PROCEEDINGS PHD SYMPOSIUM

INTERFACES IN THE BUILT ENVIRONMENT

Bridging Technology and Culture in the Baltic Sea Region

Annette Bögle, Emiliya Popova (eds.)

INTERFACES
IN THE
BUILT ENVIRONMENT

Bridging Technology and Culture in the Baltic Sea Region

Imprint

© HafenCity University
Published by the HafenCity University
with express permission by the authors.
June, 2019

Interdisciplinary Scientific Committee

Toni Kotnik
Aalto University, Finland

Karl-Gunnar Olsson, Morten Lund, Anna Kaczorowska
Chalmers University of Technology, Sweden

Olga Popovic Larsen
Royal Academy of Fine Arts, Denmark

Lotte Bjerregaard Jensen
Technical University of Denmark, Denmark

Bartosz Macikowski, Justyna Borucka, Dorota Kamrowska-Zaluska
Gdańsk University of Technology, Poland

Roode Liias
Tallinn University of Technology, Estonia

Annette Bögle
HafenCity University Hamburg, Germany

Editors and concept for this volume

Annette Bögle, HafenCity University Hamburg
Emiliya Popova, HafenCity Universityt Hamburg

Design and Layout

Andrea Buonaventura Badia, HafenCity University Hamburg

Proofreading

Tessa Hellbusch

Print

WirMachenDruck.de

Project Contact

Prof. Dr.-Ing. Annette Bögle
Design and Analysis of Structures
+49 (0) 40 428 27-5691
annette.boegle@hcu-hamburg.de
www.hcu-hamburg.de

ISBN: 978-3-941722-90-3
ISBN (online): 978-3-941722-91-0

SPONSORED BY THE
Federal Ministry of Education and Research

The symposium was organized within the Inno-BSR project
"Innovations in Interdisciplinary Research in Built Environment within the Baltic Sea Region"
(Project number: 01DS17010)
kindly funded by the German Federal Ministry of Education and Research

PROCEEDINGS PHD SYMPOSIUM

INTERFACES
IN THE
BUILT ENVIRONMENT

Bridging Technology and Culture in the Baltic Sea Region

APRIL 16, 2018

Annette Bögle, Emiliya Popova (eds.)

HCU HafenCity Universität Hamburg

CONTENTS

INTRODUCTION

Emiliya Popova — HafenCity Universität Hamburg

The general aim of the PhD symposium "*Interfaces in the Built Environment. Bridging Technology and Culture in the Baltic Sea Region*" was to explore, identify and map innovative research approaches for shaping the built environment which are based on interdisciplinary collaboration.

The motivation for the symposium's realization came from the shared belief of the members of the scientific committee that there is a growing need to establish a network of young scientists and future professionals within the Baltic Sea region, who in their research work are addressing problems related to the shaping of the built environment from an interdisciplinary perspective. There is also a need for more cooperation and understanding between the disciplines of the built environment themselves, such as architecture, structural and civil engineering, urban planning and design, artistic and philosophical studies related to space. In the context of the symposium, the shaping of the built environment is understood as a collaborative creative process which aims at improving and further thinking about the social, technical and esthetical quality of the built urban environment in order to answer the current societal needs by using diverse and interdisciplinarily oriented methodological approaches. Interdisciplinarity, on the other hand, is seen as a source of inspiration and a key to innovation. Innovation is born where active exchange between disciplines takes places and the more diverse the inputs in the exchange process, the more comprehensive the definition of the problem and the spectrum of the possible solutions.

> *"Interdisciplinary research (IDR) is a mode of research by teams or individuals that integrates information, data, techniques, tools, perspectives, concepts, and/or theories from two or more disciplines or bodies of specialized knowledge to advance fundamental understanding or to solve problems whose solutions are beyond the scope of a single discipline or area of research practice."* **[1]**

Of course, interdisciplinary research faces a lot of challenges as well, especially in terms of communication (finding common language, common definitions) and lack of recognition of differing disciplinary concepts and methodologies. Interdisciplinarity also often carries the negative connotation of being suspected of "vagueness" and having "lack of rigidity" [Weingart 2000:29, as cited by **[2]**]. Taking this critical view on interdisciplinary research into consideration and being aware of the broad thematic framework offered by the selected topic, the organizers were, therefore, not aiming at providing a static definition of the concept of interdisciplinarity in the context of the built environment — bridging technology and culture. Far more, they were aiming at offering an exploration space for all kind of innovative ideas for the built environment. As a result, it was expected from the symposium participants that they have recognized and acknowledged the fact that the problems they are addressing in their research cannot be solved within a single discipline but need to be investigated at the interface of several fields of knowledge.

For this reason, already in the application phase, participants were encouraged to reflect on their work from an interdisciplinary perspective. This included a reflection on their research question as well as on their methodology in the context of the interdisciplinary scientific research. The potential of the research outcomes for further interdisciplinary collaboration or the potential of the used methodology for further implementation in interdisciplinary context was expected to be identified and specifically addressed in the submitted abstract.

While the thematic scope of the symposium was left as broad as possible, the geographical scope was narrowed down to one specific region in Europe — the Baltic Sea region. In fact, the PhD symposium was based on an initiative in 2015 that saw a joint teaching cooperation between seven academic institutions[1] from the Baltic Sea region, all of which offer specialized higher education programs in the main disciplines of the built environment: structural and civil engineering, architecture, architectural engineering, urban design and planning, urban studies, geomatics. Led by the HafenCity University, the seven partners were together part of the BeInterBaltic project "Intersections in built environment promoting interdisciplinary higher education in the Baltic Sea Region," which took place between 2015 and 2018 and was funded by the ERASMUS+ Strategic Partnerships program[2]. Within this project a new joint international and interdisciplinary format for teaching design was established — the Baltic International Summer School — B.I.S.S., which was carried out for four consecutive years at the HafenCity University in Hamburg. Based on the experience gathered from this joint interdisciplinary teaching activity the partners, also members of the current scientific committee, very quickly recognized the need to extend the focus of the network from teaching to research by encouraging young researchers from the Baltic Sea region to collaborate with each other more actively on topics related to the interdisciplinary shaping of the built environment.

A further significant insight for the current symposium from the BeInterBaltic project was the increased awareness of the project partners, also members of the scientific committee, of the common Baltic, Hanseatic and Nordic traits in all levels of the built environment — from traditions in craftsmanship, implementation of innovative digital technology for planning and construction to strategies dealing with waterfront management and climate change challenges. The common climatic conditions and close historical relations on which the joint built heritage of the Baltic Sea countries is based became the major catalyst for the heterogonous topics of the submitted for the symposium abstracts.

The "Interfaces in the Built Environment" symposium offered young scientists and researchers a platform for individual presentations followed by common group discussions which allowed for constructive feedback and interaction between the young researchers and the more experienced ones. Furthermore, there was an external scientific input by Dr. Bianca Vienni from Leuphana University of Lüneburg, Germany, which gave a better insight and overview on the different methodological approaches in interdisciplinary research. In her lecture titled "Methods and tools for interdisciplinary research," Bianca Vienni argued that interdisciplinarity integrates disciplinary approaches in order to solve a complex problem or offer an advance understanding of a complex question or topic." Working

interdisciplinarily happens with the help of an interactive mapping of knowledge, which always takes place in context and follows three principle steps: (1) ***identification***, (2) ***differentiation*** and (3) ***integration***. It is at the third step "***integration***" where the interdisciplinary synergies are actually activated and allow for the introduction of innovative solutions **[3]**. As Bianca Vienni explained there is no universal model of integration, because inter- and transdisciplinarity vary in purpose, scale and scope, they vary in the problems and questions at hand and in the mix of expertise in the single projects; they also vary in terms of the different contexts in which the teams operate (academic, industrial, governmental settings, public sphere). Therefore, there cannot and does not exist a universal formula for the integration of interdisciplinary knowledge. Depending on the varying conditions and goals of interdisciplinary research, different modes of integration of disciplinary knowledge can be applied.

Integration through [3]:

a. Conceptual clarification and theoretical framing
b. Research questions and hypotheses
c. Using and developing integrative scholarly methods
d. Integrative assessment methods
e. Development and application of models
f. Artifacts, products and concepts as boundary objects
g. Procedures and instruments of research organization

This valuable insight in the methodological background of interdisciplinary research was the ideal starting point for the individual presentations at the symposium, since it helped the speakers and the audience to better identify and situate their individual research topics in the context of interdisciplinarity. Overall eight thematically very differing researches were selected to be presented at the symposium to a compact academic audience of around 20 people. The eight selected papers were evenly distributed in two categories: "Transmitting Structural Design" for more technically oriented topics and "Shaping Urban Space" for urban and landscape-related topics[3]. After the symposium the submitted papers went through a two-staged reviewing process before being approved for final publishing.

In the current publication five research papers are presented. Due to the heterogonous background of the topics and questions addressed in the individual papers it is difficult to distinguish a clear logical thread between the single papers. However, in terms of the strategies applied for the "***integration***" of disciplinary knowledge for interdisciplinary purposes, two distinct focuses can be recognized in the currently presented papers.

1. new approaches and modes of collaboration and communication in an inter- and multidisciplinary environment
2. implementation of knowledge integration and integration of work methods for solving problems with higher level of complexity

Where the papers written by ***Hilke Berger*** and ***Mathilde Landgren*** deal with the question of how we work collaboratively when shaping the built environment and how we communicate disciplinary professional knowledge to other groups of interested stakeholders, the papers by ***Anna Rubczak***, ***Sofie Kirt Strandbygaard*** and ***Veronika Petrova*** are focused on single specific problems which due to their complexity need the integration of several fields of knowledge.

In conclusion, the main message of the symposium remains the identification of the concepts of "knowledge integration" and "communication" as keywords in interdisciplinary research. No matter what the concrete thematic context, it is the methods and tools used for enabling knowledge integration and the creation of synergies which make interdisciplinary researches comparable. Further questions which would be suitable for discussion and for the further analysis of interdisciplinary research could be questions such as: how do we communicate disciplinary knowledge in an (inter) disciplinary environment, how do we identify the interdisciplinary scope of the complex problem and last but not least how do we choose with whom to collaborate in order to bring about innovation?

The symposium was made possible within the Inno-BSR project "Innovations in Interdisciplinary Research in Built Environment within the Baltic Sea Region," which was kindly funded by the German Federal Ministry for Education and Research (2017–2018).

Keywords: interfaces, built environment, interdisciplinarity, innovation, Baltic Sea region, knowledge integration, communication, methods and tools

[1] (1)HafenCity University Hamburg, Germany, (2) Gdańsk University of Technology, Poland, (3) Tallinn University of Technology, Estonia, (4) The Royal Danish Academy of Fine Arts. Schools of Architecture, Design and Conservation, Denmark, (5) Technical University of Denmark, Denmark, (6) Chalmers University of Technology, Sweden and (7) Aalto University, Finland.

[2] www.beinterbaltic.org

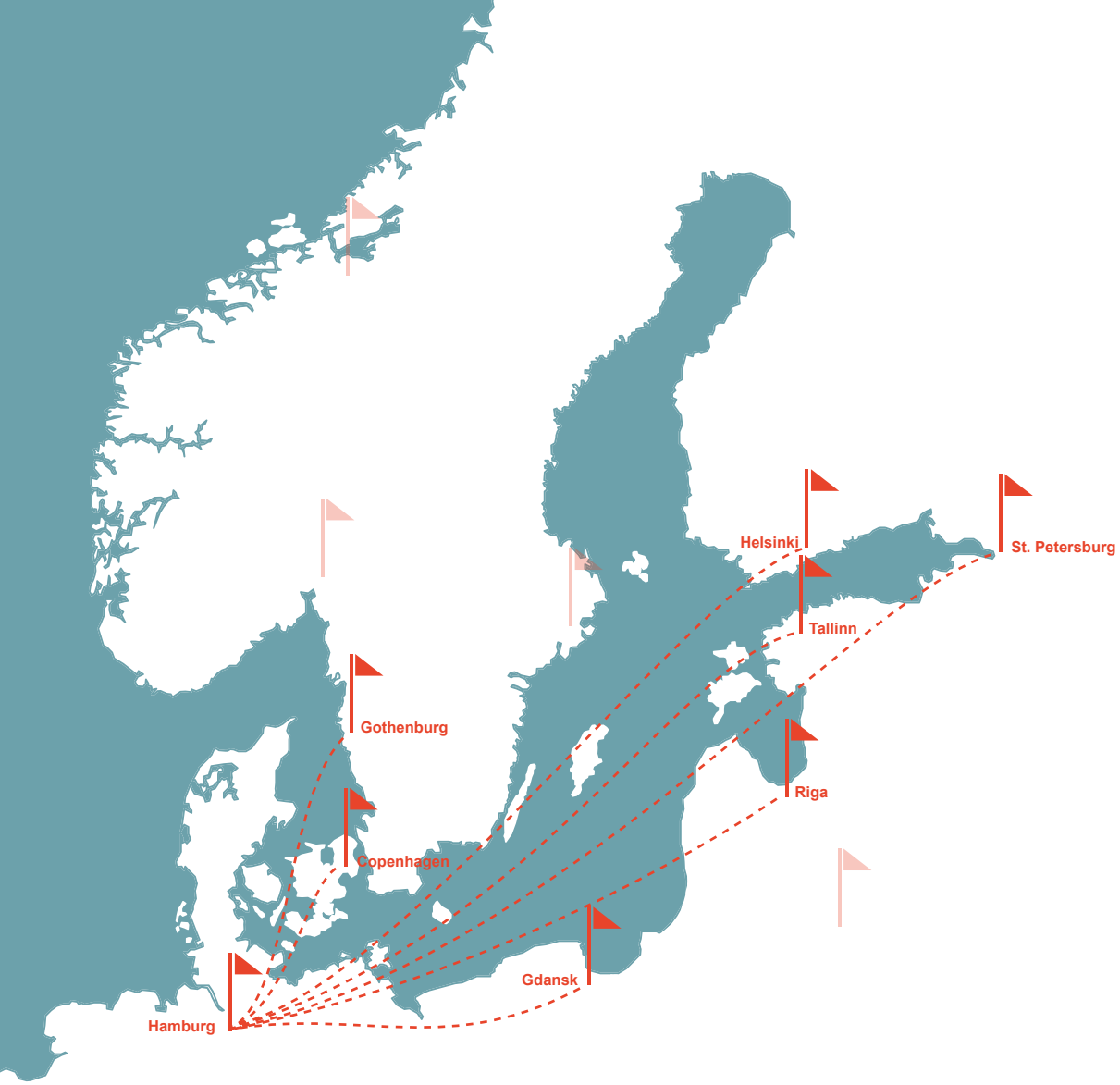
[3] see Symposium program on pages 12–15.

References

[1] National Academy of Sciences, National Academy of Engineering, and Public Policy (2005): ***Facilitating interdisciplinary research***. Washington, DC: National Acad. Press.

