, Malmö, it lasted only three weeks, but it lasted five weeks at Marsden Woo Gallery, four weeks at Gallery Oxholm and fully three months at the Danish International Museum of Ceramic Art. Once the exhibition is over, I pack up the exhibition in transportation cases and ship it back.
In the following, I will talk only about a few of these process steps. These will be the art process, sketching phases, art events, and finally in this chapter, I briefly discuss what I believe installation art, including crafts, can contribute to the design method Design in a Broad Perspective. The narrative works through excerpts from the art creation and the art events.

To be able to exhibit, artists must very often apply to the exhibition spaces to do so. This means that a year, often up to two years prior to the exhibition actually taking place, the artist must have an idea of what she wants to exhibit and be able to explain why. About a year before the exhibition took place, and I had to write up the application to the Danish Museum of International Ceramic Art and apply for financial support from the Danish Government Art Fund, I developed a general concept/idea, "Displacements, Ceramic Spaces". In both concept and applications I planned it to be a collaborative project. At that time, it was my intention that the installation art made from specific ceramic glazed concrete I would display should, besides the space and the guests at the museum, also enter into a dialogue with, yes practically clash with, ceramist Lene Roehrig Kjær's delicate finishings on red casting loam in a collaborative exhibition. [31]

A displacement is processual and involves changing existing conditions, such as physical, mental, or social conditions and cause new ones to emerge. Displacements can result in physical relocation, mental openings, or other approaches to problem solving or for example new relations, and as such have positive consequences. Displacements, however, may also result in clashes, conflicts, distancing, and as such be negative and in the worst case scenario cause massive catastrophes. Generally, displacements, whether they are positive or negative, might result in new situations that concern and move us as human beings. That is the part of the term we want to examine. We want to examine what the consequences are of displacing Grimmershus' ground plan as well the displacements of existing building materials displayed as ceramic spatial installation. We call it an examination of ceramic spaces. We consider the term displacement to entail a physical act that creates new tensions, energies, relations, spatialities, and approaches to experiencing spaces, including ceramic spaces. We displace the ground plan to achieve what we call "action lines" and we also displace the areas meaning and being for the materials from being conventional building materials to being ceramic installation objects.

- *Displacement of Grimmerhus' ground plan.*
  We displace the ground plan, both linearly and with a throwing. That means that lines will emerge both in the exhibition spaces and in the urban space out side. We describe these as "action lines." They demark the areas where, with our ceramic objects we attempt to find the visual tension fields, clashes, libera tions, and so on, that occur due to the displacement.
- *Displacement of materiality. We work with materials that are conventionally part of a building, such as bearing structures, bricks, and concrete. We will displace this through an artistic process so they appear as ceramic objects in fired and possibly glazed red clay as well as ceramic glazed concrete. We work with objects where clay and concrete clash and are as such treated as ceramics, but also with separate objects and the inclusion of other materials. These are installations that relate to the existing spatiality, action lines, tiles on the inside and outside, panels, doorframe rhythms, sequences, and movements. The goal is to explore the dialogue, relation, and the displacement's interaction with spatiality and the sensation of it.* [32]

However, as I was not given access to observe Lene's exhibitied ceramic works until a few days before it opened and we had chosen to display our works separately, I will not include her works in the narrative. [33] Specific ceramic glazed concrete at the Danish Museum of International Ceramic Art never got to clash with the red casting loam.
I was given the opportunity to test this at the subsequent exhibition at Gallery 21, Malmö, Sweden. Here I over-fired red casting loam onto the specific ceramic glazed concrete

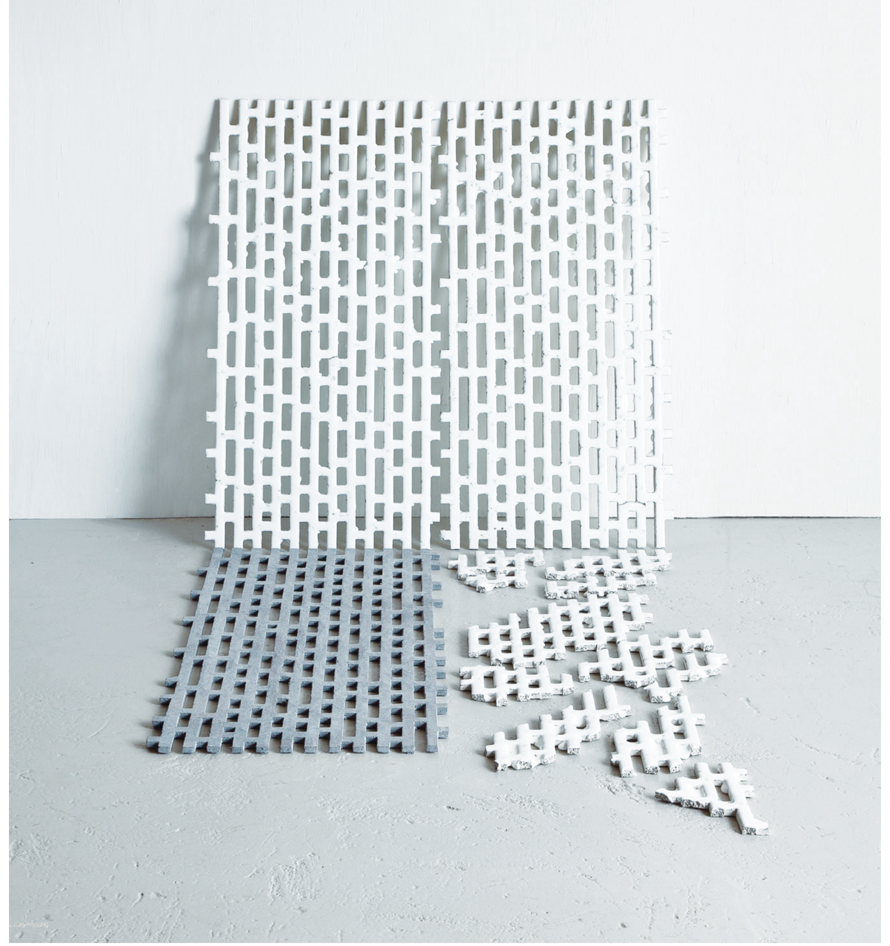
On this and the opposite page: Installation ceramics from the exhibition at Danish Museum of International Ceramic Art, 2012 with the title "Mounted forward and to the side". Six "boxes" made from specific ceramic glazed concrete. White, glossy glaze mounted on steel bars. Each box arrangement measure H: 40-50 cm, L: 100 cm, W: 35 cm. Photos: Ole Akhøj.

so the red casting loam became dark brown, almost black, and flooded the concrete.
The concept development for the three exhibitions has consisted of two steps. The first step was what I described above, developing a general concept to apply to the exhibitions. Step two in the concept development consists of concretizing the concept further in relation to the space and context in which the exhibition will take place. This requires registration and gathering data. At the Danish Museum of International Ceramic Art, visiting the place made up the registration. Here I took pictures, measured among other things doors, rooms, and the wooden planks of the floors. I sketched the patterns of the wall panels and measured their sizes. I attempted to get an impression of the place and its surroundings. The museum consists of the main building where the exhibition was to take place, and has an attached wing. In the future, an addition will be built done with the simplistic marks of the architectural firm Arkitekttegnestuen Kjær and Richter. In the following, I will talk only about the main building. It was designed in 1857 by Johan Daniel Herholdt (1818-1902). It is marked by the influences of historicism characterized by borrowed expressions of style from other countries and eras. As if applied, dark brown wood carvings squeeze out from the blue-painted entrance and mix with the exhibition walls painted grey, beige, brown, and red, clad in glossy white-painted relief panels made fromwood, moving quietly up the walls, up to a whole metre in height. The semi-circled niches painted into the plan, break up the straight levels as lavish rosettes thrust themselves downward from the ceilings. The worn wooden floors contest over direction and patterns as the cross field of parallel lines and herringbones. It is a building that loudly and deafeningly signals its need for ornament. The ground plan of the building is generally rectangular broken up by a semi-circled room. Between two rooms, a wall section is characterized by windows that have been blinded and painted white as the narrative of a past with no view. A white, enclosed fireplace with black, cast iron doors and plaster angles adorns another wall. There are white-painted panelled doors with ornamental repetition and radiators distributed as furniture. The main building of the Danish Museum of International Ceramic Art is a monumental and centrally located brick villa plastered red on the outside with white ornamentation and a string of loose rocks encircling it. It is surrounded by a garden at the edge of a beech forest, yet has a view of Lillebælt. The main building of the Danish Museum of International Ceramic Art could easily be an exhibition in and of itself with the different style elements historicism chose to bring together there.
I am inspired by the simple stringency of for example artists Piet Mondrian's paintings, Kazimir Malevich's Architectons, architect Gerrit Rietveld's chair as well as Schroederhouse, Mies Van der Rohe's Lever House, and Frank Lloyd Wright's house Falling Water. They all have structure in and of their work that simultaneously signals order, but at the same time a vitality and openness that bursts open the boundaries of that order.
The main building of the Danish Museum of International Ceramic Art offered the opposite of that and I found very little resonance in the intrusive style of historicism.
The summer day I visited the museum, the sun was shining and the light was streaming through the many windows and covered the exhibition rooms as a blanket. With a warm, light-yellow touch it revealed floors, walls, ceilings, but also furniture with a rhythmic light and shadow play. The radiators that ran like continual streamers below the window walls of the winter garden stepped out of their anonymity into the light. With vertical black and white lines, as if they were the keys of a piano, the ribs of the radiators offered up themselves. The circular shape of the thermostats became the budding notes. In this play, also the lines between the planks of the floor, the rectangular ground plan of the building, and the windows' right-angled ornamentation of the bars working as crossformations, all began to assert themselves as sounds in the rooms. It was in the geometrical shapes I located in the furniture and the exhibition rooms that I was able to relocate simplicity and stringency existing at the same time as a movement and mood. With the sunlight as a catalyst, I found a resonance in the Danish Museum of International Ceramic Art I was interested in engaging with. This was why I took up the challenge. I wanted to examine if I with specific ceramic glazed concrete would be able to shut out the noisy muzak of historicism and instead let other harmonious melodies dominate.

Opposite page and two next. Installation ceramics from the exhibition at Danish Museum of International Ceramic Art, 2012 with the title "Mounted forward and to the side". Boxes made from specific ceramic glazed concrete. White, glossy glaze and mat greengrey with markings of the component parts of the concrete, mounted on steel bars. Each box arrangement measure H: 40-50 cm, L: 100 cm, W: 35 cm. Photos: Ole Akhøj.

THE SKETCHING STEPS

Once a concept has been developed, the exhibition is yet an idea. For me it takes two sketching steps for the objects and art event to take shape and concretely emerge in the sketch and the drawing.
In sketching step one, I draw by hand on paper, but also on rapidly created physical models. [34] The first sketch is the one where the idea for how the exhibition`s objects in themselves are embedded as a feeling, a restlessness, an impatient waiting. At this stage, I rarely know what it is actually going to consist of or how it will appear. The sketching at this point is utterly unhelpful and investigative with blots on a paper and the marks of a reluctant pen.
One sketch after another they arrive with little indication of getting closer. With the pen, I probe what is possible. With this I also attempt to enter into a dialogue with the inner feelings and sense if they resonate.



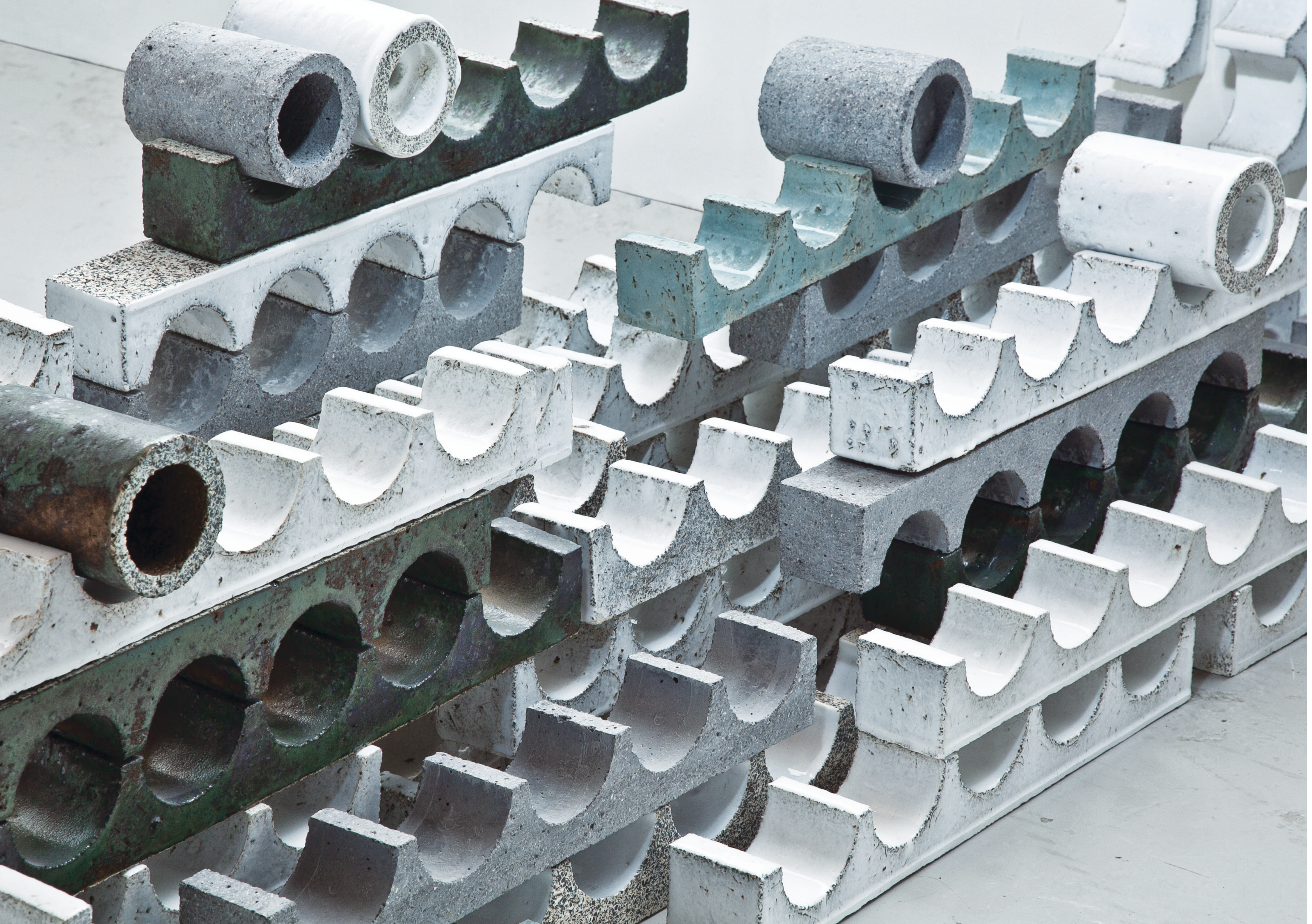
thing that constantly refuses to consider even a tiny line to be a possibility. Through the repetition of sketching, an almost meditative state emerges, disconnected from time and space. This might be where the idea begun as a hazy line, but eventually deterministically comes into its own as the objects moving towards the exhibition being developed.
It is not until after days of sketching, sometimes weeks, that the exhibition emerges, still with the openness of the sketch. The next phase of sketching is the one where specific questions to what is being developed are raised. These are questions that are attached to the artistic intention and concept, the contexts where the objects are incurred and the processual steps they are to follow. These are questions that are likely to concern:

The exhibition building in relation to surroundings/infrastructure
The history/narrative of the exhibition building
Ground plan/ichnography
Light conditions/Natural light/Artificial light/Shadows
Access routes/Perception angles/Patterns of movement
Furniture/Ornamentation/Geometry
Colour/Materiality/Texture
Scale/Proportions/Dimensions
Placement/Structure/Fixtures
Static/dynamic, Open/closed, Bearing/Borne, Inside/Outside
Form encounter/Encounters with floor, ceiling, and walls

The questions are asked of the art I want to display and the idea of its collaboration and spatial effect on the exhibition space and with the spectator. With iteration upon iteration, the design and expression of the objects and the exhibition as a whole are changed and new questions emerge.
These are questions that also relate to the spectator's patterns of movement at the exhibition. These are important to be aware of, partly since the spectator is part of the exhibition, partly because the exhibition by being an event is a relation in which also the spectator's experience of it must be considered.
Furthermore, the sketching phase contains several other questions. For example, questions that deal with the materials and the process through which they are manufactured,

Once in a while, in the difficult, initial sketching phase, it might be advantageous to draw in elements from the registration of the place. These I usually cut out or reassemble anew or I crumple up the paper and draw whatever it becomes. This is not to say that these are the solutions for what I want to make, but these exercises are a kind of warm-up. It is through them that it is possible to turn off the analytical control of the mind, that

This and opposite page: installation with the title "Resting hole displacement" ("Hvilende hulforskydning") exhibited at the Danish Museum of International Ceramic Art at the exhibition Displacements. Two plates resting on a wall and two lying on the floor. H: 100 cm, W: 53 cm, T: 0.7-1 cm. White gloss glaze and mat grey concrete. Concrete and ceramic glazed concrete. Photo: Ole Akhøj.



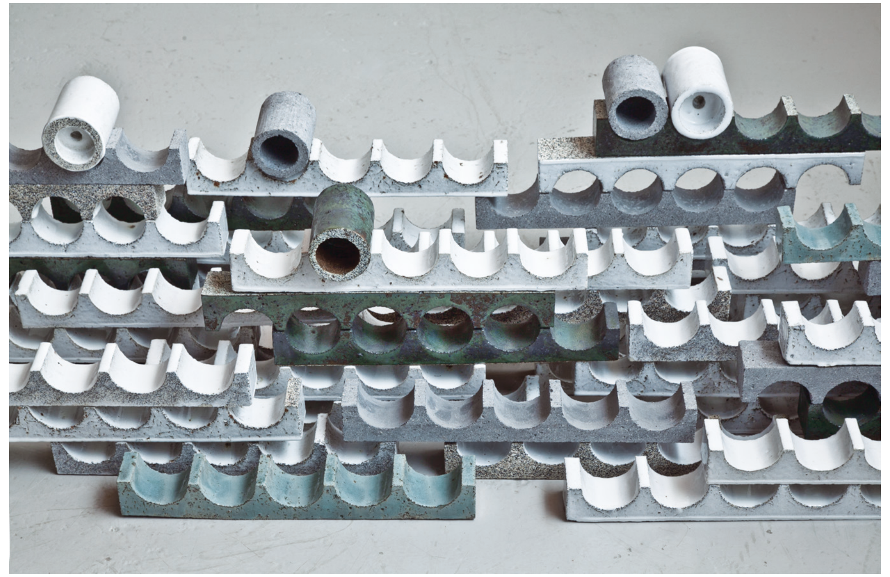
transported, and presented. These questions might deal with:

Slip in the design of objects for them to be removed from the mould
Planning of glazing so the objects can be transported between process steps
Planning of glazing so the objects can be fired without becomming attached to the kiln plates
Design so the objects are stable during firing
Requirements for mounting and stability - during object placement at an exhibition

A sketching phase starting from a concept, borne from a registration, as such develops as a complex exploration consisting of a long list of parameters and conditions that all play a part in and must be dealt with when developing the installation art.
In the design method Design in a Broad Perspective these questions are relevant to designing materials. This is one of several aspects where the materials designer can enjoy the fruits of the artist's labour. This phase in the artist's work in many ways is similar to that done by both the designer and the architect.
With time and often while sketching the participating objects, their placement and structure within the context, you begin drawing in scale as well as beginning to physically design models in scale. For the exhibition at the Danish Museum of International Ceramic Art the scale was 1:5. With scale models and drawings, it was possible to scan the dimensions and proportions and examine whether the idea and expression was still as desired. This phase is also when you design the moulds in which the objects are to be produced. This often means that the expression and shape of the objects must be changed once more. This is a process that is repeated over and over during sketching, with increasingly high degrees of detail and precision.
Once the solution has been fully located during the drawing and modelling work, it is plotted into the computer. I use CAD/CAM AutoCAD which is a precise drawing program that is also used in industry and is able to depict solutions in both 2D and 3D. Here I draw, in 2D, both the design of the object I am to manufacture in specific ceramic glazed concrete but also the design of the mould or positive mould as well as the cutting scheme for the wood. From there, the process moves on to production of moulds, casting and developing the art object, firing them and so on, and is the same of that which is described in the chapter on process, "Process/Craftsmanship".

ART EVENTS

It is when setting up the objects, exhibition, and art event that it turns out if what was intended will be realized. This is when the artist arrives with her objects packed in transportation cases, and excitedly opens them up to see whether the transportation has



Opposite and this page, installation with the title "Stacking explorations for order" ("Stabling søger orden"). 60 elements mounted on the wall and arranged on the floor. 30 cm x 6 cm x 7 cm, and 6-10 cylinders. Ø: 6 cm, H: 10 cm. Specific ceramic glazed concrete and concrete. White, glossy glaze with partially exposed concrete aggregate, green-black glaze, bluish glaze, and mat-grey concrete. Photos: Ole Akhøj.

been free from accidents. For several months, the exhibition context and the spaces have only been depicted in photos, drawings, in the atelier as a floor plan sketched out on the floor, and fragments projected onto walls, as well as a proportionally simplified version of it in the photo room created for this occasion. They have also flourished as memories of the arts and as a notion of the art event.
The exploration in the photo room is the first examination of the objects' ceramic, spatial collaboration and effect on other rooms, but it is in the exhibition space it will become clear if the concept and the idea will hold up, whether the materiality, colour scheme, proportions, lighting, meeting between them and floor, walls, and ceilings, and so on will have been successful. The initial encounter might occasion experiences that make it necessary to adjust the exhibition in the room before the opening. That is why I prefer to

travel there a few days prior to the opening of the exhibition to have time to make such adjustments.
At Marsden Woo Gallery, London, the exhibition was based on the exhibition building, the surroundings, infrastructure, and the historical layers of drawings that existed there. The registration was done virtually. Via the internet, I placed myself as a little yellow Google Earth icon man in the middle of Great Sutton Street in London where the gallery is located, and followed the arrows to get a panoramic view. I experienced and could almost hear the car turning the corner close to the gallery and was almost able to grab the football from the boy's hands.
I have addressed the ground plan of the gallery as well as the colour, materiality, and material differences between the inside and the outside. The façade of the gallery, here in particular the lobby of the gallery, seemed like a striking interface between the urban space and the inner room of the gallery. Four and fivestorey buildings coated in dark yellow and red bricks placed shoulder by shoulder on narrow, tortuous streets characterize the urban space surrounding the gallery. When you enter the gallery, the blank white walls and grey concrete floors greet you expectantly, they call out for meaning and belonging. The gallery with its regular white rooms resembles an architectural model reproduced in scale as I, stepping inside, became like the photoshopped people who are likely to appear fragmentary in the two-dimensional clarified architectural presentations making them seem human. As individuals, we construct each our reality and inscribe it into layers of frame of reference. We move in a virtual and actual reality at the same time and decode signs and actions in relation to it in order to understand and communicate them.
In her sketch, the architect creates spatial realities and reproduces them in scale models and sketch material as levels, sections, and elevation. With a frame of reference and codes they can be deciphered as the rooms they depict or will form in the future. To others, they will merely appear as what they are, abstract symbols, black lines on the paper with a condensation, spread, own ornamental rhythm and repetition, yet with no reference to anything but itself. At Marsden Woo Gallery in London, I wanted to thematize this with installation art consisting of ceramic glazed concrete, conventional concrete, wood, and paint. I wanted to display the installation ceramic that was based in the architectural

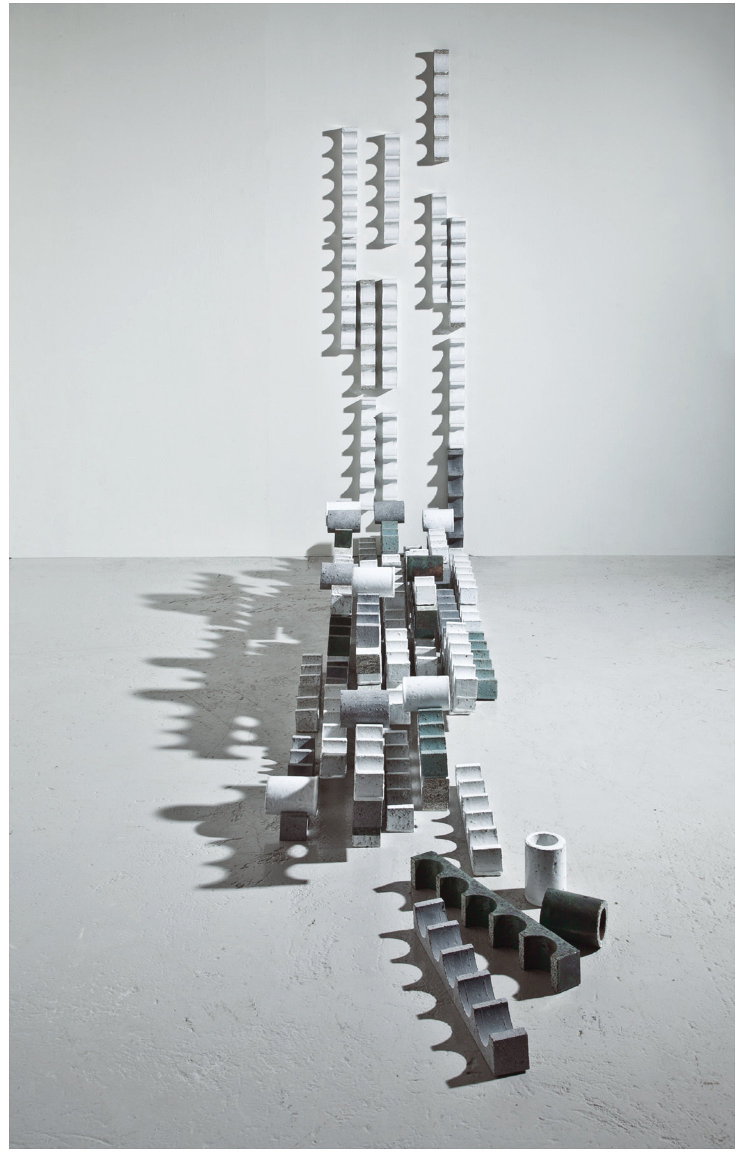
Opposite and this page, installation with the title "Stacking explorations for order" ("Stabling søger orden"). Three plates on a wall. 100 cm x 60 cm. 60 elements mounted on the wall and arranged on the floor. 30 cm x 6 cm x 7 cm, and 6-10 cylinders. Ø: 6 cm, H: 10 cm. Specific ceramic glazed concrete and concrete. White, glossy glaze with partially exposed concrete aggregate, green-black glaze, bluish glaze, and mat-grey concrete. Photos: Ole Akhøj.

use of the sign and the signified, the work with the interior and the exterior, with form and substance. Like the architect assembling her building from prefabricated elements, I wanted to make use of repetition with the possibility of variation, combinatorics, juxtaposition, and orientation to achieve a spatial, material cohesion, but also disarray. With this I wanted to question the spatial, the relationship between representation and presentation. The question was whether the installation as event at Marsden Woo Gallery was its own spatiality as reality or if it was referring to an existing one in or outside the gallery, one to be created in the future, a reference to a virtual world, or something completely different?

At the exhibition, the colour scheme was simple, retained. It seemed toned down with grey, white, and an orange colour scheme as a comment upon the gallery's grey alkyd-painted floors of and white walls and ceilings. A few days before I was to set up the exhibition I had the objects shipped from Lyngby, Denmark to London, UK. The gallery had received the large transportation cases and unpacked the ceramic when I arrived two days later. The rooms were as I had expected, from the photos and drawings sent to me by curator and lecturer Tessa Peters. [35] But when I mounted some of the panels on the walls, I learned that in the actual exhibition spaces the rhythm and orientation of the objects in relation to the room did not function as I had imagined. So I had to revise my plan a bit. Furthermore, new spatialities emerged from the encounter with the ceiling. I had the opportunity to test these, so the mounted ceiling also was included. The aim was to display ceramic spaces. The gallery allowed me to do this by allowing mounting on walls and ceiling in addition to the floor objects I had brought with me. Furthermore, they allowed me to bring in the stairway, and I was also able to draw lines out into the urban spaces to the tile formations that existed there in the shape of ornamental repetition. The exhibition became a large ceramic architectural model, a ceramic model space pointed towards the ceramic urban space with its tile covering.

At the Danish Museum for International Ceramic Art, the intention was to make objects from specific ceramic glazed concrete that were to enter into a dialogue with the rooms and the spectators. It was also for the experience of this to transform the layers of meaning implicit there. The deafening decorations were to be silent for a time to instead

Opposite ,this and next two pages: Installation with the title "Stacking explorations for order". Three plates on the wall. 100 cm x 60 cm. Specific ceramic glazed concrete, white glossy glaze with partially exposed concrete aggregate. 60 elements mounted on the wall and arranged on the floor. 30 cm x 6 cm x 7 cm, and 6-10 cylinders. Ø: 6 cm, H: 10 cm. Specific ceramic glazed concrete and concrete. White, glossy glaze with partially exposed concrete aggregate, green-black glaze, bluish glaze, and mat-grey concrete. Photos: Ole Akhøj.



allow other geometrical, simple markings in the exhibition space to speak.
The indoor garden room of the main building consists of a strikingly red wall with white-painted and blocked windows on one side, a red end wall, but otherwise walls with a low-set continual ribbon of white-painted radiators and above those windows with white cross fields of wooden bars. Furthermore, there is an inclining white-painted wooden plank ceiling and grey-brown wooden plank floors. In this room, I displayed six box-shaped objects, "Mounted forwards and to the side," ("Monteret fremad og til siden") which were placed on steel ledges. Their form was generated from the ground plan and with their pleated edges they were to enter into a dialogue with the bars of the radiators. The pattern that ran from the top of boxes down through their interior as hollow, secret passages referenced the bars of the windows. In the original plan, the boxes were to be put on wooden laths wedging up into the grooves made for them in the lower parts of the boxes. The wooden plank from the floor was in this way meant to stand erect to receive the alien objects made from specific ceramic glazed concrete and visually let them slide forwards and sideward or across the orientation of the wooden planks.
But about a month before the opening of the exhibition, I had decided to fire these and eight other objects at Tommerup Ceramic workshop. This is the leading ceramic workshop in Denmark for firing of large-scale and unusual ceramic objects specifically aimed towards art and crafts. This is where artist Peter Brandes had the three previously mentioned pots from Roskilde fired, but also where other famous Danish ceramists like Bjørn Nørgård, Bente Skjødtgård, and Martin Bodilsen Kaldahl have their larger ceramic works fired. The objects as well as the wooden moulds they had been made in were to be fired and the wooden moulds were to be burned off. As mentioned in the chapter Process/Craftsmanship, I had chosen to cast the boxes in moulds meant for only a single use. The interior hollow secret passages varied throughout the boxes so they had identical design in three fourths of the height of the boxes, but transformed in the bottom part of the box where also grooves for the wooden laths were to be placed. The moulds I designed for this were too complicated to be taken apart afterwards, which is why I planned for them to be burned off. Prior to firing, the bottom of the mould was removed from the mould and as were the sides. So the only thing that had to burned off were the pieces of wood that represented the ribs on the outside of the box, the hollow channels inside the boxes, and the mounting grooves on the bottom. When they were about to be fired at Tommerup Ceramic workshops I neglected to mention at the biscuit firing that the specific ceramic glazed concrete, unlike clay, is not supposed to rest on trivets, but must stand level.
I usually place the objects made from specific ceramic glazed concrete flatly and directly on the kiln plate. But all fourteen objects were put on supports, which produced an uneven load distribution in the boxes during the biscuit firing, and some of them therefore had writhed a little. When ceramists put their ceramic on trivets, there is only sporadic contact between the ceramic works and the kiln plates. This means that clay and porcelain, which dwindles relatively much, can do so more freely during firing than if they had been put directly on the kiln plates. Trivets also to a large degree ensure that the glazed

This and opposite page: installation "Mounted forwards and to the side" displayed at the Danish Museum of International Ceramic Art, 2012. Six "boxes" made from specific ceramic glazed concrete. White, glossy glaze and mat green-grey with markings of the component parts of the concrete, mounted on steel bars. Each box arrangement measure H: 40-50 cm, L: 100 cm, W: 35 cm. Note how the boxes and bars accentuate the lines of the room, the lines on the floor, the ceiling, the bars of the radiators and the window bars. Photos: Ole Akhøj.

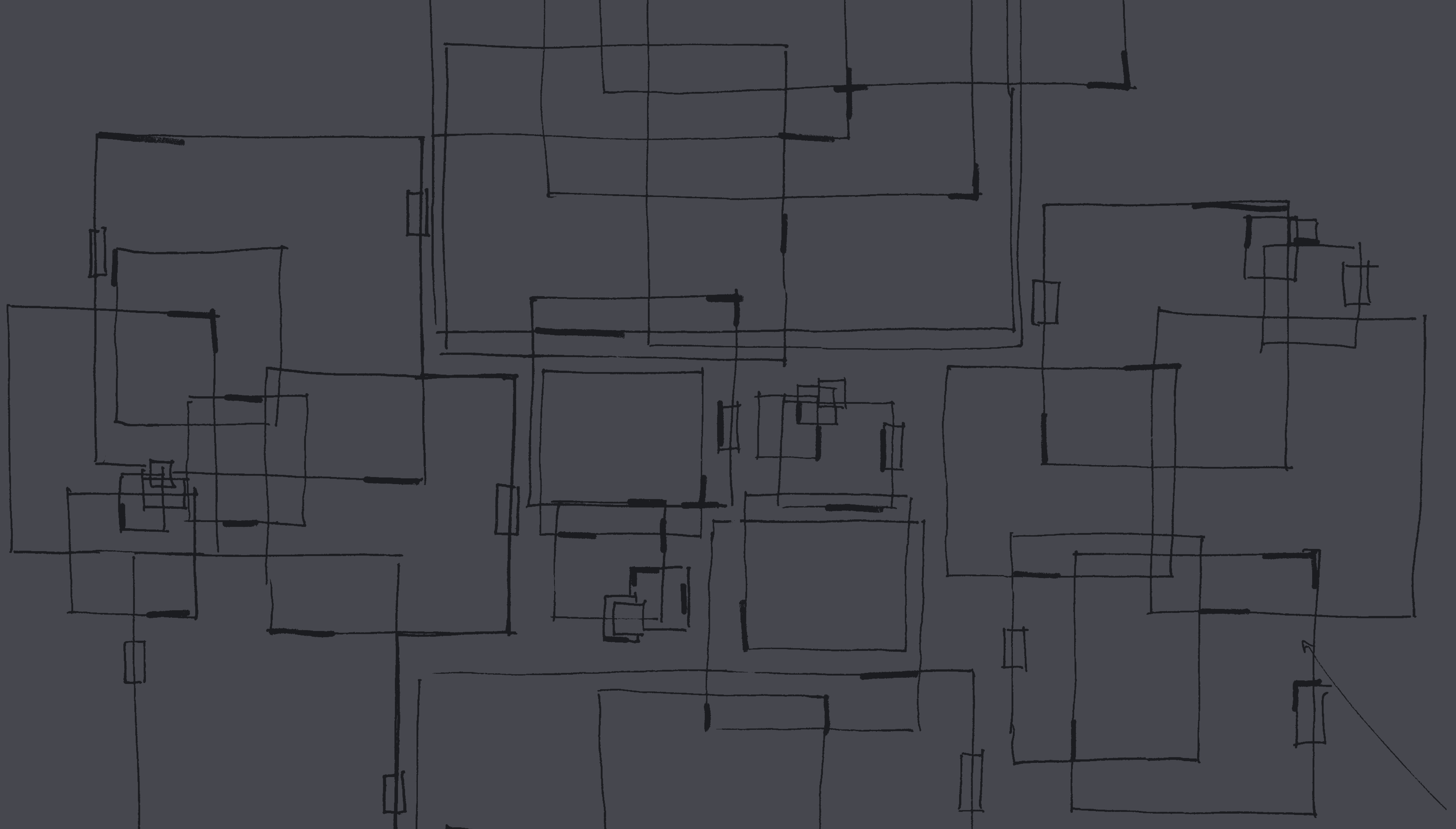
objects do not burn to kiln plates. But ceramic glazed concrete does not dwindle, but may shift and writhe due to the unequal load caused by trivets. But because it is so strange to ceramists to not rely on trivets in firings, all fourteen ceramic installation objects also at glaze firing were put on slight trivets. Simultaneously, a mistake occurred during firing that made it maintain near-maximum temperature for more than 24 hours even though I had directed for this period to be only 10 minutes. Of the fourteen objects I had spent months working on, I was only able to use six. The rest had writhed so much during firing that they had to be discarded. At this point there was only a short time until the exhibition opened and the photographer arrived. I had to discard one of the five object groups that were to make up the exhibition and think up a new one and manufacture it in a relatively short time span. This became the installation element "Resting hole displacement" ("Hvilende hulforskydning"). Of the four objects that had been misfired at Tommerup Ceramic workshop, but I had chosen to retain, two had slightly writhed. I brought these to DTU and re-glaze fired them. The entire glaze had melted off them during the over-firing. The last two of the six objects I did not discard had an unintended texture and surface quality as well as grooves that were locally writhed and as such could not hold the wooden planks they were meant to hold. The materiality and texture the two last boxes ended up with was, however, so vital and to a certain degree expressive of the relationship between ceramic and concrete that they were presented as they were following the over-firing. Furthermore, they would, I believed, be able to appear with a distinctive expression and gravity, as well as a materiality that could be beneficial as it entered into a dialogue with both the white of the room in which they were being exhibited, but also the red walls. The accident at Tommerup Ceramic workshop had caused a severe revision of my artistic intention, but at the same time had opened up new expressions and opportunities. Ultimately, these two last-mentioned boxes in "Mounted and on the Side" were the ones I liked the most at the exhibition. But the slight writhing in the grooves of all the boxes and the change in texture occasioned changes to the choices of mounting laths. Steel laths replaced the intended wooden laths. The meeting between steel and ceramic was not intended and if this had been planned in the sketch phase it would have been engaged much more, just as the meeting of the steel and the floor would have.
The box objects appear heavy and static. By placing them on slim laths as a contrast I aimed to further articulate this. It was also through the laths that their horizontal reach was to bring a kind of dynamism and movement to the boxes. The placement of the boxes on the steel laths is staggered so that some of them are placed centrally on the steel laths, while others are placed off-centre. Once more, this is to play with the dynamic versus the static. When the boxes were lifted off of the floor, the desire was for the light to spread through the inner passages of the boxes and project light and shadow play onto the floors and as such reveal the inner, ornamental sequence. The sunlight, furthermore, was to tell a tale about fronts and backs and project deep shadows across floors as well as walls. The objects "Mounted and on the side" were meant to take hold of the floor, radiators, window bars, but also the planks of the white wooden ceiling, while the spectator and objects were meant to strike a chord in the projection of light. Objects, space, and spectators were meant to join together and transform meaning in the event and hopefully help cause the rooms to seem different.
Two of the object groups, "Mounted tact" ("Ophængt takt") and "Stability explores for order" which I had displayed at the Danish Museum of International Ceramic Art, in their search for other ceramic rooms were meant to rise from the floor of other rooms and mount themselves on the walls. The objects for "Mounted tact" therefore were to be hung on the beige brown mat-painted walls of the Danish Museum of International Ceramic Art. The form and expression of the objects were based in the desire for dialogue with the parallel lines borne from the meeting between the floor planks, between the horizontal lines of the wood ornament of the wall panels, as well as the white, mat appearance of the ceiling. As white, glossy ceramic markings on the beige brown wall, the objects made from specific ceramic glazed concrete were to locate their own rhythm, colour schemes, and form, and as a string formation bring up the line sequence from floor, across wall panels to the ceiling and were to set the pace for the entire room. The objects were oblong and had dimensions of about a metre that precisely would be able to connect and bring out the string narrative from the floor, wooden wall-panels across the brown walls to the ceiling as a transition object. Each object was divided into two slim, parallel bars that seen from the front appeared as thin lines, but from the side told a story of fullness. The bars let a ray of light pass between them, enhancing the vertical orientation of the light with its marking on the wall. They had been glazed white and glossy like the wooden wall panels and would as such encounter the beige brown wall as contrast, glossy versus mat, white versus beige brown. Some of the objects were mottled and coloured and as such broke up the colour stringency. As colour, they were to a larger extent meant to near the colour scheme and the mat that was found in wall and floor. The objects were to be mounted directly on the wall in its encounter with it. As such, there were integrated, invisible mounting appliances in the objects to be used for wall mounting. Furthermore, the objects were designed to bear the weight listed as the maximum for wall mounting.
The intention of the objects "Mounted tact" was to make floor, wall, and ceiling part of the whole narrative. It was also for different surface characters, such as the glossy versus the mat or the coloured versus the white, to make the experience distinct and make the wall part of the experience. The spectator who entered the room would then see the lines in the floor and their continued sequence across the wooden panel all the way to the objects and through the white colour being brought to the ceiling. They would also experience how the lines changed depending on from where in the room one observed them.