[2] Vilsmaier, Ulli (2017): ***Inter- and Transdisciplinary Research.*** PhD Colloquium "***Innovations in Interdisciplinary Research in Built Environment within the Baltic Sea Region***." Baltic International Summer School 2017. HafenCity University Hamburg. Department of Structural Engineering. Hamburg, August 17, 2017.

[3] Vienni, Bianca (2018): ***Methods and Tools for Interdisciplinary Research***. PhD Symposium "***Interfaces in the Built Environment. Bridging Technology and Culture in the Baltic Sea Region.***" HafenCity University Hamburg. Department of Structural Engineering. Hamburg, April 16, 2018.



SYMPOSIUM PROGRAM

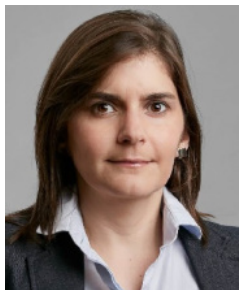
April 16, 2018 — HafenCity Universität Hamburg

9:30 – 9:45	**REGISTRATION + COFFEE**
9:45 – 10:00	Opening by Prof. Annette Bögle
10:00 – 11:30	**Keynote Lecture** on „*Methods and tools for interdisciplinary research*“ by Dr. Bianca Vienni Baptista (Leuphana University, Lüneburg, Germany) + workshop activities
11:30 – 13:00	**LUNCH**
13:00 – 16:00	**Parallel Sessions** Individual presentations + moderated discussion
17:00 – 19:00	**Professional Excursion:** IBA Hamburg „*Wilhelmsburg Mitte*“ — Showcase District with a visit of the Woodcube Project **Meeting point:** Foyer of the BSU (Ministry of Urban Development and Environment) Neuenfelder Str. 19, 21109 Hamburg
19:00 – Open end	**SOCIAL NETWORKING**

KEYNOTE LECTURE

METHODS AND TOOLS FOR INTERDISCIPLINARY RESEARCH

Dr. Bianca Vienni Baptista — Leuphana University Lüneburg



Topic

How can we construct knowledge collaboratively? How do integrative methods and tools for interdisciplinary research look like? How can different types of expertise be integrated into both a better understanding of the problem and more effective ways of addressing it?

Methods are central to the formation and transformation of different types of knowledge(s), and the challenge of working across and in between disciplines is both exciting and pressing.

This lecture offers an introduction to methods and tools for interdisciplinary research and will provide basic insights to t he emergence of interdisciplinary research in the context of changes in modern society. The lecturer will also explore the concept of "culture(s)" applied to the participants' experiences and projects and how they engage or frustrate the ways in which disciplines frame and pursue integration. We seek to provide an exploratory space for connecting interdisciplinarity to the specific research, methodological and personal interests of the participants.

About

Bianca Vienni holds a Bachelor Degree in Anthropology, a Master and PhD (summa cum laude) in Heritage Management from the University of Granada (Spain). She is a postdoctoral associate researcher at the Methodology Center (Leuphana University of Lüneburg, Germany). Until 2017, she was an Associate Professor (with full dedication) in the Academic Department at Espacio Interdisciplinario (Universidad de la República, Uruguay) and a Level 1 researcher at the National System of Research (Uruguay). Her books include „The socialization of scientific knowledge as an interdisciplinary problem: the Uruguayan archaeological heritage as a case study" (2016, in Spanish) and „Encuentros sobre interdisciplina" (2015, TRILCE, Montevideo). She also lectures in undergraduate and postgraduate programs at the Leuphana University of Lüneburg. Bianca belongs to a Latin American network of scholars working on interdisciplinary studies and the regional perspectives, named ReID. Her main research interests are about science, technology and society arrangements and inter- and transdisciplinary knowledge production and institutions.

PARALLEL SESSIONS

SESSION 1	TRANSMITTING STRUCTURAL DESIGN
MODERATION	Prof. Lotte Bjerregaard Jensen, Prof. Toni Kotnik

Structure Design through Structure Principles
Fangjie Xie — Aalto University

How evolving tools serve as a new layer of interdisciplinary exchange
Kai Schramme — HafenCity University Hamburg

Mapping the graphical communication of engineering knowledge in design teams in practice, when designing buildings with low environmental impact according to life cycle assessment
Mathilde Landgren — Denmark University of Technology

Resourceful Shelters: innovative strategies building on high/low tech
Veronika Petrova — The Royal Danish Academy of Fine Arts

SESSION 2	SHAPING URBAN SPACE
MODERATION	Prof. Olga Popovic Larsen, Prof. Anna Kaczorowska

Planning without planners: algorithms for designing egalitarian neighbourhoods based on residents' preferences
Viktorija Prilenska — Tallinn University of Technology

GIS mapping as a research method
Sofie Kirt Strandbygaard — Denmark University of Technology

Transformation instead of negotiation. The art of collectively shaping the city
Hilke Berger — HafenCity University Hamburg

Public Spaces in Waterfronts
Elida Rios — HafenCity University Hamburg

Water in the landscape of the Vistula Delta
Anna Rubczak — Gdansk University of Technology

SCIENTIFIC CONTRIBUTIONS

THE ART OF COLLECTIVELY SHAPING THE CITY

Hilke Marit Berger — HafenCity Universität Hamburg

Abstract

How can we shape livable cities collectively? This paper revolves around this central question, by taking artistically initiated interdisciplinary projects within urban space as a starting point. It takes a look at the consequences of this mostly explorative and experimental urban practice for the creation of new fields of work for a variety of involved parties and their self-understanding. To strengthen this interdisciplinary work at interfaces between urban planning, artistic practice, social work and the experts of everyday life — the citizens — we will have to find new models of organization. In order to be able to create productive frame-works for all those parties involved, interfaces between various disciplines and working cultures and their organization play a central role. Artistic projects can offer creative solutions for such new forms of organizations and are therefore presented as examples to deal with the main question: which innovative strategies for new processes and organizations do we need in order to be able to develop this art of collectively shaping our cities and fostering practical transformation?

Keywords: urban planning, participation, city as process, urban practice, urban art, urban design, interdisciplinary, urban governance, activism, interface, transformation

1. Introduction

Already more than 50 percent of the world's population lives in cities, and the numbers are rapidly rising: according to United Nations statistics (United Nations **[39]**), it will be nearly 70 percent within the next twenty years. Especially in large cities, this rapid growth indicates that the socio-economic and ecological fabric of cities is extremely challenging: lack of housing, lack of green space, diminishing public space, air pollution or crowded public transport — these are just a few of the problems citizens are increasingly confronted with in their eve-ryday life. Municipal administrations are often not able to respond quickly enough to acute problems because of their institutional restrictions. At the same time, however, the need of citizens to participate in the design of their cities and to bring about as immediate a change as possible increases. The demands for a new planning culture have led to lively discourses in various disciplines in recent years. More and more often a paradigmatic shift is referred to in which the focus shifts from a planning space, which is designed by planners and architects, to a living space that is defined by residents at eye level (Bittner **[9]**).

Many innovative strategies of urban design dealing with precisely this phenomenon, which show genuine alternatives and test putative utopias, are artistic and creative contributions to joint urban design. In testing the sustainability of seemingly impossible pathways, the artistic strategies in focus open the doors for these strategies to become more widely accessible.

This paper presents some examples of such works at the interface between art, urban planning and social work in a brief overview. By taking a look at the interfaces of overlapping urban practices in such works and the resulting consequences of co-producing projects, it aims to look at crucial questions as a first step for new ways of working together with a fo-cus on shaping the city collectively

2. New terms, new roles, new professions?

Art in this context is practiced as a collective and collaborative urban process. In this sense, art hardly constitutes a modality of debate or visualization, but a concrete act of the many who actively coproduce the city. As the artist Jeremy Deler puts it: "I went from being an artist who makes things, to being an artist who makes things happen" (Thompson **[38]**). Ac-cordingly, this art is about practical transformation, it aims at shaping the city collectively. The increase of such works, which no longer questions existing conditions, but engages in finding practical answers for sustainable societal cooperations, must be seen in the context of the so-called "social turn" in the arts. The art historian Claire Bishop diagnosed a striking change in the use of artistic practice for social issues under this name for the first time in an essay in 2006 (Bishop **[8]**). This shift describes a movement in which art and activist practic-es meet and overlap. In these projects, collaborative formats are understood as an equal cooperation of various actors. This form of engaged art can be defined less by genre and discipline than by method, format and content: "While it is difficult to categorize socially engaged art by discipline, we can map various affinities based on methodologies. These in-cidents are addressed as sustainability, the environment, education, housing, labor, gender, race, colonialism, gentrification, immigration, incarceration, borders, and on and on" (Thompson **[38]**). For several years, attempts have been made to meet the changes de-scribed using new terminology. These include, among others: "Art as Social Practice" (Lind **[25]**), "Socially Engaged Art" (Bishop **[8]**; Helguera **[19]**; Thompson **[38]**), "Relational Aes-thetics" (Bourriaud **[10]**) "Social Works" (Jackson **[21]**), "Social Design" (Banz **[3]**; **[4]**), "Community-, Social-, Project-based Art" (De Bruyne, Gielen **[13]**; Bishop **[8]**; Kester **[22]**), "Public Art" (Holub, Hohenbüchler **[20]**), "Connective Aesthetics" (Gablik **[15]**), "Dialogical Art" (Kester **[23]**), "Collaborative Art" (Billing, Lind, Nilsson **[7]**), "Participatory Design" (Manzini, Rizzo **[28]**; Simonsen, Robertson **[36]**), and "User Design" (Redström **[33]**).

The terms, as one can see, are numerous and sometimes confusing, however, this piling up on description attempts is symptomatic of the interface character and the difficulty of codi-fication. The name inflation is thus by no means coincidental. "It refers to conflicts, different constructions of (self)-identification, supposed traditions and discursive roots" (Malzacher **[27]**). The professional

self-understanding of the actors (am I a planner? A designer? An artist? A social worker?) thus becomes an essential point of reference both for the understand-ing of the art involved and for the disciplinary consequences.

The questioning of individual and representative roles is not only gaining momentum in the field of art. The fact that the rethinking, the new thinking of professions and fields of work is booming, can be seen, for example, in various events (with very different backgrounds) of the recent past. This is the case in the Urban Symposium ***Disciplinary border crossings (Disziplinäre Grenzgänge)***, which was initiated by the department of urban planning at the HafenCity University in the summer of 2016. It asked for a change of perspectives on new fields of urban planning and urban research. The same applies to the Urbanize Festival of the urban research journal ***Dérive***, which took place in autumn 2016, or the discursive festival ***theatre and action (Theater und Aktion)***, organized at the ***Schauspiel Dortmund*** in the autumn of 2015, or in the context of Darmstadt's architectural summer 2014 and the symposium ***City as a space for action (Stadt als Handlungsraum)***, which stated a new field of ex-perimentation for urban opportunities, especially with regard to new professions.

What all these events have in common is that the change or shift in their characterizing fields of action to other areas seem to be so noticeable that they need a corresponding public and/or academic reflection. They all bring about the discussion of clear movement at the edges and transitions and thus the thematization of interfaces in working fields in urban design.

3. Working at interfaces or the challenge to find new modes of organization

A prerequisite for the determination of an interface is the subdivision into different (for ex-ample) professional, aesthetic or even sociopolitical areas. The subdivided or demarcated areas then touch again in the interfaces of shared ambitions. Corresponding spaces and niches can become interfaces and, as a possibility of exchange, form interdisciplinary and transdisciplinary platforms.

The sometimes very different and often quite vague definitions of interfaces — a term that is used in various professions (most recently especially in the IT area as "the" interface, de-fined as a transition for various possibilities of data transfer) — have one important point in common: an interface is always about communication, it establishes contact, it creates a touch of different levels or areas and thus controls or initiates innovative processes and shapes relationships. Therefore the most crucial condition for the work at interfaces in transdisciplinary projects is being able to understand one another and set clear goals and tasks for the joint working process. The different use of language and the need for transla-tions between different disciplines is often underestimated. For example the word "project" in the field of urban planning is clearly understood as a process with a defined start and end-ing where a concrete output is to be delivered. In turn, in the field of art a "project" most likely is supposed to be a process with an open ending. These different understandings alone can lead to multiple problems. Therefore the goals of such processes have to be communi-cated upfront and very clearly to avoid frustration for all parties involved. This also goes for the distribution and definition of roles and responsibilities, as Klaus Overmeyer, a pioneer in the field of user-driven spatial development and transformation states: "When processes falter or even fail, this is often due to the organization of the actors" (Overmeyer **[31]**).

Working at interfaces can in this sense be understood as a phenomenon or new mode of collective work practices, which also involves citizens in other roles than in classical partici-patory formats with a clear hierarchy. Many of the protagonists are no longer satisfied with the familiar formats for participation such as world cafés, round tables, focus groups, idea competitions, juries, or civic forums. They would like to participate more creatively, more effectively and much sooner in urban developments. Hence, they reject the term civic par-ticipation completely. Because one can ask: who participates with whom, in what, and for what purpose? (Berger, Ziemer **[6]**). Nowadays this involvement is not only about participat-ing in the discussion, but also about being able to take action together, which is why verbs such as partake of and coproduce the city are used to describe the emancipated practices of the protagonists involved (Polk **[32]**). Or they are perceived in the sense of ***performing or doing the city*** (Conrad **[12]**).

Today, in the field of urban development one must be prepared to deal with rethinking es-tablished strategies and different constellations of the persons involved, which is why a se-ries of urban development offices are extending their tools and no longer only operate as communicators or moderators. They are working on the development of innovative formats that enable a dialog on equal terms, as well as transparent development processes between citizens and sectoral planning agencies and also between the various stakeholders (Berger, Ziemer **[6]**).

Nowadays, we can see an increasing amount of shared interests in the field of urban design, where the radius of work was previously much more clearly separated. There are numerous projects which involve many different professions that share tasks equally in new collabora-tive forms of work.

On the other hand this new way of working together requires a whole new skill set, that is built upon openness on the part of everyone involved. Therefore the work on interfaces, which has a fundamental openness towards the informal, temporary and unfinished, can be characterized by:

1. Self-organization
2. Everyday expertise
3. Unusual alliances (Berger **[5]**).

This is not to say that the unique professional knowledge that only comes with a special dis-ciplinary background is not needed anymore. The challenge is to take this knowledge as a fundamental background for transdisciplinary work, which sometimes requires putting your core profession back a bit, and rather define yourself as part of a collaborative group. For this new transdisciplinary profession the artist, architect and professor Barbara Holub, for example, suggests the term "Urban Practitioner" (Holub **[20]**).

A steadily growing number of examples currently shows that creative planning projects in particular are succeeding in finding new role models and structures for a concept of urban planning that promises to better respond to the growing demand by very different protago-nists for more involvement in shaping the city. The questions that need to be asked are how these relationships or alliances are shaped exactly, what new professions emerge here and what shifts are associated with them.

4. The art of taking action

As a partner in urban design processes, artistic practices are interesting for other fields of work for a variety of reasons. For example, the inclusion of artistic methods enables a dif-ferent setting in planning processes, thus allowing spaces for free thinking or different mod-els of planning. Art, with its conceded freedom of the arts, plays a decisive social role be-cause it is a basic order enshrined in the German constitution and thus protected by law (see Article 5, §3, German Constitution). This freedom, amongst other things, makes artistic prac-tice attractive for many different areas of work. As a consequence, these fields as described increasingly overlap with other fields of work. This in turn leads to questions about role models and disciplinary labels. But the emergence, the acquisition, the assertion of new roles and functions is an artistic strategy, too, which — quite deliberately — leads to uncer-tainty in a worldview that is geared towards clear categories.

To illustrate this point, I would like to refer to a practical example:

Liverpool: Together with longtime committed residents, the London Collective Assemble renovates ailing brick houses that were protected from demolition by the constant work of local initiatives, and in 2015 wins the prestigious British Turner Prize for visual arts for its project Granby Four Streets. "Assemble succeeds where city planners fail," writes the ***Süddeutsche Zeitung*** in one of its headlines (Lorch **[26]**). "Urban regenerators Assemble be-come first 'non-artists' to win Turner prize" (Brown **[11]**), the British ***The Guardian*** describes the report and characterizes the group as a "direct action collective". In the ZEIT was to be read that an artist collective won the award (Wermers **[40]**).

One of the most important trophies in the international art scene has been awarded to a collective of architects, designers, ethnologists, philosophers and artists, whose common practice of urban design can no longer be accurately described with the usual categories. The old drawers do not quite fit anymore: Is this activism? Art? City planning? Social work? According to self-description, the goal of its work is: "To address the typical disconnection between the public and the process by which places are made" (Assemble **[2]**). Thus, with both the built and the lived and practiced environment, the process of work and its result are addressed in equal measure.

The look at these reports is interesting as it brings the great uncertainty regarding the label-ing of such works to light. However, the group's quote also shows that it is commonly be-lieved that on the one hand there are people who live in cities, and on the other we have a process that shapes and forms the city, which has apparently nothing to do with those peo-ple. Unfortunately, this separation is, of course, just as absurd as it was for years firmly rooted in our institutionalized urban planning, which today still focuses primarily on the en-trepreneurial city's concept of growth and competition. Although the concept of dynamic and relational social space, prominently introduced to international research in the spatial turn, had a tremendous impact, especially in social and cultural sciences, the transfer of this understanding into structural practice is still not always self-evident.

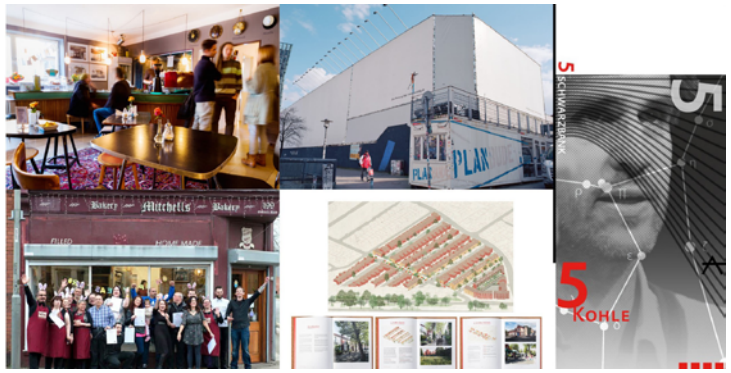
This is surprising, because in urban research there has long been a consensus, which, among others, Henri Lefèbvre already noted in the 1970s that city is a process (Lefèbvre **[24]**). It is created by the people and accordingly changed by these people. For this process of the emergence of urbanity through interaction, Heinz Schütz coined the term "urban perfor-mance" in order to make it clear that city is also the sum of its firmly established architec-tures, but above all forms a social network of actions and events, of encounters and interac-tions. "Considered in this light, the city is constantly recreated and performed by its resi-dents and visitors. Its real foundation lies in the social fabric it offers." (Schütz **[34]**). In view of this statement, the work of the British group Assemble could be described as urban per-formance par excellence, the aim of which is to reconcile this connection between people with the process of manifesting places in the built environment.

The artistic working methods in teams and collectives, the replacement of the myth of an ingenious individual creator in favor of unusual constellations and complicity — a term intro-duced by Gesa Ziemer (Ziemer **[41]**) is booming and no longer alone in the artworld. The rethinking of urban design, moving away from cities as static structures that can be grasped purely statistically, towards an understanding of the city as a plural fluid process, directs one's attention to the particular specificity of this plurality, which is always due to the socio-spatial characteristics of each neighborhood and therefore can only be unique. What ulti-mately unites all these strategies nevertheless is the claim of a real fiction. By questioning, testing out and implementing the seemingly impossible, statements of reality are not only imagined but also staged together as real alternatives and freedom of action demanded and used.

For example:

- As a **new economic culture** — as in the project ***Black Bank — Money/Coal for all!*** (***Schwarz-bank — Kohle für alle!***) by the performance collective ***geheimagentur*** (***secret agency***). One was able to pay with the currency "coal" during the project — which was self-organized by local residents — and for a long time afterwards in a network of different shops in Oberhau-sen.
- As a **hotel** — the Augsburg project ***Grandhotel Cosmopolis***, in which refugees live and work together with residents and tourists, and integration works in a completely different way, namely as a social sculpture.
- As an **old/new district**, as in the example from Liverpool, in which residents after years of protest were able to form a kind of cooperative to buy the demolished streets of the city and instructed ***Assemble*** with the organization of the renovation.
- As a **planning office**, as in the case of the ***PlanBude***, in Hamburg, St Pauli, where a transdis-ciplinary team was founded in an independent neighborhood meeting on ***DIY St Pauli*** (***St Pauli Selber Machen***) to organize the production of desires for the development of the Spiel-budenplatz.
- Or as a **bakery** — another example from Liverpool, where an almost closed traditional bakery became a collective enterprise through the artistic intervention of the Dutch artist Jeanne van Heeswijk and the involvement of local residents and offered the district new identification potential.

In intending to activate citizens and guarantee their participation, this new "art of action" (De Certeau **[14]**, Gludovatz, Von Hantelmann, Lüthy, Schieder **[17]**) is increasingly held to be politically responsible. This shift of responsibilities takes place in the context of a wider social, political and academic debate that has — as mentioned above — fundamentally ques-tioned the ways in which cities are developed and made (e.g. Bittner **[9]**, Göbel, Grubbauer, Richter **[16]**, Arnstein **[1]**, Harvey **[18]**, Ostrom **[30]**, Mouffe **[29]**, Selle **[35]**), Stavrides **[37]**).



Copyright for the pictures clockwise, starting at the top left: Alexander Kohler for "Grandhotel Cosmopolis," Alexandru Pasca "PlanBude," geheimagentur "Schwarzbank — Kohle für alle," Assemble "Grandby Four Streets," Jeanne van Heeswijk "Homebaked"

The central requirement of future-oriented urban development would have to be to use lo-cal commitment as a foil for scaling into larger contexts and, based on this, to develop strat-egies that do not result in resignation through suffocating criticism, but take local communi-ty engagement seriously. Appropriate projects should be a beginning and not an end to the discussion.

In consequence, the role of interfaces in processes of city planning and city development is a new and very important one and therefore stands at the core of this recently started re-search project about new modes of organization, new ways of working together and new perspectives on collectively shaping the city.

As described, many protagonists and institutions are increasingly calling their individual and representative roles into question and are subsequently crossing boundaries on a day-to-day level. Artists act as urban developers and vice versa, while theatre or dance institutions im-plement city projects, curators curate the city and no longer only art and architects also op-erate as social workers. Stipulated identities such as a defined profession are often no longer valid. Instead, hybrid scopes of work have developed, within which the protagonists discuss, communicate, act and design. What is needed are new city management constellations and more room for unusual partnerships. Because the crucial questions that need to be an-swered more and more urgently are: How can we integrate artistic perspectives better into institutionalized urban planning? What form of organizations are needed? Which role mod-els can we use for this? Are there examples from other countries which can be learned from? How can we foster creative thinking within city administration? Asking these questions may not be quite as gratifying as answering them, but if we take the ambitions of shaping the city collectively seriously — they can only be answered together.

References

[1] Arnstein, S., *A Ladder of Citizen Participation*, in *Journal of the American Institute of Planners*, July 1969, 216–24.

[2] [Assemble, self-description, available online at: http://assemblestudio.co.uk/?page_id=48

[3] Banz, C., *Social Design in: Kunstforum* International 2011, Vol. 207, SOCIAL DESIGN.

[4] Banz, C., *Social Design. Gestalten für die Transformation der Gesellschaft*, Bielefeld 2016.

[5] Berger, H.M., *Handlung statt Verhandlung, Kunst als gemeinsame Stadtgestaltung*, Berlin 2017.

[6] Berger, H.M., Ziemer, G. (ed.), *New Stakeholders of Urban Change. A Question of Culture and Attitude?* Berlin 2017.

[7] Billing, J., Lind, M., Nilsson, L. (ed.), *Taking the matter into common hands*, London.

[8] Bishop, C., *The Social Turn: Collaboration and Its Discontents*, in: Artforum 2006, Volume 44, No. 6; 179–185.

[9] Bittner, R., *Feldversuche in bewegter Stadt*, in: *Planning Unplanned — Towards a New Position-ing of Art in the Context of Urban Development*, Holub, B., Hohenbüchler, C. (ed.), Vienna 2015.

[10] Bourriaud, N., *Relational Aesthetics*. Paris 2002.

[11] Brown, M., *Urban regenerators Assemble become first "non-artists" to win Turner prize*, in *The Guardian*, 07.12.2015, available online at: https://www.theguardian.com/artanddesign/2015/dec/07/urban-assemble-win-turner-prize-toxteth

[12] Conrad, T., *Doing the City*, New York 2014.

[13] De Bruyne, P. Gielen, P., *Community Art. The Politics of Trespassing.* Amsterdam 2011.

[14] De Certeau, M., *Kunst des Handelns.* Berlin 1988.

[15] Gablik, S., *Connective Aesthetics*, in *American Art* 6 1992, No. 2, 2–7.

[16] Göbel, H. K., Grubbauer, M., Richter, A. (ed.), *Designed to improve? The makings, politics and aesthetics of "social" architecture and design*, City 21 (6), 2017.

[17] Gludovatz, K., Von Hantelmann, D., Lüthy, M., Schieder, R. (ed.), *Kunsthandeln*, Zurich 2010.

[18] Harvey, D., *Rebel Cities: From the Right to the City to the Urban Revolution*, Oxford 2012.

[19] Helguera, P., *Education for Socially Engaged Art*. New York 2011.

[20] Holub, B., Hohenbüchler, C. (ed.), *Planning Unplanned — Towards a New Positioning of Art in the Context of Urban Development*, Vienna 2015.

[21] Jackson, S., Social Works: *Performing Art: Supporting Publics*, New York/London 2011.

[22] Kester, G. H., *The One and The Many: Contemporary Collaborative Art in Global Context*, Durham 2011.

[23] Kester, G. H. (ed.), *Conversation Pieces: Community and Communication* in *Modern Art*. Cali-fornia 2004.

[24] Lefebvre, H., *The Production of Space*, Cambridge, 1995 (French 1974).

[25] Lind, M.: *The collaborative turn*, in *Taking the matter into common hands*, Billing, J., Lind, M., Nilsson, L. (ed.), London 2007, 15–31.

[26] Lorch, C., *Assemble gelingt, woran Städteplaner scheitern*, in *Süddeutsche Zeitung* 08.12.2015: available online at: http://www.sueddeutsche.de/kultur/britischer-kunstpreis-assemble-gelingt-woran-staedteplaner-scheitern-1.2766027

[27] Malzacher, F.: *Truth Is Concrete. A Handbook For Artistic Strategies in Real Politics*. Berlin 2014.

[28] Manzini, E., Rizzo, F.: *Small Projects/Large Changes: Participatory Design as an Open Partici-pated Process*, in *CoDesign: International Journal of CoCreation in Design and the Arts*, 2011, 7 (3–4): 199–215.

[29] Mouffe, C., On the Political, London 2005.

[30] Ostrom, E., *Beyond Markets and States: Polycentric Governance of complex economic sys-tems*, in, *The American Economic Review*, Vol. 100, No. 3 2010, 641–672.

[31] Overmeyer. K., *Navigating Transformatio*n, in *Koch, M., Rost, A., Siegmund, Y., Tribble, R., Werner, Y (ed.), New Urban Professions — A Journey through Practice and Theory*, Berlin 2018.

[32] Polk, M. (ed.), *Routledge Research In Sustainable Urbanism: Co-Producing Knowledge for Sustainable Cities. Joining forces for change*, New York 2015.

[33] Redström, J., *Towards User Design? On the Shift from Object to User as the Subject of Design*, in *Design Studies 2007*, 27(2): 123–139.

[34] Schütz, H., *Urban Performance. Performance in der Stadt/Stadt als Performance*, in: *Kunstfo-rum International*, 2013, Volume 223 October–December; 36.

[35] Selle, K., *Über Bürgerbeteiligung hinaus: Stadtentwicklung als Gemeinschaftsaufgabe? Analy-sen und Konzepte*, Detmolt 2013.

[36] Simonsen, J., Robertson, T. (ed.), *Routledge International Handbook of Participatory Design*. New York 2013.

[37] Stavrides, S.: *Common Space. The City as Commons*, London 2016.

[38] Thompson, N. (ed.), *Living is Form: Socially Engaged Art from 1991–2011*, Cambridge 2012.

[39] United Nations, Department of Economic and Social Affairs, Population Division (2017). *World Population Prospects: The 2017 Revision*. available online at: data.un.org/

[40] Wermers, N., *Künstlerkollektiv Assemble gewinnt Turner Preis*, in *ZEIT* Online 07.12.15, availa-ble online at: http://www.zeit.de/kultur/kunst/2015-12/kunst-turner-prize-assemble-nicole-wermers

[41] Ziemer, G, *Complicity. New Perspectives on Collectivity*, Bielefeld 2016.

MAPPING THE COMMUNICATION OF ENGINEERING KNOWLEDGE

USING VISUALS TO IMPROVE INTERDISCIPLINARY DESIGN TEAM PERFORMANCE FOR SUSTAINABLE BUILDING DESIGN

Mathilde Landgren, Lotte M. B. Jensen
— Technical University of Denmark

Abstract

At governmental and political levels, restrictions and requirements have been tuned and tightened to force the entire building industry to move towards energy efficiency and thereby reduce the environmental impacts of operating buildings. At the same time, there has been an increased focus on emissions during the entire life cycle of a building, including on the emissions related to the materials used for constructing buildings. Environmental buildings are now defined by low emissions over the entire life cycle of the building. Due to an increased complexity in building physics, products and technologies, more specialized knowledge has to be taken into account for every building design, which requires greater common understanding and cooperation between the various stakeholders — thus an interdisciplinary team right from the initial design phases. The simple and intuitive communication of technical information is an important factor within the interdisciplinary design team and one vehicle for this is visual communication. Two professions, architecture and engineering, are starting to increase their focus on interdisciplinary and better communication with each other, however, it is often rendered non-transparent how the actual interdisciplinary takes place in the design team. Focus on visual communication enables a better understanding of what takes place in the integrated design team.