The Danish Museum of International Ceramic Art is known to have a relatively traditional approach to ceramic art. The ceramic there is likely to be presented in the classical sense, placed on pedestals or in glass cases. This was how it was the day I visited the museum. The rooms were filled with white-painted wooden pedestals in various heights whereupon ceramic in or outside glass cases were displayed.
This was an attitude towards ceramic I wanted to challenge as my approach to art, based in the fine arts tradition, is art as installation, as an event, where even the spaces and the spectator are part of the whole narrative of an art event. This means that the art must be in direct contact with the rooms, that the materials should touch the floors, walls, and even, if possible, the ceilings. My intention with the exhibition at the main building of the Danish Museum of International Ceramic Art was to confront the tradition of ceramic art and perform an exploration for ceramic as space. At the Danish Museum of International Ceramic Art, however, I was not allowed to mount the objects that were planned for the wall, including "Mounted Measure" as well as "Stacking explorations for order". Instead, the museum chose to erect white, mat-painted, vertical and pedestal-like partition walls, boxes, on the coloured walls. Due to their irregular attachment, the pedestal boxes moved beyond the wall panels, but they did not occupy the entire wall, but only parts thereof so that both the box walls that ran from floor to ceiling as well as the colour walls with their white wooden wall-panels were exposed. The objects were to be mounted on the white pedestal boxes. This was terrible to say the least. Partly because I as mentioned reject pedestals as being a narrative of the work, partly because the interaction I sought from the rooms, the lines, the colour scheme and materiality was stolen from me. Furthermore, the primary general approach to exhibiting there, which was that I wanted to comment upon conventional ceramic art and its inclination towards pedestals was completely ruined. There I was, at the Danish Museum of International Ceramic Art, having just arrived with two tons of ceramic still in its transportation cases ready to invade the rooms, and was then forced to learn that the scope of the exhibition had been remarkably altered.
To some disciplines, where the art does not relate to the site-specific or the rooms this might have been less important, but to me this was the elimination of the very foundation of the exhibition. Most of all, I wanted to pack up the things and go back home. Due to the change, the exhibition would appear as a tame display with none of the spatial effects I had sought. However, I chose to go through with the exhibition. The specific ceramic glazed concrete meant to encounter the beige brown walls as part of a narrative of line sequences running across the panel to the floor in "Mounted tact," and "Stacking explorations for order" meant to explore ceramic spaces, now instead encountered the white, vertical pedestal, and ended up as tame decoration with no sense of belonging. As an artist, I was deeply disillusioned.[36, 37] But seen in the light of the role installation art plays in the design method Design in a Broad Perspective, even exhibitions that are partly unsuccessful can be informative. They can be informative to the artist's continued work, but also and especially the art-researcher and the materials designer. In this book, I have, as mentioned, primarily chosen to present the exhibitions through the recordings made in the photo room I built at DTU. I have done this despite the fact that they do not show the spatial resonance I sought to accentuate in the exhibition spaces nor how spectators interacted with them.

ART IN THE DESIGN METHOD

Installation art is part of the design method Design in a Broad Perspective. It questions the materials in ways that are not solely connected to its own disciplinary approach, but which are relevant also to the work with the materials of the craftsman and the art-researcher, and of the material researcher as well. Furthermore, the installation art might function as external communication of what the materials are able to do.
The artist tests and in particular challenges the distinctive expressions of the materials as well as their potential for aesthetic manufacturing. The craftsman gains insights into possible production methods, while the art-researcher can analyse and ask questions both during the creation of the art and the art event, questions that emphasize the distinctive expressions and aesthetic regulation of atmospheres.
It is in the work of the art, the materials assert their form, texture, colour, patterns, and materiality as well as their potential for dialoguing with the surroundings. This is where the materials are presented in order to be perceived and experienced by the spectator. The artist asks questions, including others than those asked by other disciplines. Some of them are answered through the work with the art, while others have still not been examined because the ways of art are inscrutable and unpredictable.
The artist is an explorer of materials, their form and expression and what influence they have on their surroundings. This is the journey the materials have been invited to partake in when it comes to installation art with physical objects as the one described above. It is the approach and freedom linked to this that makes art and the work of the artist important components in the design method Design in a Broad Perspective.
Specifically in terms of the development of specific ceramic glazed concrete, installation art has to an even larger extent provided me with insights into how to manufacture the materials, what is possible in terms of form and expression and dialogue with the surroundings. Art has furthermore contributed to communicating specific ceramic glazed concrete outwards from the materials researcher's laboratory more than it has occasioned major design changes to the material concept.
But precisely because we are talking of a concept, i.e. a group of potential materials with specific ceramic glazed concrete, installation art for the four exhibitions has demonstrated that the concept is useful with its openness to detail differences in the concrete recipes.

ART-FAÇADES



ART-FAÇADES

The city is a mishmash of relations, spaces, buildings, events, products,
social actors, and experiences that all help shape the city’s expression.
That is why the city’s expression rarely is unambiguous or simple.
But that also makes the expression of the city mutable,
where change is a basic condition precisely because the elements -
or layers - and their expression can be replaced, changed, affected, improved, or removed.
(Kracauer, 2008, p. 16)

ART-FAÇADES

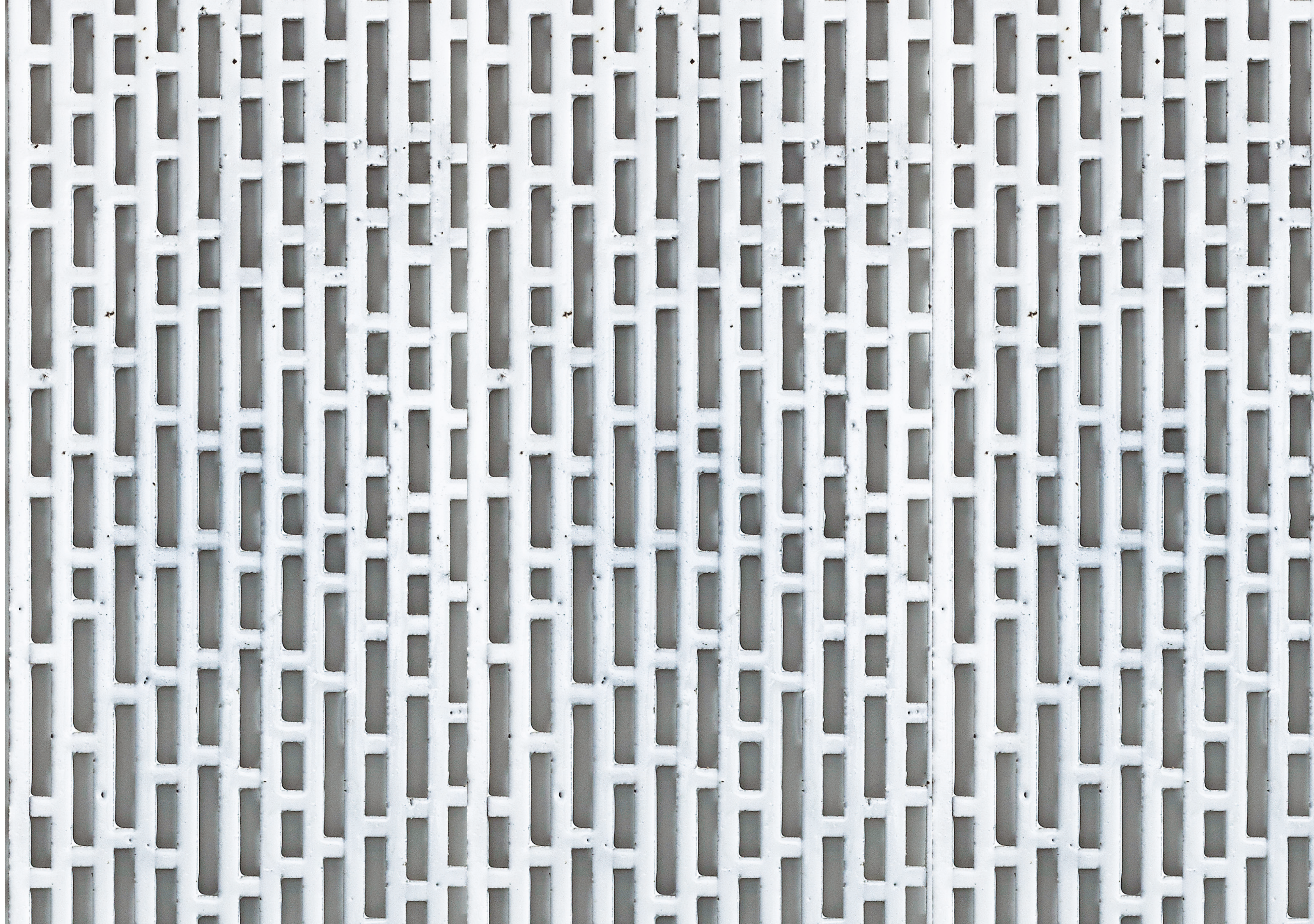
In this chapter, in the design method Design in a Broad Perspective we move inside a horizontal string, the one that has a hold of both the designer and the architecture's practice. Here we look over the shoulder of the building component designer when she, starting from architecture in this case specific concrete building, questions, discusses, and develops the initial prototypes of large-scale façades made from specific ceramic glazed concrete. The chapter is introduced with a general description of architecture, then a mention of industrialized building and building technology as well as descriptions of selected types of façades including the façade prototypes that have been developed with specific ceramic glazed concrete. The chapter concludes with excerpts from an article (Bache, 2010) where advantages and disadvantages of the scale jump of ceramic covering are discussed and identified.

ARCHITECTURE - FAÇADE

The façade is the part of the outer wall of a building that is exposed. In Oxford's Dictionary, façades are defined as "the Principal front of a building, that faces on to a street or open space." [38] It is the façade that presents the buildings and is its face to the world. It is what we encounter in the urban space. In the façade, associate professor and architect Torben Dahl (Dahl 2003) writes, we are able to read the quintessence of architectural efforts, here form, material, and proportion confront, he continues, the technical necessities such as load-bearing, ventilation, access, light, and sound.

In the façade we can read the quintessence of the architectural efforts, here form, material, and proportion confronts the technical necessities such as load-bearing, ventilation, access, light, and sound. Here the summarizing devices stand the test. Here is invitation or rejection. Here the functional provisions of the building are implied or proclaimed. Here the building is located within its stylish, social, or cultural context. (Dahl, 2003, p. 7)

This and opposite page. Two façade panels for mounted façade solution made from specific ceramic glazed concrete. 160 cm x 50 cm x 1 cm. They were cast in a combined wooden and silicone rubber mould and subsequently fired and stoneware glazed. The façades were flexible and could bend after the biscuit firing, but not after the glaze firing. Photo: Ole Akhøj.



The façade is a building component that is part of an architecturally complex whole. This means that it should relate to this whole and complexity. The façade must, if it is to belong and thus be relevant, be more than just an independent artwork, more than just applied decoration. It must form an opinion on the architecture that it is part of as well as on the urban space that surrounds it.
Architecture is about forming an opinion on the life to be lived and the conditions that make it possible. Architecture, including façades, therefore is not only about creating spaces as containers and sculpting these containers from different materials, making them decorative and nice.
The approach to creating the framework of the good life, creating architecture, varies wildly. In a previous chapter, I described how architect Peter Zumthor manufactures atmospheres as a kind of evocative, building-scenography that at the same time is site-specific.
But this is just one out of many approaches. Another approach is that which architects Daniel Libeskind, Peter Eisenman, Reem Koolhaas, and Danish architect Cort Dinesen employ called superpositioning.
This is a technique where architects create site-specific architecture by selecting and emphasizing registered cultural, demographic, topological, historical, and so on layers of meaning surrounding the place where the building is to be erected.
This means that the idea of the object as only a static and fixed object in the room is questioned. And the possibility of the object being considered in a way that reflects events and activities is identified. An object that contains dynamics and is not merely an expressive vector. (Pedersen, 1994, p. 132)
In this perspective, architecture is like the chosen narrative of an archaeologist on a place and an opinion of how it is supposed to function along the life that is expected to take place there. They draw out lines and routes as layers of meaning and arrange them in a hierarchy. In this way, narratives come together in a way that might become the message of the building.
An example of this is architect Reem Koolhas's architectural firm OMA's site-specific idea for the Bryghus project, the future headquarters of the Danish Centre for Architecture in the inner harbour of Copenhagen. This building is based on registering layers of meanings such as patterns of movement, local historical stock of buildings, and infrastructure as well as the desire to create life in this part of the harbour that today is characterized by the very lack of life. In Reem Koolhaas' solution, the superpositioned layers make up a centre and form a narrative of juxtaposition. The architectural firm draws lines out into

This and opposite page: Rasmus Holst's computer rendition of the façades in a building technical context.

the urban space, but at the same time also into the building that functions as an active part of it. Reem Koolhaas even allows for a road to pass through the building. [39]

The building has been designed with the intention of generating urban life in the area. An urban engine where buildings, plazas, a flurry of people, restaurants, and a café at the top of the building come together while traffic passes right through the building to and from the automated parking facility. [40]

In this context, façade design is a small part of a complex whole and should take its starting point in or at least relate to the overall architectural idea. This is the case with façades as an integrated part of the architecture, but also to façades that function as the "decoration" of the building. The façade as integrated design or artistically intentional and site-specific decoration is a restricted art form, partly because it has to fulfil several functions, partly because it must be subsumed under or relate to a general architectural program as well as the urban space that surrounds it.
According to Roman architect and engineer Marcus Vitruvius, who more than two thousand years ago wrote ten books about architecture, architecture must contain and synthesise firmitas, utilitas, and venustas. (Dalgren, 1998) In his second book, Vitrivius introduces a graphical model, the "Vitruvian triangle". This is a model that has subsequently been interpreted, elaborated, and adjusted for different contexts. It still, however, seems operational as the simplified principled, general overview of architecture it is. In the interpretation I use in this book, it is translated into how architecture must contain and synthesize technique, function, and aesthetics. The façade as such must relate to and possibly comment upon the general architectural program and its idea, the urban space that surrounds it, but also what the Vitruvian triangle consists of: technique, function, and aesthetics. [41, 42]

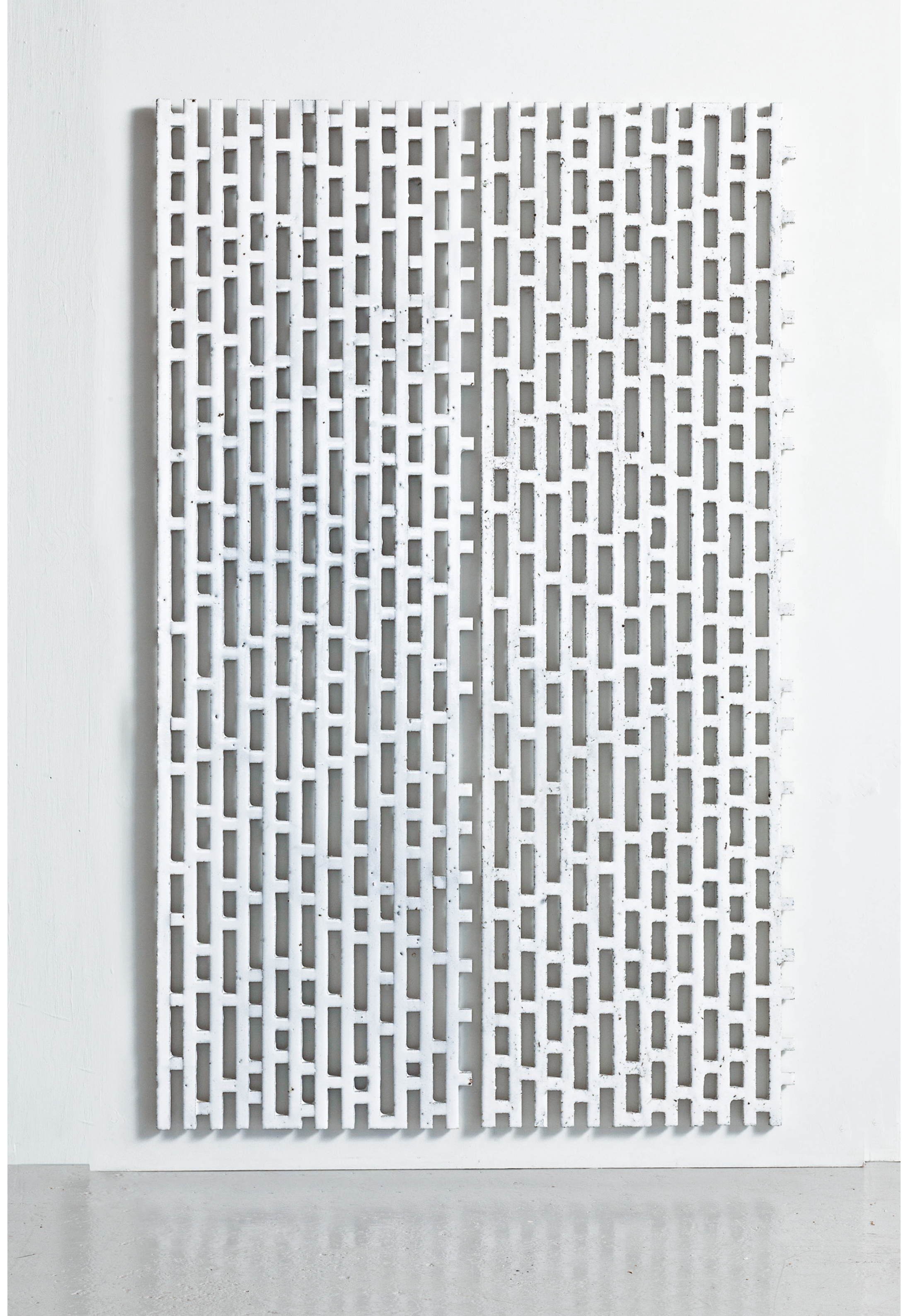
THE FAÇADE DESIGNER

The architect addresses this complexity, makes choices, and with the help of syntheses creates the setting where our lives take place. She does this in close contact with other disciplines. In this book, two of these are mentioned, the ones that are relevant to the design method Design in a Broad Perspective. This is the civil engineer with specific, technical knowledge about for example materials, statics, and energy, but also the building designer, educated at a technical university, such as the one I work at, the Technical University of Denmark, DTU.
The building component designer I point to as part of the horizontal string of the design method is an architect or building designer. Beyond having the wide knowledge of the engineer, the building designer, however, must also know much about and have practical

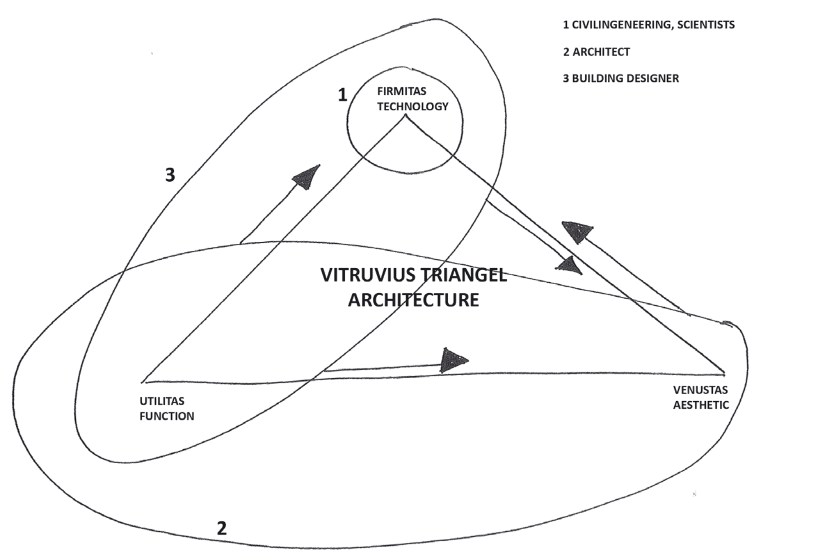
experience from architecture and art.
The role assignment between the cited disciplines can be illustrated with the help of the Vitruvian triangle. Here the building designer based in the engineering disciplines, takes her starting point in the line of the Vitruvian triangle that connects technique to function. She attempts to make engineering and architecture work together and seeks bridge the disciplines. Her starting point is not the corner of the Vitruvian triangle that represents aesthetics, but in her solution she will try to approach aesthetics. Oppositely, the architect is likely to take her starting point in the line of the Vitruvian triangle that connects aesthetics and function, but her approach never extends to the technical depths. The building technical engineer in general only treats one corner of the Vitruvian triangle, the one that deals with technique, even if, for example, she is working with building materials. Considering this, that is why the civil engineer of building technology, the building designer, and the architect might find it advantageous to work together and share their knowledge. This is where the building designer in the engineering discipline might be creative and come up with solutions, but also is communicative in her role as bridge builder between architecture and engineering science. But, as mentioned earlier, this bridge building function can only be realized, the way I see it, if a building designer during her training acquires a deep understanding of architecture as well as the tools for working with the discipline of architecture gained from once in a while working from the same starting point as the architect. This means that if the building designer initiates her search for solutions by starting from the line between aesthetics and function in the Vitruvian triangle and from there also welcomes all the technical knowledge that they contain. It is not because the building designer based in engineering is supposed to be the architects of the future, but because the dialogue between the specialized engineer and architect must develop better circumstances.
For that reason, when I teach the building component design course at DTU, I ask the students to begin their designing process by tasting the design. This is for them to begin their work with a starting point on the line that connects function with aesthetics in the Vitruvian triangle to then a little later in the process also welcoming the technology they are so skilful at into the holistic design process. The students, therefore, must work artistically, sensuously, bodily, as well as by using their feelings during the design phase before they can involve technology as way for them to practice.

INDUSTRIALIZED BUILDING

The industrial era of concrete building in principle begun when ship builder Joseph Louis Lamboth invented steel-reinforced concrete in the middle of the 19th century. It was first presented at the World's Fair in Paris, 1855. (Collins, 1959) It wasn't until the late 19th and early 20th centuries, however, with engineer François Hennebique's (1842-1921) development and construction of several concrete carcass building systems, based in both prefabrication and on-site casting, that it led to actual industrialized building.



Using reinforced concrete was back then no inevitable condition and the conception of architecture at the time rested entirely on the styles of architectural history that neither knew of or acknowledged the kinds of buildings reinforced concrete could produce. Therefore, it took about 70 years from Lamboth presented reinforced concrete to concrete begun being used as exposed façade material in public buildings.
This happened in 1923 when French architect Auguste Perret (1874-1954) built a church, Notra Dame du Raincy, in the city Raincy, [43] from prefabricated but also on-site cast and exposed concrete. August Perret was one of the first architects to recognize the architectural potential of reinforced concrete. In his projects, Perret sought to express the qualities and character of reinforced concrete both as construction material and in terms of its materiality, and surfaces. (Bache, 2000)
The industrial manufacturing of concrete buildings with exposed concrete surfaces was pushed forward once more in the middle of the 20th century with concrete buildings made by architects like Le Corbusier and Oscar Niemeier as well as engineer Pier Luigi Nervi. They built several important buildings by combining prefabrication and on-site casting. Here, concrete was challenged and presented in various unique buildings. Some of the buildings had been made to suit industrial building, but were produced in so low numbers that we are not quite able to call it industrialized system building.
It was not until the 1960s and 1970s that concrete building truly was developed into an efficient, industrialized, and standardized system building in the form of actual mass production. At this time, there were severe housing shortages across Europe and a need for cheap and functional housing that lived up to contemporary demands of comfort, air, and light. The prefabricated concrete element building was the solution. With systematized delivery, few element types, and relatively simple methods of assembly, thousands upon thousands of similar homes were built that were inexpensive and could be erected in a relatively short time. Concrete housing was done with many storeys with no variance, site-specific belonging, or relation to the human scale. This was crane-track building inspired by Fordism's efficient car manufacturing. Concrete buildings were practically delivered from assembly lines. Users were given buildings that lived up to demands of comfort, light, and air, but they felt alienated and found it difficult to relate to and make a personal mark on their new home. This meant that concrete as material and concrete element building in particular was criticized and discredited. Terms such as concrete jungle, concrete grey, and concrete lament was associated with concrete and the buildings. These are terms that stick to this day. Industrialized concrete building, however, is still widely used, but often as hidden elements by being the underlying or hidden carcass construction and is rarely used as exposed façade elements.
A new kind of industrialization, where for example IT tools provide new opportunities, boasts about being able to deliver buildings that meet the demands of comfort, function, light, and air, but also variance, flexibility, and individual solutions adapted to place, user demands and wishes.



Above. Principle sketch of the Vitruvian triangle, which illustrates that architecture is a synthesis between firmitas (technology), utilitas (function), and venustas (aesthetics). The building designer with a background in engineering takes her solution starting point in firmitas and utilitas, the architect in utilitas and venustas, while the researcher and civil engineer take their starting point from and remain in the corner firmitas. Opposite page: Prototypes of specific ceramic glazed of the mounted faced, 160 cm x 50 cm x 1 cm. Photo: Ole Akhøj.

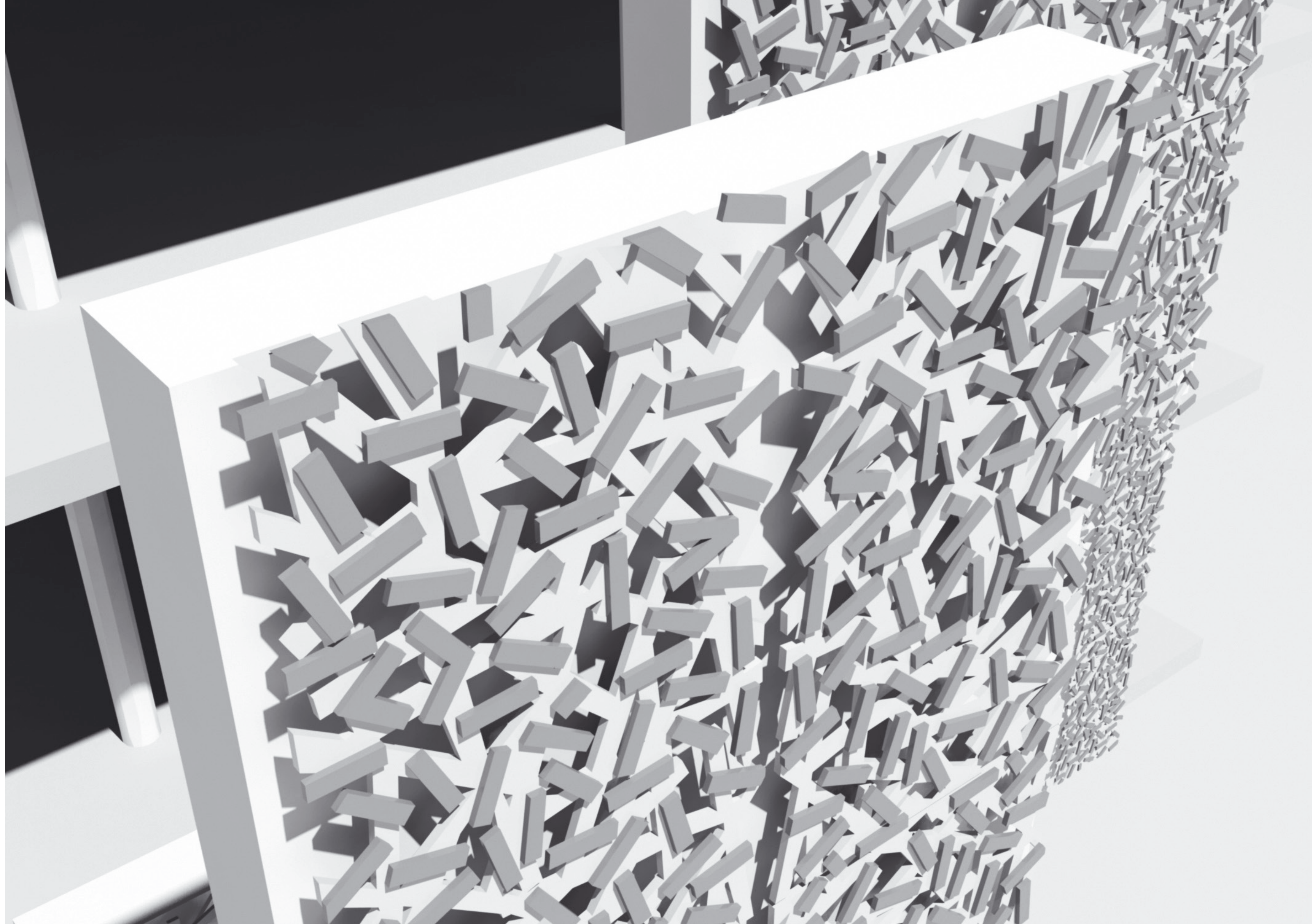
New industrialization does not only revolve around standard products to be repeated, as we know it from the large housing projects of the 1960s. It is about so-called mass customization. New IT tools make it possible to deliver products where the processes certainly are standardized, yet with products that offer much possible variation. (Svendler Nielsen, 2005)

This, however, requires the concrete industry to seize the opportunity, adopt the new IT tools and challenge and utilize them while simultaneously addressing the transformed building technical framework of contemporary building.
The façades I have developed in specific ceramic glazed concrete are to be the initial prototypes analogous to unique productions. In the future, they are expected to be part of industrialized concrete building in the form of unique mass production related to new industrialization's desire to introduce site-specificity, variance, flexibility, and user involvement early on in the design process.

CONCRETE BUILDING

In concrete building, the on-site cast building, prefabricated building, and combinations appear. On-site cast concrete building is what is built and cast at the building site, while prefabricated building entails concrete elements made at a factory subsequently being mounted at the building site, modular building design. On-site cast building and modular building differ in terms of technique as well as appearance.
On-site cast building might be characterized by having concrete façades in the form of large, monotonous, almost monolithically uniform surfaces. They are usually locally separated with expansion joints, that appear as lines to break up the continuity of the concrete surfaces. Expansion joints also allow for the building to expand and contract along with temperature swings without cracks appearing in the building elements.
Danish architectural firm C.F. Møllers Tegnestue utilized such joints to form part of the whole narrative at the Darwin Centre, 2009, the addition to the London Natural History Museum where they produced the largest spray cast construction in all of Europe. The addition is designed in the shape of a huge concrete cocoon and houses the museum's impressively large collection of insects. The expansion joints have been laid out so they symbolize the thread surrounding a silk cocoon, a symbol of how the distinguished collection must be protected as a larva in a chrysalis. [44]
Others consider expansion joints unsightly in terms of the continual sequence that the concrete surface is to express and find ways to avoid them. At the public school Au-Langmatt in Switzerland from 1995, designed by the architectural firm Burkard, Meyer & Partners, they have used a special building technique in order to avoid expansion joints in a 100-metre-long on-site cast concrete façade wall. The wall has been on-site cast with lengths of thirty metres with two-metre-spaces in between at full façade height. After the concrete had hardened for two months, the last openings were cast. This produced an untreated, raw concrete surface with no expansion joints. (Dahl, 2003, p. 120)
Like C.F. Møller's spray cast cocoon at the Natural History Museum in London, the on-site constructed concrete building can be smoothened before hardening so that its surface is entirely smooth. The form materials the concrete is cast on, the chosen formwork materials, might also influence it. These might appear as markings in the concrete from the ores of trees or knots when the formwork is made from wooden planks, as well as the lines from where the planks meet. They can appear as markings in the concrete, such as small relief-like cylindrical depressions from the form-claps that hold the plate formwork in place during casting and hardening. The latter we know especially from Japanese architect Tadao Ando's extremely breathtaking minimal and raw concrete buildings such as "The Church of Light" and "Koshino House". With his use of concrete in buildings, Tadao Ando transmits an unbelievable sensitivity worth seeing for those who need examples of how amazingly sensual concrete can be when it is manufactured with aesthetic effect in mind. He uses the form material as ornamental repetition in the concrete.
The prefabricated concrete building appears as though it is composed of individual components, building components made in a factory. This is modular building that often has an expression characterized by the juxtaposition of building elements. In modular building, it is precisely the encounters, the spaces in-between and any potential overlaps between the mounted prefabricated building elements that are significant to the expression and accumulated narrative of the building. The large, curved shells in architect Richard Meier's Jubilee Church in Rome are examples of unique prefabrication. These were produced from white concrete mixed with TV-Milennium white as self-cleaning concrete. Here the lines emerging from inbetween the prefabricated concrete elements emphasize and accentuate the shape of the curve.
In terms of the exposed concrete of the façade, prefabricated concrete building is characterized by a network, a grid, of often vertical and horizontal lines. These are the places where two or more façade elements meet. In concrete building these lines can for example be air spaces or joints. The surface expressions of the prefabricated concrete elements are, like in on-site cast concrete building, very liberated in terms of pattern formation. This also depends on the formwork the concrete is casted upon. But in the prefabricated concrete element, the patterns will be limited by the proliferation of the concrete element. Unfortunately, in many cases this results in the concrete façade element being marked with a specific decorative pattern that neither relates to or actively integrates the general grid pattern that emerges from the juxtaposition of several building elements. The pure, ornamental narrative of a building therefore is often lost in the confusion of competing pattern formations.
Building elements, façades, made from specific ceramic glazed concrete are targeted at both on-site and prefabricated building. They have been developed as an attempt to accommodate the scale and proportions of the concrete element and to, in that way, enter

Opposite page: Rasmus Holst's computer rendition of the façades in a building technical context.



into a dialogue with it and accentuate and highlight the narrative about this dialogue.

FAÇADE BUILDING TECHNOLOGY

The expression and design of the façade depend, as mentioned above, on several circumstances: the general vision of the architecture, the surrounding urban space, function and aesthetics, but also technology, including, for example, building technology. For example, it is important when designing a façade to know whether it is part of a building's accumulated load-bearing construction or if it has no such function as its proportions and design will depend on this.
A building, simply put, consists of load-bearing construction systems and non-load bearing building parts. The load-bearing construction of the building is what keeps it erect, while the building elements applied to the building have other functions.
The façade used to provide a clear visual narrative of how the building had been constructed. The outer load-bearing walls of the timber-framed buildings consisted of wooden laths with filler between them, while brick buildings were hardy and solid and displayed the material they were made of. The expression of the façade was a direct product of, tied to and in tune with the load-bearing system of the building. This type of load-bearing outer walls offered little flexibility.
Today, the outer wall is divided into layers and functions and the façade in many cases has no part in the load-bearing functions of the buildings. The façade, as such, is flexible and freed from several functional binds, including load bearing.
The outer wall in some construction systems is part of the entire bearing construction of a building. But as the outer wall is divided into layers and in principle consists of an end wall, a layer of insulation, and a front wall and since the end wall is likely to be the one that is load-bearing, the front wall, the façade, is often freed from any bearing functions.
The outer wall actually consists of more functional layers than the three mentioned above. There are, for example, also vapour seals and plaster walls. But since only the front and end wall, as well as the layer of insulation, are relevant here, these are the only functional layers I refer to in the following.
Concrete building can be done with several different kinds of building systems. The ones I focus on here are the shear wall system, the transverse system, and the pillar-beam system. These are building systems, that make up the load-bearing constructions of the concrete building.
In shear wall systems, the outer wall is part of the load-bearing constructions. The outer

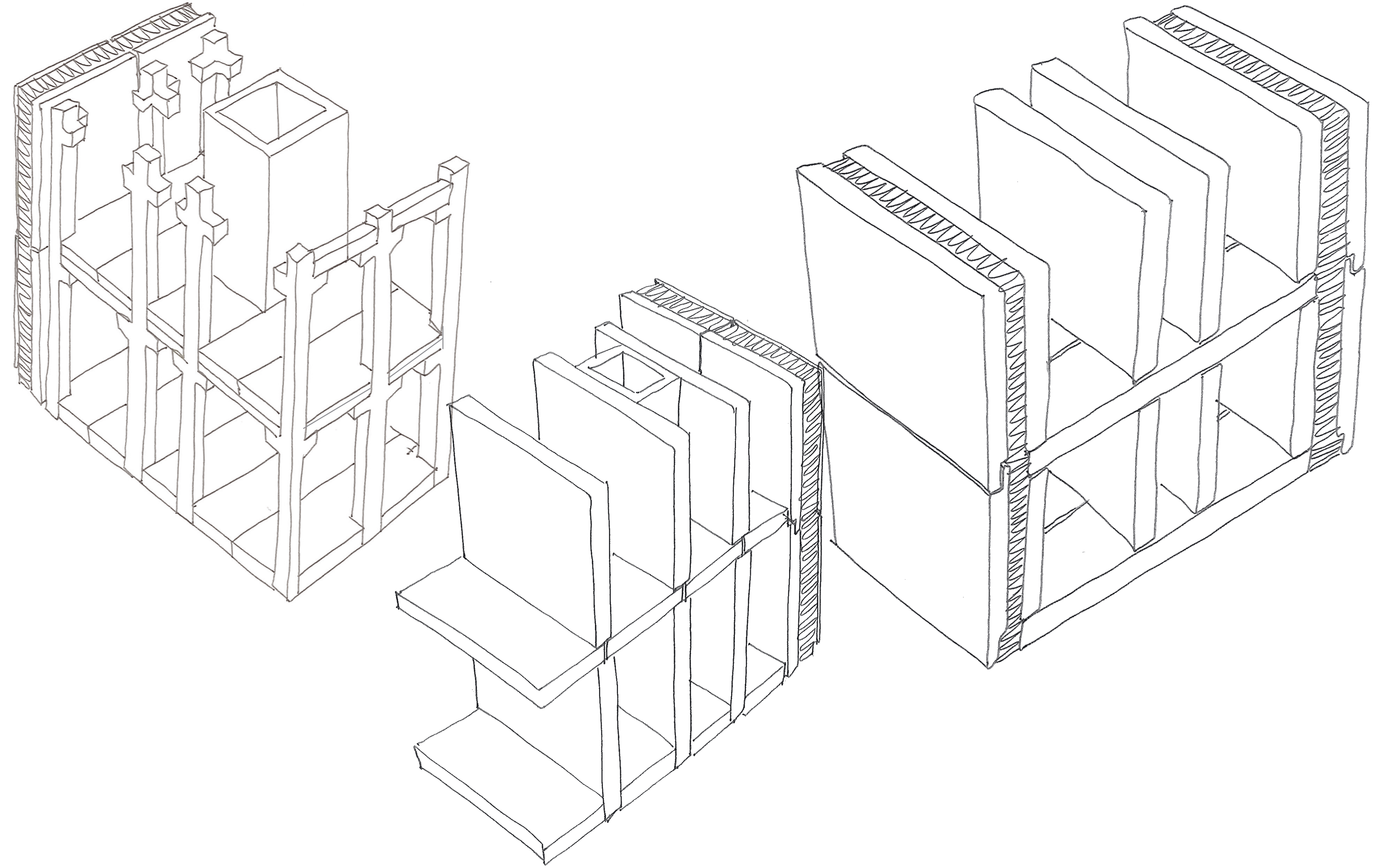
This and opposite page. Façade panel for mounted façade solution in specific ceramic glazed concrete with exposed fired concrete juxtaposed with a white stoneware glaze, 160 cm x 50 cm x 1-2 cm. Photo: Ole Akhøj.

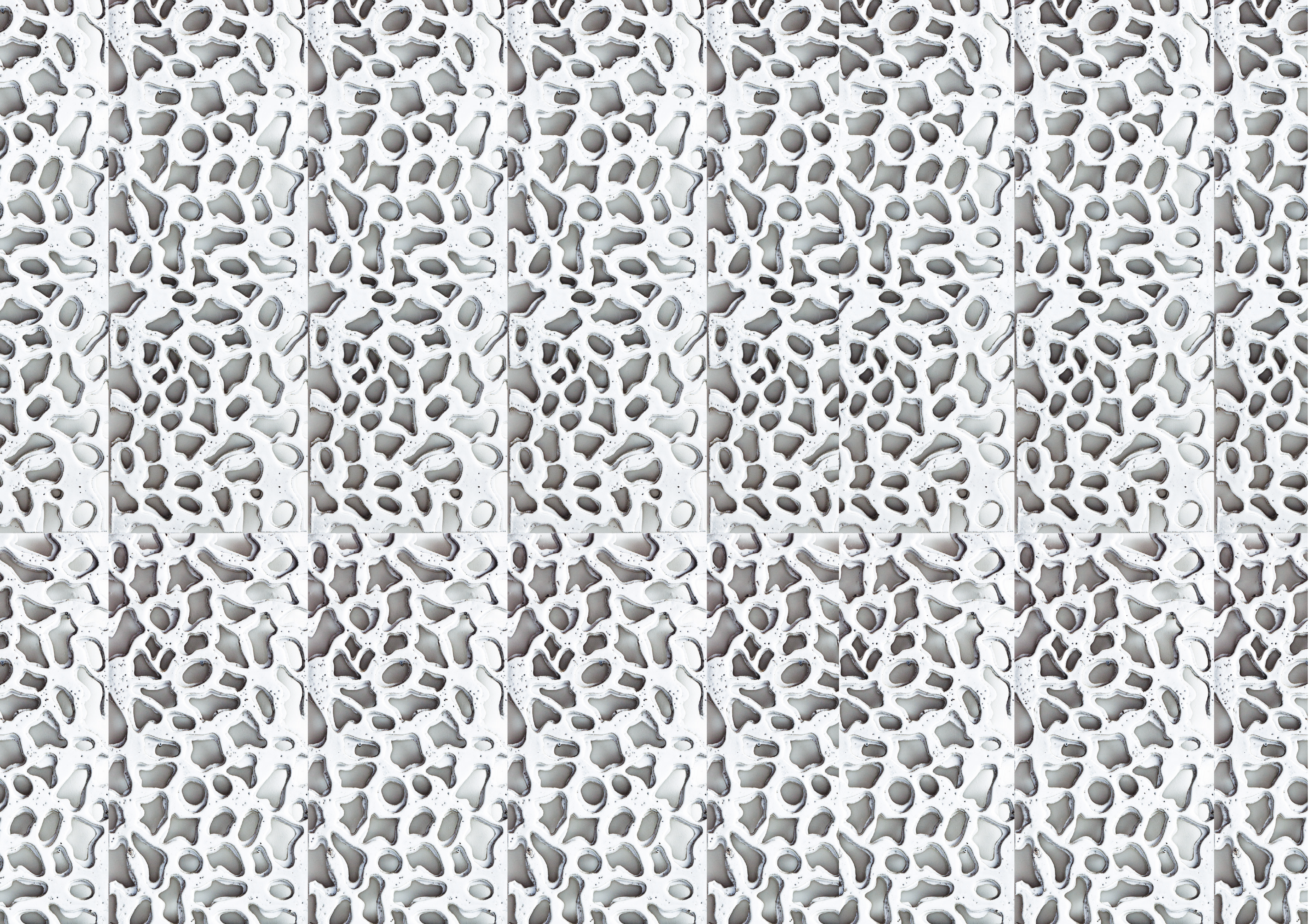
walls bear the floor levels of the building, and also prop it up usually along with stairs and elevator shafts. However, in these kinds of buildings it is likely that it is the end wall that makes up the load-bearing part of the outer wall while the front wall, the façade, is flexible and non-load-bearing.
In shear wall systems, it is quite common to use sandwich constructions. These are prefabricated concrete elements, walls delivered fully manufactured with end wall, insulation, and a front wall. The front wall might be a facing made from bricks or concrete. This was very popular in the 1960s-1980s, but seems to be used increasingly less today as solutions in high-rises and public buildings while it is still a rather popular system for the construction of industrial buildings.
It is also very common to separately prefabricate front and end walls. This is especially useful when the prefabricated building elements are used only as end walls for the carcass construction or solely as the front wall, the façade.
In both the transverse and the pillar-beam (pillar-frame) concrete building systems the outer wall is not load-bearing. In the transverse system, the transverse walls, and in the pillar-beam solution, the pillars in combination with the beams, are load-bearing. Elevator shafts and stairwells similarly partially bear and are particularly important to the propping up of the building.
It is the front wall as non-load-bearing façade in the shear wall system, the transverse system, or the pillar-beam system, I will discuss in the following. Such a façade can be part of a building in a variety of ways.
The three building technological solutions in terms of façade that I have worked with are the mounted one, the self-supporting one as well as the façade that functions as lasting formwork. All three types of façade are, as mentioned, freed from bearing the building. However, the façade that functions as lasting formwork can be projected as being load-bearing along with another load-bearing end wall.

THE MOUNTED FAÇADE

The mounted façade is often mounted on the back wall or a floor slab panel. It might also, however, be mounted on a special bearing-system intended only for the façade. Mounted façades are used in new building developments, but also in energy renovation of existing buildings.
With the changed demands in terms of energy that aim for lower energy consumption in terms of, for example, the heating of buildings, thicker layers of insulation than before might be a demand. In new developments, the outer walls, including insulation layers, are dimensioned according to this. In older concrete buildings, for example those from the 1960s or 1970s and even the ones from the 1980s that were energy renovated, there is need for extra re-insulation according to the new rules in this area.
In principle, this could be done by moving non-load bearing front walls outwards and in that way make room for the extra layer of insulation. It could also be done by insulating inwards, by inserting another layer of insulation on the interior side of the walls and mount new plaster walls on them. The most common method is to mount another layer of insulation on the existing front wall, the façade, and then mount another façade on this. In this case, it will either be mounted directly onto the former front wall, preferably connected to the end wall, or a new, external load-bearing system is set up to accommodate the new façade solution. A new load-bearing system for a façade of this kind requires that also a local point base is made dependent on how heavy the façade is.
Especially different foam boards with plaster solutions are very popular solutions for energy renovations of buildings nowadays. This means that what appears to be plastered brick walls are actually plastered insulation. That it is actually foam boards can be appreciated when you look closely at edges and the details, but also be revealed by tapping the wall. The sound is completely different. It is an easy solution because foam boards weigh relatively little compared to other solutions and also because they are cheap. But it also impoverishes the building as it insipidly mainly addresses our visual sense by itself.
The mounted façade is likely to be prefabricated and have a remarkable stretch. This means that once more façades are joined, this encounter will be part of the building's entire narrative, preferably with a grid of vertical and horizontal line sequences.
The fittings or any other mounting devices that benefit the mounting of the façade can be either visible or hidden to accommodate the full façade narrative of the building.
Today, many mounted façades are ventilated. This means that the façade with its potentially external bearing system, has been pulled 2-3 centimetres in front of the underlying outer wall's other layers. In this way, the flow of air behind the façade is ensured,and this hinders accumulation of condensation and thus prevents mould fungus.
The mounted façade usually then hangs in front of a layer of insulation, in front of a front wall when it is a re-insulation, or, if it is a new development, an end wall. It might be advantageous to have it function as a static or movable screen against sunlight in front of window sections.
An example of a façade functioning as static solar protection can be seen in Barcelona's Biomedical Research Park, Barcelona, created by the architects Pinearq and Brullet De

Opposite page: Three different construction systems. The one on the left is a pillar-beam system where the outer walls are not load-bearing. The one in the middle shows the principle of the transverse system where the transverse walls are load bearing, while the outer walls also here are freed from bearing. The system on the far right is the shear wall system where the outer walls are load-bearing, but here only the back wall of the layered outer wall does that. Principle sketches: Anja.





Luna. Here, the façade is a combination of window sections and a solar protection-component made from red cedar wood. Both are mounted on the concrete layer of the building.
The freedom in relation to designing a mounted façade is massive. That is why we get one more colourful façade after another today. What is remarkable is that what we experience in the cityscape might be a façade with a thickness of a few millimetres that has nothing at all to do with the rest of the building and more or less has lost its materiality and significance as material.
The façade has become a piece of clothing and virtually changes as frequently as clothes fashion. An example of these façades can be found at the waterfront in Oslo, Norway. Here slight building bodies, especially office buildings, pile up toward the sky with loud, mottled patterns and colours. They crowd outwards, away from the city as if they were taking part in a race towards the edge of the water and architectural firm Snøhettan's brilliant opera house. With their Titanesque heights, they enclose the city and prevent a view of the water from within the city. These are façades that do not seem to care about context or what surrounds them nor a narrative of the plan, typology, or function of the building. They let out high-pitched calls for attention and as such have become visual noise.
The freedom in varying the mounted façade's expression should be attended to with the inherent accountability of making oneself known in the spaces we are all part of, the urban space, in mind.
Dorthe Mandrup Arkitekter does this with the smart, small addition to Bording School in Copenhagen. The façade consists of a combination of red and white bricks and red-brown weathering steel plates. The materiality of the building is significantly different, but at the same time is able to enter into a dialogue with the colour scheme, lines, and materiality of the neighbouring building. The mounted weathering steel plates are perforated and therefore allow for both looking in and looking out as they simultaneously shield against the noise of the traffic outside. This is genuinely acknowledged with exposed mounting fittings as well as having the façade be lifted a few centimetres off the ground level. The steel plates have been pulled out from the building's underlying brick body and in this way create an outside space that contains stairs, but also allows for a stay between the brick wall and the weathering steel plates. The façade follows the road's as well as the neighbouring building's orientation. As such, it denotes an intentional route through

This and the opposite page. A façade panel for a mounted façade solution in specific ceramic glazed concrete. 160 cm x 50 cm x 1-2 cm. On the opposite page shown when they are juxtaposed to illustrate that ornamentation is considered in regards to the meeting between two or more panels. Photo: Ole Akhøj.

urban space. I point out Dorthe Mandrup's addition to Bording School precisely because it oscillates between being an actual, mounted façade, a curtain to a staircase, and an artistic installation in urban space. The addition, as such, is a small masterpiece, a sculpturally new spatiality in the urban space and appears as much more than just a decorative, level façade application.
With meticulous decisions, it is possible not only to convert a building, but also through this very converting to emphasize the lines of the rest of the urban space, manufacture new spatialities, and/or strike a chord that makes us see the urban space in a new light.
It has been my intention to develop façades that partially relate to the function of the building, partially its building technology and materiality while they at the same time enter into a dialogue with what surrounds them. The mounted façade made from specific ceramic glazed concrete is supposed to be used in both new developments and renovations as well as offer opportunities to become solar protections or ventilated façade.
The mounted panels made from specific ceramic glazed concrete I developed at the Danish Art Workshops[45] sought to remake materiality as well as weight in the mounted concrete façade. They were based on, among other things, the artistic fabulation on the curtain wall principle.
A Curtain wall is a façade that is mounted and therefore made from light materials.

curtain wall […] a façade that "hangs" on a building without being part of its load-bearing construction. The building can be built with a load-bearing pillar or from construction that keeps the façade clear and thusly allows large façade sections to be made from light materials such as glass. [46]

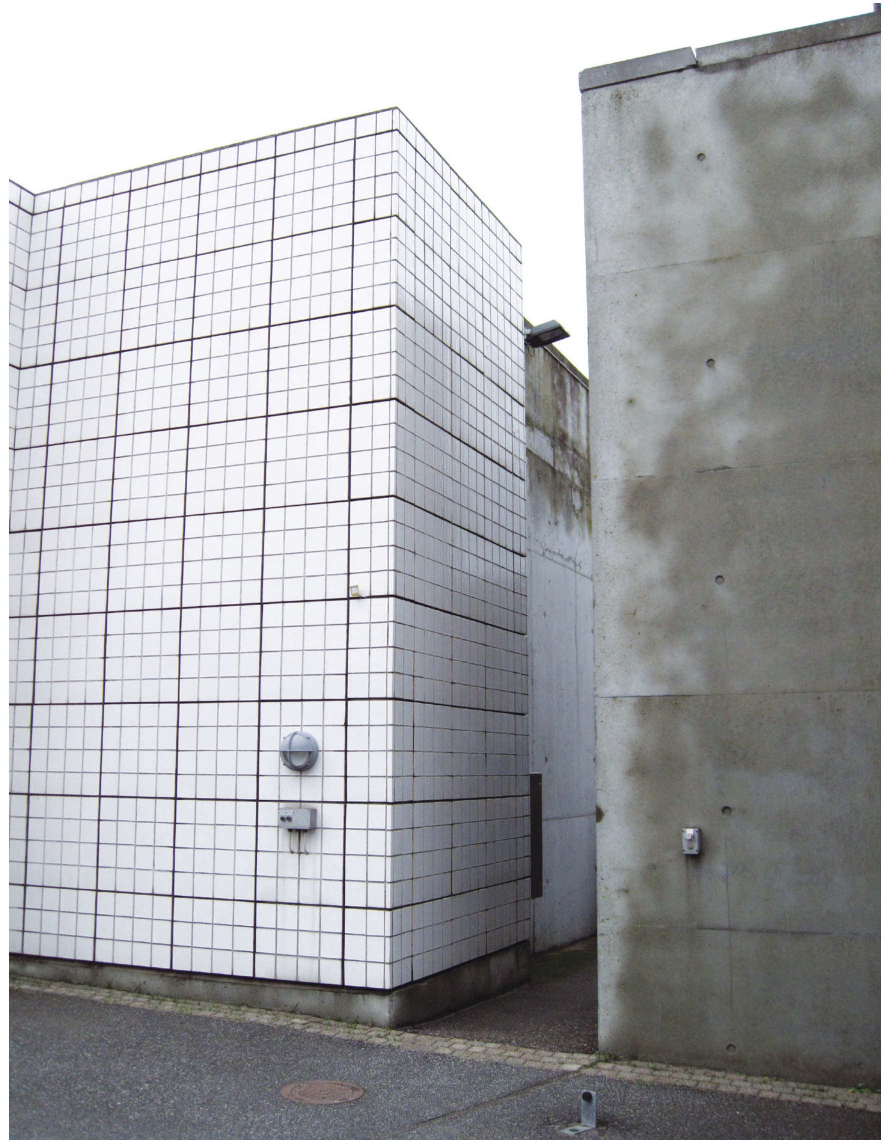
When it was first introduced in USA, glass was often used, but in principle, as the term denotes, it can also be a façade made from textile. As we shall see in the part on scale-jump in ceramic coverings of buildings, it is precisely textile's play with light that is one of the fascinating characteristics when relying on the smaller ceramic elements to cover buildings. It is precisely the lightness of the textile, its play with light as ornamental structures and repetition I have wanted to transform into large-scale façades made from specific ceramic glazed concrete as mounted façades.
Japanese architectural firm Shigeru Ban Architects has taken the consequences of the curtain wall principle and have constructed the façade in form of a curtain made from white, flapping textile covering walls of glass that can be displaced individually.
It is in relation to the façade as a curtain wall principle, as a suspended textile, I have manufactured and designed prototypes for mounted façades made from specific ceramic glazed concrete but with the conditions of concrete.
In those very façades, I have tried to have form meetings, often characterized by lines in a horizontal and vertical sequence of lines between several mounted façades, be part of the façades' pattern. This means that either the gridlines that characterize modular building's expressions are not part of the façade encounters or that the lines are repeated and continue into the pattern formation of the façade panels.
Some of the hole patterns, furthermore, are produced in order to examine if this possibly could be advantageous in relation to sustainability.
In several of the ornamental patterns I created as component designer, I was able to detect that some patterns were better at handling with crack diffusion than others. In some of the hole patterns, the crack was unable to spread because there was no material to continue into. In the same panels, I also observed that after biscuit firing they were flexible, meaning that locally in each of the façade panels a flexion of about five centimetres could be registered without any kind of crack formation accompanying it. But once I glazed the panels, the flexion became much less pronounced. I still need to produce fracture mechanical design of the glazes. In some of the mounted façades I have developed in specific ceramic glazed concrete, furthermore, I have incorporated mounting modules as part of the whole expression. This, for example, can be seen in the mounted façades where wooden fillets are used to mount upon.
The mounted façades made from specific ceramic glazed concrete will in principle, as mentioned, hang in front of layers of insulation or sections of windows. When I talk about entering into a dialogue with conventional concrete, in terms of ideas this will be in relation to the load-bearing construction system found in the back of the many functional layers of the outer wall and how it is a narrative about this. It will also be when the façades made from specific ceramic glazed concrete only partially cover the entire façade of a building and the rest of it remains as concrete façades. Furthermore, it can be if specific ceramic glazed concrete functions as a dynamic solar protection system on a concrete building built with exposed concrete façades. In this case, the façades made from specific ceramic glazed concrete will be pushed away from the windows in front of the concrete façades and as such collaborate with it materially and in terms of scale and proportion.
In the façades I have developed, I have maintained the white glaze, but also maintained the exposed concrete in some of the panels precisely in order to achieve the material dialogue with conventional concrete.
I have mentioned above that I aim to revitalize materiality, but also weight. For the mounted façade meant to be borne by other construction elements, it would be advantageous for the façade to not weigh too much. These are two conflicting interests. In the façade made from specific ceramic glazed concrete I have developed, I have precisely sought to produce them with relatively low thickness, all the way down to eight millime-

Opposite page. Detail of façade panel for a mounted façade solution in specific ceramic glazed concrete. 160 cm x 50 cm x 1-2 cm. Photo: Ole Akhøj.

tres in the cases of some of the larger panels. But at the same time, I have relied on the edge as narrative on fill and weight in terms of the mounted façade panels' ornament. The edge is where the light fractures on the façade level and tells of its three-dimensional character.
The façades made from specific ceramic glazed concrete are thusly expected to enter into a dialogue with both the on-site cast concrete buildings, but also the prefabricated ones. The ornaments of the façade panels will in the case of the holed panels appear as dynamic light and shadow play on that which is behind them, insulation and concrete walls, or they will allow for light and shadow play in the interior of the building.
As a result of the movements of the sun, seasons, and circadian rhythms, they will appear dynamic and perpetually in motion.
Such façade panels can partly shield against the light and in some cases, depending on whether or not they are perforated, their size, and how many holes they have, shield against rain, wind, and snow, but also function as sound absorbers of traffic noise.

THE SELF-SUPPORTING FAÇADE

The self-supporting façade is a front wall that is able to bear its own weight but also the weight of front walls being placed on it in multi-storey buildings. The self-supporting façade is likely to be supported by being connected to the wall behind, but also requires a kind of support in its design.
If the façade is too thin or if it has a design that resembles, for example, a level piece of paper, it will tend to bend outwards at larger thrust loads as Charlie Chaplin's cane did when he leaned on it. This is likely to happen with strong materials as well. That Chaplin's cane bends has much to do with the shape of the cane and the stiffness of the material it is made from. If Chaplin's cane were made from a cylinder with a much larger diameter, it would not bend under his weight. By increasing the diameter of the cane, its inertia force will increase. When designing self-supporting façades that must also be able to withstand thrust loads without bending, the stiffness is obtained by partly attaching them to the wall behind, partly by letting the façade increase in volume. In the case of Chaplin's cane,



This and opposite page, Elsinore water purification plant by architects Lene Tranberg and Bøje Lundgård with artistic ornamentation by artist Lin Utzon. Here whole or "broken" white, glossy tiles and on-site cast concrete are used. The almost textile ornamentation that emerges between the tiles and the concrete, as well as their glossy surface, appear as a dynamic contrast to the grey, continual, and mat concrete that is only broken up the the formwork plates' expression as a murmur of what used to be. The materials accentuate and enhance each other's qualities. Photos: Anja.

this might entail making it with a larger diameter. If the cane simultaneously remains solid, it becomes too heavy to fulfil the function it is intended to, i.e. support and ease of transportation. In Chaplin's case, where the cane functioned as a mouthpiece for his mood swings, the cane therefore had to be rotated by hand when he was ecstatic or in love. The diameter of the cane can be increased, but at the same time it would be advantageous to hollow it out, making it resemble the hollow cylinder even more. In that way, it will not bend outwards under his weight and can still be transported relatively easily. That the cane in Chaplin's case was supposed to bend, especially in his silent movies, is a different story. The façade is mostly not meant to bend.

When designing the self-supporting façade in specific ceramic glazed concrete I have chosen to provide the façade with more spatial abundance to acquire stiffness, while I also sought to minimize the thickness. I did this to minimize the use of the material, but also the energy resources needed for firings and for the façades to be easy to handle during manufacturing, mounting, and disposal.

If we once more turn our gaze towards the materials researcher, she would now remark on the work of the building component designer by adding that the materials as well can be designed with the façade's tendency towards bending in mind. In the chapter on material technical design and approach to material, I told of how materials can be designed with fracture mechanical design in mind. Here was included the possibility of selecting materials based on different material qualities and thusly improve fracture energy. One of the qualities I emphasized in this context was the materials' elasticity module, E. The higher the E-module, the larger the fracture energy and thus the more of the ductile fracture behaviour we strive for. But a higher elasticity module, E, is also desirable in terms of minimizing the bending of a construction. The composite materials, then, can besides being designed with the size and proportions of the construction in mind, be designed in relation to how the constructions must behave in terms of bending. The self-supporting front wall generally can be prefabricated, but also on-site cast. The self-supporting façade made from specific ceramic glazed concrete will always, however, be prefabricated as mentioned above or be a combination of prefabricated lasting formwork and the on-site back cast.

Spanish architectural firm Mestura Architects at their Martinet Primary School in Barcelona, Spain, use different kinds of self-supporting front walls. There is one made from white-glazed bricks, another that consists of a stabling of differently glaze-coloured

This page: Façade panels for mounted bar solution, 160 cm x 20 cm x 10 mm in specific ceramic glazed concrete with white stoneware glaze. Photo Ole Akhøj. The Opposite page: façade panels for mounted bar solution, illustrated as principled by Rasmus Holst's computer rendition.

spatially extruding ceramic tiles, and finally a self-supporting façade made from on-site cast concrete with the markings of the formwork boards. At first, this sounds as if it has a gaudy expression, but this is far from the case. The architects have masterfully been able to maintain a toned down and harmonious level while including these materials in a vital interaction with also a ceramic covering in different colours. This is a building that appears minimalistic in its design in terms of its references to modernism with decorations integrated into the architectural whole.
In the self-supporting façade solutions I have developed, I have remained focused on maintaining low thickness while designing with constructive stiffness in mind. As such, I have worked with the façade solutions in three dimensions, sculpturally, and spatially. Once more, I have chosen to play up the light and shadow conditions, as the parts of the façade planes are oriented perpendicular to one another to, as mentioned, create abundance and consequently stiffness, but also to obtain the different light nuances, from the very light to the grey tones and the wholly dark. Furthermore, there are openings in the self-supporting façade that allow for light to pass through in stripes that emphasize the form, but also make it possible to look out from inside the building.
In the self-supporting façade elements I have developed, there are fixtures for armament bars for them to be exposed and become part of the entire visual identity of the façade. Both at the bottom and at the top of the façade panels there has also been made recesses for pipe couplings for when more self-supporting front walls must be constructed on top of each other. They will then be invisible in the entirety of the visual expression.
In these panels, I have once more chosen to leave some of the concrete exposed while having other be white-glazed. In the glazed surfaces, the metal fibres emerge and appear as black graphic markings. I have chosen to locally thicken the planes in the middle to thereby increase the inertia force, the stiffness of the elements.

THE LASTING FORMWORK

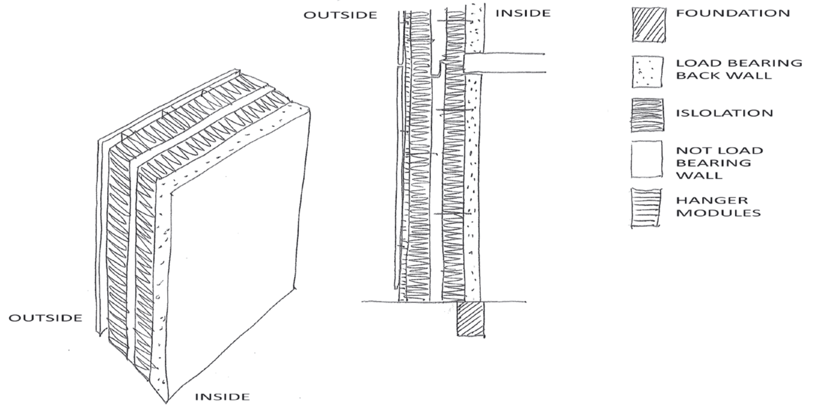
Formwork is a kind of mould that is usually used at the building site for on-site casting of concrete. It is likely to consist of wooden planks or large plates made from wood, metal, or a different material. Once the concrete has been cast and hardened, the formwork can be removed and re-used for another casting elsewhere. A lasting formwork is similar to the on-site casting of concrete constructions at the building site, but is not removed after the concrete has hardened. It remains as part of the cast, in this case as part of its front wall and façade.
Lasting formwork for specific ceramic glazed concrete can be done in several ways. For example, it can consist of a kind of form plates against which conventional or high-strength concrete is cast. It might also be a kind of hollow moulding box. This hollow moulding box is made from specific ceramic glazed concrete at a factory and transported

to the building site. At the building site, the moulding box is mounted correctly and subsequently a, for example, light concrete is cast into it. It will then be the moulding box made from specific ceramic glazed concrete that greets us in urban space in the form of building covering.
Such a principle can for example be used to cover pillars, inside and outside. A hollow prefabricated pillar made from specific ceramic glazed concrete is then delivered to the building site. Herein armament bars are placed and after that a different conventional concrete is casted. The ceramic covering of the pillar will in this case be an unbroken piece, while it today is likely to be divided into smaller pieces. This process has not yet been tested. However, it is possible for several of the solutions I have produced to be used as lasting formwork in the level façade solution.

CERAMIC COVERING

The glazed large-scale concrete panel made from specific ceramic glazed concrete is expected to function throughout the entire spread of the concrete element and not, as is most commonly seen, be divided into mosaics, tiles, and joints. This will invariably affect the visual expression, the articulation and expression of the façade itself as well as the sequence and rhythm of the urban space.
This was what I examined and wrote an article on in 2010. It is excerpts from this article I here revise and discuss. The question was wheter large-scale ceramic glazed concrete panels could add new qualities. It was also a question of locating which qualities might be lost and which might be transformed from the smaller ceramic façade covering to the larger ones and how so? This study took its starting point in observations of a few selected existing building façades clad in mosaic tiles or glazed tiles, primarily located in the Copenhagen area. It is important to point out that the study is marked by a subjective approach and was produced as preliminary study. In the article, I discuss buildings clad in ceramic elements such as glazed and unglazed tiles as well as mosaic tiles. Some of the ceramic elements resemble glazed clay objects but are actually smalti, small glass mosaics, while others are clay-based, glazed, or engobed. Furthermore, there are ceramic elements that shimmer due to different placements in the kiln environment. All of them contribute expressions that are unique to urban space, which is usually characterized by glass, steel, concrete, brick, or plastered surfaces. The question is whether it is possible

This page: Façade panels for mounted bar solution, 160 cm x 20 cm x 10 mm in specific ceramic glazed concrete with white stoneware glaze. Opposite page: same bars arranged as spatial object as exploration and light/shadow narratives. White stoneware glaze. Photos: Ole Akhøj.



This and opposite page. Façade panels for mounted façade solution in specific ceramic glazed concrete, white stoneware glaze. The panels are here shown with exposed mounting modules, wooden bars that are part of the entire ornamentation. Photo: Ole Akhøj. Above: principle sketch of a load-bearing outer wall, with a load-bearing back wall, while the front wall, the one in the middle, is self-supporting. The outer wall is thoroughly re-insulated with an extra layer of insulation on the outside as well as a mounted and ventilated façade panel. Sketch Anja.

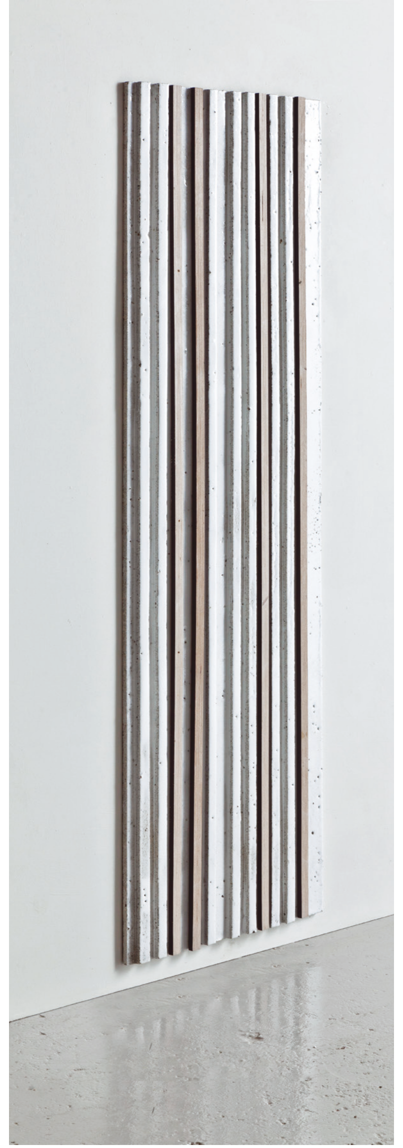
to similarly develop a distinctive expression from specific ceramic glazed concrete and if these potential constructions might add new qualities to the urban space.