The aim of this research was to define and describe the effect of visual communication of engineering knowledge to architects and other stakeholders participating in the interdisciplinary design team in the early stages of a building project. The research is based on extensive project materials consisting of presentation material, reports, simulation results and case studies. The material was derived from one of the largest European engineering consultancies and a large architectural office in the field of sustainable architecture in Denmark. Inquiries into the project material have resulted in a mapping of communication concepts from the practice that the material represents. In addition to this, the researchers with competences in both engineering and architecture took part in ongoing design teams which contributed additional information to the mapping of how engineering knowledge is communicated, received and affects the design process. The research shows that visual communication by engineers increases the frequency in which architects base design decisions on technical knowledge, which is a prerequisite for the ability to reach the goal of buildings with low environmental impact. In reverse, the quantification of architectural quality improves the understanding of the engineers and their acceptance of the architect's work. An interdisciplinary approach is thereby reached from two bridging sides by switching the methods with each other that are traditionally the approach of the other profession.

Keywords: visual communication, case study, interdisciplinary design, low environmental impact buildings, quantitative architecture

1. Introduction

Increasing the development of sustainable buildings, which are highly complex, will require more professions to be dependent on the decisions of one another, which again will require and lead to further development of interdisciplinary communication. Visual communication is moving to the fore of engineering education because interdisciplinary design teams require close corporation to ensure a holistic and uniform final product **[5]**.

In an integrated design process engineers are expected to be able to proactively influence early design decisions in the interdisciplinary design team, however industry is uneven in its willingness to alter the traditional roles of consultancy **[4]**. The fact that traditional consultancy roles linger on in industry influences the design process and forms a barrier for interdisciplinary early phase design processes **[4]**. However, a number of engineering consultancies are challenging these traditions by focusing on new communication strategies through visual communication **[6]**. Traditionally, visuals are a part of the schools of architecture (e.g. through modelling, diagrams, visualizations, renderings, 3D models, and sketches) **[1]**. The increased focus on early integration of technical knowledge in design decisions and the frequent aim of achieving sustainability certification of buildings call for architects to consider the communication of architectural quality. Quantification of architectural quality is challenging and some architects would claim that it is not possible, yet it could be one way of accommodating this request **[14]**. The German Sustainable Building Council (DGNB) offers a sustainability certification system in Germany that addresses Life Cycle Assessment (LCA) and Life Cycle Costing (LCC) as add-ons to the legal- and regulation-based focus on indoor climate and energy calculations. Thus it is expected that also LCC and LCA are considered from the early design phase. This means that architects need to develop quantifiable and knowledge-based design decisions **[11]** to be made in the early design phases. Therefore, classical engineering tasks are introduced to the architects who have to take them into account if a sustainability certification is the goal. As a result, the architects gain knowledge of the engineering fields **[1]**.

2. Method

2.1. The two case study consultancies:

There has been an increased focus on the importance of early design decisions since research has shown that the economic influence of early design decisions is high. For the last decades, this knowledge has set the demand for changing the mindset and work processes for both architects and engineers; these processes are now rapidly evolving [4]. In the following, the quest to inform early design decisions with technical scientific knowledge and the ways that architects and engineers try to create a common ground is investigated by looking at the role of visual communication first in a large engineering consultancy and then in the quantification of design decisions in a large architectural office. The paper is based on several case studies. However, three were selected for discussion in this paper. These case studies are derived from two companies in Denmark: a large architectural office with a focus on sustainable buildings, and the Danish part of a large European engineering consultancy. The engineering consultancy has more than 1,000 employees in Denmark and around 15,000 worldwide [8]. It is organized in special units. Each unit has profound specialist knowledge in its field. A selection of these units is shown in the organization diagram in Table 1.

Table 1. Organization diagram showing a selection of the units and some of the related subjects in the engineering consultancy [8]

ARCHITECTURE	BUILDING ENG.	ENERGY	MANAGEMENT SERVICES	ENVIRONMENT	WATER
Accessibility Architecture BIM Lighting design	Buildings Energy labeling and energy optimization Renovation	District heating Energy efficiency Solar energy	Commissioning FM Sustainability Work environment	Building contamination Nature conservation Waste	Adaptation to climate change

The architectural office has around 80 employees and is organized in three main units — City & Housing, Learning & Culture, and Business & Health — with a range of different specialist knowledge. A selection of this knowledge is shown in the organization diagram in Table 2 [9].

Table 2: Organization diagram showing a selection of the many subjects at the architectural office [9]

CITY & HOUSING	LEARNING & CULTURE	BUSINESS & HEALTH
Public housing Care Centers Renovation Landscape	Day care Schools Colleges Universities	Hospitals Laboratories Business Landscape

2.2. Engineering approach — Visualizing engineering knowledge

The engineering consultancy has developed its own tool called “Game Changer,” which is a set of technical guidelines meant to serve as tools to facilitate early phase dialog. It is based on a report conducted by a group of anthropologists [6], who observed the working processes in the engineering consultancy. They detected three challenges within the routines at each organizational level that affected how the clients experienced their interactions with the engineers. The three organizational levels are the leader level, the project leader level, and the technical specialist level. In this work, only the challenges related to the technical specialists are considered. The diagram in Figure 1 shows the challenges at the Technical Specialist level. This was the starting point for the company to understand the relationships between the potential behaviors of the employees and the resulting client experience.

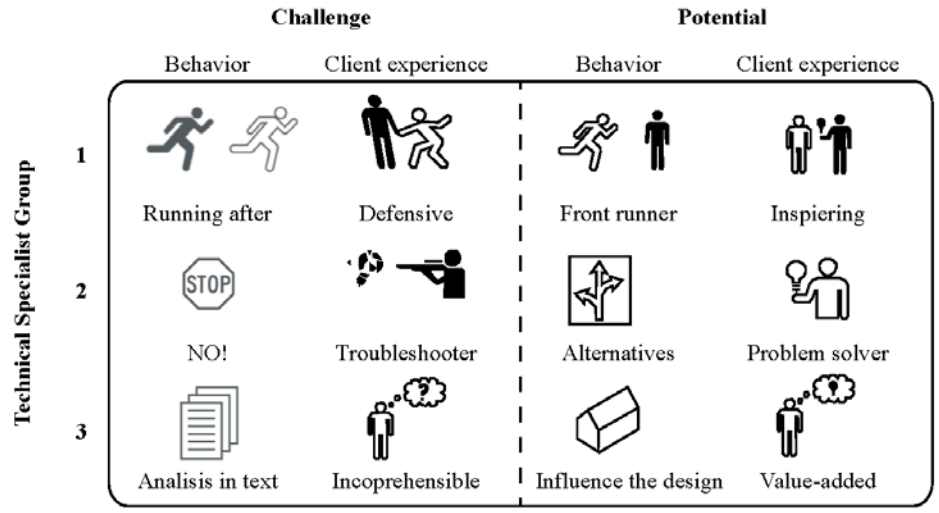


Figure 1. The Technical Specialist level and the three related challenges [6]

One of the challenges defined by the anthropologists at the Technical Specialist level is “Analysis in text.” Clients feel that “Analysis in text” is incomprehensible, since they do not share a common medium for dialog. Here, visuals may be a potential medium for communicating the engineering tasks and making the expert knowledge more comprehensible; however, this would require a different work strategy [6]. When changing work strategies, it is not always enough to offer an introductory course and a list of guidelines. The entire routine-based workflow and mindset of each employee has to be taken into account. Emotional intelligence (EQ) also has a great impact on the capability of utilizing communication tools, therefore EQ is an important qualification for employees to work within the complex environment of interdisciplinary design teams in the building industry [2]. By visualizing the complexity of the general technical issues in the guidelines, they become a qualitative description of design principles instead of quantitative values in a report. This is more easily incorporated into the design process and invites dialog about a wide range of design decisions [6]. Visuals as a tool for communication can be an advantage since they are easier to understand and to remember than text, as they engage the imagination and increase creative thinking [3].

2.3. Architectural approach — Quantification of design decisions

At the architectural office, there was no explicit aim to make communication more visible since they already work very visually. However, the increased number of interdisciplinary design teams and the demand for sustainability certification of buildings has introduced a need to quantify design decisions.

At the architectural office, the DGNB certification system is used as a basis for the definition of sustainability, which leads to an increased focus on resources, consumption, and emissions in relation to LCA, as well as on the economic aspects related to LCC. Internal changes are in development for the architectural office, where the entire mindset of the classical architect has to be modified and an awareness of the benefits of quantification as the background for their design decisions has to be introduced. The DGNB system proactively pushes this development at the architectural office by requiring ten early phase sustainability concepts to be developed in interdisciplinary teams as seen in Figure 2.

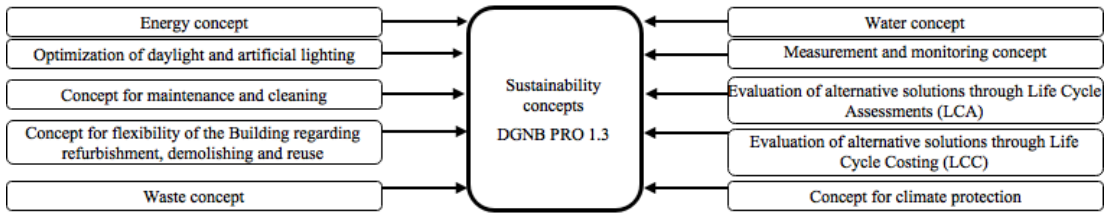


Figure 2. DGNB, PRO1.3 – New office buildings criteria: the ten introduced concepts that give points **[11]**

2.4. Method of research

Although several case studies have been conducted, two case studies were selected as being illustrative for influencing the initial design phase, prior to actual design: one at the engineering consultancy and one at the architectural office. The third case study illustrates the influence in the schematic design phase at the architectural office. The results of the case studies are compared, categorized, and reflected upon in relation to the visual communication of engineering knowledge, quantified design decisions, and the DGNB certification system. The case studies were conducted based upon the active research approach of four steps; planning the process, action through involvement in design teams, observing and collecting data, and reflection upon the findings **[16]**.

2.5. Case 1

Two engineers participated in the first initial meeting of a project with the entire design team. The design team consisted of engineers and architects. At the meeting, the engineers presented technical guidelines as visuals and after the meeting they reflected on what worked and what did not. The case study is based on Figure 1, "Analysis in text" at the Technical Specialist level. The current project has an open beginning, where the architect develops the building mass. This gives the engineers the possibility to include their knowledge from the very beginning. For the first meeting, all of the specialists brought their most relevant technical guidelines to be presented. The technical guidelines consisted of visualizations of the technical issues, which could be the result of the selected design decision and the accompanying list of the pros and cons for the specific design.

2.6. Case 2

One engineer employed at an architectural office participated in the initial design phase to assist the design team with the quantification of their scenarios for the project definition. The project started with a request from the project leader to quantify the economic value of two scenarios for an existing building through LCC calculations. The two scenarios were either to demolish and rebuild the building or to renovate it. For the calculations, a simple tool developed in Denmark called LCCByg was used **[12]**. The available material for the existing building was rather limited; the necessary data for the calculations was derived from old drawings. Included in the calculations were new components, maintenance and operation, supply and cleaning.

To assist the LCC calculations with the environmental and social aspects of the two scenarios, a simple tool from the Municipality of Copenhagen called the MBA (Environment in Buildings and Construction) was used **[13]**. The client requested its use since the project focused on a public building. The feedback based on the quantified data and the following responses were observed from the client for the current case study. The case study was mapped in a large matrix developed to align cases with regards to sustainability criteria, technical input, influence by the technical input, design decision and level of sustainability. The matrix is seen in Table 3 below.

Table 3: Matrix for case studies at the architectural office.

CASE No.	CASE 2	CASE 3
JJWs role	–	–
JJW included design phase(s) (Description of Service)	–	–
Sustainability focus	–	–
Technical inputs (my inputs) Requested by	–	–
Technical inputs (my inputs)	–	–
Technical tools	–	–
Design variations and decision	–	–
Reason for design decision	–	–
Level of sustainability	–	–

2.7. Case 3 — Informing the design process through visuals

The third case was derived at the architectural office as well, by quantifying design decisions during the design process. Also here the data was collected based on the matrix in Table 3. Here a number of daylight simulations were conducted by the sustainability team and submitted to the design team through reports and presentations. The daylight simulations done were testing the influence from type of glazing, solar shading, and depth of balcony overhang, and ceiling surface, upon the daylight conditions in the room and thereby the number of workspaces possible due to requirements of daylight conditions on workspaces of 2% daylight factor **[15]**.

3. Results

3.1. Case 1 — Visuals at an engineering consultancy

Figure 3 shows a representative technical guideline illustrating the placement of the toilet cores in a multi-story building. The guideline also includes lists of the pros and cons related to the technical installations.

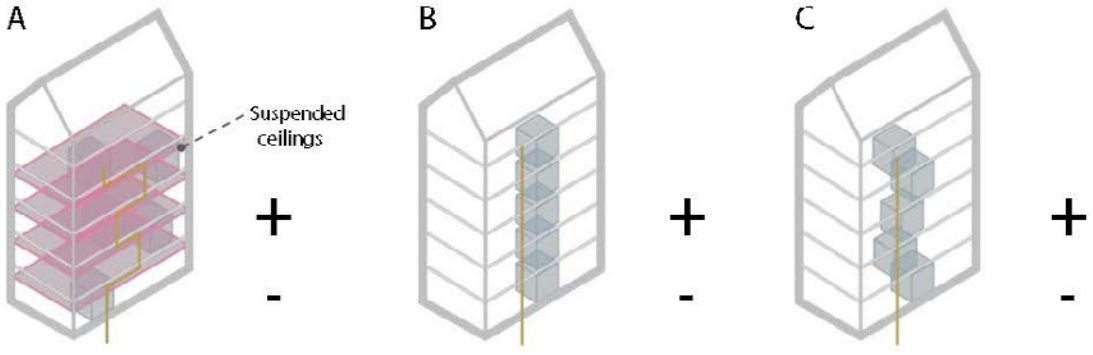


Figure 3. An example of the technical guidelines; these are always accompanied by text for the pros and cons: (A) Suspended ceilings result in high flexibility in the plan layout; the toilet cores can be placed in various locations. (B) Centered toilet cores on all floors ensure minimal routing for pipes. (C) Flexibility in plan layout with centralized routings **[6]**

Planning and action: Addressing the issue of toilet core placement in a multi-story building at the first meeting before the design processes started was intended to avoid a common challenge of technical installations that arises from a lack of organization of the cores.