THE SMALL-SCALE MOSAIC TILE

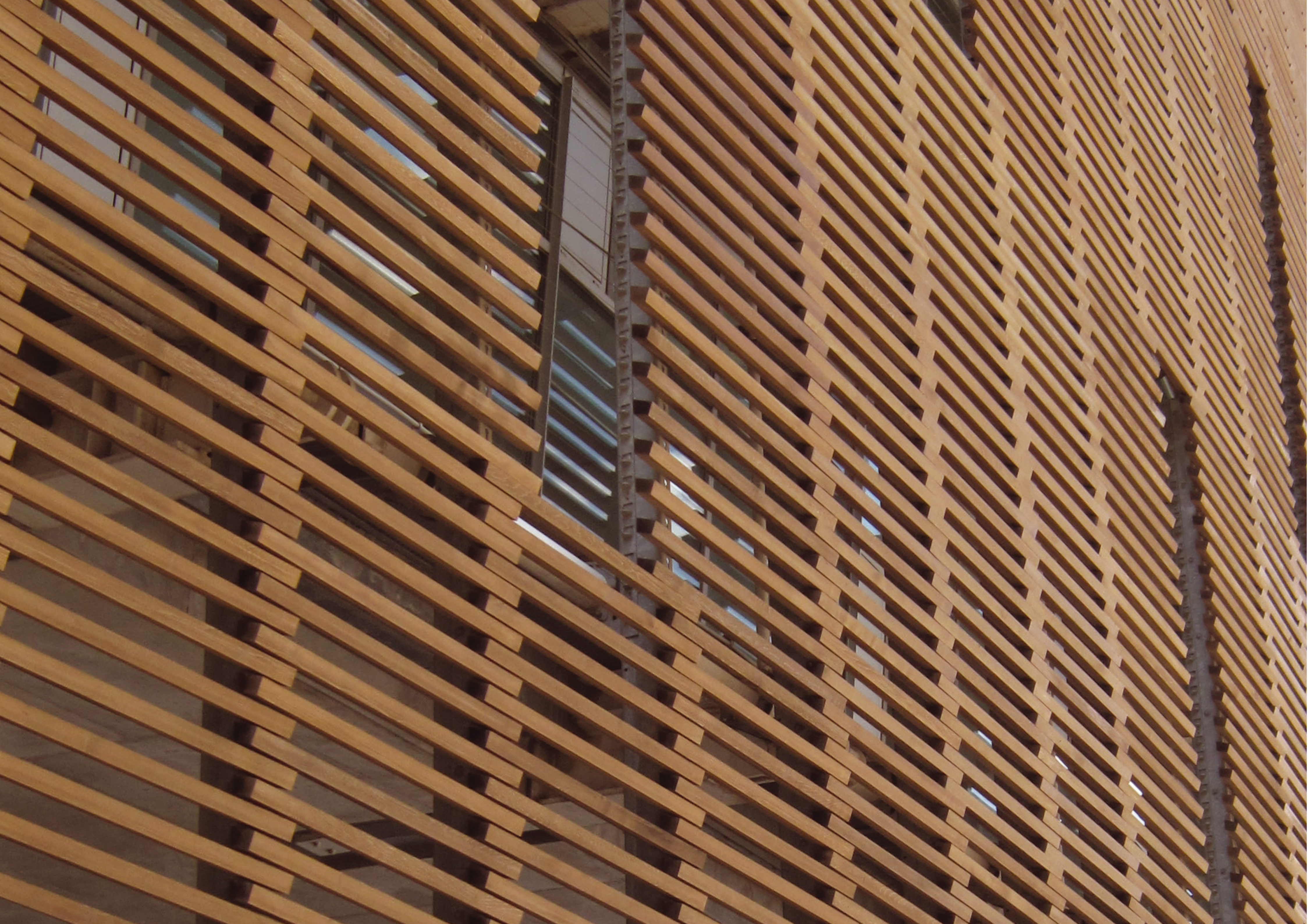
The way a façade's materiality, colour, patterns, and rhythm are read depends on the distance the spectator has to it as well as the context in which the building exists. Depending on whether it is in a town area with narrow streets like in a medieval town centre, or buildings erected in empty areas away from the congested city, the reading will differ. In the congested city, where the façade covering runs from foundation and upwards, the

building's details are experienced from a distance of centimetres to a few metres. It is possible to touch the façade, listen to its sound by tapping it, and feel its heat absorption, its raw or smooth surface with your cheek. We can taste it and as such relate to the façade of the building with our body and senses.

It is this intimate reading that is made possible in registering Danish furniture designer Nanna Ditzel's house in Klareboderne 4 in the centre of inner Copenhagen. In the 1960s, Nanna Ditzel chose to cover a formerly plastered building from the 18th century with Italian glass mosaic tiles, smalti. These are tiles made from melting glass and colouring oxides in a kiln, pouring the melt onto a plate to cool off, followed by a manual clipping into the desired dimensions and geometry. (Biggs, Emma, Hunkin, Tessa, 1999) Nanna Ditzel's house in Klareboderne is located on a narrow, one-way street with pavement on each side. It is possible to move up close to the building so you can both see and touch the mosaic tiles of the covering. They are about 2 by 2 centimetres with small deviations from the stringency of the square with uneven sizes and oblique angles. The primary colour scheme shimmers from Prussian blue over cobalt blue to light grey in the five-storey building, only interrupted by horizontal storey-dividers made from smalti tiles in either the yellow or gold-ochre colour spectrums. At the initial registration, the tiles of the façade resemble clay-based tiles. But by closely studying the corners, door and window sections where the edge of the tile is exposed, you discover that the tile is grained and made from glass. Here you also see that the smaltite tiles have been attached or moulded onto light-grey mortar. The regular attachment procedure with mosaic tiles is to glue them to a façade and then mortar the tiles and finishing by washing off the front so surplus mortar does not cover the tiles. (Biggs, Emma, Hunkin, Tessa, 1999) We must assume that the same procedure has been used here. If you lay a hand on the front of the façade, you sense unevenness. The tiles cover a level surface, but due to their varied thickness, even in the same tile, they will either angle slightly in ratio to the level or protrude or extrude. Furthermore, the joints, which are slightly recessed, add another deviation to the level of the façade. Daylight, streetlights at night, and the headlights of cars will in the faceted glass tiles and surrounding joints of the façade create dynamic, ever-changeable light-shadow effects. The façade is seen as a vibrating, living organism, as a huge textile whose texture plays with the light. Nanna Ditzel is famous for her furniture design that has a singular detailed poetry and rhythm about it. Nanna Ditzel has upholstered the building in Klareboderne as if it were a piece of furniture in its fanciest dress that still, forty



This and opposite page: façade panel for a mounted façade solution in specific ceramic glazed concrete, 160 cm x 50 cm x 1-2 cm, white stoneware glaze. The panel is shown with exposed mounting modules, wooden bars that are part of the entire ornamentation. Photo: Ole Akhøj.



years later, appears with organic and is patinating in the most beautiful way possible.

THE LARGE-SCALE TILE

Danish architect Arne Jacobsen's service station from 1939 at Skovshoved Harbour (Dahl & Wedebrunn, 2000) can also be experienced up close. Today, it is a gas station with car wash and an ice cream store with the best ice cream cones in the area. It can be seen from Strandvejen, which about 3 kilometres further down the road presents Arne Jacobsen's famous Bella Vista. The gas station can also be seen when you stop there to fill up both your car and your stomach. The cubical carcass of the building is covered in light-grey, glossy, industrially manufactured similar ceramic tiles with the measurements 15x30 cm. (Dahl & Wedebrunn, 2000) The dark-grey joints five millimetres behind the tiles emphasize the boundaries of the tiles and divide the surfaces of the building into repeated and mutually displaced levels. The tiles and the underlying joints appear in their details and light fracturing as a contrast to the sculpturally continual moulded concrete mushroom that appears as if it had been formed in one movement by the hand of the sculptor. The mushroom and the carcass hang together, but have distinct expressions. The building carcass' ceramic covering exhibits the perfection and standardized repetition of industrialization. The tiles` surfaces remain on the same level with the exact same colour and shape. They, unlike smalti, do not rouse curiosity. From far away their textile expression remains intact, but up close it is dissolved into joints and tiles. The light is reflected and on warm days the tiles signal refreshing cooling and distance and during the winter, coldness. Only the scale of the tiles, which corresponds to the stretch of a hand, demands intimacy. Otherwise, the gas station, with its tiled carcass and mushroom-shaped iron-concrete construction appears like a monumental work at a museum. It should be looked at, but does not invite touch. If the whipped cream from the ice-cream store with marmalade and chocolate sprinkles drops from the kid's hand and hits the façade or a spot of oil or gasoline dirties the façade, no harm has been done. It can be wiped off with a rag and the light-grey colours of the tiles will once more appear in their magnificent splendour. Only the joints indicate vulnerability, seem open to change and ageing the way we deal with them in the cleaning of our bathrooms.
Industriens Hus by Erik Møllers Tegnestue is today covered in a harlequin patterned glass façade from architectural firm Transform's façade solution. Wheter this is to tell of how

Opposite and this page: mounted façade made from red cedar wood as solar protection in front of window sections at Barcelona's Biomedical Research Park by architects Pinearq and Brullet De Luna. Photos: Anja. The Two next pages Panels, 160 cm x 50 cm x 2 cm. Ceramic glazed concrete. Photos Ole Akhøj..

Tivoli is next door, I do not know, but it could easily be mistaken for one of the amusement park's rides. Before this covering, the building was covered in clay tiles from the first to the sixth floor. The urban space surrounding Industriens Hus is large enough to allow for standing at a distance from the building, even far enough for it to be read as a whole. Industriens Hus has a lobby that points towards Martin Nyrup's Copenhagen City Hall on H.C. Andersens Boulevard built in red brick and with a long wing that accompanies Tivoli's garden down Vesterbrogade. (Arkitekten, 1975) The building is experienced up close from the cross walk or from your bike or car when you travel past it on one of the main thoroughfares of Copenhagen.

Industriens Hus was a building you passed on your way without really noticing the details of the building. The bottom part is made up of storefronts and these are the ones most people are likely to notice when they pass by.

But if you chose to look up, you would see tile covering with much variance in terms of colour and texture, yet kept in subdued, red and brown-black nuances. The tiles that measured about 10 by 10 centimetres were cast into mounted concrete panels, 16 horizontal and 19 vertical. The light-grey concrete joints or spaces in-between were noticeable and so were the more discernible expansion joints between the concrete panels. The façade of the building functions as an amazingly large patchwork arranged according to the strict geometric logic of the concrete element building. It spoke to Nyrup's city hall with materiality, but also made it clear with its mounted façade panels that it had been erected relatively recently. It was a slightly messy building façade that wanted to do too much. This could be seen, for example, from the vertical steel bars installed on the mounted façade. The steel bars that were meant for hanging advertisements from accentuated the vertical lines while the building's division in ribbon windows separated by the tile façade pointed towards the horizontal line sequence. It was not possible to touch the tiles; they could only be seen from afar. The tiles shimmered both in terms of colour and texture.

This and opposite page. Dorthe Mandrup Arkitekter's addition to Bording School in Østerbro. The façade is made from Corten-steel and creates new spatiality in the urban space. It is done with much finesse and sculptural beauty that precisely demonstrates new potentials for the mounted façade that otherwise seems so invasive with little substance in many façade coverings today. The façade at Dorthe Mandrup's Bording School uses visible mounting modules as an active part of the entire visual narrative as also the space between the mounted Corten steel plated adds to the honest narrative of mounting. It is a façade done with much artistic value and sensitivity towards materiality and the surrounding urban space. Photos: Anja.

Tile products have an unusually large amount of expressions. They can be unglazed with the many red-yellow colours of the clay, glazed with an infinite spectrum of colours, more or less opaque, translucent, or transparent, or they might be engobed, which in many ways resembles glazing, but actually is a more fusible kind of clay potentially combined with colouring oxides. An orgy of colours can be attained, but there is not really any tradition for this in Denmark. Here we mostly use muted colours that enter into a dialogue with surrounding buildings made from bricks, concrete, wood, or glass. In Industriens Hus, the tiles are exposed. They are neither glazed nor engobed. Yet, there is much variance in terms of colour and gloss. Some are red, while others are practically dark-brown nearing black. There are tiles that seem perfectly smooth as if they were glazed, while some are mat and look as if their surfaces are porous and vulnerable.

At Arne Jacobsen's Service Station, we experienced the possibilities of industrial process in terms of manufacturing completely identical tiles. In Industriens Hus, the tiles have likewise been manufactured industrially, but here the possibility of variation stems from the kiln environment. The colour and texture of the tiles, thusly, are a function of where they have been placed in the kiln and how close to the heat source they have been. This is what makes ceramic so interesting. There are so many factors to play with: materials and their mutual relations, kiln environments, temperature curves, holding time, and so on. It is both exciting but also a great challenge if the fully identical tile is to be produced by the thousands. To return to Industriens Hus, this covering tells us of the possibilities for variation that exist in a standardized industrial process and thusly offers a solution to what is sought by new-industrialism through rather few devices.

The tiles rouse curiosity and a desire to read each tile closely. But the distance prevents it. On the other hand, it is precisely the read from afar and the variation of the tiles' expression that make the façade vibrate dynamically like thousands of pixels in the big picture. If you walk a bit down Strøget in the Copenhagen city centre, you arrive at Gammel Torv and Nytorv. At Gammel Torv, you see Stellings Hus, designed by Arne Jacobsen in 1937. (Møller, 2001) The façade of Stellings Hus is clad in light grey-blue, smooth, glazed Siegerdorfer tiles, some of which are level, while others are curved, including both those that are used to end the façade covering sequence towards the lower window section, and

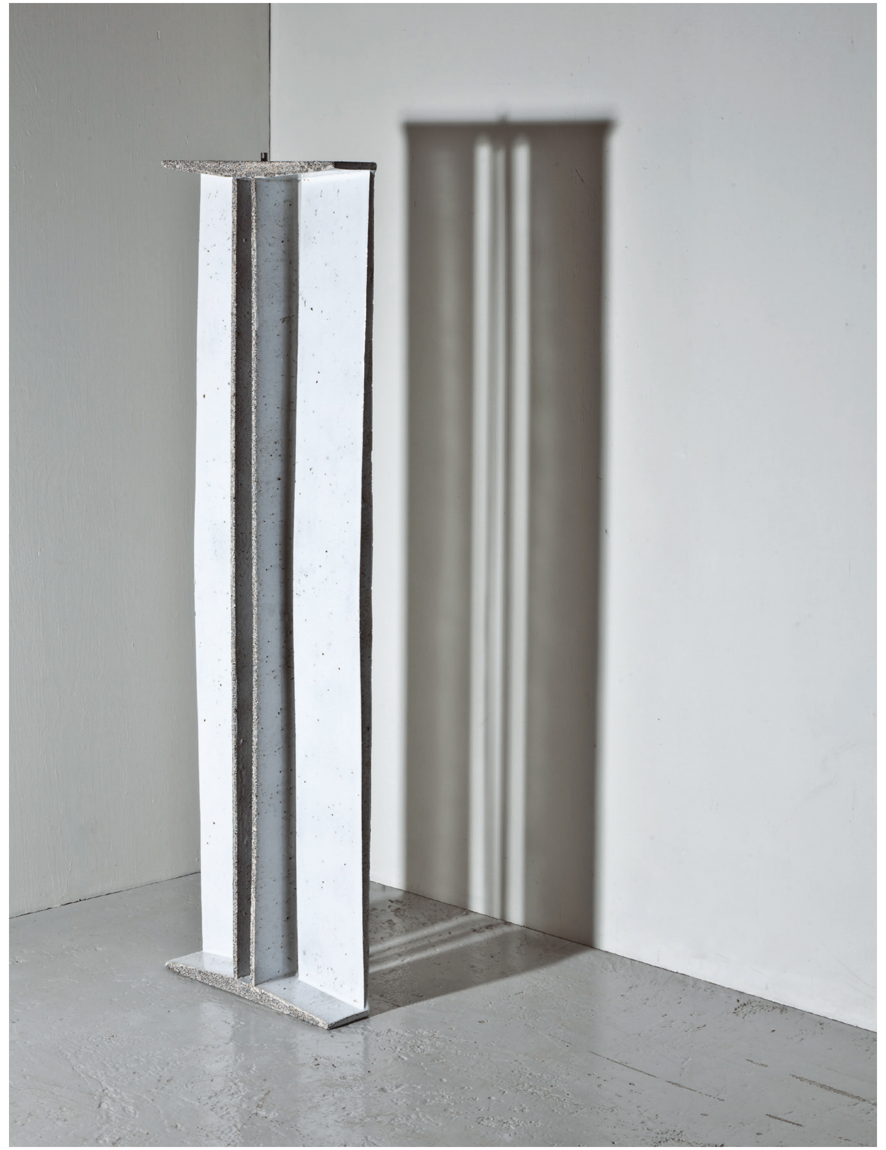
Opposite page: detail that shows the meeting between two self-supporting façades when these are put end to end. Please note that the reinforcement bars are visible and are part of the jointing technique. The objects are made from specific ceramic glazed concrete with whole or partial white stoneware glaze. Photo: Ole Akhøj. This page and the two next pages: one of the self-supporting façade solution where form stability is achieved through low thickness but with more spatial fill than the level as an examination of light, shape potential, and materiality. 160 x 50 x 1-3 cm. Photos: Ole Akhøj.

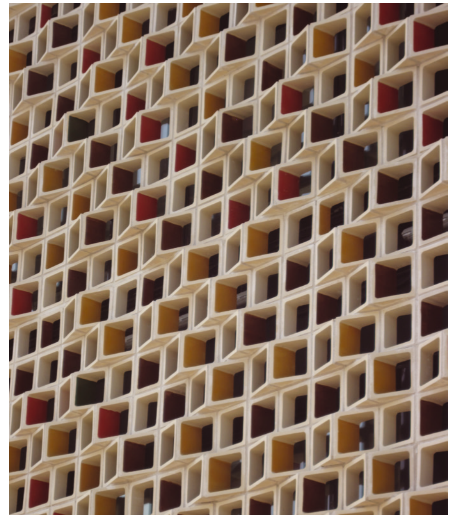
those in the softly rounded corner sections. The tiles measure 52 by 52 centimetres and are mounted on cast metal anchors spaced with five millimetres. (Dahl & Wedenbrunn 2000) The building owner, Stelling, was one of the largest paint dealers of his day and had the house built to house both the company's art supply store and its offices. (Møller, 2001) If made today, with our interpretation of and ideas on branding, it could very well have become a façade covering with a plethora of colours. Instead, Arne Jacobsen opted for modernistic building and toned down the colours of the tiles, entering into a close dialogue with the lower floor's sand-blasted, green-painted metal plates and window sections.

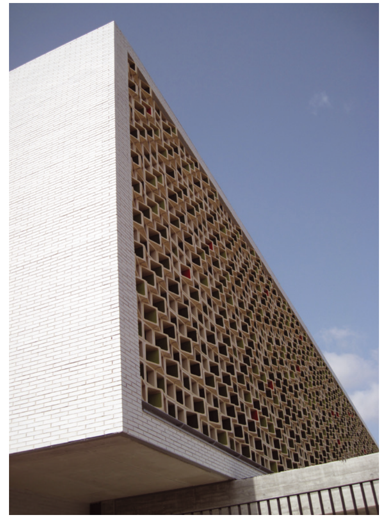
Both in Industriens Hus and Det Berlingske Hus, which I will discuss in more detail later on, the tiles are not glazed and fired clay is exposed in a more mat version. Here the light is not reflected, but absorbed by the roughness and porosity of the materials and tells a story of this. On Stellings Hus, the tiles are glazed and the underlying material is not visible. Here the tiles made from clay approach the expression of the painted and enamelled metal plate and very much resemble it. The only thing that evokes the clay tiles is their size, as metal plates tend to be larger, and also the reading of the edge of the tiles, which are visible in the quadratic windows. Here you see that the tile has a certain thickness that is much larger than and uncharacteristic of the metal plate. The size of the tile relates to the dimensions of the window so it is made possible to have three tiles along the height of the window, and three along its width. It does seem, however, that the large tiles cause some problems by covering the entire building. As such, in the rounded corners, they are divided into smaller tiles split in half. I have a difficult time seeing why this was necessary, since the underlying tiles are not divided but nonetheless are able to remain the same size. In Stellings Hus, the tiles are so big that despite the larger distance to the people reading them they no longer have the textile expression.

Arne Jacobsen's Stellings Hus articulates industry to a much larger degree than his service station on Strandvejen. The covering functions as a portent of what was to come in the following decades in the form of numerous metal façades.

This and opposite page: self-supporting façade solutions made from specific ceramic glazed concrete with exposed and visible reinforcement barsand connector. 160 cm x 50 cm x 1-3 cm. Photo: Ole Akhøj.







The Spanish architectural firm Mesturas Architects' The Martinet Primary School in Barcelona. An example of a sensuous juxtaposition of different materialities and colours. With a self-supporting/borne façade made from glazed porcelain with an inserted frame of concrete and white and blue glazed tiles. The spatial three-dimensional porcelain element is glazed in an off-white with colours shimmering in red, yellow, and green. The porcelain wall enters into a poetic dialogue with the continual on-site cast concrete wall that is layered. It is cast on a wooden formwork, part plate, part long laths, and thusly contributes its own rhythm when studied up close. Photos: Anja.

SCULPTURAL TILE - SCULPTURAL EFFECT

In Berlingske Hus, which used to house the oldest newspaper in Denmark, on the corner of Sværtegade and Pilestræde in the Copenhagen city centre, each clay tile is manufactured sculpturally, referencing contemporary typesetting symbols and newspaper production. Architect Bent Helweg Møller's Berlingske Hus, which today is used for stores, residences, and offices, is from the first floor up clad in yellow-ochre relief tiles of about 10 by 10 centimetres. The tiles are cast in light-grey concrete that appears as light, encircling joints in a network of vertical and horizontal lines. Each tile is a sculptural relief in its own right; a one-off multiplied with industrial production methods to acquire the homogeneity of the standard product. The façade, as such, is clad in thousands of completely similar, sculpturally designed tiles moulded in negative mould. The distinctiveness of each tile fades out of sight in the endless repetition, arranged in the spread of the façade as a flickering light and shadow play that suspends weight and mass and is transferred to the textile covering. Here are no visible dilation joints between concrete panels nor any horizontal metal bars for hanging advertisements. Here are only the windows that break up the tile covering and become a narrative about scale and the interior functional divisions of the building. The level tile here has moved into the three-dimensional space, which, however, being seen from afar fades into a two-dimensional pattern of light and shadow. The sculptural effect disappears with distance, but surprises with close reading. Bent Helweg Møller's Berlingske Hus has just undergone renovation, and the tiles are completely new. Their colours are brilliant and have yet to absorb the dirt of time and develop patination. It will be interesting to see how they will look years from now.

Other kinds of three-dimensional tile coverings include tiles that remain in the level, but follow an underlying formwork. This is seen, for example, in EMBT Architects' canopy for the Santa Caterina Market in Barcelona from 2005. Here the roof is clad in richly coloured level tiles. These, however, have been chosen to be so small that they approximately follow the richly curved surfaces of the canopy. (Baena, David, (et al), 2005)

In Daniel Libeskind's proposal for the extension of the Victoria & Albert Museum in London, the "Spiral," the larger, level surfaces have been purposefully displaced so, similarly, a relief effect emerges, as fractals fracturing. (Liebeskind, 2001)

TILES AND GLAZED TILES

If we now move northwest of Copenhagen we will encounter one of Arne Jacobsen's major works, Toms Chokoladefabrik. Here we move into one of the early Danish architecturally designed industrial buildings where both the broad outline and the small details have received much attention. Toms Chokoladefabrik was built in 1959-1961 on an entirely empty and very level field as a 23,000 square-metres production plant (Skriver, 1962). It consisted of a two-storey elongated and closed building carcass that in the front was vertically broken off by the six-storey main building and by the cylindrical chimneys reaching for the sky at the back of the building. The factory had skylights, but was in all other respects as closed as Pandora's box with only the well-known TOMS sign on the main building suggesting that the factory produces candy and chocolate, which it still does today.

From afar, the building is experienced as a white, shining, monumentally sculptural mixture of stringent geometrical shapes such as cube, cylinder and rectangle, while it up close is dissolved into black vertical and horizontal lines of several metres in a uniform grid, which stems from the joints between the large, concrete sandwich elements of one square meter. When examined up close, something only guests or employees can do, this grid as well is dissolved into a more fine-meshed grid as a narrative of the many 5 x 5 cm white, smooth tiles, which are cast into the metal frame of the sandwich element.

Toms' factories are still there and have the same tiled coating. However, much has happened, which unfortunately causes the building as a whole to lose its sculptural stringency and magic; bushes have been planted, and a large driveway as well as a large parking area in front of the building have been built and this prevents the building complex from ever being seen as a whole. Furthermore, the body of the building has been opened colour-wise with several large gates that are scaled to fit the proportions of a truck for delivery of products. These gates were there before, but had been kept in white colours like the tiles and they therefore did not interfere with the monumental whole. The brown-green gate frames on the other hand stand out of the whole very clearly, though without beautifying it. These are openings that seem functionally destined, but to a lesser extent relate to the colouring and rhythm of the building. It had been favourable if the changes had been done with more care and consideration of the visual expression and the gem Toms Chokoladefabrik used to be.

In the 1960s and 1970s when industry was expanding and new factories were being built, one senseless industrial area after another with cheap, prefabricated elements shot up. These were often built in empty areas where we did not have to consider their monotonous, grey repetition on a daily basis. Today, however, the cities are growing so rapidly that they now surround these industrial areas.

At the same time, there has for several years been focus on industrial plants designed by architects for branding and promoting a company and finally, the factories have become more considerate in terms of pollution, noise and odorous nuisances. Today, it is therefore not entirely strange to place large factories or other industrial buildings, close to or in city areas, near habitation, offices, or public parks. This also puts new demands on the appearance of these buildings. They now have to be able to enter into a dialogue with surrounding houses, offices and recreational facilities with regards to scale, materials, colour, and texture. I believe that Toms Chokoladefabrik easily did this in its original form with its stringent shape, its choice of colours, lustre, materials, and awareness of detail.

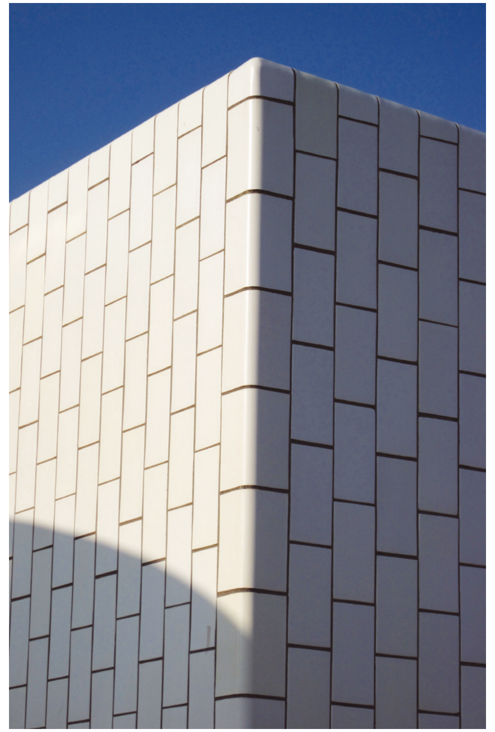
Another industrial plant that can enter into a dialogue with the residential buildings of the city is Elsinore water purification plant by architects Lene Tranberg and Bøje Lundgård. It looks like a small fortress, as a modern counterpart to the much larger Kronborg Castle of Elsinore, but in a scale that matches the large, surrounding mansions of the affluent Strandvejen. A ferry berth, the thoroughfare of Elsinore, railway lines, and a residential street with old patrician houses surround it. Elsinore water purification plant is located behind a light grey, faceted concrete wall of two to about four metres, interrupted at the entrance where there is a series of cylindrical concrete pillars. With the workmanship of artist Lin Utzon, these have been covered with cast, broken white tiles. The pillars are slightly staggered so that people walking around the plant can see the purification plant behind the walls. There is also a main building built in glass and steel, while the rest of the plant is made from on-site cast concrete covered in white, smooth, unbroken tiles (Keiding, 1998). The signalling value here is substantial: we have now returned to the swimming facilities, environments connected to water and cleansing; here the water is cleaned. Marketing is obsolete; the tiles tell the whole story.

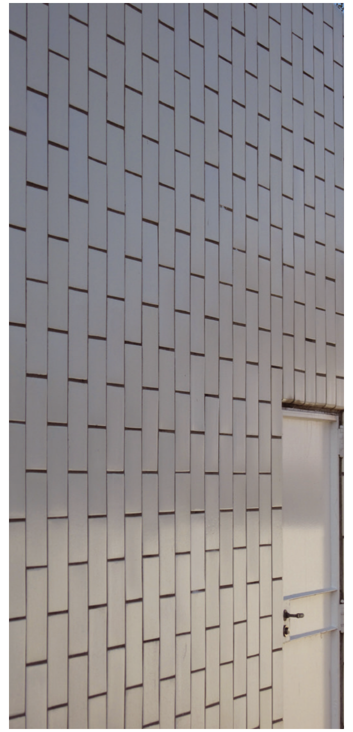
At Elsinore water purification plant, we see the device that Arne Jacobsen also used at the service station, the details of the small tiles and joints as a contrast between the continual material sequence, the mushroom in the gas station, the grey fortress, and the concrete walls also inside the water purification plant in Elsinore. This creates a tension and a material-wise and scale-wise relation and difference that add quality to both materials and accentuate their distinctiveness. This will be lost by the use of large, similar panels. The question is if instead, another form of dualistic tension can be achieved.

THE SMALL SCALE VERSUS THE LARGE SCALE

Several buildings with various types of mosaic and tile covering have been described.

A façade covered with smaltite. Furniture designer Nanna Ditzel's house in Klareboderne 4, inner Copenhagen. Photo: Anja

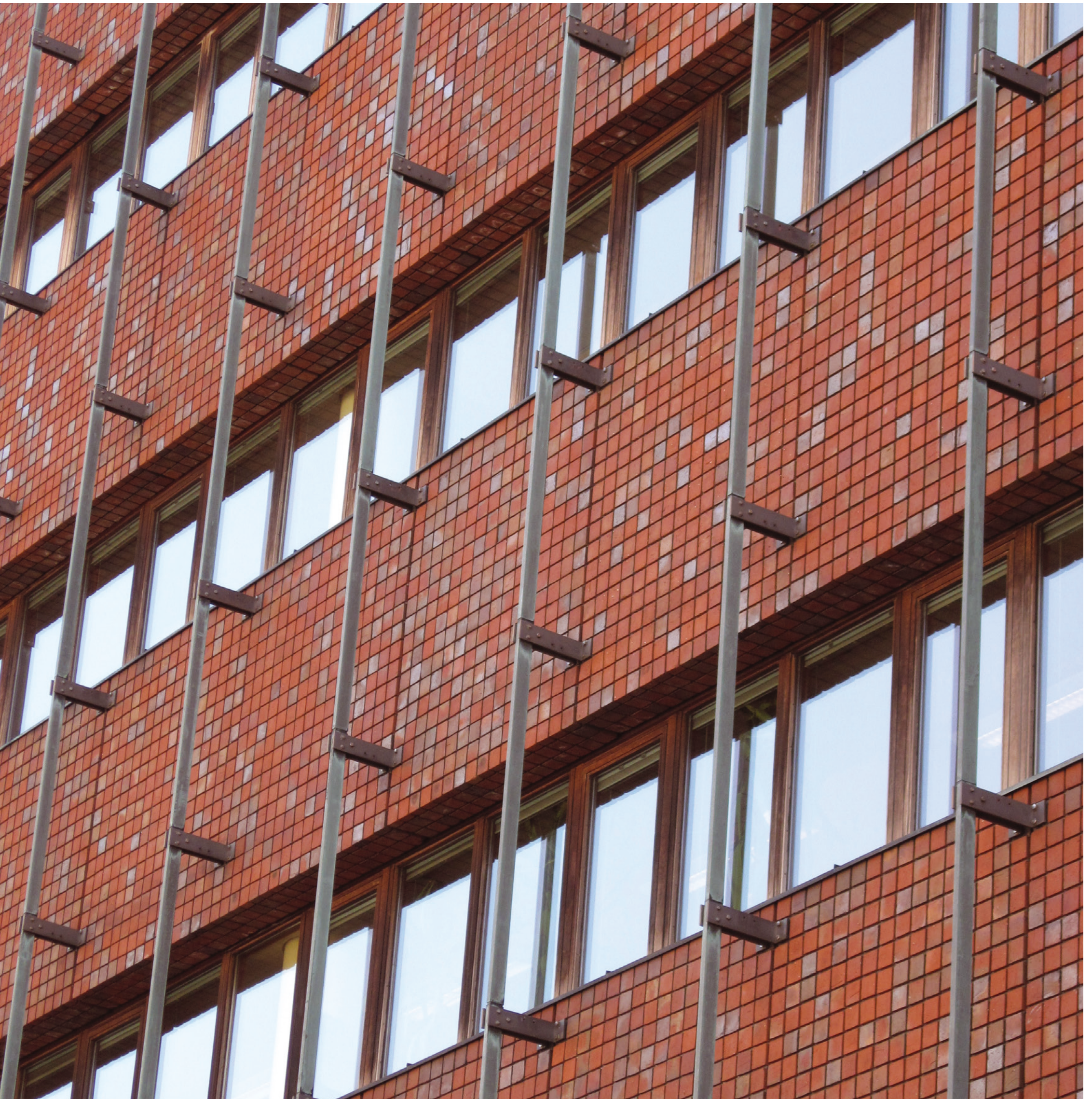




Consequently, some of the advantages of using such materials have been pointed out. In the following I shall briefly outline these and then discuss if large glazed concrete panels can offer the same qualities, possibly transformed, or entirely different qualities, as well as if there are any problems in using these.
The listed qualities are considered in terms of reading distance and context and in relation to experiencing the surfaces sensuously bodily.
It is the close reading, the one where you get up close and touch, fell and taste, found in, for example, Nanna Ditzel's smaltite tile-coated building in Klareboderne in the centre of Copenhagen or Arne Jacobsen's gas station in Skovshoved outside the city. Then there is the experience in the dense urban area where it is not possible to touch, but only to see the described façades. These are Erik Møller's Industriens Hus, Bent Helweg Møller's Berlingske Hus and Arne Jacobsen's Stellings Hus. Finally, there is the reading of façades from afar on the aforementioned industrial buildings: Arne Jacobsen's Toms Chokoladefabrikker and Lene Tranberg and Bøje Lundsgård's Elsinore water purification plant.
For the close reading of the building, where you can touch and feel, as well as for the close reading where you can only see, I have mentioned qualities such as:

- Variance between the individual mosaic and tiles, Nanna Ditzel's house in Klareboderne, Industriens Hus, Elsinore water purifications plant and the rotundas by artist Lin Utzon
- Dynamic play between joints and mosaic, all buildings mentioned.
- Shimmering colours in each tile, Nanna Ditzel's house in Klareboderne and Industriens Hus
- Richness of detail, all buildings mentioned.
- Sculptural three-dimensional shape in each tile, Berlingske Hus.
- Materiality, Nanna Ditzel's house in Klareboderne, Industriens Hus.
- Sizes of tiles and mosaic relating to the scale of surrounding buildings' material and as such entering into a dialogue with these. All buildings mentioned.
- Colours, textures, and lustres are generally subdued with not much difference to the appearance of the cityscape, All buildings mentioned.
- Surfaces are clean, washable and reflect light even on dark days, Arne Jacobsen's Service station and Stellings Hus, and Lundgård Tranberg's Elsinore water purification plant
- Articulation of cleansing, Arne Jacobsen's service station, Elsinore water purification plant.

Arne Jacobsen's service station from 1939 by Skovshoved Harbour with white glazed tile coverings. Photo: Anja.



- Quality and attention to detail and choice of material, all buildings mentioned.

These are all aspects that I believe are qualities for the selected buildings coated in smaltite tiles, glazed tiles, or regular tiles. That is because they rouse our curiosity; we want to close-read and touch the façades with a sensuous approach to perception. The buildings thus become meaningful, bodily, and attractive.
If we now move to seeing buildings from afar, such as we did with Toms Chokoladefabrikker and to a certain extent Elsinore water purification plant, the details more or less disappear and then the qualities can be that:

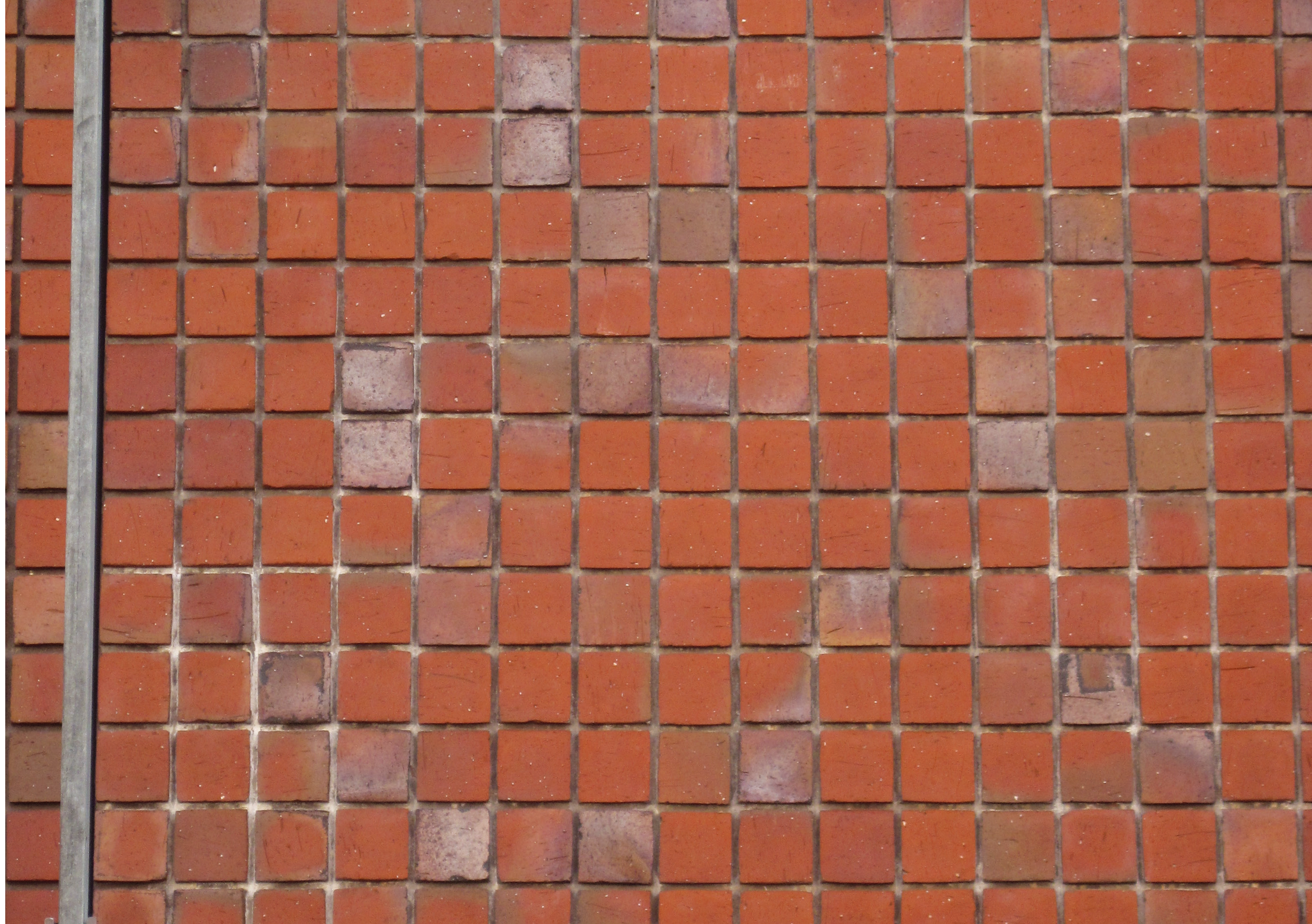
- The buildings can be seen as a whole, as a monumental, sculptural shape.
- The narrative of the surfaces is simplified.
- The glazed surface can be read as the same distribution as the pre-fabricated concrete elements.