Observations: Some of the attendees at the meeting found the information banal and narrow. However, the simple visual and adjacent text made the point precise and clear and ensured that those who were not experienced understood and could use the information. The mapping indicated the different types of feedback on the guideline, which provided a basis for collaborative dialogue.

Reflections: The engineers decided to further develop the visuals so that they would support an open range of solutions instead of suggesting just one solution space (the technical cores), and in this way accommodate the architects' feedback.

3.2. Case 2 — 'Quantification' at an architectural office

Planning and action: a report was exported from LCCByg showing the results of the calculations through column diagrams. The final sustainability ranking from the MBA (Environment in Buildings and Construction) **[13]** was included as well and illustrated through a circle diagram. These diagrams can be seen in Figure 4. The results show that the economically preferred scenario is "demolish and rebuild" due to the very poor conditions of the existing building. The sustainability ranking supports the economical preference based on more environmentally friendly materials, improved possibilities for maintenance, and improved functionality of the building (since it will better fulfil the needs of the users). The calculations and sustainability ranking ensured a thorough investigation of the scenarios and ensured a design solution based on both quantified data and qualitative data.

Observation: the project leader brought the outputs from Figure 4 to a pre-meeting with the client. The client expressed that he was impressed by the thorough investigation and very clear visualized outputs. The analysis achieved here convinced the client to follow the advice by the architects to demolish the existing buildings and rebuild due to poor existing quality and high costs to renovate.

Reflection: limited resources are available for public buildings and costs are thus the highest factor, therefore this was a crucial aspect to document from the architects' perspective to quantify in the initial design phases.

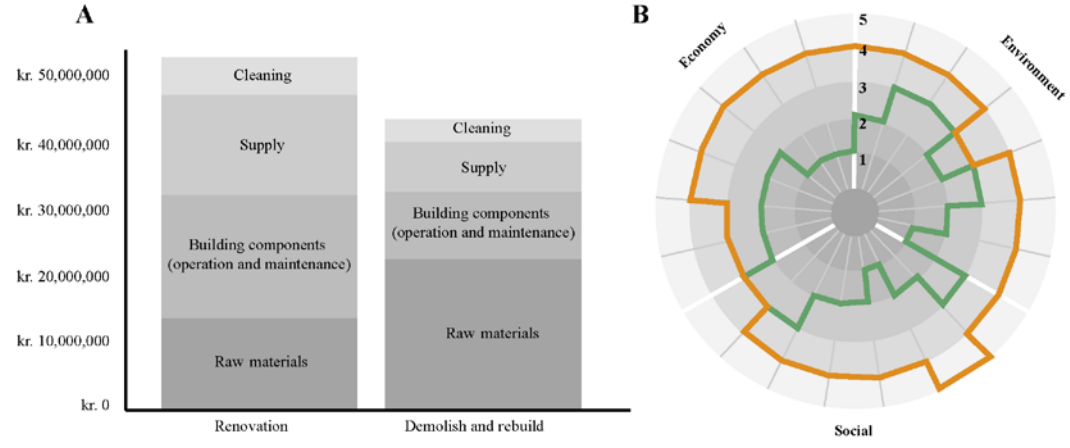


Figure 4. (A) The column diagram shows the costs for each process for the two scenarios from the LCCByg report. (B) The circle diagram illustrates the social, economic, and environmental ratings as outputs from the MBA. The orange represents the new building and the green represents the renovated buildinggs as outputs from the MBA. The orange represents the new building and the green represents the renovated building

3.3. Case 3 — Informing the design process through visuals

Planning and action: one output of the daylight simulations is seen in Figure 5, having the limit of 2% daylight factor illustrated on the floorplan of the room, for easier communication to design team and client.

Observation: the design loops and design decision parameters were collected in the matrix for case studies. The design team aimed for a design to ensure highest possible number of workplaces in the room having no additional solar shading to the balconies. This was argued to be possible through the daylight simulations, however only with white plane surface of the ceiling. The design team accepted and included the output from the daylight simulations through the design process to ensure best possible conditions of final design.

Reflections: each iteration of design suggestions was followed by a daylight study to inform the design decisions. Mostly the esthetics was the source for decision, however where the daylight simulations could make a case for more workplaces in the room, this was the design decision factor.

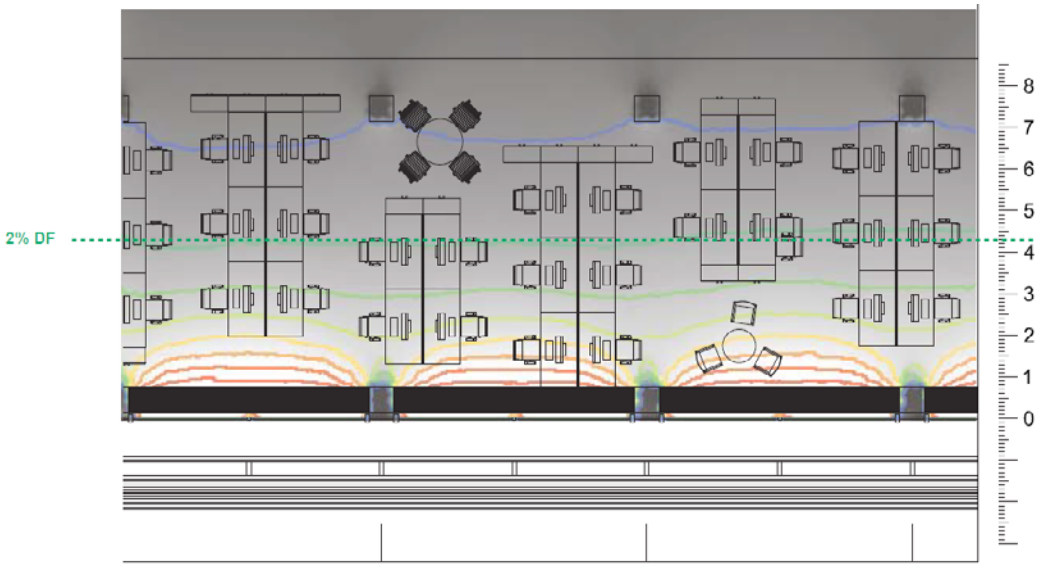


Figure 5. The figure shows the daylight simulation of the room, with the green line as the 2% daylight factor limit in the room. On the right is a scale showing the depth of the room in meters from the façade

4. Discussion

Requirements for more sustainable design and increased use of interdisciplinary design teams led both engineers and architects to alter their means of communication. The engineers focused on simpler and more visual communication strategies that helped avoid predictable problems by influencing how the architects organized the building masses during the early design phases. The architects, in turn, aimed to quantify their design approaches so they could influence decisions that would otherwise be determined by the engineers and financial considerations. This study also shows the importance of the disciplines' individual methods supplemented by the other disciplines method to increase the level of knowledge-based design and not just a change in methods.

The engineers succeeded in including technical knowledge simply and clearly right from the initial design phase. However, some experienced architects felt that the discussions were banal and that this process limited them in their scope for solutions. This feeling is crucial to address in the future since it can limit creativity in the design process. By being upfront with quantified design decisions, the architects were able to make important decisions that underlined their concept and visions, and ensure an open range of solutions, as illustrated in case 3. This makes the architects receptive to engineering knowledge in the early design phases.

All three case studies illustrate the impact of visualizing technical knowledge to ease communication between professions and to ensure informed design decisions in practice. The use of visuals is important in all design phases as illustrated here both in the initial phase and the schematic design phase. The need for quantification of design decisions to shape the design based on informed design decisions is also apparent.

All case studies expanded the range of communication means and made the aim for sustainable buildings and low-emission buildings easier to approach.

References

[1] Luyten, Laurens (2009), ***Communication between architect and engineer in a creative environment — A glimpse of the mutual knowledge required for interdisciplinary design***, http://bit.ly/2efEh81 accessed 14.2.2018]

[2] Riemer, Marc J. (2007), ***Communication Skills for the 21st Century Engineer***, Global Journal of Engineering Education, vol. 11 (1) pp: 89–100.

[3] Woeppel, Mark (2015), ***Visual Project Management: Simplifying Project Execution to Deliver On Time and On Budget***, Pinnacle Americas, Inc.

[4] Luyten, Laurens (2010), ***Architect and structural engineer communicating in multidisciplinary creativity,*** ICSA 2010 – 1st International Conference on Structures & Architecture, Guimaraes, Portugal, July 21–23, 2010, CRC Press 2010.

[5] McGrath M.B., Brown J.R. (2005) ***Visual learning for science and engineering***, IEEE Computer Graphics and Applications, Volume: 25, Issue: 5.

[6] Jacobsen S.S. and Wohlenberg B. (2016) **Visual Communication — of Professional Engineering Know-how as a Tool in Integrated Design Processes**, Special Course Report, DTU — Master in Architectural Engineering.

[7] Sweco webpage (2017) available online at: http://www.sweco.dk/en/contact/, accessed 25.01.2017.

[8] JJW webpage (2017) available online at: http://www.jjw.dk/?page_id=999, Danish, accessed 25.01.2017.

[9] JJW webpage (2017) available online at: http://www.jjw.dk/, accessed 24.01.2017.

[10] DK-GBC (2014) DGNB System Denmark — kontorbygninger 2014 1.2, Green Building Council, Denmark.

[11] Trafik- og Byggestyrelsen | Statens Byggeforskningsinstitut. 2016. LCCByg. Available online at: http://lccbyg.dk/, accessed 25.01.2017.

[12] Municipality of Copenhagen, MBA (2016) available online at: https://byk.kk.dk/indhold/udbudsdokumenter, Danish, accessed 26.01.2017.

[13] Tanga A., Babarb M.A., Gortonb I., Hana J. (2006) ***A survey of architecture design rationale***, Journal of Systems and Software, Volume 79, Issue 12.

[14] Trafik-, Bygge- og Boligstyrelsen (2014) Bygningsreglement 2015, available online at: http://historisk.bygningsreglementet.dk/, Danish, accessed 26.01.17.

[15] Swann C. (2002) ***Action Research and the Practice of Design***, Massachusetts Institute of Technology, Design Issues, Volume 18, Number 2, Winter 2002.

GIS MAPPING OF INTERDISCIPLINARY DATA

URBAN CHARACTERISTICS AFFECTING PASSENGERS' PERCEPTION OF SAFETY AT TRAIN STATIONS

Sofie Kirt Strandbygaard, Lotte M. B. Jensen
— Technical University of Denmark

Abstract

This study is part of a PhD project about the urban environment's influence on passengers' perception of safety in public transport. It suggests GIS (Geographic Information System) mapping as a research platform for analyzing interdisciplinary data related to urban public transport nodes. The focus of the analysis is to locate and measure parameters influencing passengers' perception of safety at the train stations. GIS mapping makes it possible to create layers of geographic information and to identify correlations between interdisciplinary types of urban information like planning typologies and passengers' perception of safety. GIS mapping is a strong communication tool to inform transport decision makers — politicians, chief executives from DSB (Danish State Railway) and planning authorities in Danish municipalities — about the different urban parameters that influence passengers' perception of safety at transport nodes. The results indicate that data should have strong correlations to communicate a graphic result in GIS and a statistical correlation analysis is needed for correlations not graphically traceable.

The second part of the study suggests a sketch for a scheme to measure CPTED (Crime Prevention Through Environmental Design) related parameters in the built urban environment and thus measure how parameters in the urban layout influence passengers' perception of safety. The result indicates that the method is functional and is to be further developed.

Keywords: interdisciplinary analysis, GIS mapping, fear of crime, public transport, urban public space, CPTED

1. Introduction

The design and planning of transport facilities and intermodal structures are shaped by engineering efficiency and traffic safety. However, another type of safety is equally important when designing public transport facilities: to feel safe from physical harm or crime. Users of public transport are sensitive to numerous parameters inherent in our built environment and society: stations and transit areas are regarded as public space, but the behavior here is quite different a shopping mall or a street (Tonnelat **[1]**). Results from international passenger surveys show that the level of anxiety and alertness is higher here than in other part of the public realm, e.g. due to crime patterns, fear of crime at stations, stress in relation to trains, noise, timetables, crowdedness, meeting marginalized citizens, etc. (NPR-CEN/TR 14383-7 **[2]**) (Crime Concern **[3]**). These environmental parameters make it important to create built environments that have a positive influence on the perception of safety.

The parameters affecting our perception of safety are more diverse and complex to manage than traffic safety such as safety distance on train platforms or digital traffic information. An indication of the transport nodes' quality is possible to measure through passenger surveys of perceived safety at the stations, but thus far, little research exists about how to evaluate public transport environments from a perceived safety point of view.

This paper suggests GIS mapping as a research element functioning as platform for analyzing station environments in order to categorize and measure different parameters' influence on passengers' perception of safety. The purpose is to visualize parameters in the built environment in GIS alongside data such as passenger numbers, crime or passenger surveys, to treat them with equal importance when performing transport modelling and planning transit areas. The analysis targets both the train station and the surrounding urban environment.

Additionally, this study sketches a scheme to quantify urban features from the built environment into quantitative data. For this, CPTED (Crime Prevention Through Environmental Design) methodology is used as it focuses on the built environments' influence on crime and perception of safety in urban space, e.g. natural surveillance like open façades and visual contact to people in the street (see CPTED methodology next section). By quantifying the data, it can be GIS mapped and added to the interdisciplinary station analysis (Figure 1).

The PhD project is based on case studies of the 84 S-train (urban rail) stations in the Copenhagen metropolitan area. The CPTED scheme is tested on 30 of the case study stations.

First, this paper presents a brief overview of the research related to the topic and CPTED methodology. The method section addresses GIS mapping and the case study. The result section presents the data selected for GIS mapping, a test of visual comparison and a sketch for evaluating CPTED parameters. The analysis/discussion touches upon the many challenges related to the method.