Besides the qualities of façades that stem from readings up close or from a distance, a quality I have also mentioned is that the building's appearance changes according to the distance of the reading, so it from a distance is seen in the unique sculptural shape, but up close reveals much richness in detail and dissolution into elements of smaller scale.

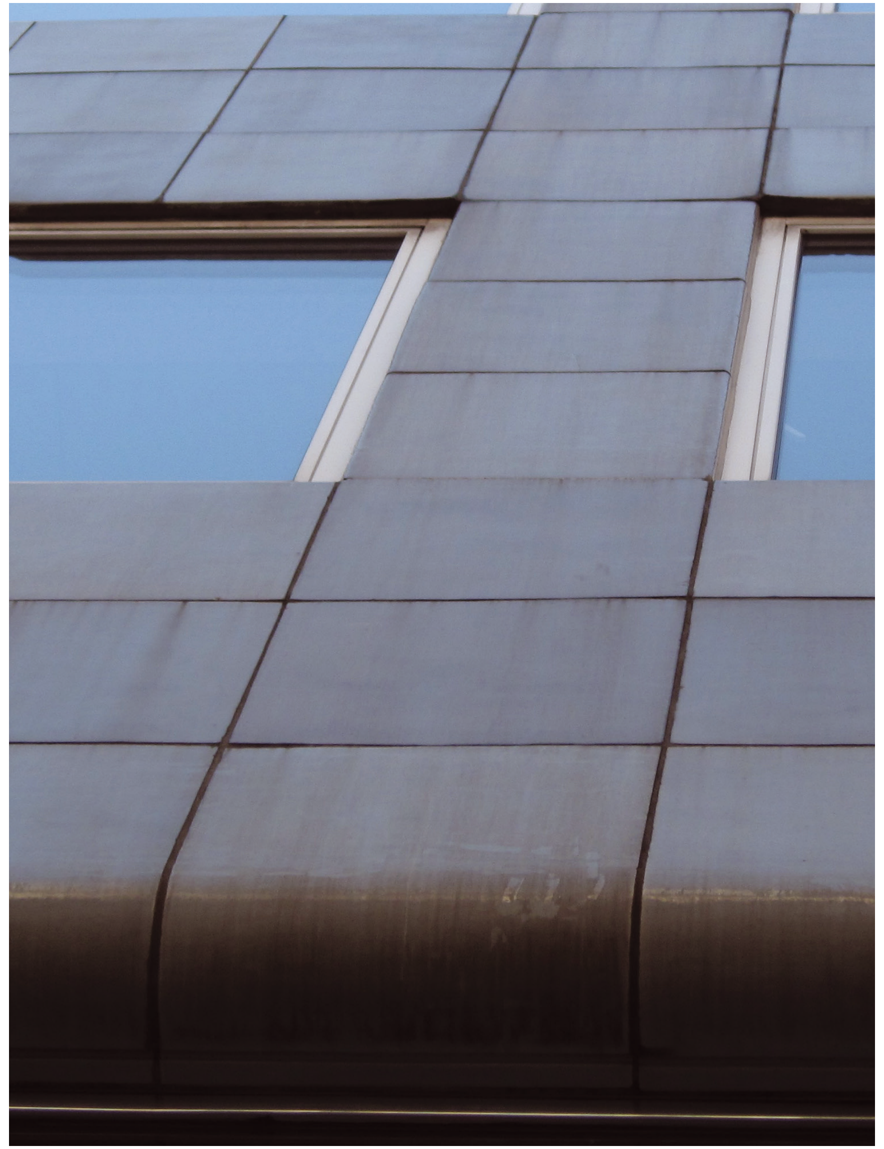
LARGE-SCALE GLAZED CONCRETE PANELS, FAÇADES, QUALITIES

If we on building façades in the future use large glazed concrete panels made from specific ceramic glazed concrete whose colour and texture are even across the entire surface and also remain level, several aspects will be lost. For example, the dynamic textile expression that using mosaic and smaller tiles in conjunction with the joints produces. There is also the size dialogue between mosaic, tiles and the materials such as bricks that the surrounding buildings are made of. In many cases they have similar sizes. Finally, the relationship between the filigree expression found in the small tiles and for example the large unbroken surface, which is found in for example Elsinore water purification plant or Arne Jacobsen's gas station, will be lost.
The large panels will be able to cover entire sides of a house façade for smaller buildings

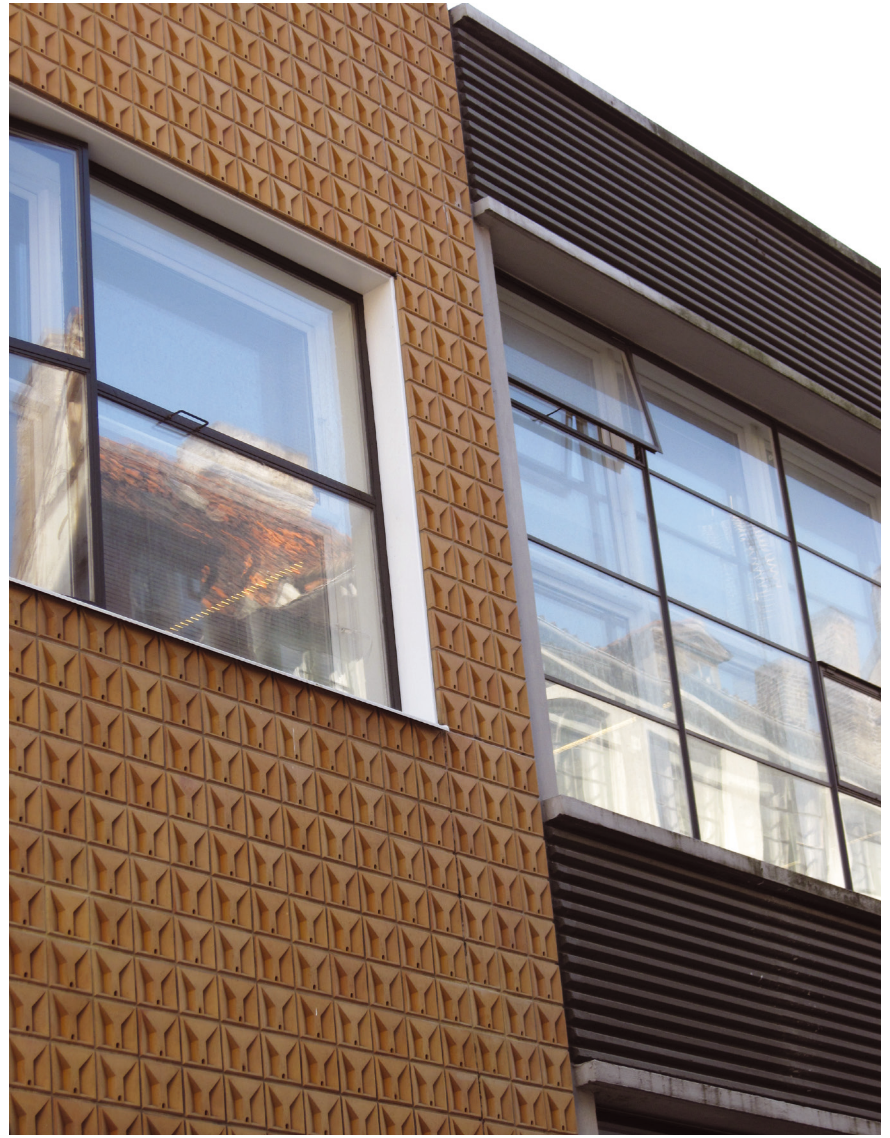
Industriens Hus by architect MAA Erik Møller at the corner of H.C. Andersens Boulevard and Vesterbrogade in inner Copenhagen, covered in unglazed tiles cast into the mounted concrete panels and covered with exterior metal bars for hanging advertisements. Opposite page: the clay tiles up close show their shimmering colour caused by their respective placements in the kiln during firing. Photos: Anja.



and they will as individually connected plates cover the façade of larger buildings. The joints and spaces that emerge here will to the close-reader not at all have the filigree expression, which is characteristic to mosaic and tiles. Instead, the large-scale, glazed concrete panels will be able to articulate the distribution, proportion, and rhythm of a building. This will be possible due to the joints accentuating and emphasizing corner sections, foundation, the meeting of the ground and the roof element. In multi-storey buildings, they can articulate elements, floors and compartmentalization in the building as a whole as well as mounting and juxtaposition. The large, glazed concrete surfaces will thus enter into a dialogue with pre-fabricated elements such as glass sections in office environments, concrete element buildings in general, and perhaps even plastered façades. They might also function as solar protections that stretch from floor to ceiling.
If the large glazed panels instead are produced with glaze that shimmers and has a texture that can enter into a dialogue with the concrete body it can enrich both the detail richness and the close reading.
Glazes can have many colours and mixing them can create even more. There is also the possibility that the same glaze from afar appears as one colour, but up close breaks up into smaller colour varieties. Furthermore, it is possible to take advantage of the potentially many different expressions of concrete. It can be entirely white and have a single colour like the utilized concrete has once it has been fired, but it can also be sanded down to half body and display the aggregate. Furthermore, fibres, if they are made from metal, will appear as black graphic lines in the white concrete body. If the glaze is chosen to be transparent or translucent, it can enter into a dialogue with the concrete body and play with its possibility of details.
It is also possible to take advantage of the concrete's ability to be marked on the surface, for example with a relief effect or actual holed patterns, just as it is possible to integrate hang-fitting and back casting materials into the visual expression as its own kind of poetry, rhythm, and repetition.
The large, glazed concrete panels will also be easier to clean and maintain than the small tiles, because there are fewer vulnerable joints. As with the tiles, these will be able to articulate cleanliness and cleansing as well as, I believe, quality as panels that address our senses and emotionally touch as something aesthetically sublime.
In the article "Æstetiske og konstruktive synspunkter på facader af beton," (Aesthetic and constructive opinions of concrete façades) by Svenn Eske Kristensen (1975), the article



Stellings Hus from 1937, designed by architect MAA Arne Jacobsen, located at Gammel Torv, Nytorv in inner Copenhagen and covered in glazed, mounted Siegerdorfs tiles. Photos: Anja.

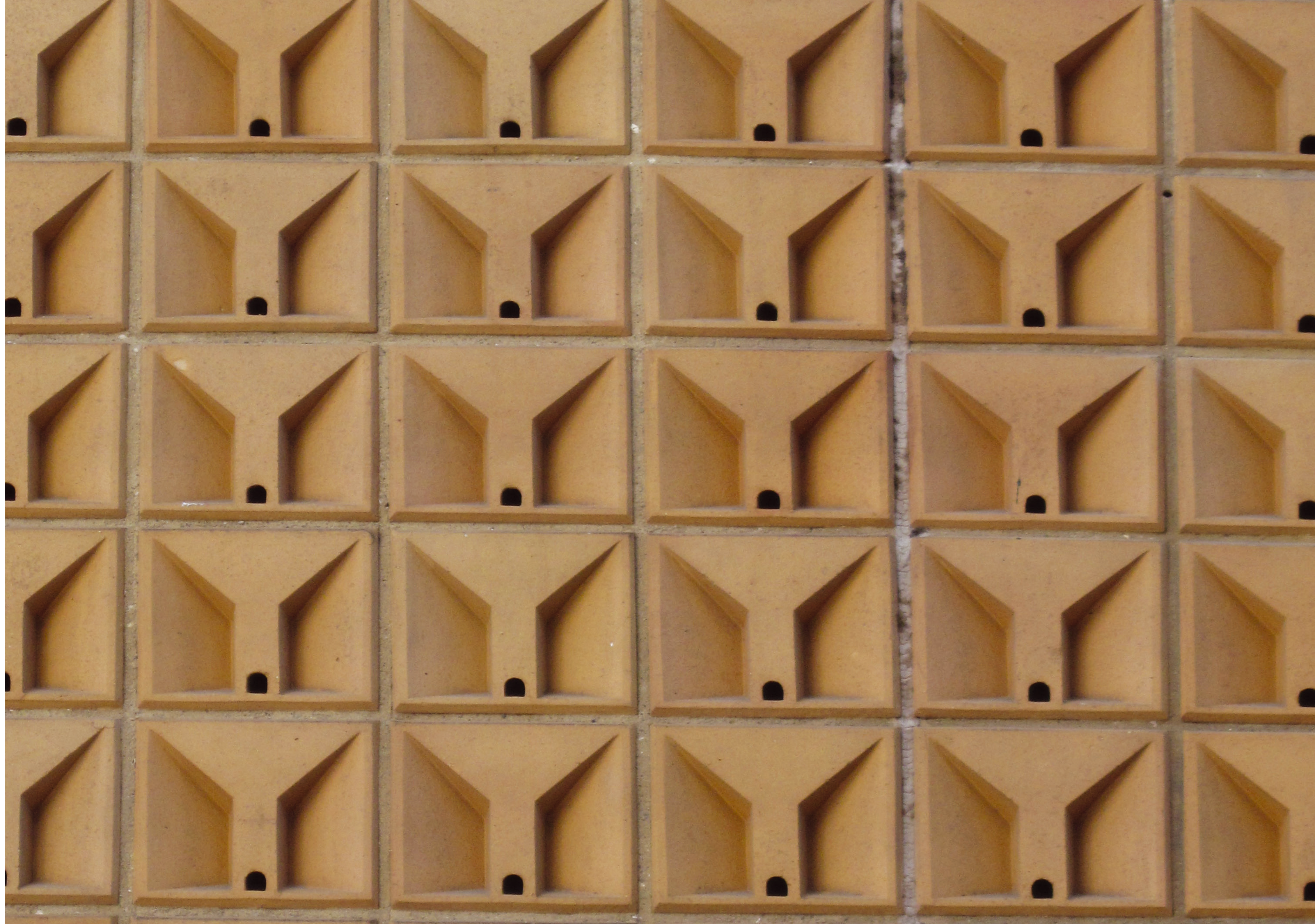


is concluded with a call for façades where the concrete material is utilized in a new and inspirational fashion. That is what I aim to do with my development project. This is what I have tried to do by developing specific ceramic glazed concrete. It is thus my hope to develop new large-scale, glazed concrete formwork and façades for future concrete building. But I am not at all there yet. The façade panels, the initial prototypes I have developed, pointed towards possibilities, but also a host of tests, technical as well as artistic, in relation to the concrete building that lies ahead.

PROTOTYPES FAÇADES

The façades I present in this book, as the initial prototypes for large-scale ceramic façades made from specific ceramic glazed concrete, have been developed as to propose the façade as artistic ornamentation. It is directed towards concrete building in general, with the desire to achieve the same scale as the concrete element, but also to engage in visual conversation with conventional concrete, so that the materiality and material qualities of conventional concrete once more can stand out in the urban space as exposed surfaces. These are not supposed to be deserted concrete wastelands, but function as spread-out elements that work and dialogue with other materials. As I see it, it is precisely in the juxtaposition of the encounters that more of the distinctiveness and qualities of materials can emerge. It is with this in mind I have developed specific ceramic glazed concrete. This is concrete that will work with conventional concrete in urban space and concrete building, and thusly nurture the qualities of both material groups. The initial prototypes of façades I have developed do not correspond to the size and scale of the concrete element. This is because, until now, I have been unable to locate proper kiln facilities that permit such proportions. As such, the prototypes function as the initial demonstration of the potentials of future façades made from specific ceramic glazed concrete aimed at concrete building, both the on-site casted and the prefabricated. When I say I want to enter into a dialogue with the typology of concrete building, I am referring to the building systems I have mentioned, the shear wall system, the transverse solution, and the pillar-beam system. The building elements that are part of these systems are assembled in a kind of grid as an ornamental pattern characterized by direction, proportion, repetition, and mutual relations. It is with the desire to work artistically with the grid of building systems. This grid is likely to be characterized by what the building systems are supposed to bear, but also strictly addresses the plan of the building. This means that by approaching

Berlingske Hus on the corner of Sværtegade and Pilestræde that used to house one of Denmark's largest newspapers in inner Copenhagen, designed by architect Bent Helweg Møller. It is covered in unglazed yellow-ochre tiles of about 10 by 10 centimetres that reference the former type cases of printing technology. Photo: Anja.



the building system as ornamentation, I am also able to implicitly include the building's rhythm as scale, proportion, and repetition as well as being able to indirectly tell of the life to be lived and the relation the building might potentially have with its surroundings. Once the concrete element buildings are clad in ceramic building elements on the façade, the grid that emerged between them and the grid that emerges between the concrete elements, might have different impacts on the expression of the entire building as long as the ceramic elements are smaller than the spread of the concrete element.
By developing ceramic façades as large as the prefabricated concrete element, for example the front wall in the shear wall system, I am able to accentuate the line sequence that emerges from juxtaposing the façade elements in modular building and thusly emphasize its expression. When developing these prototypes, I have given myself much artistic freedom and, as such, have fabulated upon the curtain wall principle in regards to the mounted façade panels. Others of the façades I have developed in specific ceramic glazed concrete are made from a fabulation on the facing wall as a self-supporting construction. The façades emerge from, among other things, the tectonics of concrete buildings, as comment upon this, and a search for a new large-scale façade covering of it. But also with the desire to, with large-scale façade covering, revitalize conventional concrete as exposed material in the façade as well. With this, it is my desire to acquire future façades that express materiality and weight.

CONCLUSION FAÇADE CHAPTER

In the chapter on architecture, the road has been long. It started from the design method Design in a Broad Perspective, the horizontal practice string that links architecture and design, in building component design aimed towards building, specifically including façades. In the chapter, I have also gone over concrete building, including building systems, building technology, industrialized building, and different types of façade. I have done this to present the many aspects that might come into play for the building designer when she is designing façades, but also to the material designer designing materials, in this case specific ceramic glazed concrete.

This and opposite page: Toms Chokoladefabrik from 1959-1961 by Arne Jacobsen is covered with white 5 by 5 cm glazed, glossy tiles, cast in the metal frame of a concrete element. The images show details of the covering as well as the building as it looks today with large portals for delivery by trucks. Photos: Anja

CONCLUSION

In this book I have with excerpts from an on-going development project presented the state of the art of the design method Design in a Broad Perspective and specific ceramic glazed concrete as a design concept.
I have told of the vertical and horizontal practice strings of the design method and the way in which they meet. I have done this in trying to verbalize both as well as provide my perspective on how I believe we advantageously can design materials interdisciplinarily.
In a similar manner, I have described specific ceramic glazed concrete through the different approaches of the strings, including somewhat more or less submitted questions that might be relevant to ask in this context.
Neither method nor specific ceramic glazed concrete have been fully developed. There are several areas that have yet to be examined and furthermore, several fine tunings and clarifications need to be made.
An aspect the reader might have found lacking is thoughts on sustainability, cries for which come from many quarters today. This is no conscious rejection. It has been on my mind, but I have consciously not included it in the design method nor much in the development of specific ceramic glazed concrete. This of course is a lack and should be a point of attention on equal footing with concerns, for example, on the aesthetic aspect of the material designed.
When I nonetheless have decided to publish a book and in it told of the design method Design in a Broad Perspective and the material concept specific ceramic glazed concrete, with lacks and all, it is to spread the message to a wider circle. This is the message that calls for us to design materials not only in relation to their technical performance, but also in relation to how they affect us sensuously, bodily, and emotionally. We should want to kiss the materials we develop for the urban space and buildings; that which surrounds us and sets the stage for our lives. We can do this by sharing knowledge and asking questions across.
In the catalogue, "A Room Defined by its Accessibility" about Danish-Norwegian artist couple Michael Elmgreen and Ingvar Draget's exhibition in the X-room at the National Gallery of Denmark in Copenhagen, Marianne Tarp writes about how the ambiguity of their works creates different structures of meaning:

Several of Elmgreen and Draget's works creates, precisely, a "situation" where it is difficult to tell the existing from the intervention. This ambiguity also appears in each work that refers to several functions and aesthetics at once and thusly also to different structures of meaning. (Tarp, 2001, p. 5)

In the chapter "Art-façades" I wrote that architecture in some cases takes its starting point in the superpositioning technique to locate site-specific solution spaces and narratives. In the superposition technique, selected site-specific layers of meaning were emphasized rather than others. It is this principle I make use of in the design method Design in a Broad Perspective. I select layers of meaning of and perspectives on materials and layer them on top of each other to achieve ambiguity and an opening towards wide solution spaces. I do not tell one story, but set the stage for several being told at once. I do not hierarchize the layers, but seek to provide all layers with similar amounts of significance. Later in that same catalogue, Marianne Tarp points to the open indeterminability as the space where several states exist simultaneously and thusly free themselves from well-defined structures and open up a host of possibilities:

This state of deterritorializing that is neither one nor the other, but by contrast a place where several states co-exist and together make up an ambiguity and instable zone that is central to Deleuze and Guattari's thinking. Elsewhere, they describe this state as being nomadic and fundamentally movable. It is not a passing phase of a development, but central in and of itself, because this open indeterminability contains a freeing from existing and well-defined structures and opens up possibilities of new, potential experiences. (Tarp, 2001, p. 8)

It is precisely the central basis of the the design method that in the encounter between the different layers of meaning, new states arise that differ from what the disciplines can deliver separately. One of the challenges, professor Robert I. Sutton (Sutton, 2002, p. 196) writes, is to make the awkward, yet usually talented loner function in a group setting. Too much consensus in development groups are bad as you should be able to disagree on how to solve a problem - and in that way move the process forward. (Sutton, 2002, p. 196) Here touches upon something essential. Through almost two decades, it has been possible for me to work within this interdisciplinary superposition field, but now the task is to make the work function in teams. This is what I will try by establishing two new interdisciplinary research and development centres as collaborations between the Technical University of Denmark and The Royal Danish Academy of Fine Arts, Schools of Design, Art, and Architecture, as well as industry.
There are already environments rather similar to what I suggest in this book. For example, the centre that professor, architect Mette Ramsgård Thomsen has established at the Royal Danish Academy of Fine Arts, School of Architecture, called Centre of IT and Architechture (CITA). Here experts from different disciplines gather to examine what the coupling of IT-technology and architecture can mean to future architecture, both in practice and in terms of mind set.

CITA is an innovative research environment exploring the emergent intersections between architecture and digital technologies. Identifying core research questions into how space and technology can be probed, CITA seeks to investigate how the current forming of a digital culture impacts on architectural thinking and practice. [47]

A visit to this department bears witness with models, tests, photos, material samples, and more of design processes and examination types based in spatial experiments. They develop, for example, interactive wall systems that with sensors relate to what surrounds them and moves accordingly. At the centre, they work in the macro scale, corresponding to the scale of building, but also the micro scale, in relation to design of interactive textile structures. Their physical works and models alternate between being the open experiment as an idea generator, as spatial art, and actual building components. These are models that breed new ideas, but also mind sets.
In the platform I propose with this book, naturally my focus is on developing materials that can be used in urban contexts and building and that we want to kiss. But my proposal is that the road to this is far more experimental than what the case is today, and that it must be artistically creative, and amenable to detours, with untraditional perspectives as if it were a large play area. What I contemplate is very much like what is taking place at CITA, but also what we see in Danish-Icelandic artist Olafur Eliasson's workshop, except with different perspectives and focus areas. It is the openness towards the experiment, not as what needs to be verified, falsified, or measured, but as what is to generate new ideas, what brings forth new mind sets. At CITA, the focus was on IT technology and architecture aimed at architecture, at Olafur Eliasson's workshop the focus is generally art related to the physical experiment concerning light as well as architecture and construction design. Olafur Eliasson might be most well known for his exhibition at Tate Modern in 2003 where he displayed an artificial sun. But also his Your-Rainbow-Panorama, 2012, at the top of the art museum ARoS in Aarhus is spectacular.

Your rainbow panorama enters into a dialogue with the existing architecture and amplifies what has already been provided; the view of the city. I have created a space that practically erases the boundaries between inside and outside - where you become uncertain of whether you have stepped into an artwork or into a part of the museum. This uncertainty is important to me because it encourages people to think and sense beyond the dimensions they usually move within. [48]

Furthermore, I can mention the façade of Henning Larsen's Architect Islands, the Reykjavik concert hall where Olafur Eliasson has displayed a self-supporting façade made from steel and glass as a Quasibrick inspired by the rock, basalt.
Olafur Eliasson attracts researchers, architects, and artists from around the world who work with him to realize the art projects he develops. They are at once solution-oriented, but at the same time make room for experimentation that does not necessarily seek out solution spaces, but might be the entranceway to the unexpected.
It is such a platform of superpositioned disciplines and layers of meaning I seek out, a play area, but with orientation towards material design and development of materials as well as development of artistic components for buildings and urban spaces we want to kiss.
In this book, I have presented the play area I have moved within. This is where I have developed and displayed specific ceramic glazed concrete. With this book I invite others to join me in this play area.

APPENDIX 1 CONCRETE RECIPES

When working with concrete manufacturing, it is important for health reasons to be wearing mask, gloves, and preferably safety shoes as well as safety goggles, ear protectors or earplugs. Furthermore, the workshop must have exhaustion. The ingredients of the concrete and glaze mixes can be hazardous to health, especially skin, eyes, and lungs.

Recipes, mixing procedures, hardening time, and methods for making conventional concrete, high-strength concrete, and ceramic concrete are listed in the following. They take their starting point in some of the products on the market and can then be revised according to context, and desires of aestehetics as well as mechanical, chemical, and static performances as described in the book. The descriptions of processes, for example mixing and casting, are thoroughly detailed in the chapters "Materials" and "Process/Craftsmanship".
Please note that conventional concrete or high-strength concrete cannot be fired at either earthenware or stoneware temperatures. Only the two ceramic concretes I mention are able to be fired at such temperatures.
Please further note that these are roughly estimated recipes that you can use to design your materials. If they are to be part of, for example, a load-bearing construction in a building they should undergo several standardized tests in relation to this.
Some of the concretes are listed with the information that was provided by the dealer. Please note that other dealers have different mixtures and directions. It is important that the dealer's directions are followed carefully especially when it comes to high-strength concretes and ceramic concretes that contain dispersal agents.
The concrete recipes produce mortar. This means that they have relatively small size aggregate, while concrete for larger building components tend to contain larger sized aggregate. When I in principle solely have chosen to list recipes for mortar it is because these have been adjusted to ceramic objects that have a thickness of about 10 millimetres. If the thickness of the objects being cast were larger than that or if other strengths or types of performance are desired, the concrete recipes, including the size of the aggregate, can be adjusted. I address this in the chapter "Materials" and "Process/Craftsmanship".

RECIPE CONVENTIONAL CONCRETE, (v/c=0,5)
6 kilos cement, Portland Cement
18 Kilos sand 0-25- 4 mm, for example sea gravel or something else
3 kilos of water

MIXING
Put the sand in the paddle mixer and after that the cement. Let it dry mix for a minute. While the blender is running, pour in water and the mass will be mixed in about three minutes.

CASTING
See chapter Process/Craftsmanship and the part on the concrete casting process
Vibration at the vibration table about 50 Hz

HARDENING
Cover the concrete cast under plastic sheets and let it harden for 5-7 days in a damp environment.
Compression = 30 MPa, no standardized tests have been done here.
E-modul = 30 GPa
Density = 2500 Kg/m^3
Tensile Strength=1-3MPa

For any possible principal armament, the covering layer for this should be about 2.5 centimetres or more.

HIGH-STRENGTH CONCRETE
Here we use a high-strength binder (sold in sacks of aggregate), from Densit, Densitop Basic, but other deals and similar products can be used. I do stress, once more, that the dealers' directions and mixing procedures should be followed carefully.

25 kilo Densittop Basic (v/c=0,24-0,26, included in this is 1-3 mm quartz sand)
2,3 - 2,5 litres of water per 25 kg sack
2-6 percentage by volume fibres, (brass coated steel fibres Ø: 0,15 mm in diameter with a length of 6 mm., (Stratec)

Mechanical qualities are listed for Densit binder with no aggregate or fibres.
Compressive strength = 110 MPA
Pend/Pull strength = 15 MPa
E-modul 50 GPa = (ultra sound)

E-modul static = 45 GPa

This is a mixture that contains Portland cement, micro silica, and quartz sand, as well as super dispersal agents.

MIXING
The mixture is dry mixed in a paddle mixer for one minute. After this, while continueally mixing, three quarters of the water is added. Please note, that the mixture initially might seem dry. Be careful not to add any more water as this will ruin the mixture. Mix for four to five minutes and then add the rest of the water and mix for another four to five minutes. This is when the dispersal agents react and the mixture starts to appear wetter. If fibres are being added, they should be sprinkled in now, little by little and as the mixer is going. After this, the mixing should continue for another two minutes.

CASTING
See chapter "Process/Craftsmanship" and the part on the concrete casting process.
Frequency of the vibration table about 50-70 Hz.

HARDENING
Cover the concrete cast with, for example, plastic sheets and let it harden for about 2-3 days in a damp environment.
Please note that the strength is not fully developed after 2-3 days, but it has acquired strength of about 80% of that amount.

DEALERS
For relatively large amounts, more than two ton,
I refer directly to
Densit ApS
www.densit.com
46, Gasværksvej, P.O. Box 220
DK-9100 Aalborg
Phone +45 98 16 70 11
Fax +45 88 18 49 79, Denmark
For smaller amounts of about 1-2 ton
http://www.bjarmodan.dk/produkter/
Fibres that fit, Ø=0,15 mm L= 6 mm, can be purchased at:
http://www.stratec-gmbh.de/
STRATEC GmbH
An der Schleuse 3
D 58675 Hemer
Tel. +49-2372-9270-11
Fax +49-2372-9270-30
www.stratec-gmbh.de
info@stratec-gmbh.de

CERAMIC CONCRETE TYPE 1
10 Kilo Wearcast 2000 HT
520 Gram of water
600 gram steel fibres,
These fibres are from Fibretech, Metal X Fibre, Ø=0.4 mm L=12m. They might, however, also be from other dealers. They are listed with the length and size in which they are sold, but should be adjusted for mixing process and the desired object to achieve optimal design and in relation to the content of the book. Wearcast 2000 HT from Densit Aps is sold, for example, in 25-kilo sacks. They contain cement, micro silica, dispersal agents, as well as corundum aggregates of up to three millimetres while the steel fibres are added separately. This is the concrete binder (cement, micro silica, and dispersal agents) I have based my project on. This is what I have revised and it is for this I have developed the various glazes that will be listed later in appendix 2. The mixture is listed here as it is sold and the reader can then revise it according to aesthetic, static, and chemical performance as described in the book.

MIXING
The mixture is dry mixed for one minute in a paddle mixer. After this, while still mixing, water is added, and the mixing is kept on for another 5-7 minutes. Please note that the mixture initially can appear very dry. For this reason, it is important that the paddle mixer is quite heavy-duty. It can be observed that the mixture's consistency moves from dry to a more wet one after about 3-4 minutes. If fibres are added, they should be sprinkled in after the 5-6 minutes of wet mixing, a little at the time and as the mixer is going. After this, the mixing process should continue for another two minutes.

(with fibres)
Density 3050 kg/m^3
Compressive 170 strength MPa
Flexural strength 16 MPa
Dynamic E-modul 70-80 103 GPa

CASTING

See chapter “Process/Craftsmanship” in the part on the concrete casting process. It should not last more than half an hour as the concrete settles quickly. There should be a relatively high frequency on the vibration table. I usually cast with a frequency of about 90 Hz.

HARDENING
Cover the concrete cast, for example with plastic sheets and leave it to harden for 2-3 days in a damp environment.
Please note that the strength is not fully developed after 2-3 days, but it has acquired strength of about 80% of that number.

FIRING CURVE AT BISCUIT FIRING
Temperature rise of an interval of 50C°/H to 125C°/H where the temperature is kept constant for six hours and after this the temperature increases by 50C°/H again till it reaches a maximum temperature of 1260 C°/H where there possible might be a standing time of 20 minutes so the entire object reaches this temperature. Then turn off the kiln and the temperature will decrease exponentially.

DEALERS
For more than 1-2 ton
Densit ApS
www.densit.com
46, Gasværksvej, P.O. Box 220
DK-9100 Aalborg
Phone +45 98 16 70 11
Fax +45 88 18 49 79, Denmark
For smaller amounts, up to 1-2 ton:
http://www.bjarmodan.dk/produkter/
Fibres
http://www.fibretech.com/index.htm, Metal X fibre
Linda Bostock
Sales Coordinator
Fibre Technology Ltd
Tel: +44 (0)1773 864 200
Facsimile:+44 (0)1773 580 287
Mobile: +44 (0) 7595 204 372
www.fibretech.com
Email: linda.bostock@fibretech.com

CERAMIC CONCRETE TYPE 2
In my development project, this is a relatively new mixture to which I have still not developed a panel of glazes. I do list it here, however, as an alternative to the ceramic concrete type 1 mentioned above. This is ceramic concrete type 2 that I have used for the panels in the installation art at Gallery Oxholm 2013, which I display in the book.

7.5 kilos Secar 710, (heat-resistant cement with a relatively low percentage of calcium in relation to aluminate oxide)
2.5 kilos micro silica (Grade 940; there are different grades of purity, and they might advantageously have larger purity degree than this)
3 kilos corundum 0.25-0,5 mm (Brown Fused Aluminia, BFA equalling corundum aggregate)
3 kilos corundum 0.5-1 mm
9 kilos of corundum 1-3 mm
600 grams fibres. MetalX 12mm heat-resistant up to 1260 C°, for example 0.15 x 6 mm
180 grams Supla 161, dispersal agent
1500 grams water, less is possible

MIXING
Pour corundum or similar aggregate into the blade mixer first, then micro silica and cement. Dry mix for one minute. After this during continuous mixing, add water and dispersal agents (they must be mixed prior to this) and mix for about three to five minutes. The recipe is listed with the amount of water that has been used, but the amount might advantageously be reduced just like the amount of dispersal agents can be reduced to 160 grams as noted by the dealer. But the mixture I list here flows relatively easily and is easy to handle. If fibres are added, this should happen after this. They are gradually sprinkled in as the paddle mixer is going. After this, the mixing process should continue for another two minutes.

CASTING
See chapter on “Process/Craftsmanship” and the part on the concrete casting process. It must be done relatively quickly, preferably in less than 20 minutes because the concrete sets quickly. Once more, it is dependent on how much water and dispersal agents have been used and how well it flows, the vibration table can work at a frequency of 50-90 Hz.

HARDENING
Cover the concrete cast, for example with plastic sheets and leave it to harden for 2-3 days in a damp environment.
Please note that the strength is not fully developed after 2-3 days.

BISCUIT FIRING CURVE
Temperature rise of an interval of 50C°/H to 125C°/H where the temperature is kept constant for six hours and after this the temperature increases by 50C°/H again till it reaches a maximum temperature of 1260 C°/H where there possible might be a standing time of 20 minutes so the entire object reaches this temperature. Then turn off the kiln and the temperature will decrease exponentially.

DEALERS
Secar 71 is sold by Niels Grønborg, info@grønborg.dk and
worldwide http://www.kerneosinc.com/secar71.php
Microsilica is sold at http://www.elkem.com/
Dispersal agent Supla is sold by
Maurizio Bellotto
product manager
Giovanni Bozzetto S.p.A.
via Provinciale, 12
I-24040 Filago (BG) Italy
[Office] +39 035 996832
[Fax] +39 035 4942945
[Mobile] +39 347 5252912
www.bozzetto-group.com
The fibres MetalX are sold at http://www.fibretech.com/index.htm
Corundum is sold at:
Wester Mineralen GmB
http://www.wester-mineralien.de/de/kontakt.html
Heerstraße 41
53347 Alfter-Witterschlick
Deutschland

Tel: +49 (0) 228 - 987200
Fax: +49 (0) 228 - 9872011
Email: info@wester-mineralien.de

CERAMIC JOINTING
2 kilos Wearflex 1000 HT, binder
248 grams of water

Mix for 3-4 minutes so the mass has a good, manageable consistency for the jointing, meaning wet, cohesive, mouldable, and non-fluid. Objects that have been wetted can be attached to it, possibly with built-in mechanical fittings for small scale objects, see the chapter on “Process/Craftsmanship” about this.
Put under plastic for hardening for two days.

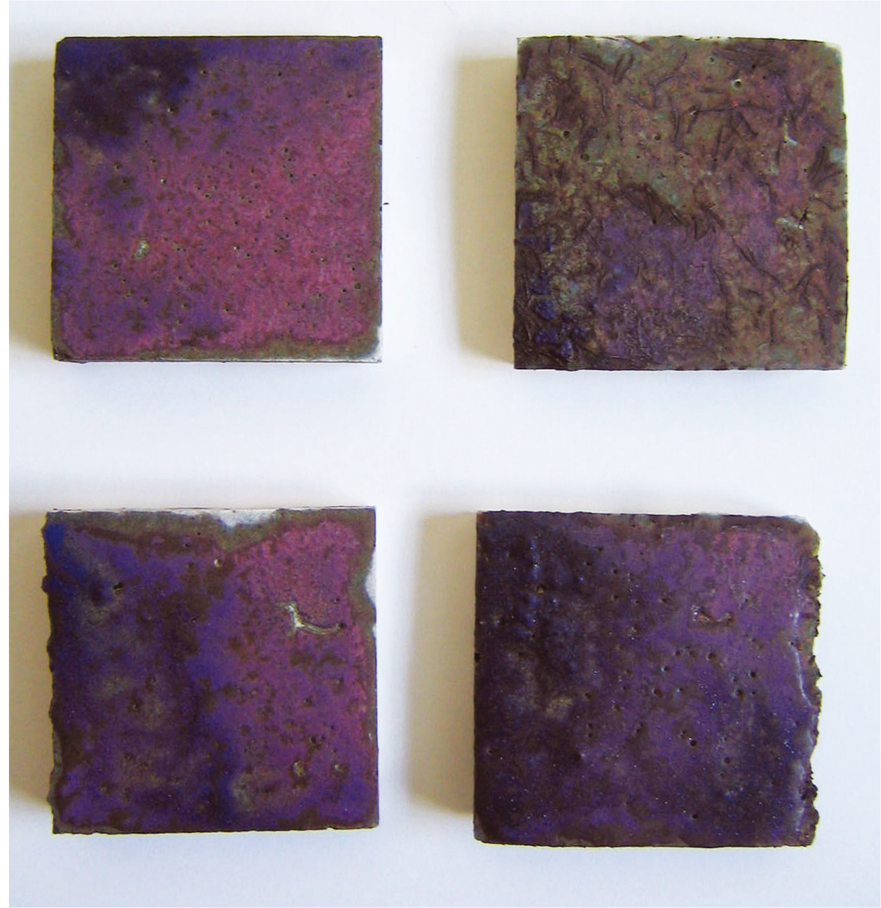
BISCUIT FIRING - FIRING CURVE
Temperature rise of an interval of 50C°/H to 125C°/H where the temperature is kept constant for six hours and after this the temperature increases by 50C°/H again till it reaches a maximum temperature of 1260 C°/H where there possible might be a standing time of 20 minutes so the entire object reaches this temperature. Then turn off the kiln and the temperature will decrease exponentially.

DEALER
http://www.bjarmodan.dk/produkter/

APPENDIX 2 GLAZE RECIPES

In the following I will list a few stoneware glaze recipes that have been adjusted for Wearcast 2000 HT with and without fibres. Please note that glazes must often be revised in case other ingredients are incorporated in the concrete mixes, but also in case of large scale jumps in the constructions. This is, for example, very marked depending on whether or not there are fibres. A glaze adjusted for a concrete mixture with no fibres will often behave entirely different once fibres are incorporated. Using Fraser, Harry's Ceramic Faults and their Remedies, (Fraser, 2005) the glaze errors can be identified and adjusted in relation to the guidelines the author gives. This book is highly recommended when developing glazes. Most of the glazes I have based my recipes on come from Emannuel Cooper's book: The Potters Book of Glaze Recipes (Cooper, 2004). Furthermore, I mention two glazes from a dealer that have already been mixed. All ingredients I have bought at: Cerama: www.cerama.dk, Cerama High Temperature Products A/S . Hammerholmen 44 . DK2650-Hvidovre . Tlf. +45 36772222 . Fax +45 36772624 . E-mail: cerama@cerama.dk
I mention a few feldspar glazes, ash glazes as well as alkali glazes adjusted for Wearcast 2000 HT with and without fibres. The fibres contained in the concretes are the ones for specific ceramic glazed concrete I worked with at the beginning of the development project and are the ones sold by Stratec. These are not, then, the fibres I recommend in the book for other reasons, those that come from Fibretech. If these are used, there should be made new glaze tests to ensure the same result. Firing curves for biscuit firing are listed in appendix 1 along with the concrete mix. I do not mention them here. How to apply the glazes is described in the chapter "Process/Craftsmanship". I do not touch upon that here. I will, however, stress that the layer of glaze must be relatively thick compared to the layer thicknesses usually found in stoneware glazes.

FELDSPAR GLAZES
Glaze firing feldspar glazes: temperature increase 80-100 C°/H to maximum temperature of 1260 C°.

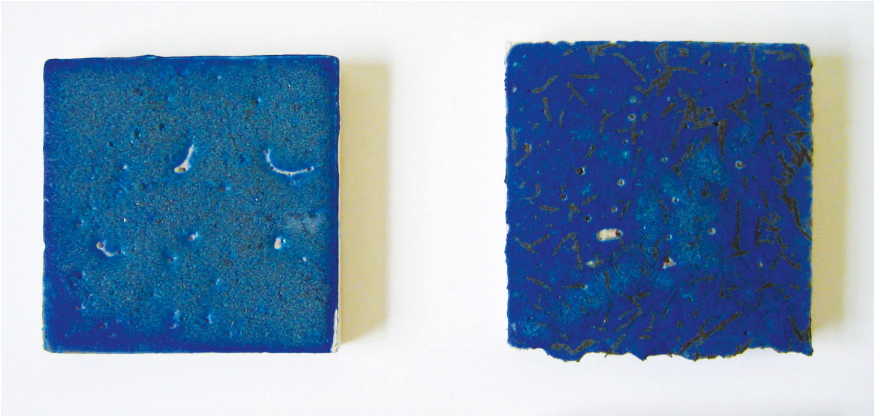


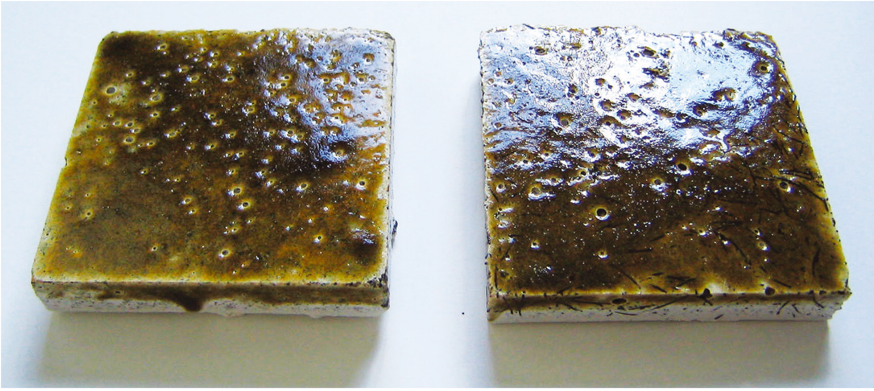
Glaze recipe 1 (light red-dark purple). Thin layer on the top left on Wearcast 2000 HT with no fibres and on the right with fibres. Bottom left, same glaze but with a thick layer, on the left no fibres and the right with fibres. Glaze fired 80 C°/H up to 1260 C° with a standing time of 30 minutes. Photo: Anja.

STANDING TIME:
10-30 minutes in an oxidizing kiln environment.

GLAZE RECIPE 1 (LIGHT RED-DARK PURPLE)
Kalifeldspar, (Norflot), 35 grams
Barium carbonate 40 grams
Kaolin, (China Clay), 5 grams
Zink oxide 15 gram
Nickel oxide 3.2%

GLAZE RECIPE 2 (TURQUOISE - BLUE MAT)
Nepheline Syenite 80 grams
Barium Carbonate 70 grams
Whiting 10 grams
China Clay 20 grams
Flint 54 grams
Copper carbonate 2%, (Here 4 gram).





Top: Glaze recipe 2 (Turquoise-blue mat). Left on Wearcast 2000 HT with no fibres. On right with fibres. Glaze fired 80 C°/H up to 1260 C° with a standing time of 30 minutes. Bottom: Glaze recipe 3 (brown black). Left on Wearcast 2000 HT with no fibres, right with fibres. Glaze fired 80 C°/H up to 1260 C° with a standing time of 30 minutes. There are holes in the surface of the object that the glaze here does not offset. Photo: Anja.

GLAZE RECIPE 3 (BROWN BLACK)
Kalifeldspar, (Norflot) 86 grams
Chalk 20 grams
Pipe clay 16 grams
Flint 52 grams
Iron oxide 8 %, (Here 16 grams)

GLAZE RECIPE 4 ("OPAQUE WHITE") (WITHOUT NICKEL OXIDE)
Kalifeldspar, (norflot) 35 grams
Barium carbonate 40 grams
Zink oxide 15 grams
Kaolin,(China Clay) 5 gram

Top: Glaze recipe 4 (Opaque white). Left on Wearcast 2000 HT no fibres, on right with fibres. Glaze fired 80 C°/H up to 1260 C° with a standing time of 30 minutes. Bottom left: glaze recipe 5 (glossy), top specific concrete with no fibres, below with. Glaze fired 80 C°/H up to 1260 C° with a standing time of 30 minutes. Bottom right: glaze recipe 5 (semi-transparent with copper oxide). Top: Specific concrete with no fibres, below with. Photos: Anja.

GLAZE RECIPE 5 (GLOSSY) AS WELL AS VARIATION 1 (+K), SEMI-TRANSPARENT GLAZE WITH COPPER OXIDE
(soda, have chosen natron feldspar) 114 grams
Chalk,(whiting) 42 grams
Zink oxide 36 grams
Pipe clay, (Ball Clay) 18 gram
Flint 90 gram
VARIATION 1: ADD COPPER OXIDE 1,5 %
Mix of glaze recipes: here 50% of glaze recipe 1 and 50% of glaze recipe 2.
Glaze recipe 2 (50%) (Turquoise-blue mat) + Glaze recipe 1 (50%) (Light red-dark purple)

Glaze recipe 2 (Turquoise-blue mat)
Nepheline Syenite 80 grams
Barium Carbonate 70 grams
Whiting 10 grams
Kaolin,(China Clay) 20 grams
Flint 54 gram
Copper carbonate 2% (4 grams).
There should also have been 6 grams Lepidolite in the mix, but as it was unavailable I have left it out.
Mix with
Glaze recipe 1 (Light red-dark purple)
Kalifeldspar, (norflot) 35 grams
Barium carbonate 40 grams
Zink oxide 15 grams
Kaolin,(china Clay) 5 grams
Nickel oxide 3,2 %

Top: mix 50% glaze recipe 1 mixed with 50% glaze recipe 2. Left on Wearcast 2000 HT with fibres and on the right no fibres. Glaze fired 80 C°/H up to 1260 C° with a standing time of 30 minutes. On the right Ceramas white, glossy stoneware glaze 1302 on Wear-cast 2000 HT with fibres. Glaze fired 80 C°/H up to 1260 C° with a standing time of 10 minutes. Photos: Anja.

GLAZE RECIPE 6. CEREMA'S WHITE
glossy stoneware glaze, cerama number 1202, fired at 1020 to 1260 C°. Here fired at 1240 C° in a Wearcast 2000 HT with Stratec steel fibres. This is the glaze I have used for many of the objects I display in this book.

ASH GLAZES FOR WEARCAST 2000 HT WITHOUT FIBRES
80-100 C°/H, 1260 C°, standing time 30 minutes, oxidizing

ASH GLAZE AS(1)
Kalifeldspar 150 grams
Kaolin 30 grams
Quartz 30 grams
Bone ash 90 grams

AS(1)(1) + 4 % Nickel oxide
AS(1)(2) + 4 % Copper oxide
AS(1)(3) + BLANK

ASH GLAZE AS(2):
Kalifeldspar 135 grams
Flint 30 grams
Bone ash, (Cerama) 35 grams

AS(2)(1) + 4 % Nickel oxide (Expected to be red)
AS(2)(2) + 4 % Copper oxide (Expected to be black)
AS(2)(3) + BLANK

GLAZE FIRING - ALKALI GLAZES FOR WEARCAST 2000 HT WITH NO FIBRES.
80-100 C°/H 1260 C°, STANDING TIME 30 MINUTES, OXIDIZATION

ALKALI GLAZE AL(1):
Nepheline syenite 135 grams
Barium carbonate 120 grams
Quarts 30 grams
Kalifeldspar, (norflot) 24 grams
Quarts 15 grams
Fluorspar 6 grams
AL(1)(1) + 1 % iron oxide (Expected to be green)
AL(1)(2) + 4 % iron oxide (Expected to be yellow)
AL(1)(3) + BLANK

Top: Alkali glazes from left to right: AL(1)(1), AL(1)(2), Al(1)(3). Middle from left to right: ash glazes AS(1)(1), AS(1)(2), AS(1)(3), and bottom ash glazes AS(2)(1), AS(2)(2), AS(21)(3). Glaze fired at 80-100 C°/H up to 1260 C° with a standing time of 30 minutes. Photo: Anja.

APPENDIX 3 MOULDS

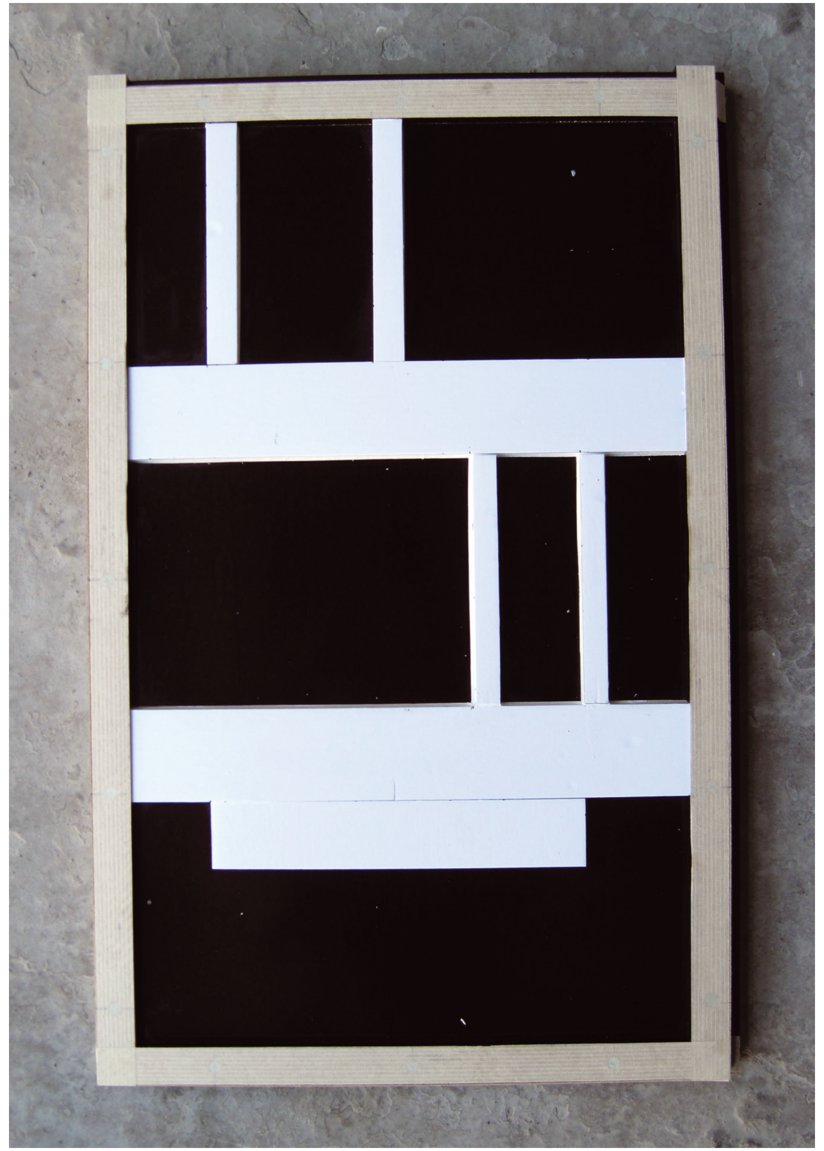
The manufacture of different kinds of moulds is described.
In the development of the ceramic glazed concrete, I have primarily worked with the casting process for manufacturing concrete objects. This demands that the concrete is either cast in or against a mould.
In the following I will go over how three different kinds of moulds can be manufactured. These are moulds that can be used both for conventional concretes, high-strength concrete, and specific ceramic glazed concrete.
Some materials are better suited to be used for moulds than others. With high-strength concretes and specific ceramic glazed concrete the demands of the surface qualities of the mould are relatively significant. They must have smooth surfaces, otherwise the concrete will stick to the mould and therefore be difficult, practically impossible, to remove from the mould once the concrete has hardened.
Plaster is used for moulds in casting loam production. Plaster, however, is not viable for concrete because it absorbs water and the smallest particles of the concrete in their surface and thusly binds the plaster and concrete together.
Experience shows us that plaster with alkyd paint and other surface paints do not seem to work. Likewise, oiling has no effect. Plaster, therefore, is not presently a material I would recommend for moulds used for high-strength concretes and specific ceramic glazed concrete. These require a silicone rubber mould in between the plaster and the concrete. I will talk more about that in this chapter when I go over the horizontal, level mould with part-mould inserts.
Textiles can be used to some extent. They produce concrete objects that in their form clearly signal the pressure and weight of the cast concrete construction. I have not used textiles and will not discuss them further. Instead, I refer to professor Mark West at CAST Centre for Architectural Structures and Technology, the University of Manitoba, Canada and his work with fabric formwork for concrete casting, (West 2002-2010) and architect, PhD, Anne Mette Manelius PhD dissertation on this subject. (Manelius, 2012).[49]
Generally, moulding plywood, steel, silicone rubber, plastic, or other metals are used to make moulds. Selecting the materials for moulds depends on how many concrete objects of the same shape are to be cast as well as their shape and the finances of the project.
If several objects of the same design are to be manufactured, steel might be solution, but also a very expensive one. If 10 to 20 of the same object are to be manufactured, silicone rubber moulds can be used, but this material is expensive as well.
Wooden moulds made from moulding plywood can also be used for the manufacture of 10 to 20 of the same unit, but are only suited for some designs. I have primarily worked with wood, foam board, silicone rubber in combination with wood or plaster as well as foam board. These are what I discuss in the following. I describe the horizontal, level mould, with and without inserts as well as the vertical, spatial mould.

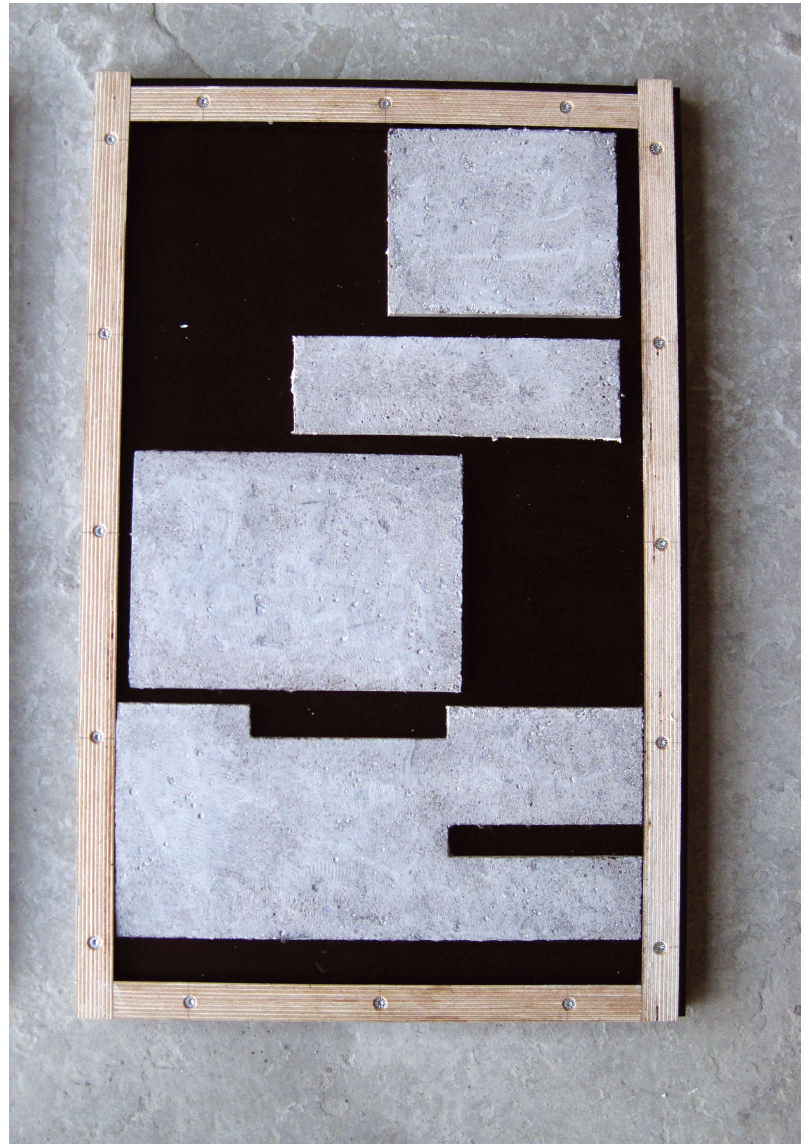
HORIZONTAL MOULD - LEVEL PLATE

The horizontal level mould is used to manufacture level concrete plates. If mechanical fittings for such have been installed, these concrete plates can be assembled afterwards to make spatial objects through jointing or other kinds of mechanic assembly with fittings.
The simplest design is the level, rectangular concrete plate with a distinct, but uniform, thickness. A mould for this can advantageously be made from moulding plywood. Moulding plywood is plywood with a smooth film on either one or the other side of the plate or on both sides. It is possible to attach wooden sides similarly made from moulding plywood, with screws from above on the bottom plate. Drilling is required to ensure that the wood is not destroyed.
It might be advantageous to cover the screws during casting to ensure that the concrete does not flow into them. I usually use masking tape to do this. The sides must be dismounted once the concrete has hardened. The bottom plate must have the side with the smooth film up so that there is only film on one side of the plywood plate. The smooth side must be the one that meets the concrete when it is cast. With the sides mounted, an open box mould is attained. It is advantageous for the edges of the box to be as tall as the concrete plate is meant to become. Then the concrete can be levelled off with a pin drawn across the concrete as it is supported by the edges. In this way the thickness can be controlled and managed.
The mould is drizzle sprayed with mould oil before casting. The surfaces must glisten without being wet and there can be no pools of oil. The mould is placed level on the vibration table when the casting happens. After the concrete has hardened it is relatively easy to take out the screws, remove the edging and remove the concrete object from the mould.

HORIZONTAL MOULD - LEVEL PLATE IMPRINT

Level horizontal mould made from moulding plywood, on the left with masking tape on the edges to protect the screws from concrete and foam board insert to form the level concrete plates. On the right, the wooden mould with no tape, as well as the level concrete plates that can be attained from such a mould and foam board inserts. Photos: Anja.



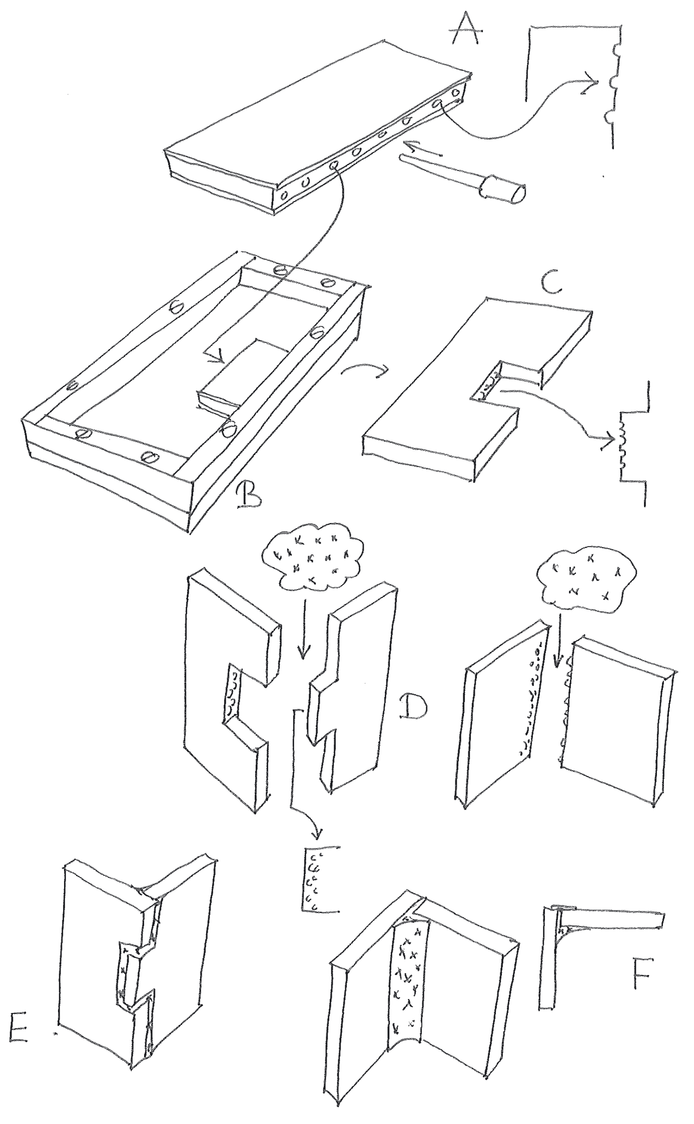


If you want a concrete plate with an imprinted relief pattern, hole pattern, varying thickness, or with fittings for eventual jointing, this can be done by making mould inserts on the level, open mould as mentioned above. Inserts can be made from various materials, but I have primarily used foam board, clay, or silicone rubber. These are materials with which I have also made fittings for jointing to small concrete plates.

MOULD INSERTS MADE FROM FOAM BOARD

If only one plate with imprints is to be made, this can advantageously be done with foam board. Clay can also be used, but it might be harder to control in terms of thickness and stretch because it tends to dwindle and dry out during the process. Furthermore, clay can be difficult to remove after the concrete has hardened. Generally, I have worked with foam board. This is what I discuss in the following.

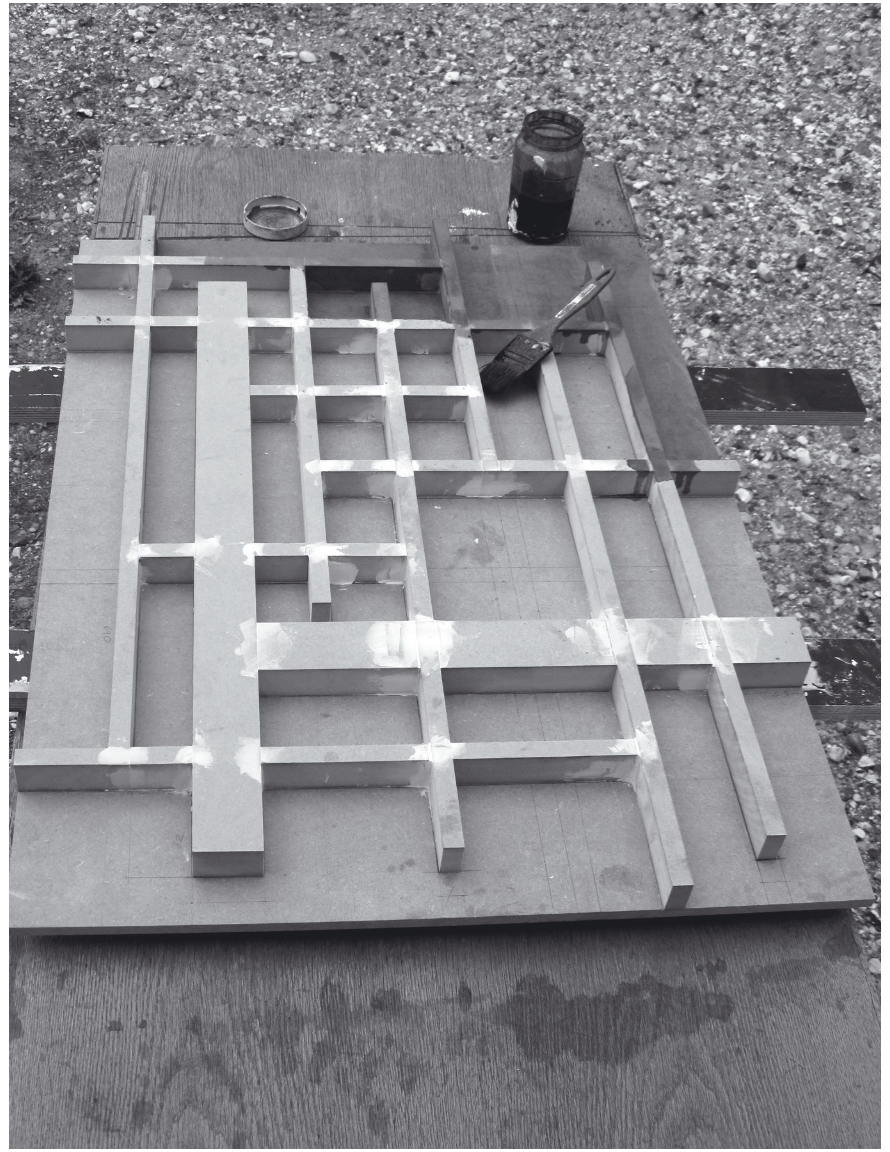
Foam board is available with very low thickness and is relatively easy to cut into with a sharp Stanley knife. It is easy to make patterns. Foam board can be glued to the mould made from moulding plywood (it should not be oiled where the foam board is glued on) with a glue gun and is easy to remove once the casting is over. Wood glue, however, is not a solution because it is very difficult to remove. If foam board is placed at the bottom of the mould made from moulding plywood and if the casting on top of the foam board is done locally, it is important that the thickness of the foam board is relatively little, about 10 mm. If it is any thicker, the vibrations from the vibration table might not spread throughout the concrete and prevent it from flowing as expected. If foam board inserts are made in a wooden mould, the foam board should be an inverted replication of the desired relief or hole pattern. This means that the foam board should be placed where no concrete is wanted. Foam board cannot handle mould oil and must therefore not be oiled before casting the concrete.Mechanical fittings for jointing to small concrete plates can consist of rough edges and locally rough surfaces on the plate. This can be achieved by for example locally stamping the edges and foam board surfaces. With a blunt instrument, you can poke holes in the foam board. Doing this creates grooves in the surface that during casting become a rough surface and edge to the concrete plates.



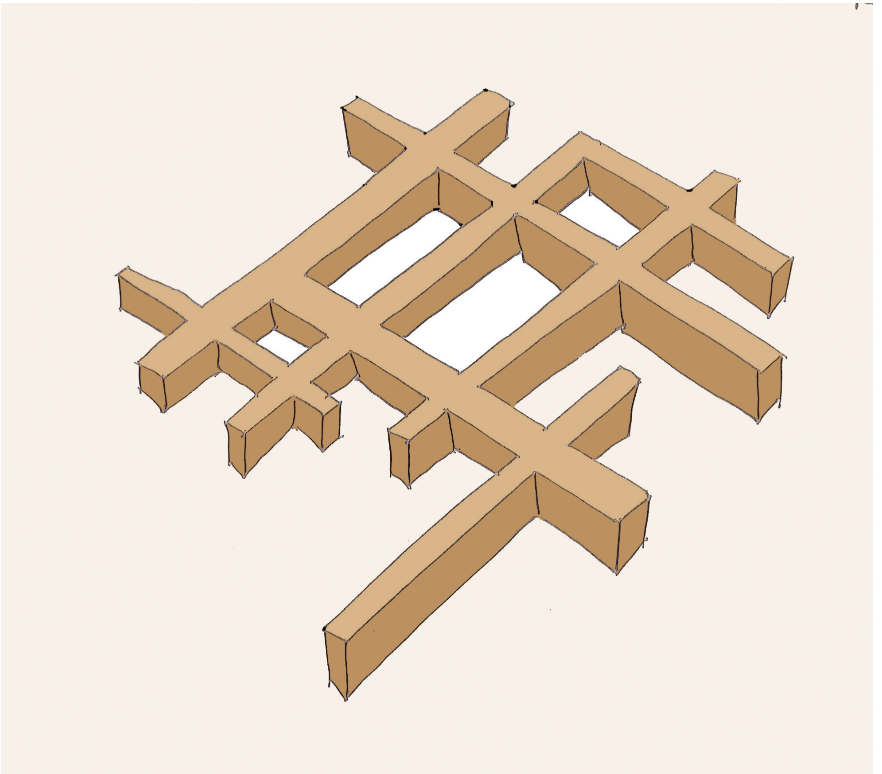
Principle sketch of moulding of level surfaces with mechanical fitting and jointing of these to three-dimensional spatial objects. A: imprinting foam board with awl. B. Foam board is placed in the wooden mould. C. The level concrete plate that comes from this where locally there are mechanical fittings for jointing. D. Jointing with joint filler and letting the two sides with mechanical fittings meet. E. The spatial object and F. The jointing creates imprecise, rounded transitions between the levels. Opposite page: concrete plates before jointing on the left and after jointing on the right. Photos: Anja.

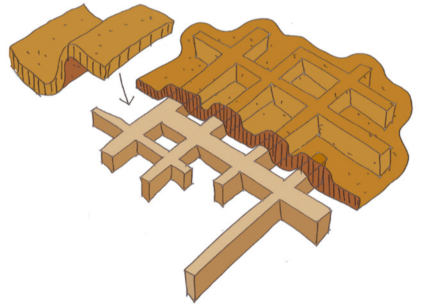
MOULD INSERTS - SILICONE RUBBER MOULD

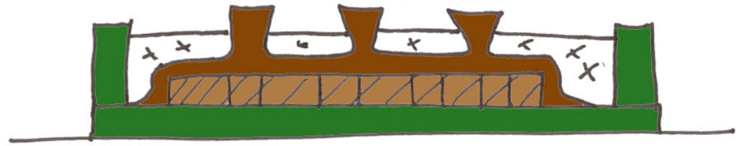
If more concrete objects of the same design, for example three to 20, are needed, it might be advantageous to make a mould insert from silicone rubber.
This is a more complicated process, but can produce more identical concrete casts. The silicone rubber mould must be pulled, or find its shape, when it is produced in a positive mould. A positive mould is a copy of the desired shape and surface character of the finished concrete object. The positive mould, however, is mostly done from different materials than concrete. This might be materials such as wood (MDF boards for example), clay, or a different material.
If the positive mould is made from wood or plaster, it might be advantageous to shellac these to acquire a smooth surface so the silicone rubber mould can be pulled across it and let go of it after hardening.
The positive mould is placed in the wooden mould where the silicone rubber mould is to be an insert. The sides of the moulding plywood mould should extrude one centimetre above the highest point of the positive mould once it has been placed in the wooden mould, but preferably no more than that. Once the silicone rubber form is moulded, the layer of silicone rubber that sticks up above the positive mould will be what will eventually be the bottom of the final mould. If the layer of silicone rubber is thicker than about one centimetre, the vibrations from the vibration table cannot spread throughout the concrete. Similarly, there should be about one centimetre from the positive mould to the edges of the wooden mould. If there is much less, the silicone rubber mould will be too thin and not strong enough. This will become particularly pronounced during de-moulding as it might easily break. If the distance to the wooden edges is much more than one centimetre, the usage of silicone rubber will be larger than necessary. Silicone rubber is expensive, so economizing might be a good idea.
When it is placed in the plywood mould, the positive mould will hit this bottom. The positive mould should be fastened to this so no silicone rubber flows underneath it. If the positive mould is made from wood, this can be attached to the bottom of the level, horizontal mould made from plywood.
However, if the positive mould is made from plaster, it is necessary to depress it, for example with a couple of heavy weights or something similarly heavy.
The positive mould and the wooden mould are oiled with a mixture of soap flakes and corn oil (4:1) in a very thin layer. Be careful that it does not clump.