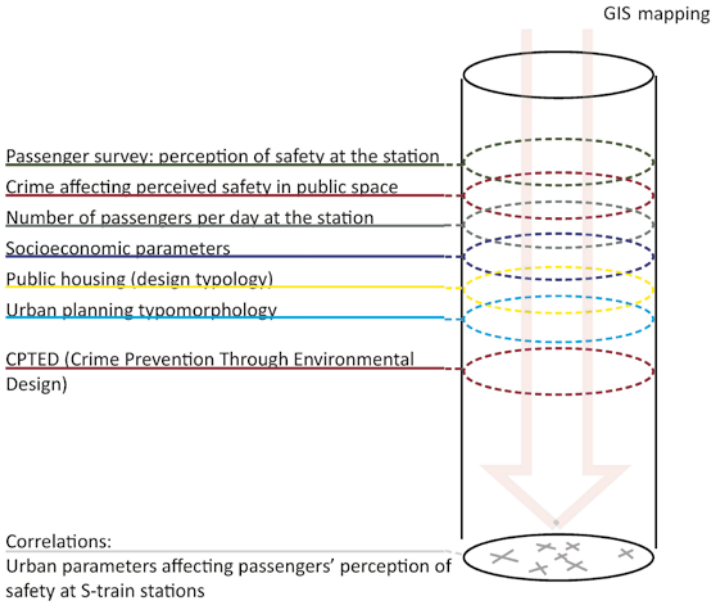
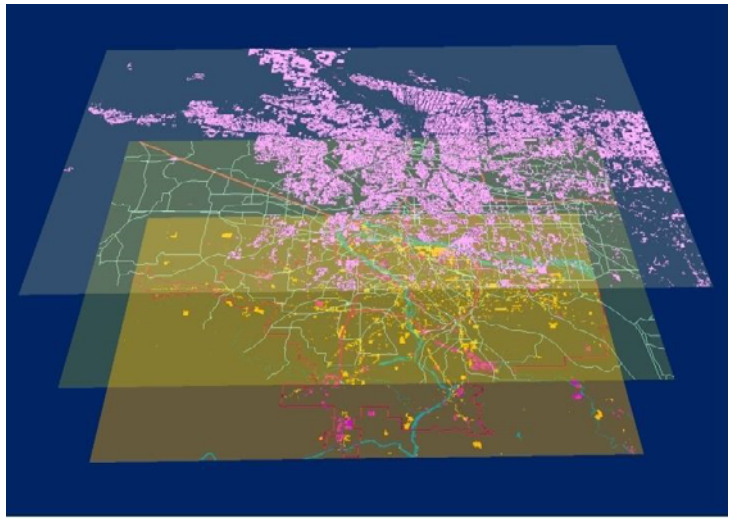


Figure 1. Interdisciplinary layers of data in GIS. Source: S. K. Strandbygaard

Best practice

GIS

GIS (Geographic Information System) makes multilayered mapping possible and can provide useful overviews of intersecting layers of information like sewer systems, greenery and street inventory (Yeh [4]). Therefore, GIS has been incorporated in most urban planning offices since the late 1990s and quickly spread to all other disciplines working with geocoded data. In transport research GIS is used to create models of transport network. An example of interdisciplinary transport GIS shown in Figure 2.



Another view of the same Portland, Oregon GIS data: residential parcels (top), transportation network (middle), and commercial and industrial parcels (bottom). A total of 371,300 land parcels are rendered in 3D in this figure, while the digital transport network has 130,141 arcs and 104,048 nodes.

Figure 2. Visualization of GIS data. Source: Mei-Po Kwan 2003-2016. Department of Geography and Geographic Information Science, University of Illinois

In the book "Putting Fear of Crime on the Map" (Doran & Burges [5]), geographical recordings of residents' avoidance behavior, based on individual interviews and hand-drawn maps, are compared to hot spots of crime committed in public space. The GIS map illustrates the overlap between the general collective avoidance concentration and crime hot spots within the CBD of Wollongong, Australia (Figure 3).

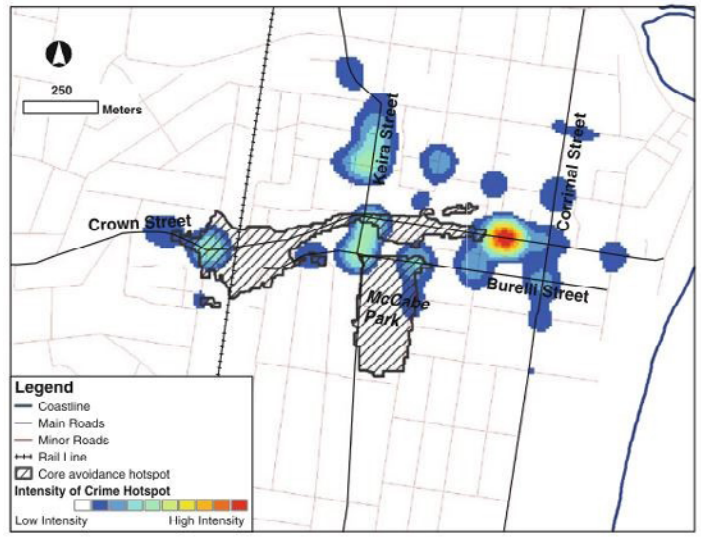


Figure 3. The degree of overlap between general areas of avoidance and crime hotspots. Source: "Putting fear of crime on the map" by Doran and Burges, 2012

Scorecard to measure CPTED parameters

The Australian study "Development and Application of a Scale to Measure Station Design Quality for Personal Safety" (Rahaman et al. [6]) develops and tests a unified measure of the overall design quality of train stations in terms of the main elements of CPTED: surveillance, access control or target hardening (deterring access to potential targets; a term used in the security industry), maintenance, territoriality, and activity support (see CPTED methodology next section). The study proposes a scorecard to measure different CPTED parameters in the station layout, such as the number of cameras or sightlines from the entrance to the platform. These are indexed and prioritized in accordance with the ranking of the safety measures of public transport facilities cited in existing research. The results are in numerical values that can be used to compare different stations. The study does not contain any qualitative research.

CPTED methodology

The methodology used for the urban analysis is Crime Prevention Through Environmental Design (CPTED) (Jeffery [7]), also referred to as "safe by design" or "secure by design." It is rooted in the criticism of modernism that began in the 1960s with an analysis of crime-prone post-war modernistic housing projects. It borrows from Jane Jacobs' theories (Jacobs [8]) on active streets and territoriality, but has a close relation to criminology and crime prevention. As a result, there is a long tradition for measuring cause and effect of design and planning with CPTED strategies. CPTED aims to reduce crime, violence, and fear of crime through environmental design. This also includes planning the location of different urban functions, robustness of materials, and creating environments that stimulate activities other than crime (Grönlund [9]).

CPTED theory addresses seven key concepts:

1. Territoriality (ownership of a place and the inclination to exercise social control)
2. Surveillance (both natural surveillance through “eyes in the street” and technical surveillance through cameras)
3. Access control (this covers both intelligent design of entrances and sightlines to create natural control, and public-private zones to clarify and delineate how to behave)
4. Image management (a place that is cared for and supervised)
5. Activity support (human activity where appropriate to provide the feeling of safety)
6. Target hardening (bolts and locks)
7. The geographical juxtaposition (the surrounding area and activities there affecting the station environment)

CPTED is the preferred methodology for developing guidelines for public transport. All existing guidelines for station design and security at stations are based on CPTED (Wilson, Boas **[10]**) (Huijsmans, Muller, Tilstra, Wassens, Boiten, Woldendorp **[11]**). Likewise the European Committee for Standardization published “Design and management of public transport facilities” (NPR-VEN/TR 14383-7 **[2]**) focus on station management, the level of crime and safety, and the influence of the surrounding urban area.

CPTED when used in the USA often focuses on access control and electronic surveillance, while Scandinavian countries and Holland focus on natural surveillance and territoriality through design and community engagement (Grönlund **[9]**). Since this is an analysis in the Danish context, the latter is the prevailing choice when considering analysis parameters.

Method

The study is based on case studies of S-train (urban rail) stations in the Copenhagen metropolitan area; seven lines, 170 km of track, and 84 stations covering the entire metropolitan area and therefore all types of station environments, urban planning typologies, and socioeconomic structures. The CPTED scheme yields that 23 S-train stations are perceived as being unsafe and seven test stations as safe. The analysis targets the urban layout of an extended transit zone defined by a radius of 800 meters around the station platform. This is based on US Transit Oriented Development radius (approx. 800 meters) (webpage **[12]**) and on the Danish version: principle of proximity to train stations (det stationsnære kerneområde) (600 meters).

The GIS mapping and graphic visualization is made in ArcMap 10.4. Data for the CPTED scheme is collected on site and through GoogleEarth. The different types of interdisciplinary data is collected through various channels described in the following section.

When GIS mapping and comparing data from a large number of stations (84), the selection of data must be made to process as many stations as possible to look for significant correlations in the data. The datasets should be as large as possible and address the most influential quantitative parameters affecting perceived safety in public spaces. The parameters selected for case studies of the S-train system are outlined below.

Results: GIS mapping of selected data

Crime. International research establishes that there is a close relation between crime and fear of crime at stations with crime in the surrounding area (Uittenbogaard **[13]**) (Loukaitou-Sideris **[14]**). The crime types mapped are only those affecting the perception of safety in public space: fights in the street, graffiti, reckless moped driving, reckless car driving, vandalism, narcotics sales, threats, theft of bags/purses, theft of cars, and violence (Politiet **[15]**). When used in large-scale GIS mapping, the separate crime types need to be aggregated at the separate stations and statistically correlated with the stations in the network. Hereafter it is possible to visualize a comparison of crime between the different stations.The data is available, but the correlation maps have not yet been produced. (The crime map of the extended transit area at Brøndby Strand Station is shown in Figure 4.)

Socioeconomic patterns. These play a major role when analyzing passenger surveys. An individual’s perception of safety is affected by the person’s previous experiences, economy, educational level and similar parameters (Pantazis **[16]**). Socioeconomically vulnerable areas with high levels of unemployment, or other stigmas have a bad reputation and thus evoke a fear of crime in public spaces. A detailed socioeconomic map is on its way in corporation with Statistics Denmark (Danmarks Statistik). (Figure 5 shows a provisional map from 2011.)

Passenger surveys of perceived safety at the station. The data is from the 2016–2018 “Passagerpulsen” [1] (the public transport passenger survey) supported by unofficial data from the 2009–2016 DSB (Danish State Railway) passenger survey on perceived safety at S-train stations. The survey question asked is: “At the station: how satisfied are you with … safety at the station?” The survey runs every quarter based on 16,000 questionnaires. Only stations with more than 500,000 passengers a year are represented in the survey. The large amount of aggregated data highlights which stations and urban areas are perceived as unsafe (Figure 6).

Public housing. The western region of the Copenhagen Metropolitan Area has the largest amount of public housing in Denmark because it was included in the post-war development strategy for Copenhagen. As a part of the strategy, large areas of public housing cluster around the train infrastructure (Figure 6). The larger part of public housing areas is inspired by modernism and carries the characteristics that CPTED and Placemaking criticize for having a negative influence on urban space. Therefore, they are important to map, to test and see whether that layer correlates with other layers of information. The data is from Almenbolignet.dk (public housing) combined with OIS.DK (property data for geocoding the building typologies in GIS).

Number of passengers per day. CPTED stresses the importance of presence of people in urban space in relation to perceived safety. It creates a feeling of personal safety (given that they are not engaged in crime or antisocial behavior) and supports an informal social control (Pantazis **[16]**). The number of passengers a day is from 2015 and stems from the Danish Traffic Construction and Housing Agency (Figure 6).

Urban typology. Categorizing of the surrounding urban planning: A — fragmented suburb, a predominant character for post-war planning. B — coherent suburb (structures of single-family houses mostly built before 1950), and C — dense urban area, predominant for the center of Copenhagen. A research paper on this analysis is “How urban typologies correlate with socioeconomic patterns and passengers” perception of safety at train stations’ (Strandbygaard **[16]**). (Figure 6)

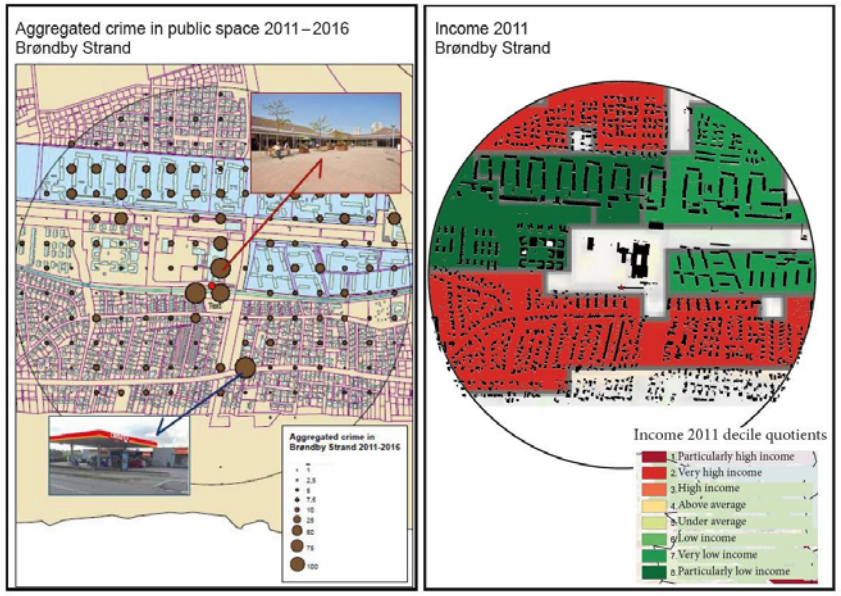


Figure 4. GIS mapping of crime committed in public space at Brøndby Strand in the extended transit area from 2011–2016. Source: S.K. Strandbygaard.
Figure 5. GIS mapping of income at Brøndby Strand extended transit area 2011. Source: S.K. Strandbygaard

Results

Figure 4 shows that patterns of crime committed in public spaces are concentrated around the station and there are more incidents in the modernist inspired structures north of the station. This is the public housing area with lower income (Figure 5) (green color on the income map).

The four maps in Figure 6 illustrate that Brøndby Strand station (the red circle) has relatively few passengers compared to the other S-train stations which results in a low level of activity at the station and thus low level of natural surveillance. The maps illustrate that passengers' perception of safety is low and it has a high concentration of public housing close to the station. The urban typology is fragmented suburb, a planning pattern which correlates with low urban density and low activity in the street/street life.

All gathered information informs us about the extended transit zone at the stations: the stations' geographical juxtaposition, which influence passengers' perception of safety. This also informs us about the level of influence the geographic juxtaposition has on the station.

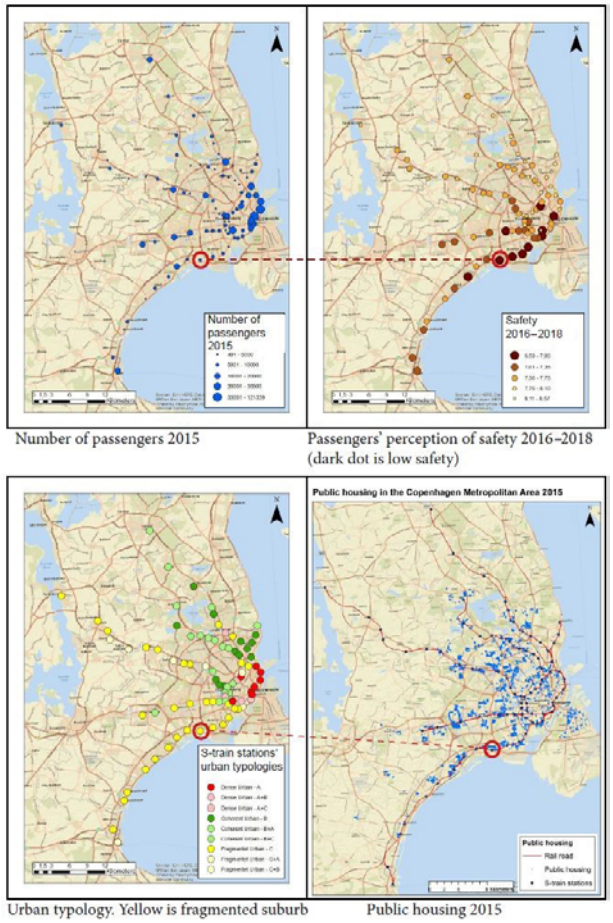


Figure 6. Brøndby Strand S-train station on different GIS maps.
Source: S.K. Strandbygaard

Test: a sketch of a scheme to value CPTED parameters at station environments

This CPTED analysis is tailored especially for Danish S-train stations. The stations are not manned, but some have a 7-Eleven kiosk at the station, a small handful have other shops as well. The stations have open platforms and no turnstiles or ticket booths and are an integral part of the surrounding environment. This background is paramount for station analysis. (An example of an S-train station is shown in Figure 7).