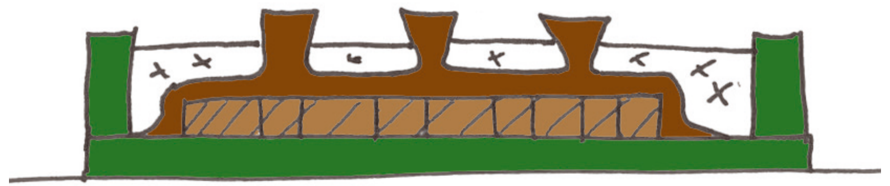
Positive mould made from MDF boards adjusted with polyfilla so unevenness is made even and shellacked to make the surface smooth so it will more easily let go of the silicone rubber mould when it is pulled across the positive mould. Photo: Anja.

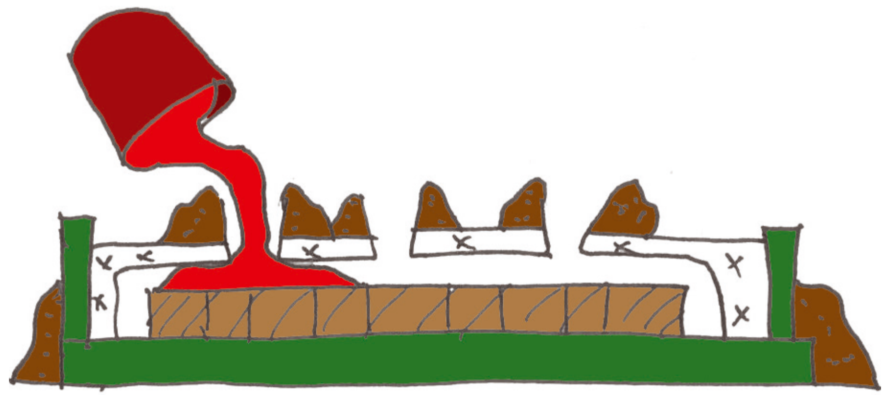


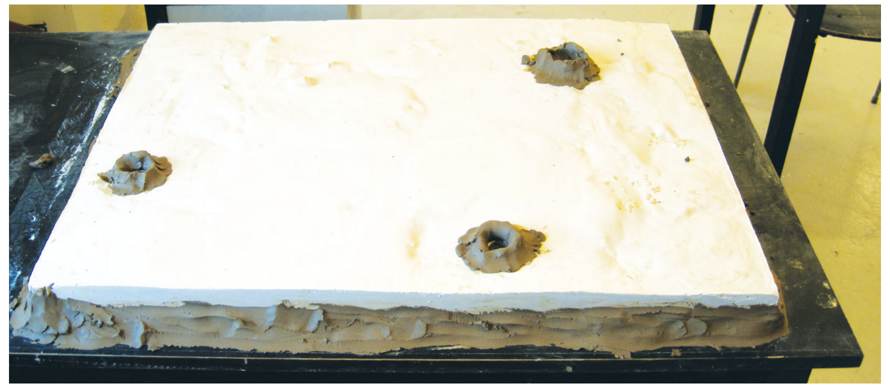




This lubricant is made from stirring and heating soap flakes in water, melting the soap flakes. The corn oil is mixed into this. The mixture is then set somewhere cool, and acquires a solid, yet greasable consistency, much like cool butter. In some cases, it might be a good idea to grease both the positive mould and the surrounding wooden mould with W40, either to replace or supplement the soap-oil mixture. This should be a thin layer with no pools.
The wooden mould with the silicone rubber mould insert is now placed on a sheet of plastic with a stretch that is somewhat larger, about 40 centimetres in all directions, than the horizontal mould. The plastic ensures that the surrounding layer is not dirtied. The silicone rubber in its fluid state tends to flow into even the smallest crevices of the mould. For this reason, I usually close them off with clay wherever two wooden surfaces meet each other in a joint. In this case, the side edges of wood are fastened to the bottom of the wooden mould. Usually, there will be discrepancies and small holes of air that are not immediately visible.
Before casting the silicone rubber, it is important to make sure that the mould is level. Otherwise the silicone rubber will locally run off the mould.
Once this is done, the silicone rubber is mixed. There are many kinds, but most important is the fact that it is a strong silicone rubber and that it is able to be bend and turned inside out to get off the concrete object once hardened.
I use a two-component silicone rubber mixture. It is available from the company Kemitura, www.kemitura.dk. It consists of ten parts of two-component silicone rubber RTV-896A and one part hardener RTV-896 B.

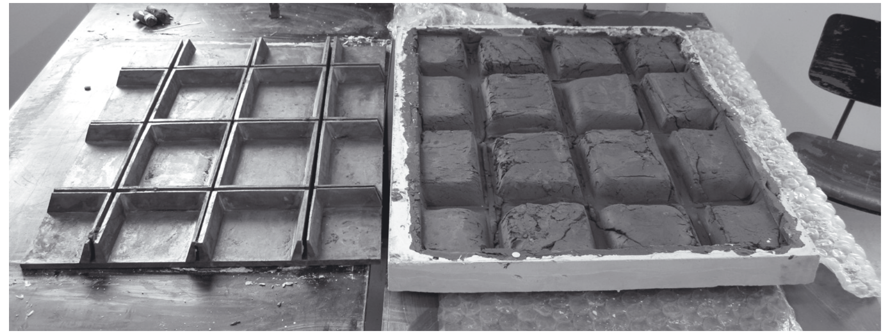


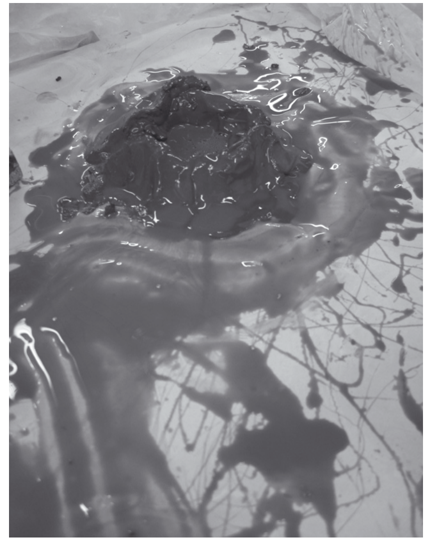


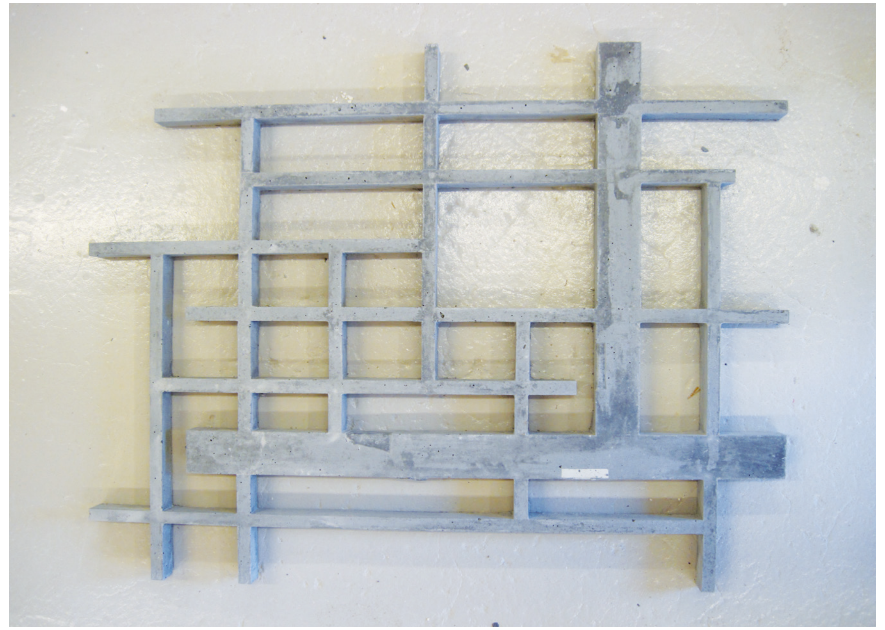


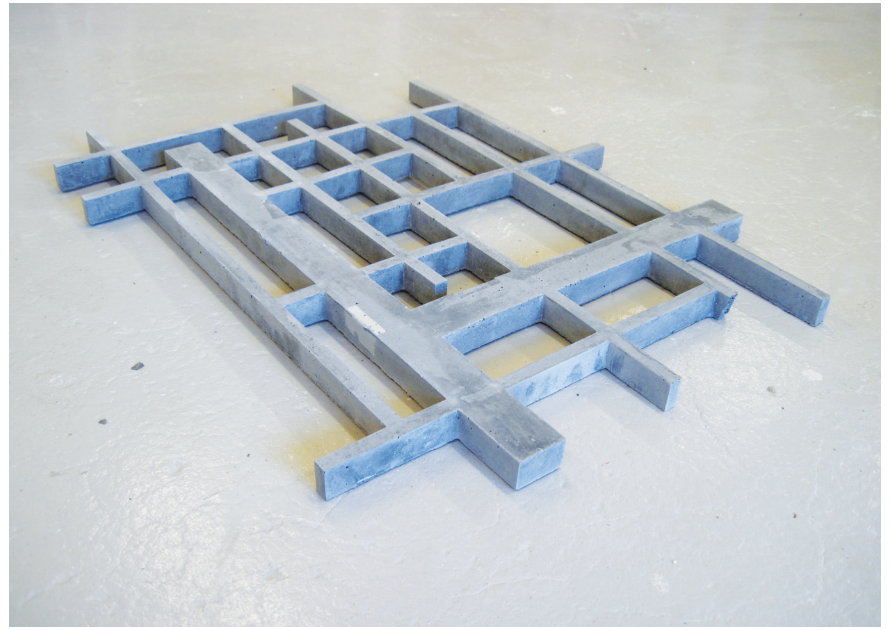
Top: Section of plywood mould wherein an MDF positive mould has been placed. Above that there is a layer of clay that is one centimetre thick and also casting cone cylinders made from clay that extrude from the layer of plaster that is cast on top of the clay and to the edge of the wooden mould. Middle: the clay has been removed before it dries, between positive mould and plaster, weights have been placed on the plaster to keep it in position and the silicone rubber can be poured into one of the casting holes. Notice the hollow casting cones at the feeding holes are 5-10 cm high. Bottom: plaster mould and clay around feeding channels and an edge of clay surrounding it so the silicone rubber does not run out at the bottom. Photo: Anja.

Opposite page, top left: the layers of clay and plaster are removed from the positive mould so the clay can be removed. Top right. The clay is removed. Bottom left: Weight is put on the plaster mould when the silicone rubber mould is to be made. The silicone rubber is mixed with two components and poured into one of the feeding channels while the others are used as control holes where you can see if the silicone rubber is flowing as it should be. Photos: Anja.









The silicone and the hardener are mixed thoroughly with a large stirring ladle or so mething similar in a bucket or container. It is very important that the hardener is fully mixed into the silicone, otherwise the finished mixture will locally never harden and the mould will be useless. The finished silicone rubber is poured into the plywood mould, on top of the positive mould so it is covered up to the edge, meaning one centimetre above the highest point of the positive mould. At the same time, be aware of whether the sili cone rubber tends to run out of the mould anywhere. If this happens, the hole must be filled with another lump of clay pressed on the mould. It takes about a few hours for it to harden. As clay easily dries up and shrinks, it might be necessary to change the clay during the process and hereby ensure that the silicone rubber does not run out of the mould. If the silicone rubber hardens for 24 hours it gets very strong so this is

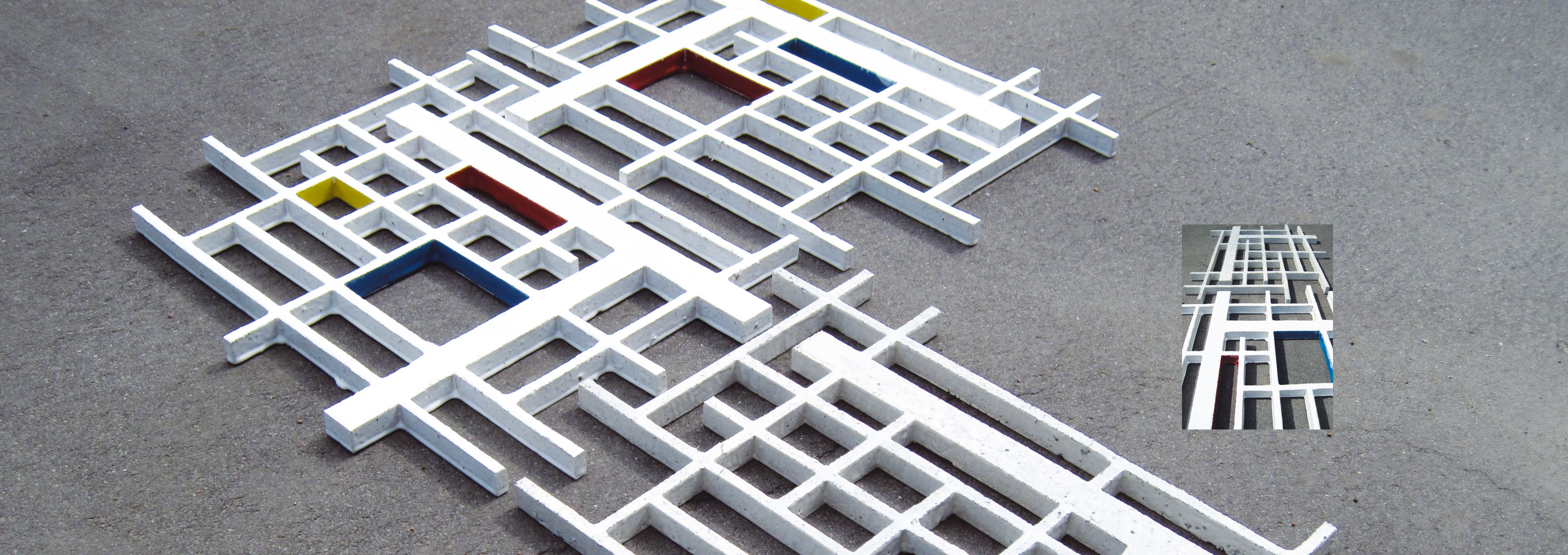
recommended. After it has hardened it can be removed from the positive and wooden

Opposite page: mould with silicone rubber insert inserted with plaster cover and the outer mould made from plywood. This page the concrete object it produces. Photos: Anja

mould.The silicone rubber mould is flipped and placed in the wooden mould, the open box (the positive mould has been removed) and once it has been greased with moulding oil, it is ready for the first cast.For a more detailed description, I refer the reader to later in this appendix under "Mould - spatial objects - silicone rubber".

VERTICAL MOULD - SPATIAL OBJECTS

The vertical mould is the one that produces the spatial concrete objects. These are objects that extend across three dimensions. Obviously, so does the level plate, but since the stretch of the thickness of the plate is considered to be relatively small compared to the other two dimensions, it here is categorized under the level surface.
Moulds for manufacturing the spatial object can be relatively complex to produce. It is therefore important for the mould to be carefully planned and designed in relation to the desired concrete form and surface, but also the process. The vertical mould can be made from many materials. One of the most important aspects of manufacturing a mould is that the concrete object can be removed from the mould after the concrete has har- dened. This can be done by designing the mould so it has embedded slip, working with moulds that can be bended or screwed off, or disassembled somehow, or it can be done



by burning off the mould. The latter solution is only possible with specific ceramic glazed concrete while the other concretes mentioned cannot be burned without being ruined. As mentioned earlier in the book, burning off the mould is undesirable, not only in terms of the wasted resources and work hours, as the mould cannot be reused, but also due to the environmental impact it causes in terms of CO_2 and air pollution.
I therefore primarily talk of the other spatial, vertical moulds, those that somehow can be demounted from the concrete object and reused.
Those I talk about are made from wood; silicone rubber and wood; as well as silicone rubber, plaster and wood. Textile shuttering, such as those professor Mark West is known for, are a possibility also. I do not discuss that here, however.

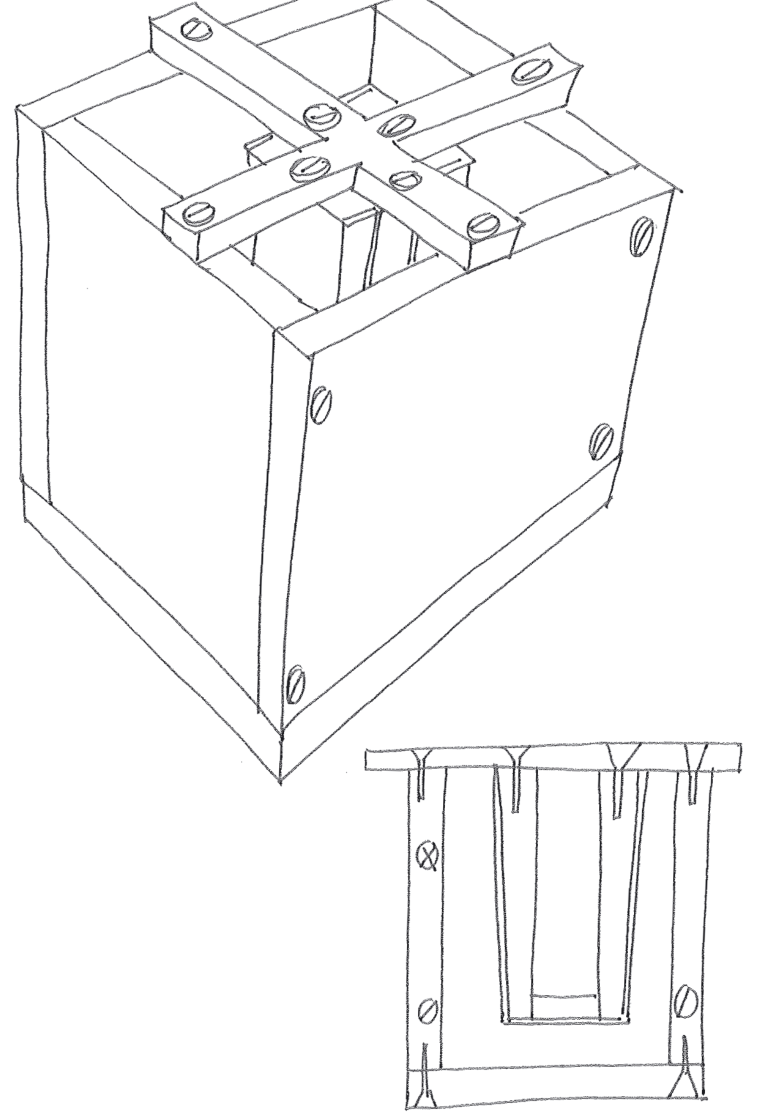
MOULD - SPATIAL OBJECTS - WOOD

If the mould is made from wood, it is often because it can be disassembled. It can also be produced, however, so it has slip. Then the concrete object, after hardening, can be practically "poured" from the mould if the sides of the mould are slippery. Moulding plywood is recommended for both kinds of moulds.
The simplest mould of this kind is the open mould made from wood with high edges screwed on from the bottom of the mould. Such a mould will produce a solid concrete block.
If, instead, the concrete block must be hollow or a box-shaped cylinder, a core can be placed in the mould. The surrounding concrete can anchor this inner core very well. So even when the core is made with slip it should also have a kind of "handle" installed. This must be fastened well to the core so it can be pulled from the concrete object when it is to be de-moulded.
It might be a good idea for the moulding core to consist of parts that can be disassembled and removed separately.
The inner core must, if the product is to be a concrete box, be raised from the bottom of the mould. This can be done by fastening the core of the mould to an upper fillet as shown in the principle sketch. It can also be done by screwing screws into the mould core from the bottom of the mould. The latter solution is not the best one for specific ceramic glazed concrete as the screws cannot be removed. Despite the oil, they are usually not possible to remove once the concrete has hardened. It might also be a problem to the final concrete object that it has unintended holes.
For concrete objects that are spatial and consist of level, slim surfaces, but are different

Top. Vertical spatial mould made from moulding plywood with tape to protect screws and an internal core to achieve a box-shaped hollow cylinder as shown at the bottom of the picture. Photo: Anja.

from the individual concrete box, solid or hollow, wooden moulds might be a solution. In the case of these moulds, moulding plywood is also preferable. The concrete must often flow into the narrow casting channels across a lengthy span. If the mould surfaces are not smooth, they will locally be resistant to the casting. Furthermore, the pressure from the moulding material will be relatively small. In the previously mentioned horizontal, open mould, the concrete material will add pressure to the concrete in the mould and thereby result in a better casting. This benefit is much less pronounced when casting in the vertical mould through narrow channels because that amount of concrete is limited locally.
The spatially more complex mould made from moulding plywood should mostly be designed in a way that allows for disassembly. The wood is assembled with screws and the moulding plywood should have holes drilled for this. The screws must be placed so they, also after casting, can be removed so the mould can be disassembled.
The mould must be designed to allow for the vibrations from the vibration table to be distributed equally across the entire mould. This can be achieved by having a level bottom plate that follows the shape and spread of the vibration table. All surfaces that make up the spatial shape must somehow be connected to this bottom wooden plate. If this does not happen, locally there will be less vibration or worst-case scenario, none at all. This will cause the concrete in those places to not be cast correctly and then does not result in the desired concrete object.
The casting cycle planned across the mould has much importance to whether or not it can be done, and so does the angles of the casting cycle.
Furthermore, in some designs and mould solutions there might be problems such as air being captured and thus counteracting the mould.
I have shown some of these aspects in the principle sketches. In the first of these, the casting cycle is defined with a vertical casting channel immediately followed by a horizontal casting cycle through a narrow casting channel over a certain distance. This casting cycle is possible with an easily flowing concrete, but practically impossible with the much more inert specific ceramic glazed concrete.
It will be necessary to partially angle the transition from vertical and horizontal, for example making it 45 degrees, so it is relatively soft. It might also be possible to angle the form sides of the inner core so this is not horizontal, but angled 3-10 degrees from being horizontal. Naturally, this will also change the shape of the concrete object.

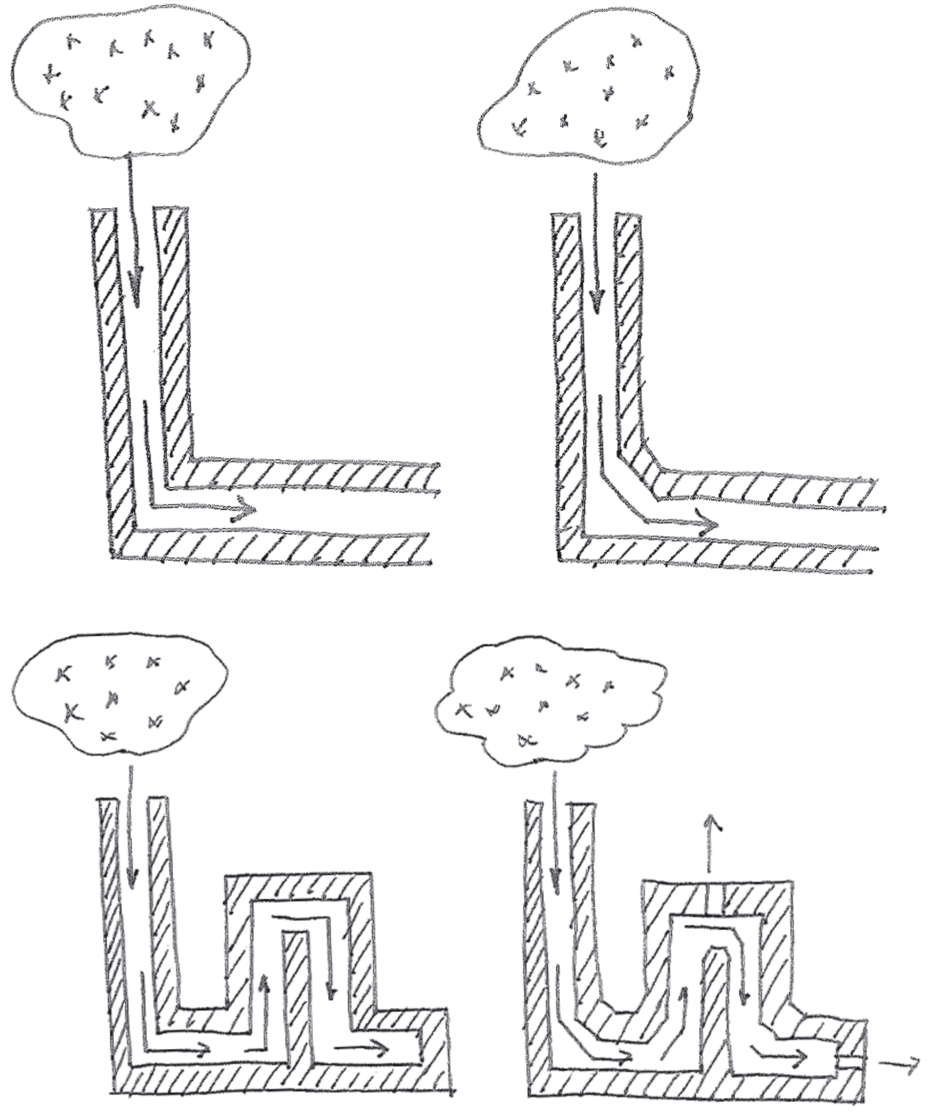
Top, principle sketch the same mould for hollow box object in concrete. Top there are wooden pegs for holding the core as well as for removing the core. Both inner and outer mould parts are made from plywood and can be de-moulded by taken the parts apart. Bottom: Note that the bottom is attached to the sides of the mould by screwing them on from the bottom.



In the other principle sketch, I have displayed a casting cycle that varies between heading straight down vertically, horizontally, with an abrupt transition and upwards vertically. With such a cast it might be an advantage to make the transitions soft as mentioned previously. But even when taking these measures, there might be problems with air caught in the casting channels that cannot be released through the concrete material and thereby hinders a correct casting of the concrete.
It might be easier to drill a hole in the mould for the air to be released through.
It is not rare when working with the complex, spatial mould to adjust it, and you should be prepared for this and that it probably will be necessary to do one or two test castings.

MOULD - SPATIAL OBJECTS - SILICONE RUBBER

I have previously talked about mould inserts made from silicone rubber for the level, horizontal mould. See the principle sketch and pictures of such on previous pages of this appendix. I choose to mention it here in the form of inserts in the vertical, spatial mould as it is different from the one I mentioned previously. The silicone rubber mould must still be pulled over a positive mould. But because of the spatial spread of this, it will often cause a too large usage of silicone rubber as well as locally too thin layers if the silicone rubber is simply poured onto the positive mould in the moulding box.
Manufacturing the silicone rubber mould once more requires the making of a positive mould, meaning an exact replica of whatever object you want to manufacture in concrete. The positive mould is likely to be made from other materials than concrete, such as wood, plaster, or clay. I usually use MDF boards. It is a good idea to shellac both wood and plaster so the silicone rubber mould becomes level and even.
The positive mould is fastened to the spatially surrounding wooden mould that has edges that are 5-10 cm higher than the highest point of the positive mould. This is a height that allows for the about one centimetre thick silicone rubber layer and after that an encasing layer of plaster of about 4-9 centimetres. If the positive mould is made from wood as well as the positive mould, it can be fastened with screws from the bottom of the outer wooden mould.
After fastening the positive mould to the encasing wooden mould, a centimetre of clay



Top left, narrow casting channels in the vertical mould with abrupt transition between vertical and horizontal making a good cast difficult, while on the right the casting cycle is softer in its transition from vertical to horizontal with only a 45 degree angle. This will ease the cast some. On the bottom, other measures besides this rather complicated casting cycle, such as drilling holes so repressed air can be released and thereby not prevent and press against a good cast.

plates are laid on top of the entire positive mould. The thickness of the clay layer may be achieved by running lumps of clay through a printing press. The clay is placed between two plates with textile on them and run through the press that is adjusted for one centimetre thickness. The clay is pressed softly onto the positive mould so it matches its design.
Furthermore, three or more of the highest points of the positive mould are selected. Here a lump of clay formed into a cylinder is placed to later function as a casting channel for the liquid silicone rubber.
While the clay is still wet, it and the positive mould are covered in plaster up to the edge of the wooden mould. It is important for the clay cylinders to extrude from the plaster as they are meant to be used later as casting channels for making the silicone rubber mould.
Plaster is made by putting water in a bucket. After this, the plaster powder is carefully drizzled into the water with exhaustion and while wearing a mask.
Ultimately, it will not be possible to pour in any more plaster powder as it seems as if the plaster no longer sinks into the water. Then the mixture is saturated and must be stirred carefully for one minute. Then it should be left alone for about a minute and then poured into the mould on top of the clay and the positive mould. It is important that the plaster mould upwardly is level because this is what later, when casting the concrete object, will be the bottom of the mould. Through this and the bottom of the wooden mould, the vibrations from the vibration table must spread throughout the concrete material.
Leave the plaster to harden for a few hours.
Remove the plaster mould and take away the clay both from it and the positive mould. It is very important that the positive mould is placed in the wooden mould exactly the way it was when the plaster was cast. It therefore has to be tightly fastened to the wooden mould or its placement should be drawn onto the wooden mould before it is taken out to be cleaned. Once all the clay has been taken off, the positive mould is placed in the spot where it originally was in the wooden mould. It is then oiled with the mixture of corn oil and soap flakes (1:4) mentioned earlier and subsequently the plaster mould is placed on top and with the exact location of where it was when it was made.
Then there will be a hollow layer between the positive mould and the plaster mould, corresponding to where the clay used to be. This hollow layer will be as thick as the clay, so about one centimetre. Furthermore, the plaster will have open casting channels where the clay cylinders used to be. These channels will be surrounded by clay cylinders that extrude about five centimetres off the top of the plaster mould. They are to ensure that there is pressure on the silicone rubber when this is cast. They also indicate whether the silicone rubber has been cast throughout the object, because if the mould is fed with silicone rubber from one spot, it will emerge through the other feeding holes. Finally, it ensures that air can escape from the external parts of the mould.

The silicone rubber is mixed. I use a two-component silicone rubber mixture. It is available from the company Kemitura, www.kemitura.dk. It consists of ten parts of two-component silicone rubber RTV-896A and one part hardener RTV-896 B.
The silicone and the hardener are mixed thoroughly with a large stirring ladle or something similar in a bucket or container. It is very important that the hardener is fully mixed into the silicone, otherwise the finished mixture will locally never harden and the mould will be unusable.
The finished silicone rubber is poured into one of the feeding channels and when all of the filling channels are filled, the cavities between the positive mould and the plaster mould will be filled and the silicone rubber mould will be produced.
The silicone rubber mould is to harden for 24 hours or more to achieve its strength.
After hardening, the silicone rubber mould along with its back-supporting plaster mould is removed from the wooden mould, flipped, and placed back into the mould. Now the mould is ready for casting.
This too must be greased with moulding oil so it glistens, but does not have pools of oil.
Casting the concrete material, once again, takes place on a vibration table.

CLEANING MOULDS

There will practically always be some leftover concrete in the mould following de-moulding. Usually it will be the lighter concrete paste, which is relatively easy to remove. It can be done with a spatula, but in many cases also with a greased rag.
For cleaning moulds with inserts of silicone rubber, a spatula must be used carefully to make sure not to dent the rubber. There, a rag dipped in mould oil is much preferable.

APPENDIX 4 DISTINCTIVE EXPRESSION

In the following, I will illustrate a suggested art-researcher's method to point out the distinctive expressions of materials, albeit very simplistically. As such, I observe nothing but one object in a white room with grey concrete floors. The object is made from specific ceramic glazed concrete with a variation in the processual treatment and manufacturing. As such, the object includes specific ceramic glazed concrete pre-firing, post-firing, unglazed, sanded, and unsanded as well as fired and glazed concrete. The art researcher examined the distinct expressions of the materials by observing the object in the room as well as asking herself questions. Her primary approach to this examination is observation, but could in principle also refer to for example taste and haptic registration.

Are the materials distinctively expressive?

Describe the form category with the object's form:
The object consists of four component-objects. Each component-object consists of a horizontal level with rectangular, discretely distributed holes, and several discretely placed vertical levels. The vertical levels both run above and under the horizontal level and raise the horizontal levels above the surface. The horizontal levels have no holes.

Describe the form category with its composition:
The four component-objects of the object are separated. They are flexible in terms of location and can be arranged randomly in relation to each other. This means that generally the object has much possibility for variation in terms of composition and the whole expression of the object.

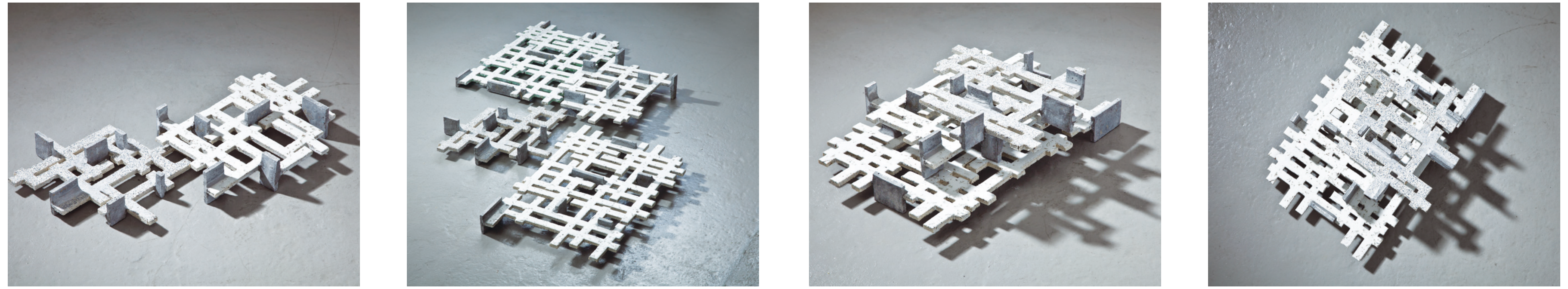
Describe the form category of the object with its Directions:
The entire object can, due to its many variation possibilities, have different directions. It can have a primarily horizontal orientation when the parts are placed after one another with the vertical level represented much less. On the other hand, if the objects are placed on top of each other, the direction will be both horizontal and vertical with generally the same distribution. Each component-object has a pronounced horizontal orientation with a hint of vertical direction.

Describe the form category of the object with its Proportions
The object as a whole can vary its proportions. The horizontal level of each object is larger scale-wise than the vertical ones. The proportions of the vertical levels' proportions are related to the proportions of the hole pattern.

Describe the form category of the object with its Volumes:
With the object's large flexibility of composition, the variation of the spread of the volume is similarly large.
It, for example, can consist of a compactly packed volume, but also a flat, open, and lengthy volume defined by horizontal levels as well as the space created above and under them in the vertical levels.

Describe the form category of the object with its Shape Encounters:
Collectively, the entire object is made up of different shape encounters. These are what is part of each of the four object parts. This is the shape encounter between the horizontal and vertical level. These are characterized by a rounding emerging from the jointing of the two levels that meet each other at 90 degrees. Then there is a shape encounter that occurs when the component parts are juxtaposed. Depending on the chosen composition, these might consist of two horizontal levels encountering each other in the horizontal stretch. In some of the parts, it could also be an encounter where one horizontal level crosses the other horizontal level without touching it because the vertical levels raise the horizontal levels to different heights. Finally, the shape encounter can be when the vertical level of one component-object encounters another component-object´s horizontal level defined by a right angle. The final shape encounter is what occurs when the object meets the surface it has been put on or leans on. The angle here might be 90 degrees for a location on a horizontal floor, while it might have different angles if the component-objects are leaning on a wall.

Describe the object's form category with its Size:
The entire object as a whole can vary in size. It can be stretched out, discretely distributed across long distances and therefore become very large. It can also be much smaller when the component-objects are placed on top of each other. Once more, it depends on how the parts have been composed. Each of the parts have two objects of the same size, a length of 50 cm horizontally, while the smaller vertical levels vary in size from five to eight centimetres, although not within the same object-part. The two final object-parts are smaller and do not have the same mutual size.
The hole pattern of the horizontal level is different sizes within the same component-object. All of the levels, both the vertical and the horizontal, have the same thickness of one centimetre.



Object consisting of four component-objects made from specific ceramic glazed concrete manufactured differently. Photos: Ole Akhøj.

Describe the surface quality of the object with its Colours/Materiality
In the entire object, the colour scheme changes from entirely white to locally black. It is the concrete grey on the vertical levels and jointings. These are elements attached to the levels after these have been manufactured, including the glazing and firing. Those made from the specifically manufactured ceramic concrete appear in the same component-object with variation. Here it is a fired white concrete, a fired white concrete with exposed black aggregates distributed like spots on one side of the horizontal level. On the other side is white glaze with graphical black lines oriented in a random direction as markings of the steel fibres. One individual component-object, furthermore, is glazed with green glaze on its edges.

Describe the objects' surface quality with its Patterns:
In the entire object there is much possibility for variation in terms of pattern schemes. Each component-object in the horizontal level consists of a hole pattern that is a segment of a larger pattern, the entire scope of which we are unaware of. The pattern is characterized by several different rectangular expressions that appear as holes in the level.
The horizontal level, as such, is characterized by light spots marked by the white-glazed concrete and rectangles marked by the absence of materials. Depending on the viewing angle, the edges might become another detail in the pattern scheme. The pattern will change through different mutual locations of the individual component-objects. As such, it can change from the ordered, easily recognizable pattern to chaos with no control. There are also other patterns in the component-objects. They are both determined by a certain amount of random location and orientation. There is the spot pattern due to the exposed corundum aggregate and the line pattern that emerges due to the steel fibres. Furthermore, a pattern defined by the light/shadow conditions emerges from the surface the object encounters in the form of a shadow.

Describe the object's surface quality with its Textures, Gloss, Materiality:
Locally in the object there is an even, ultrafine texture that appears as a smooth surface with full gloss. This is in the horizontal level and glazed surfaces. There are also locally grainy surfaces in other parts of the horizontal level of the objects, its edges and on the vertical levels. They appear rough and mat. Finally, there are locally at horizontal levels of the object, markedly chipped surfaces. This is where mechanical fittings for jointing have been prepared, but left unused, thus exposing them.

Describe the object's surface character with its Light/shadow:
The entire object's play with light will, dependent on the composition and the direction of the light, be entirely illuminated locally on the surface that catches the light, and otherwise fade to dark shadow in other places on the object. Furthermore, there will be shadow on the surface the object meets. To each component-object, the light will produce a front, an edge, and a back. They will appear fully illuminated with a transition to no lights for the own shadow of the component-object. The light, furthermore, will reproduce the hole pattern as a shadow on the surface the objects are placed upon or leaned against. If the component-objects are placed on top of each other, the upper component-object will make shadows on the component-object next to it and so on for the compo-

nent-objects stacked on top of each other. If all the component-objects are placed on top of each other, it is possible, dependent on how the hole patterns are arranged in relation to each other, to attain full shadow inside the entire object, as well as having the shadow on the surface no longer tell of the hole pattern, but solely delineate the contours of the entire object's circumference.
Light/shadow conditions, obviously, depend of lighting conditions. If the light is defined by sunlight, the object will appear dynamic, because the light's light/shadow conditions are variable.

Describe the object's design character with its Shell/Mass:
The entire object can vary its expression from solely being a shell to, if placed close together, appearing as a solid mass.

Describe the object's design character with its Arbitrariness/Precision:
The object as a whole can be arranged with precision when the lines of the component-objects follow each other. However, it can also appear to be very arbitrary if the component-objects are arranged arbitrarily in hole pattern orientation in relation to each other. The component-objects are defined by local precision, but in other places by arbitrariness. The precise consists of choices in terms of spread, thickness of vertical and horizontal levels, as well as the hole pattern. The arbitrary is within the object related to local imprecisions. This can be seen in the jointing's rounding radius as well as encounters between the two levels, the vertical and the horizontal level. This also consists of the fact that some of the edges of the component-object's horizontal levels' are fittings for jointing that appear as chipped, uneven surface as they have not been used to attach a vertical level on. The arbitrary is, furthermore, the markings of the aggregates and the fibres. Finally, there is a kind of arbitrariness in relation to the placement of holes in the horizontal level's hole pattern.

Describe the object's design character with its characteristics of Geometric/non-geometric
The part objects are defined by geometrically well-known shapes, levels, rectangles, and lines.

Describe the object's design character with its characteristics of Open/closed:
Each component-object is an open volume. The hole pattern as well as the smaller and discretely distributed vertical levels allow for readings of the fronts, edges, and to some extent the backs at the same time. The entire object might vary from being open to entirely closed when the component-objects are placed on top of each other.

Describe the object's design character with its division into Bearing/borne:
The entire object can consist of some component-objects bearing others. In each of the component-objects, the horizontal levels are borne by the vertical ones.

Describe the object's design character with its articulation of Heavy/light:
The entire object and component-objects articulate lightness with low thicknesses and their transparency.

Analysze. Are the materials distinctively expressive:
Starting from the result treatment of observing the object in space as well as comparing it to what is possible in relation to clay-based ceramic and conventional concrete, an analysis is done. An analysis normally would include all of the observed, abstract objects that are part of one or more art events. It would also address the context and the spectator. This is omitted here for reasons of clarity.
To the question of whether the ceramic glazed concrete is distinctively expressive, in the case of the chosen object the answer is no in terms of form category and shape characteristics as it is possible to acquire similar expressions from both clay-based ceramic and conventional concrete. It should be noted, however, that this is only the case with the observed object and the accompanying analysis. In the chapter on installation art and the one on art-façades, specific ceramic glazed concrete appears in other design categories and with different characteristics and is in this case assessed to be distinctive in its expression, also in relation to the two categories mentioned. But this, however, is not relevant to this chosen abstract object and as such will not be discussed further. Specific ceramic glazed concrete is in the case of the observed object unique in terms of its surface characteristics. The unique aspect consists of the juxtapositions of textures, patterns, materiality, and gloss that can appear in the same component-object when using specific ceramic glazed concrete. It is when specific ceramic glazed concrete appears with some of its different expressions in one and the same object.
This is for example, when the mat, white, fired but unglazed specific ceramic with exposed aggregates and fibres appear on the same ceramic object as a specific ceramic glazed concrete with markings of fibres in its glaze.
What is unique is the juxtaposition of patterns and materialities, as well as the textures that are to be found there as well as the colour play and the gloss. It is also when both aggregates and fibres are part of the visual, ceramic narrative as markings in the concrete and glaze.
This is when I, through comparative studies with other materials, believe I am able to point out one of specific ceramic glazed concrete's distinct expressions in the observed object in terms of both ceramic in the traditional sense as well as conventional concrete and other materials.

Partial conclusion: Are the materials distinctively expressive:
Based on the questions of art-research of the chosen abstract spatial object made from specific ceramic glazed concrete, the treatment and analysis of the results point to specific ceramic glazed concrete being distinctively expressive in terms of its surface qualities.

NOTES

1. http://www.denstoredanske.dk/Sprog,_religion_og_filosofi/Filosofi/De_store_systematikeres_tidsalder,_1600-t./Filosoffer_1600-t._-_biografier/Johann_Amos_Comenius

2. October 2, 2007. "Den bløde videnskabs hårdhed og den hårde videnskabs blødhed – eller videnskabens enhed og differens" http://oplysningskritik.blogspot.dk/2007/10/den-blde-videnskabs-hrdhed-og-den-hrde.html

3. Line Kramhøft, Taktil beton; www.taktil.dk

4. To the reader who wants to know more about ceramic glazed concrete and who wants to work with ceramic glazed concrete, the publications, including in particular Alasdair Bremner and Fahad Alkandari's PhD dissertations are a good and recommended supplement for this book. Links are provided in the bibliography under their names.

5. Alasdair Bremner and David Binn's concretes with recycled glass after firing get a distinctive expression that both tells of the glass and the concrete. http://www.uclan.ac.uk/research/environment/groups/silicate_research_unit.php

6. Cf. articles. Bache, Hans Henrik, 23.02.1981, Udviklingen fra beton til Densit, CBL Intern Rapport No.26, Aalborg, Aalborg Portland A/S Bache, Hans Henrik, Densified Cement/Ultrafine particle based materials. The second International Conference on Superplasticizers in Concrete, CBL rapport nr. 40, Ottawa, Aalborg, Aalborg Portland, Bache, Hans Henrik, 1992, Ny Beton - Ny Teknologi, Betonteknik 8/04/, Aalborg Portland A/S, Bache, Hans Henrik, 1995, Concrete and Concrete Technology in a broad perspective, The Second CANMET/ACI International Symposium on Advances in Concrete Technology, Las Vegas, Nevada, USA, June 11-14, Aalborg Portland A/S CBL reprint no 27

7. Cf. articles Bache, A, (2008), Technology transfer, Arkitekten marts, Arkitektens Forlag, København, Bache, A, (2007), Urban Light, Det Multifunktionelle Lysmøbel i ny kompositteknologi til byrum, Arkitekten September, Arkitektens Forlag, København.

8. These are processes that are also relevant to high-strength concrete and ceramic glazed concretes in general.

9. Event here refers to the encounter between objects, places, time, context, and space as well as spectators. It is not the event that in the chapter on aesthetics refers to Benjamin Gadamer's (Gadamar, 1984) and Ole Fog Kirkeby's event (Kirkeby, 2007) as being an epistemological one.

10. The designer Helle Hove moves between crafts and architecture in her search of space starting from repetition of different kinds of elements. http://www.hellehove.dk/

11. Kinaesthetic sense (from Greek kinein 'move' and derivation of aisthesis 'feeling, sense'), the sense of the body's movements, position, weight, and power through senses from muscles, tendons, and joints. The kinaesthetic sense and the inner ear's sense of balance here work closely together. Thereby, there is continuous control and coordination of the activity of the body in space. Man's active examination of himself and his surroundings starting in infancy is a prerequisite for developing bodily-kinaesthetic competency. Kinaesthetic sense is very developed in, for example, football players and dancers. For the dancer, dancing is basically an on-going examination of the body, its movements, and the body in space. Http://www.denstoredanske.dk/Krop,_psyke_og_sundhed/Psykologi/Psykologiske_termer/kin%C3%A6stetisk_sans.

12. http://medical-dictionary.thefreedictionary.com/sense.

13. Rudolf Steiner points out that there are twelve senses. In this book, I choose seven senses. This is, however, in no way a rejection of other approaches. Rudolf Steiner's approach to this can also be relevant.

14. Concrete binders: conventional concrete consists of a hardening binder, fluid, and fillers. The hardening binder and the water are together called the binder of the concrete and the filler is called aggregate. (Gyldendals Leksikon, 1973)

15. Model laws are not adequate for the final design, but are a good tool in the development phase of the design process. Model laws can be used if they fulfil some frame conditions. I leave those out here, however, but I just want to make sure that model laws are used carefully.

16. Unfortunately, a large part of the literature Hans Henrik Bache has written about Densit and CRC is in Danish.

17. Densit binders are characterized by being packed so densely that they are frost proof to minus 50 degrees Celsius because there is no room, for example, for water to be transformed into ice. Furthermore, it is allowed to have five times smaller covering layer with reinforcement steelbars used to protect these compared to what is advised for conventional concrete. This is because Densit materials are so densely packed that water from the outside has a hard time penetrating the concrete.

18. Silica melts at 1700 C° while aluminate oxide melts at about 2040 C°.

19. With densely packed binders, the temperature increase during biscuit firing is only about 50 C°/h.

20. The terms I take from Willy Ørskov's book "Aflæsning af abstrakte objekter", in the collection, "Samlet", (Ørskov, 1999) the author has not listed in this way. He merely mentions them as potential terms that can be used.

21. In appendix 4, I provide a very simplified example of how this could be done. The simplification is that it is only one object, placed in a white room that is analysed rather than all observed objects. The analysis as such deals only with one selected object made from specific ceramic glazed concrete.

22. Catalogue of the exhibition can be found at http://www.anjabache.com/wp-content/uploads/2012/08/Anja_Bache_Glazed_concrete_Catalogue_installationart_exhibition_2012.pdf

23. Catalogue of the exhibition can be found at http://www.anjabache.com/wp-content/uploads/Anja_Bache_Ceramic_-on_-tour_Catalogue_low_Mba1.pdf

24. Catalogue of the exhibition can be found at http://www.anjabache.com/wp-content/uploads/Anja_Bache_Catalogue_Marsden_woo_gallery_London-2.pdf

25. It is mostly the exhibition at the Danish Museum of International Ceramic Art I refer to in this book. Other exhibitions can be seen at www.anjabache.com

26. http://nbmaa.wordpress.com/2010/04/30/installation-art/

27. At http://cargocollective.com/klink a homepage is reproduced that displays current ceramic tiles, including as covering for buildings. Here you can discover some of the potentials of ceramic in urban space. What I miss in some of these is that they move beyond covering, but also create their own spatial narrative and to a larger extent confront the building and its structure, construction, and underlying narrative. In many of the displayed examples covered in ceramic tiles, it is as though the buildings are covered in a piece of cloth. It is impressive, but I would also like to see the ceramic covering enter into a dialogue with the building and the space around it, including, for example, producing its own distinct materiality.

28. The Danish Museum for International Ceramic Art is being expanded with a whole new exhibition wing that seems to open up to more radical ceramic installation art than what I was given the opportunity to display there.

29. Excerpt of the application to the architectural committee of the Danish Government Art Fund, 2010, as a complex of ideas of the spatial examination I wanted to develop during an artist residency at The International Ceramic Research Centre, Guldagergård in specific ceramic glazed concrete at the stage it was in then.

30. Project journal note, 2012, Anja Bache.

31. The exhibition at The Danish Museum of International Ceramic Art was originally thought up as a joint exhibition with ceramist Lene Roehrig Kjær as a meeting between specific ceramic glazed concrete and Lene's work in red casting loam. However, we ended up doing two independent and separate exhibitions.

32. Excerpts from the application to The Danish Museum for International Ceramic Art I wrote in 2011, Anja.

33. http://www.leneroehrig.dk/

34. It is likely to be models done in clay, model cardboard assembled with a glue gun or another thing that materializes. The idea is in the three-dimensional rapid productions as casual sketches in the space. It is to examine, among other things, form encounters, light, and spatial effect. But it must be maintained as sketches with similarly rapid examinations such as the sketch done in hand.

35. I have never before encountered such a professional gallery. To me as an artist, it was a great experience. Curator Tessa Peters is very responsible for this as is the rest of the staff, owner Tatjana Marsden, gallery manager Siobhan Feeney, Alida Sayer, Creative Consultant at the gallery as well as artist Ruper Ackroyd. Thanks a lot.

36. Museum inspector and art historian, Pia Wirnfeld wrote an incredible article about the exhibition for Ceramic Art and Perception (Wirnfeld, 2012) with pictures from the

photo room. The message of the intentions behind the exhibition, as well as the link to French philosopher Gilles Deleuze's foldings. (Delueze's philosophy on the folding has been a great inspiration to me as an artist). I am deeply grateful for this.

37. The museum is run with much help from volunteers and only a few paid staff members. They have all been very helpful, including cultural communication consultant Claus Fenger who edited and finalized the catalogue and Pia Wirnfeld who was very open and extremely forthcoming. This is in no way a criticism of the museum. I wanted to turn perspectives of conventional ceramic referencing the crafts tradition on its head, and here I did not succeed.

38. http://oxforddictionaries.com/definitions/english/facade

39. Building has just begun and is planned to conclude in 2017.

40. http://www.dac.dk/da/dac-life/copenhagen-x-galleri-1/igangvaerende-eller-fremtidigt-byggeri/bryghusprojektet/

41. The interpretation of the terms in the Vitruvian triangle has however varied over time and many claim that the model is too simple in terms of the complexity that defines the creation of architectural works.

42. The Vitruvian triangle consists of firmitas, utilitas, and venustas. These are what I in the book have translated to technique, function, and aesthetic. There are, however, other translations of these terms.

43. Twenty minutes drive from Paris.

44. Statement, partner, architect MAA, C.F.Møllers Tegnestue, Lone Wiggers.
http://www.cfmoller.com/r/dansk-kokon-til-londons-insekter-faerdigbygget-i12627.html

45. Statens Værksteder for Kunst www.svfk.dk
The Danish State's Art Workshops are high-quality workshops with technical staff. Here you apply for a residency two years in advance due to its popularity. Each artist is given his or her own workshop and access to the common workshops. There is also housing attached for foreign artists or artists coming from far away in Denmark.

46. http://www.denstoredanske.dk/Kunst_og_kultur/Arkitektur/Bygningstyper/curtain_wall

47. http://cita.karch.dk/

48. http://www.aros.dk/samlingen/your-rainbow-panorama/

49. Textile designer Line Kramhøft's textile manufacturing of concrete, http://taktilbyggeri.dk/. As well as architect MAA, PhD, Anne Mette Maneluis' textile formwork with imprints of the textile on the surface, http://concretely.blogspot.dk/

BIBLIOGRAPHY

Alkandari, Fahad A H H (2011) Islamic ceramic ornamentation and process: proposals for a new aesthetic vocabulary in contemporary architectural embellishment within kuwait http://clok.uclan.ac.uk/2800/

Andersen, Johs. & Møller, Viggo Sten, 1946, Keramik, Keramisk Teknik, Keramisk Kunst, København, JUL. Gjellerups Forlag.

Andersen, Niels Åkerstrøm, 1999, Diskursive analysetrategier, Foucault, Koselleck, Laclau, Luhmann, Nyt fra Samfundsvidenskaberne, København

Arkitekten, 1975, nr. 4, side 76-77, Industriens Hus på Rådhuspladsen København, København, Arkitektens Forlag

Bache, Anja, (2007), Urban Light, Det Multifunktionelle Lysmøbel i ny kompositteknologi til byrum, Arkitekten September, Arkitektens Forlag, København.

Bache, Anja, (2008), Technology transfer, Arkitekten marts, Arkitektens Forlag, København.

Bache, Anja. (2002). Compact Reinforced Composite, undersøgelse af en ny betonteknologis Arkitektoniske potentialer vurderet I forhold til holdbarhed, Komfort og form, Aarhus, Arkitektskolen i Aarhus. 262 siders hovedrapport og 262 siders appendiksrapport.

Bache, Anja, 1991, Dispergering og flydeopførsel af finpartikel væskesystemer med høj volumenkoncentration, Aalborg, Aalborg Portland A/S, 47 sider.)

Bache, Anja, 1992, Undersøgelse af Tilslag i frisk beton som funktion af bindemiddelsammensætning og fremstillingsproces, CBL Rapport nr. 50, Aalborg, Aalborg Portland A/S
Bache, Anja, 1994, CRC-metal et brudmekanisk design, Lyngby, Procesteknisk Institut, Danmarks Tekniske Universitet

Bache, Anja, 2000, To betonkirker, Arkitekten Magasin, 04 102 årgang, s. 10-17, København, Arkitektens forlag

Bache, Anja, 2004, NY beton Ny Form for kæmpekonstruktioner, Århus, Arkitektskolen Aarhus

Bache, Anja, 2012, Ceramic Glazed Concrete, New Ceramics, 4/2012, The European Ceramic Magazine, Side, p. 21-23.,

Bache, A. 2010, Glazed Concrete, Development of Large Scale Ceramic glazed Concrete Sculptures in Public spaces, Ceramic Art and Perception, Technical,No.31. New Richmond,Wisconsin USA.

Bache, A. 2010, Large Scale Glazed Concrete Panels a dialogue with Architecture, 2010, Conferencepapers, Colour and Light in Architecture, International Conference, Venice Italy, IUAV University of Venice Italy,

Bache, Anja, 2012, Keramiske rum, Forskydninger, keramisk glaseret beton, DTU-BYG, ISBN 9788778773357, http://www.anjabache.com/wp-content/uploads/2012/08/Anja_Bache_Glazed_concrete_Catalogue_installationart_exhibition_2012.pdf

Bache, Anja, 2013, http://www.anjabache.com/wp-content/uploads/Anja_Bache_Ceramic_-on_-tour_Catalogue_low_Mba1.pdf

Bache, Anja, 2013, http://www.anjabache.com/wp-content/uploads/Anja_Bache_Catalogue_Marsden_woo_gallery_London-2.pdf

Bache, Hans Henrik, 1970, Model for strength and Brittle Materials, Built up of Particles joined at points of Contact. Journal of the American Ceramics Society,

Bache, Hans Henrik, 1973, The Processing on Fresh Concrete, Physical Suvey, Rilem Seminar on Fresh Concrete, Leeds, England, BFL, Intern rapport nr. 189

Bache, Hans Henrik, 1987, Højstyrkebetons udvikling gennem 25 år, CBL særtryk nr. 17, Aalborg, Aalborg Portland A/S

Bache, Hans Henrik, 1990, Brudmekanik, Beton-Teknik 3/12, Aalborg, Aalborg Portland A/S

Bache, Hans Henrik, 1992, Ny Beton - Ny Teknologi, Betonteknik 8/04/, Aalborg Portland A/S

Bache, Hans Henrik, 1995, Concrete and Concrete Technology in a broad perspective, The Second CANMET/ACI International Symposium on Advances in Concrete Technology, Las Vegas, Nevada, USA, June 11-14, Aalborg Portland A/S CBL reprint no 27

Bache, Hans Henrik, 1981, Udviklingen fra beton til Densit, CBL Intern Rapport No.26, Aalborg, Aalborg Porland A/S

Bache, Hans Henrik, 1981, Densified Cement/Ultrafine particle based materials. The second International Conference on Superplasticizers in Concrete, CBL rapport nr. 40, Ottawa, Aalborg, Aalborg Portland

Bache, Hans Henrik, 1987, Introduction to Compact Reinforced Concrete, Oslo, Nordic Concrete Federation, (Ed).

Bache, Hans Henrik, 1991, June 24-26, Principles of similtude in Design of Reinforced Brittle Matrix Composites, Intenational Workshop, “High Performance Fiber reinforced Cement Composites”, Mainz Germany, CBL, Reprint no. 23, Aalborg, Aalborg Portland A/S

Bache, Hans Henrik, 1988, The New Strong Cements Their use in Structures, CBL, Reprint No. 16, Aalborg, Aalborg Portland A/S

Baena, David, (Med flere), 2005, Moulding assembling designing, Ceramics in Architecture, ASCER, Spain, ISBN 84-609-9212-8

Balling, Morten, 2012, politiken.dk/debat/ECE1644979/aestetik-er-en-pose-varm-luft/ 04/06/2012 –

Baumgarten, Alexander, 1750, Aisthetica,

BAZANT, Zdenek P and, Kaplan, Maurice F, 1996, Concrete at High Temperatures, Material Properties and Mathematical Models, England, Longman Group Limited

Biggs, Emma, Hunkin, Tessa, 1999, Smukt & enkelt - mosaik 1. udgave, 1. oplag. - [Kbh.] : Aschehoug,

Bisgaard, Ulrik & Friberg, (Ed.). Carsten, 2006, Det æstetiskes aktualitet, Multivers, København

Brandt, Per Åge, 2002, Maurice Merleau-Ponty, (1908-1961), Kunst og Filosofi i Det 20. Århundrede, Det Kongelige Danske Kunstakademi, København

Bremner, Alaisdair, April 2008, PhD Thesis An invenstigation into the potential creative applications of refractorry concrete, GB, The Lanchashire University, Department of Design

Brenner, P. (1984) From Novice To Expert. Menlo Prak, Addison-Wesley

Brock, Linda, 2005, Designing the exterior wall An architectural guide to the vertical envelope, John Wiley &Sons, Inc., New Jersey

Bronson, Stanley, Peterson, John R., Schumacher, Edward B., August 1980, Ceramic Fibre Reinforced Ceramic, US PATENT 4558016,

Bundgård Peer F , 2004, Kunst, Semiotiske beskrivelser af æstetisk betydning og oplevelse,P Haase & Søns Forlag

Böhme, Gernot, Juni 1995, Inszenierte Materialität, Daidalos nr.56, Gütersloh p.43.

Böhme, Gernot, 2006, Architektur und Atmospäre, Wilhelm Fink Verlag, Müncjen

Böhme, Gernot, 2012, “The art of the stage set as paradigm for an aesthetics of atmospheres” Paper
delivered in the University of Aarhus, March 16-17th, http://conferences.au.dk/fileadmin/conferences/Understanding_Atmospheres/abstracts.pdf

Böhme, Gernot, 2010, On Beauty, The Nordic Journal of Aesthetics No. 39 , pp. 22–33

Chalmers, A. F., 1995, Hvad er videnskab? En indføring i moderne videnskabsteori, på dansk ved Gitte Lyngs. - Gyldendal, København

Collins, Peter, 1959, Concrete, the vision of Architecture, London, Faber and Faber

Cooper, Emmanuel, 2004, The Potters Book of Glaze Recipes, 2.ed. A&C Black Publisher Limited, London, Isbn 07136-61 15-1

Crow, James Mitchel, March 2008, The Concrete Conundrum, Chemestry World, www.chemestryworld.org

Dahl, Torben Ed., 2003, Facaden - teori og praksis, Kunstakademiets Arkitektskole, Institut for Arkitekturens Teknologi, København

Dahl, Torben & Wedebrunn, Ola, 2000, Modernismens bygninger, Miljø og Energiministeriet Skov og Naturstyrelsen, København

Dalgren, Birgitta, 1989, Vitruvius om Arkitektur, Tio Bøcker, Stockholm, Byggforlaget.

Dehs, Jørgen, 1984, Æstetiske teorier, En antologi, Odense Universitetsforlag, Odense

Dixon, N.,1971, Sublimal Perception. London: McGraw-Hill

Dixon, N.,1981, Preconscious Processing. Chichester: John Wiley.

Einstein, Albert, Infeld, Leopold, 1938, The Evolution of physics, From Early Concepts to Relatively and Quanta, Cambridge University Press

Emmecke, Claus, 2010, Hvad er forskning? : Normer, videnskab og samfund / redaktører, Nyt fra Samfundsvidenskaberne, Frederiksbergs

Faffnsøe, Sverre, 1998, Filosofisk æstetik Jagten på den svigefulde sandhed, Museum Tusculanums Forlag, Københavns Universitet, København

Fraser, Harry, 2005, Ceramic Faults and their Remedies, Second Edition, Gentle Breeze Publishing, Isbn-10/ 1-889-250-50-3

Friberg, Carsten, 2006, Æstetisk værdi, s.183-193, Det æstetiskes aktualitet, Multivers, København

Friberg, Carsten, 2007, Æstetiske erfaringer, Multivers, København

Galle, Per, (2003), Forskning i de kunstneriske designfag. [Research in the artistic design disciplines; in Danish.] Nordisk Arkitekturforskning, 16(3), 81-88.

Gallileo Galilei, 1954, (i 1638) Dialogues Concerning two New Sciences, Dover Publications Inc, New York,

Gadamer, Hans Georg, ,1984, Det betænkelige ved den æstetiske bevidsthed, s. 95-106, i Æstetiske Teorier, Dehs, Jørgen, (Ed.), Odense Universitetsforlag, Odense
Gammelgård Nielsen, Anders, 2002, Materialeæstetik, Krydsfiners æstetiske potentialer, PhD afhandling, Arkitektskolen Aarhus, Århus, p. 40

Goodman, Nelson, 2007, Kunst og erkendelse, i Æstetiske teorier, En antologi, p. 10-130, Odense Universitetsforlag, Odense

Gordon, J.E., 1984, The New Science of Strong Materials, 3. edition, Prince University Press

Gyldendals Leksikon, 1973, 2. oplag, Beton, København, Gyldendals Leksikon, bind 1, A-K, s.105

Hald, Peder, 1958, Keramikkens Teknik, København, JUL, Gjellerups Forlag

Hamer, Frank and Janet, 2004, The Potters Dictionary of Materials and Tecniques, Fith Edition, Bloomsbury Publisher, ISBN-13/978-0812238105

Hansen, Claus Domino, 2001, Håndbog i Studiekeramik, Teori og Teknik, Vejle, Kroghs Forlag A/S

Hansen, Finn Thorbjørn, 2012, Er undren en kraftkilde for kreativitet, og kan man undre sig uden ord? http://www.designskolenkolding.dk/fileadmin/PDF/news2011/undring_uden_ord.pdf

Holliday, Leslie, 1996, Composite Materials, Amsterdam, Elsevier Publishing, Company

Hove, Helle, 2010,Design kompetencer; formgivning; æstetik; form giving; æstetisk dømmekraft; aesthetics; design competences; aesthetic judgement, København, The Danish Design School Press,

Jensen, Per Bak, 13 marts 2011, Bevægelse, Katalog til udstillingen Bevægelse, Gammel Holtegård, Holte

Jørgensen, Dorthe, 1997, Den blå blomst og den pukkelryggede mandsling, tekster og tankebilleder om kunst, liv og filosofi, 1. oplag. , Modtryk, Århus

Jørgensen, Dorthe, 2003, Skønhedens Metamorforse, Syddansk Universitetsforlag, Odense

Jørgensen, Dorthe, 2006, Skønhed, En engel gik forbi Aarhus Universitetsforlag, Århus.

Jørgensen, Dorthe, 2008, Aglaias dans, På vej mod en æstetisk tænkning, Aarhus Universitetsforlag, Århus

Jørgensen, Ulla Angkjær, 2007, Kropslig kunst, Æstetik, køn og kunstanalyse, Museum Tusculanums Forlag, Københavns Universitet, København

Kanaev, V.K., 1969, Technical Glazes for Keramzite Concrete Wares, Russia, Structural Ceramic Research Institute

Kant, Immanuel, Kritik der Urteilskraft, 1790,1799), Ed. K Vorländer, Felix Meiner, Hamburg 1974

Keiding, Martin, 1998, Modernistisk juvelerarbejde, Arkitektur 3, s.161-176, København, Aritektens Forlag

Khan, Louis, 1973, Materials, Forelæsning ved Pratt Institute, School of Architecture, N.Y.

Kirkeby, Ole Fogh, 2007, Skønheden sker, Begivenhedens æstetik, Forlaget Samfundslitteratur, Frederiksberg,

Kirkkopelto, Esa, 2008, New start : artistic research at the Finnish Theatre Academy, Tidsskriftsartikel
p. 16-27, Nordic theatre studies, Vol. 20

Kracauer, Siegfried, 2008, By + Rum, Det Fremmede i det Kendte, Byens Rum 1, Arkitekturforlaget B. p. 16

Kragelund, Minna, 2005, Materialitet og dannelse, en studiebog. - 1. udgave., Danmarks Pædagogiske Universitets Forlag, København

Kristensen, Svend Erik, 1975 Nr. 4, 25 febraur, Æstetiske og konstruktive sysnpunkter på facader af beton, København, Arkitektens Forlag

Kulturministeriet, Det Danske, 2009, Http://www.kum.dk/Documents/Publikationer/2009/Forskningsstrategi_for_Kulturministeriets_omraade/html/chapter04.htm. Kulturministeriet 2009

Kyndrup Morten,Drotner Kirsten, Richard, Anne Birgitte, Stigel Jørgen, Svendsen Erik, Ørum Tania,Rasmussen Mikkel Bolt, ,Kulturens fremtid æstetik uden grænser, Statens Humanistiske Forskningsråd, København

Kyndrup, Morten og Madsen, Carsten (Ed.), 2010, Æstetisk teori?, Æstetikstudier VII, Aarhus Universitetsforlag, Århus

Kyndrup, Morten, 2008, Den æstetiske relation, Sanseoplevelsen mellem kunst, videnskab og filosofi, Gyldendal, København

Lassen, Steen Nepper, 2005, Europæisk dialog : Et essay. European dialogue: PRO 2005, Charlottenborg, rbog. p. 22-23. København

Laurents, Kamma, 1966 ,Spørge Jørgen 14. oplag, Gyldendal, København

Le Corbusier, Charles-Edouard Jeanneret-Gris, (1927), 2008, Vers une Arhicture, FLAMMARION, France

Lefteri, Chris, 2003, CERAMICS, Materials for inspirational design, Swittzerland, Roto Vision SA Linnet, Erik, 1996, Keramikernøglen, København, G.E.C GAD

Liebeskind, Daniel, 2001, The space of encounter, London, Thames & Hudson Ltd

Linnet, Erik, 1996, Keramiknøglen, København, G.E.C. GAD

Lorenzer, Alfred, 1984, Tiefenheremeneytische Kulturanalyse, P.23., Taschenbuch, Frankfurt an Main

Lotz, Kathrine, 2003, Transparens, originalitet og gyldighed, Nordisk Arkitekturforskning, nr.1,

Lynggaard, Finn, 1976, Keramisk Håndbog, København, Aschehoug

Madsen, Carsten, 2002, Deleuzes og Det Æstetiske, Æstetikstudier II, Aarhus Universitetsforlag

Manelius, Anne Mette, 2007, Flydende sten, Betons Arkitektonisk ePotentialer, Cinark Overblik, Det Kongelige Danske Kunstakademi, København

Mikkelsen, Hans & Riis, Jens O,1989, Grundbog i projektledelse, Prodevo Aps.

Muffit, Stephen, 11 march 2002, The Glaze Book, A Visual Cataloque of Decorative Ceramic Glazes, Thames and Hudson Publisher, ISBN-10/ 0500510431

Murray, Scott, 2009 , Contemporary curtain wall architecture, Princeton Architectural Press, New York

Møller, Vibeke Andersson, 2001, Stellings Hus, København, Fiskers Forlag

Neville, Adam, 1975, High Alumina Cement Concrete, New York, John Wiley & Sons

Olsen, Kasper Nefer, 1992, Stoffets genkomst, Basilisk Babel, København

Pallasmaa, Juhani “Space, Place and Atmosphere- Peripheral perception in existential experience,”
(2011) In Ghost 13, p. 1-16

Pedersen, Poul Bæk, 1994, Rummet og det arkitektoniske object, Space and the architectural object, Fonden til udgivelse af arkitekturværker, Arkitektskolen Aarhus, Århus

Rasmussen, Thomas Schiødt Rasmussen, 2003, Kunstnerisk Udviklingsarbejde, Nordisk arkitekturforskning, http://www.arkitekturforskning.net/Tidsskrift/2003/2003_debat_rasmussen.pdf.

Rhodes, Daniel, 1968, Clay and Glazes for the Potter, London, Chilton Book Company

Ronneberger, Klaus, FRA REGULERING TIL MODIFICERING, Det Fremmede i det Kendte, Byens Rum 1, Arkitekturforlaget B. p. 19,20

Sangild, Torben, 25.juni 2012, Svar på spørgsmålet:”Hvad er æstetik?”, http://kunsten.nu/artikler/artikel.php.?torben+sangild+hvad+er+aestetik

Schittich Christian ed.,2006, in DETAIL: Building skins, DETAIL, Berlin

Seel, Martin, 2000, Ästhetik des Erscheinens, München

Seel, Martin, “ Aesthetics of Appearing,” (2005), Chapter II.5 – Situations of Appearing

Schusterman, Richard, 1997, The End of Aesthetic Experience, The Journal of Aesthetics and Art Critism, Vol. 55, No.1, p.29-41

Schön, D.A. (1983) The Reflective Practitioner. New York: Basic Books.

Skriver, Poul Erik, (Red.), 1962, Toms Fabrikker A/S, Arkitektur side 217-231, København, Arkitektens Forlag

Sloterdijk, Peter, “ Atmospheric Politics,” (2005), In Making things visible, by Latour and Weisel (ed.), p.
944-951

Solleveld, Floris, 2012, A Paradign For What? Review of: Henk Borgdorff, TheConflict of the Faculties: Perspectives on Artistic Research and Academia. Leiden University Press,xvii, 277 pp.Krisis, Issue 2

Sutton, Robert I, 2002, Besøg på Stanford University, Designforskning, En International Oversigt, Thomas Dickson, Dansk Center for Integreret Design

Svendler Nielsen, Hans Peter, 2005, Vi har brug for ny-industrialisering, Industrialiseret Arkitektur, Økonomi, Proces, Produkt/værk, Kunstakademiets Arkitektskole, Cinark, København. P.12-17

Tarp, Marianne, 2001, A Room Defined by its Accessibility, Michael Elmgreen & Ingar Dragset, X-Rummet, København, Statens Museum for Kunst

Thyssen, Ole, 2012, Det filosofiske blik, Europæiske mestertænkere, 1. udgave. Information, København

Tilst Peter, 1994, Livet forstås baglæns, men må leves forlæns, Gyldendal, København

Vindum, Keld, 2012, Anja Bache Concrete Ceramics, Arkitektur 03-2012, s. 66-72

Wackerhausen, Birgitte og Steen, 1999, Tavs Viden, Pædagogik og Praksis,

Watts, Andrew, ,Modern construction facades, MCF, Springer, New York

Wedebrunn, Ola, 2012, Displacements and Cohesion, p.7 In keramiske rum, Forskydninger, keramisk glaseret beton, DTU-BYG, ISBN 9788778773357

Wirnfeldt, Pia, 2012, Anja Margrethe Bache, Ceramic Displacements, Ceramic Art and Perception, December 2012, New York.

Wolf E. Matthes. 1985, Keramische Glasuren, Darmstadt Publisher.

Zahavi, Dan, 2001, Husserls Fæmonologi, Gyldendal, København

Zumthor, Peter, Oktober 2005, Atmospheres, Architectural Environments Surrounding Objects, Birkhauser, Berlin, Forord og interview, Birgitte Labs Ehlert

Ørskov, Willy, 1999, SAMLET, Aflæsning af objekter, Objekterne, Den åbne skulptur, 1. oplag, Borgen, Valby

http:pub.uvm.dk/pub/1999/prakspor/4.htm

Http://www.denstoredanske.dk/Krop,_psyke_og_sundhed/Psykologi/Psykologiske_termer/kin%C3%A6stetisk_sans.

http://medical-dictionary.thefreedictionary.com/sense.

Http://www.kum.dk/Documents/Publikationer/2009/Forskningsstrategi_for_Kulturministeriets_omraade/html/chapter04.htm. Kulturministeriet 2009

http://nbmaa.wordpress.com/2010/04/30/installation-art/