The proposed setup depicted in Table 1 is a sketch for an analysis — to test the main analysis setup. The assessment is made so that a positive answer to a negative element gives a numbered score. Therefore, the higher the joint count, the more vulnerable the station. For example, according to previous research, underpasses are perceived as unpleasant urban environments (Blobaum **[18]**). Question: Is there an underpass? Yes=1, No=0 (one station has three underpasses/tunnels, this amount to three points).

The station evaluation parameters are:

1. Number of underpasses,
2. Open space around the station due to parking or land use (registered on site for this test but with Isovist in ArcGis for the entire network). (TOD **[12]**
3. Next to busy road/highway structure (TOD **[12]**).
4. Platform (as opposed to a station which can create life and maybe have personnel present),
5. Lack of planning characteristics that draw people into public space (Foster **[19]**),
6. Does the station need a store? (people/personnel present).
7. Low socioeconomic level, which has a high influence on the level of fear of crime in a neighborhood (Pantazis **[16]**),
8. hiding places/shrubbery (Blobaum **[18]**).
9. Number 9 is a categorizing of the surrounding urban planning:
   A — fragmented suburb (fragmented suburb is predominant for post-war planning),
   B — coherent suburb (single-family houses), and
   C — dense urban area.

The test is performed using data from 2009 to 2015 of the 23 stations perceived as the most unsafe and on seven stations perceived as safe (Table 1). The station joint count (marked with blue in Table 1) is possible to GIS map to create an overview of the station qualities.

Figure 7. Avedøre S-train station
Source: S.K. Strandbygaard

MOST UNSAFE 2009–2015	NAME	TUNNELS	OPEN SPACE AROUND THE STATION SIZES 1=L, 2=XL, 3=XXL	ROAD / HIGHWAY TRAFFIC CLOSE BY	PLATFORM (AS OPPOSED TO STATION BUILDING)	LACK OF PLANNING CHARACTERISTICS THAT DRAW PEOPLE INTO PUBLIC SPACE	DOES THE STATION NEED A STORE?	POOR SOCIOECONOMIC LEVEL	HIDING PLACES / SHRUBBERY	C — FRAGMENTED SUBURB	B — COHERENT SUBURB	A — DENSE URBAN AREA	TOTAL
1	Brøndbyøster st.	1	1	0	1	1	1	1	1	C			7
2	Åmarken st.	1	2	1	1	1	1	0.5	1	C			8.5
3	Avedøre st.	3	2	1	1	1	0	1	1	C			10
4	Vallensbæk st.	1	1	0	0	0	0	0	1	C			3
5	Brøndby Strand st.	1	3	1	0	0	0	1	1	C			7
6	Skovbrynet st.	0	3	1	1	1	1	0	0	C			7
7	Nørreport st.	1	0	1	0	0	0	1	1			A	4
8	Danshøj st.	1	0	1	1	1	1	0	1		B		6
9	Nørrebrost.	2	0	1	0	0	0	0	0			A	3
10	Taastrup st	2	0	1	0	0	0	0.5	1		B		4.5
11	Hundige st.	0	3	1	0	1	0	1	1	C			7
12	Ølby st.	0	1.5	0	0	0	1	1	0	C			3.5
13	Enghave st. (closed)	–	–	–	–	–	–	–	–	–	–	–	–
14	Sydhavn st.	1	2	1	1	1	1	1	1	C			9
15	Langgade st.	0	0	1	0	0	0	0.5	1			A	2.5
16	Skovlunde st.	1	1	1	0	0	0	0.5	0	C			3.5
17	Karlslunde st.	0	2	0	1	1	1	0	1	C			6
18	Ryparken st.	0	2	1	0	1	1	1	0	C			6
19	Husum st.	0	0	0	1	1	1	0	1		B		4
20	Malmparken st.	0	2	1	1	1	1	0	0	C			6
21	Jersie st.	1	0	0	1	1	1	0.5	1	C			5.5
22	Ny Ellebjerg st.	0	3	1	0	1	1	0.5	0	C			6.5
23	Friheden st.	1	3	1	0	1	0	1	1	C			8
	SAFE TEST STATIONS												
47	Vangede	0	0	1	0	0	0	0.5	1		B		2.5
51	Valby	1	0	0	0	0	0	0.5	0			A	1.5
58	Vigerslev st.	0	1.5	0	1	1	1	0.5	1	C			6
70	Buddinge	0	0	1	0	0	0	0.5	1	C			2.5
79	Birkenrød	0	0	0	1	0	1	0	0		B		2
83	Charlottenlund	1	0	0	0	0	0	0	1		B		2
84	Holte	1	1	0	0	0	0	0	0		B		2

Table 1. Sketch of station evaluation scheme in Excel. Source: S.K.Strandbygaard.

Results

The stations perceived as most unsafe have the highest total count and the most parameters that influence the perception of safety negatively (the top of the blue colored column: 7, 8.5, 10, apart from station no. 14, Sydhavn, which has a high total count of 9). The stations perceived as most safe (from no. 47 Vangede to no. 84 Holte) have a low total count, apart from no. 58, Vigerslev, with a relatively high total count of 6.

Discussion and conclusion

GIS mapping makes it possible to compare spatial parameters and urban data very fast and in detail — something that is hardly achievable in text. It is a way to contain and visualize all the different analyses in one tool, but most importantly, mapping visualizes and communicates urban structural problems and affords possibilities to look at a case from several perspectives at once in order to understand its interactions, relations, cause, and effect. However, maps only communicate strong patterns that are visual to the eye. There will always be a need for a statistical correlation model to make detailed case studies.

Urban space and architecture have a subtlety in a variety of parameters that can be complex to capture. Mapping spatial urban data is time-consuming, thus starting out by mapping a selected number of parameters is preferable. In order to make an analysis of a large number of stations, data that has already been geocoded is a good idea to begin with. A visit to a variety of stations in the system at hand outlines the most important parameters affecting perceived safety in a negative way. In the case of the Copenhagen S-train system, the lack of activity and urban density around the stations is of importance.

In order to register and evaluate the built environment, there is a need for a person trained in CPTED to visit the station and to walk around the area to map features such as closed façades, unclear definition of private/public areas, inactive ground floors, and street lights. This should be done regularly since the urban environment changes constantly, for example during night and day, winter or summer, when a bar opens or shops close, when families move out, and so forth. Criminologists call this the “backcloth of crime” because street lighting, shrubbery, stores, rush hour and everything else shape the opportunities for crime and also shape more architectural parameters such as the urban experience. These are elements not captured by looking at Google Maps or the like; one has to visit the place. One has to study an environment to understand what affects peoples’ perception of safety.

The principle idea of the CPTED scheme, Table 1, is convincing, but although some of the evaluation can be done from a desk, it underlines the importance of visiting the stations when a station has a low total count (safe environment), but is perceived as unsafe in the passenger survey.

Passengers’ perception of safety can seem intangible to grasp; however, passengers’ perception of safety is measurable and so are most of the features and characteristics at station environments that affect the notion of safety.

The difficulty with transforming the built environment into quantitative numbers is the same that the Australian research paper by Rahaman et al. struggles with: from an architectural point of view, the CPTED numbers might be correct, but there might be some cases where the ambience of the place is

still awful, as the study is purely based on quantitative research. This calls for yet another layer of information that might try to encapsulate the atmosphere or ambience of a place.

Occupancy evaluations, in the form of qualitative interviews with users and inhabitants of the surrounding area are also essential in order to supplement the GIS mapping. Through interviews, it is possible to map passengers preferred routes, recreational spots, and areas to avoid.

The next step of the research is to validate soft qualities like the perception of a space and maybe even ambience through one or two case studies to create an example of how these elements can be quantified.

[1] Data can be retrieved from Passagerpulsen@fbr.dk Att. Lars Wiinblad

References

[1] S. Tonnelat, *"The sociology of urban public spaces,"* Territ. Evol. Plan. Solut. Exp. from China Fr., pp. 1–10, 2010.

[2] European Standardization, *"NPR-CEN/TR 14383-7 Prevention of crime — Urban planning and building design — Part 7: design and management of public transport facilities,"* Brussels, 2009.

[3] Crime Concern, *"People's Perceptions of Personal Security and Their Concerns About Crime on Public Transport: Research findings,"* London, 2004.

[4] A. G.-O. Yeh, *"Urban planning and GIS,"* Geogr. Inf. Syst., vol. 2., no. 1, pp. 877–888, 1999.

[5] B. J. Doran and M. B. Burgess, ***Putting Fear of Crime on the Map.*** School of Environment & Society Australian National University, Canberra Australia: Springer, New York, NY, 2012.

[6] M. Rahaman, G. Currie, and C. Muir, *"Development and Application of a Scale to Measure Station Design Quality for Personal Safety PAPER NUMBER _ 16-1405,"* J. Transp. Res. board, no. 2540, pp. 1–12, 2016.

[7] C. R. Jeffery, ***Crime prevention Through Environmental Design***, 2 edition. Butterworth-Heinemann, 1971.

[8] J. Jacobs, ***The life and death of great American cities.*** New York City: Vintage Publishing, 1961.

[9] B. Grönlund, *"IMPROVING SAFETY FROM CRIME IN STREETS AND PUBLIC SPACES AND REDUCING FEAR OF CRIME — THROUGH THE MEANS OF URBAN PLANNING AND DESIGN,"* in sustainability and future urban transport', D. Mohan, Ed. Delhi, India, 2013, p. 29.

[10] T. Wilson and Y. Boaz, *"Station Design Principles for Network Rail,"* p. 43, 2015.

[11] M. Huijsmans, A. Muller, T. Tilstra, M. Wassens, W. Boiten, and T. Woldendorp, *"Kwaliteitscatalogus,"* 2013.

[12] A. C. Uittenbogaard, ***Crime Clusters and Safety in Underground Stations,*** 1st ed. Stockholm: KTH Royal Institute of Technology School of Architecture and the Built Environment Department of Real Estate and Construction / CEFIN, 2014.

[13] A. Loukaitou-Sideris, R. Liggett, and H. Iseki, *"The Geography of Transit Crime: Documentation and Evaluation of Crime Incidence on and around the Green Line Stations in Los Angeles,"* J. Plan. Educ. Res., vol. 22, no. 2, pp. 135–151, 2002.

[14] Politiet, *"Politiets tryghedsindeks — Metoderapport,"* December 2016.

[15] C. Pantazis, *"Fear of Crime, Vulnerability and Poverty,"* Br. J. Criminol., vol. 40, no. 3, pp. 414–436, Jun. 2000.

[16] K. S. Strandbygaard, *"How urban typologies correlate with socioeconomic patterns and passengers' perception of safety at train stations,"* 2018, pp. 1–22.

[17] A. Blöbaum, *"Perceived Danger in Urban Public Space: The Impacts of Physical Features and Personal Factors,"* Environ. Behav., vol. 37, no. 4, pp. 465–486, 2005.

[18] S. Foster, B. Giles-Corti, and M. Knuiman, *"Neighbourhood design and fear of crime: A social-ecological examination of the correlates of residents' fear in new suburban housing developments,"* Heal. Place, vol. 16, no. 6, pp. 1156–1165, 2010.

LOOKING FOR THE SPACE-TIME CONTINUUM OF THE VISTULA DELTA RIVER

Anna Rubczak — Gdańsk University of Technology

Abstract

The historical Baltic region of the Vistula delta river is characterized by unique spatial development. In the past, development of settlers was associated with the dewatering process and serious risk of flooding. Between 1945 and 1990 rich cultural heritage was not protected. Today, the local community activity and interest in the heritage of the hydraulic civilization has an influence on the modern space–time continuum. **The point of research is to answer the question of how to take the direction of spatial development of the functional region of the Vistula delta river to transform lost regional spatial identity and to look at the role of waterways in rebuilding the identity in the Vistula delta.** Interdisciplinary research involves comparing historical knowledge of the Dutch settling phase to contemporary sustainable development. The role of waterways in society, economy, ecology and history contains contextual analysis, which underlines the relationship between the regional experience in creating resilient public spaces and the protection of the heritage. The history of the region before the loss of regional identity is an indication when creating typological solutions that protect the historic landscape in the research using design methods. The answer to the research question emphasizes the important role of historical knowledge in transformation of spatial development to revitalize water identity. Hypothetical revival of waterways and architecture connected with water will be the new trend of development.

Keywords: cultural heritage of the Vistula delta river, landscape architecture connected with water, typology

1. Introduction

In spring of 1945, as a result of hostilities, the polder infrastructure was destroyed, causing flooding of areas below sea level. A complete exchange of indigenous people with repatriates from the Eastern Borderland, Central Poland and Ukraine was carried out. Cultural continuity was interrupted. Characteristic elements of cultural heritage, Teutonic, post-German, Pomeranian monuments, windmills, arcaded houses were completely destroyed or devastated. Since the end of World War II, the area of fertile soils, with functional potential for tourism, has been struggling with the problem of the disappearance of spatial regional identity. Before 1945, the region showed the phenomenon of a hydraulic civilization. My research looks at the question raised in the 1980s about solving the problem of the lack of spatial identity. Identification of factors which have an impact on the preservation of spatial continuity before and after 1945 is the background of the study. This paper's main research question is how to take the direction of spatial development and the role of waterways to create spatiotemporal continuity.

In the second paragraph, I describe the technical and cultural heritage of the Vistula delta river. The purpose of this part of the text is to emphasize the phenomenon of this region of Europe. It also explains how important the Dutch colonization phase was for technical development. The diagram of the Polish polder system shows the number of water areas under and below sea level. Responsibility for flood protection is the same in both regions of water dominance. The purpose is to show that the polder system works in the Netherlands but without loss of spatial identity. In the third paragraph, I present a context of analysis study. This contextual analysis looks at the role of waterways in the reconstruction of the regional identity. The role of waterways, implementation methods, influence on the landscape in society, economy, ecology and history all underline the interdisciplinary nature of the topic. Planning, architecture and technology is a buckle connecting issues and can potentially be used in the revitalization of the region where the revival of waterways is the key common concept. Discussion leads to conclusions about what the role of waterways is in the building of spatial identity. In the fourth paragraph, I describe a possible new development trend which is connected to waterways. The paragraph looks at the typology of water-related solutions presented in research by design method. The main objective of the paragraph is to describe the issue of technical architecture evolution in case of new technical possibilities. I emphasize the relationship with Dutch regional construction and experience in creating resilient public spaces. Similar genesis and way of functioning in the past can be a source of inspiration for the future. In the last paragraph the concept of flood protection responsibility is returned to; I describe Beemsterpolder and Eilandspolder. This interesting area is an example of Dutch regional cultural heritage. Protection of cultural landscape is connected with waterways. Exploration via polder waterways by electric boats is very common in the Netherlands, but still not popular in Poland. Polders protection has not been implemented in Poland yet. The link between studying two areas is hidden in history; Dutch polder under protection; Beemsterpolder and Eilandspolder and Polish polders Żuławy Gdańskie have plenty of similarities recognized in the landscape as rural polder canals. Both areas — in which the same technical knowledge was used for construction — were developed with the involvement of various socio-economic determinants.

2. Technical and cultural heritage of the Vistula delta river

The most important places of the Vistula delta are sluices, water knots, polders. Polder depressions undergo transformation over the years thanks to the art of shaping space. In contrast to polder water management and drainage, Cebulak describes this art as a polder spatial economy existing in spite of nature in the mechanical, not hydrological system. These are places that are important for the layout of inland waterways (Cebulak **[4]**). The area of the Polish Vistula delta existed in its original form until the end of the 13th century, shaped by accumulation processes. The impact on the appearance of the landscape in the Middle Ages was the activity of the Teutonic Order (Zakon Krzyżacki). Dehumidification of subsequent parts of the area has led to the creation of historical rural and urban layouts as well as permanent landscape changes visible to this day. Thanks to the Frisian, Flemish and Olęder (Holęder) settlements, a unique area of the heritage of hydraulic civilization was created. The most important period of polder system development was in the 16th and 17th century during the colonization by the Dutch, which saw this area become agriculturally developed. Throughout the development period, the significance of waterways varied depending on the economic and social situation as well as on climate change. The open landscape of the delta of the river Vistula and the rural landscape called Żuławy is characterized by an extremely strong regional identity in the surrounding areas. The main reason is the diversity of the geographic and natural environment as well as civilizational and cultural patterns created by settlers and colonists, which is different than the native tradition in the vicinity of the area. An interesting aspect is the existence of a strong community of new settlers and the hermetic nature of their environment, that despite the fact that they were not very many immigrant populations, they accepted hardly any local features. They were immune to all cultural influences from the outside for a long time (Lipińska **[6]**).

Figure 1: Picture of the Vistula delta river [photo: Landstad satelite]

Over the years, a polder system of the delta has been created. It is a special, unnatural space that has the polder hydraulic system of pumping stations. It differs in a significant way from the natural system of the delta based on the Earth's gravity (Cebulak **[4]**). The system consists of areas situated under sea level–polders which constitute 70 percent of the surface. Areas that are dewatered by gravity constitute 30 percent of the surface. Rivers, canals and drainage ditches are the skeleton of this system. They amount to 3,000 waterways channels, 17,000 drainage ditches, and rivers. The system is connected to pump stations which run consistently. Due to its elevation, the region has been divided into areas:

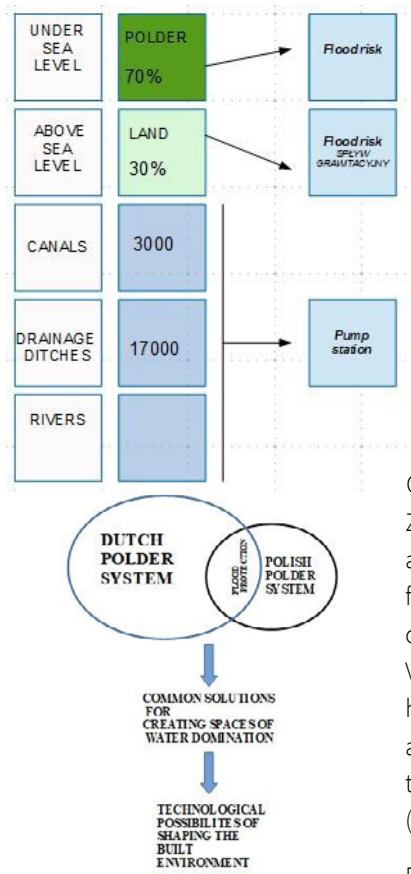


Figure 2: Polder system of the Vistula delta and the basic common developmental determinant [Rubczak]

- depressive (454 square kilometers)
- located from 0.00 to 2.0 meters above sea level (690 square kilometers),
- located above 2.0 meters above sea level (526 square kilometers)
- Lake Drużno complex (30 square kilometers).
- Other areas that interact and adjoin the area are 450 square kilometers in size. The basic common developmental determinant of the flood protection is the same in Poland and the Netherlands.

German researches by Schmid, Bertram, Baume, Kloeppel or Zirkwitz have investigated the area and drafts of historical architecture today and their first typologies are fundamental for future researchers. Today their studies are the source of photos of the pre-war landscape. For instance, Bertram's map of the Vistula delta in 13th century shows the region before first hydrotechnical interventions and polderization. This map is still a very important reference to all subsequent considerations on the role of cultural landscape transformations (Schmid **[10]**), (Bertram et al **[3]**), (Zirkwitz **[13]**).

Between 1955 and 1956, an inventory was conducted by Stankiewicz, which was to assess the condition of the monuments. After very short and cursory research, monography was to be created. It wasn't finalized, but Stankiewicz conducted research which showed that all drainage windmills had been dismantled. In 1976 a collective work was issued for editing by Augustowski. This complete work under the Polish title Żuławy Wiślane consists of work by researchers and modern thinkers of the time. In the 1980s in Poland, during the rule of the socialist political system, researchers began to emphasize the irreversible consequences of the devastation of the cultural landscape. It was mainly a consequence of a new agricultural system in which elements like buildings, roads, technical solutions were culturally alien. It was the time for destroying a parceling system, village structures, valuable monuments, the significance of the unions called Związki Wałowe, which were responsible for the operation. The Soviet type of agriculture didn't

care about local identity (Stankiewicz [11]), (Augustowski [2]). Researchers Lipińska and Cebulak noticed the need to rebuild the identity of the region (Lipińska [6]), (Cebulak [4]). The subject of redevelopment of the Vistula delta was continued in the 1990's. Inhabitants who rebuilt the region after 1945 worked very hard, even though they had to live in a difficult problematic geopolitical system. The priority of preserving cultural continuity and caring for the past moved on to the next phase of action. The most important thing was survival. This state of affairs lasted until the turn of the 80s and 90s when rethinking about lost spatial identity returned. The process of its reconstruction continues to this day. Historical spatial comparison between the two countries Poland and Netherlands, both countries of heritage of hydraulic civilization, are made to answer the question of the future spatial development.

3. Contextual analysis

To answer the question of which direction to take the spatial development of the functional region, I analyze contexts of society, economy, ecology and history. Contextual analysis in macro-, meso- and micro-scales indicates the important role of waterways in shaping the landscape and architecture. It shows that waterways influence the landscape. Methodology of proceedings in particular stages of revitalization of waterways have an impact on the process of transforming the landscape (Rubczak [9]). The role of waterways depends on context. For society, waterways can be a key concept of revitalization. The preservation of landscape heritage is inseparable from the preservation of natural values as Natura 2000. The economy of the region can be boosted by developing the tourism sector. Tourism development needs new ecological, cheap and sustainable solutions. Perception of cultural heritage via the waterway is also a method of promoting hydrography and the unique 17th-century development. To protect natural aspects and to find solutions according to the room for river paradigm, it seems that revitalization of waterways in Poland can be a way to create the typology of water development so as to protect cultural heritage. This typology can also be involved in harbor heritage protections in such cities as Gdańsk or Elbląg. In Rotterdam, where functions of harbor areas were lost, the next step was re-using water dwellings (Adams et al [1]). The program for the region "Complex for Flood Protection — Żuławy 2030" has become an opportunity in the Vistula delta to explore factors that affect the development of the region in looking at lost spatial water identity. Creating resilient public spaces along rivers and canals is an opportunity to emphasize identity in evolving socio-economic circumstances (Programm [8]). See Table 1 (p.53)

Contexts and role of the waterway, implementation can be the basis for decision rules when planning in the future. The presented solution is an example of the regional potential that is associated with numerous waterways. For example in the case of a change in the function of farm housing to a touristic destination, it can be assumed that the change will be achieved. A more in-depth analysis of the cases of examples that have successfully changed their function may be a valuable guide for interested investors. The future transition of the region, from agricultural economy towards an economy based on waterways and local culture should be the topic of wide interdisciplinary discussion. This type of discussion, encouraged in an academic environment, local society, in regional government leads to sound political decision-making. The fundamental program of protection of the region against floods increases attractiveness of the Vistula delta. The right decision about revitalization of waterways is now implemented and can be the key concept.

CONTEXTS	ROLE OF WATERWAYS	IMPLEMENTATIONS	INFLUENCE
SOCIETY	• changes in perception of cultural landscape • waterways as common concept of revitalization	• activities involving local community *(Żuławski Historical Park)*	• responsibility for preserving cultural heritage and protecting polder landscape
ECONOMY	• tourism development • looking for innovative building solutions in microscale • looking for innovations in regional identity • changing perception of cultural landscape	• UE structural funds • UE agendas • local partnership • B+R (Business + Research)	• the typology forms according to the rules. flood areas (criterium) • development of ecological innovative forms of construction • retention • ecosystem services
ECOLOGY	• preservation of biological diveristy • types of settlements in NATURA 2000 • settlement • marinas	• value of existing landscape • sustainable development *(act locally — think globally)*	• the typology develops according to the rules; flood areas (criterium) • development of ecological innovative forms of construction • retention
HISTORY	• knowledge; retrospective factors shaping regional identity • decision (protecting cultural landscape e.g. 17th century rural areas)	• receiving information from historical resources • promotion of hydraulic civilization	• preserving of heritage of the Netherlands. • understanding functionality (agriculture)
PLANNING, ARCHITECTURE & TECHNOLOGY	• knots in regional pattern, new types of water dwellings, ecological, sustainable solutions	• strategic documents, typology, new technology	• base for legislative decisions

Table 1: Contextual analysis [Rubczak]

4. Innovative water dwellings and flood protection — new development trend of the Vistula delta river

Water dwellings and flood protection are interrelated in aspects of engineering solutions. Floating objects involves many technical variables such as likelihood of sinking, dependent on its construction, wave protection, stability and trim. Infrastructure solutions as flexible cables and a guiding pole for floating up and down make this kind of architecture technically very sufficient and modern. Now amphibious housing in the Netherlands is common. Just a few decades ago, urban development and urban regeneration was reverse. Almost always, those processes involved filling in or draining lakes, canals, waterways and harbors, annexing and impoldering areas adjacent to the rivers. Now the opposite is true, a new paradigm is the hot topic in the world of professional designers and in the public debate (Nillesen **[7]**). Currently, there is an infinite number of technical possibilities to reinterpret old architectural solutions in the spaces of water domination. The question about spatial identity used in innovative projects is always associated with the past and the future. Is it possible to keep up the continuum in the Polish circumstances? If Dutch spatial solutions are the result of experience gained through years of hard work of many generations, maybe this pioneering spirit will be a source of inspiration in the Polish water space of the Vistula delta? Climate, weather, and flooding are influenced by the way that communities and urban infrastructure are designed and built. Design for flooding builds on the emerging concept of resilience and considers flooding as a natural process. Addressing flooding as a given natural process of weather and water leads to imaginative and comprehensive approaches to resilient design, applicable on a regional, community and building scale (Adams et al **[1]**). Several designs, which are conceptual only, can show what an important role it plays to get flood protection. Such design is a concept of developing the boulevard along the Tuga river in Nowy Dwór Gdański. It will enable the creation of an attractive, multifunctional and publicly accessible space by ensuring a consistent image of architectural forms and taking into account spatial and landscape relationships with the surroundings. It is proposed to apply adequate elements of the development of the wharves, which will ensure their availability, and thus the functionality and attractiveness of the shoreline. It is particularly important to take into account changes in the water level of the Tuga river. The urban layout of the city of Nowy Dwór Gdański becomes an attraction for the local community thanks to the space that will be used at the lower level of the river.

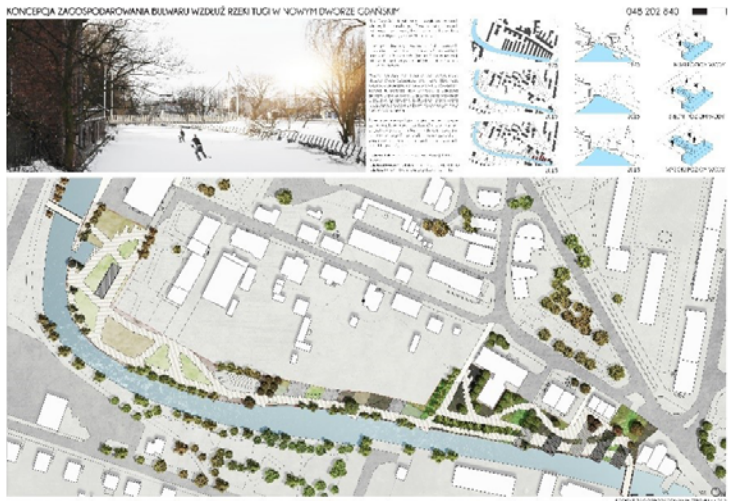


Figure 3: The concept of developing along the Tuga river in Nowy Dwór Gdański [design team; Nyka, Borucka, Burda, Cudzik and Radziszewski]

Making a typology of water solutions in the scale of architecture in the Polish delta, in aspects of technological possibilities to preserve and protect the landscape (open landscape), I set up a complementary time–space relationship. Building traditions of the past and common problems of the same flood protection polder provide examples of new solutions using new technology. Traditional spatial forms for the landscape, such as terp dwellings, water streets (ulicówka wodna), canals and polders are common elements in Poland and the Netherlands. Flood protection as a determinant of survival is the most important parameter that determines the technical solution in individual spatial cases. For instance, modern types of terp water dwellings with modern technical solutions can nowadays be transformed into modern types of forms. Types of waterside dwellings can easily be transformed into amphibious dwellings in case of flooding. Modern ecological materials used in the prototyping of architectural solutions are very important to biodiversity. The typological solutions that I have proposed can be treated as a helpful tool to support decision-making, affecting the improvement of accuracy in the selection of the most optimal solutions in economic terms. The aspect of the region's identity on the architectural scale assumes different spatial forms and ideological criteria in this case. The typology of landscape solutions for preserving its values in design by research methodology is presented below.

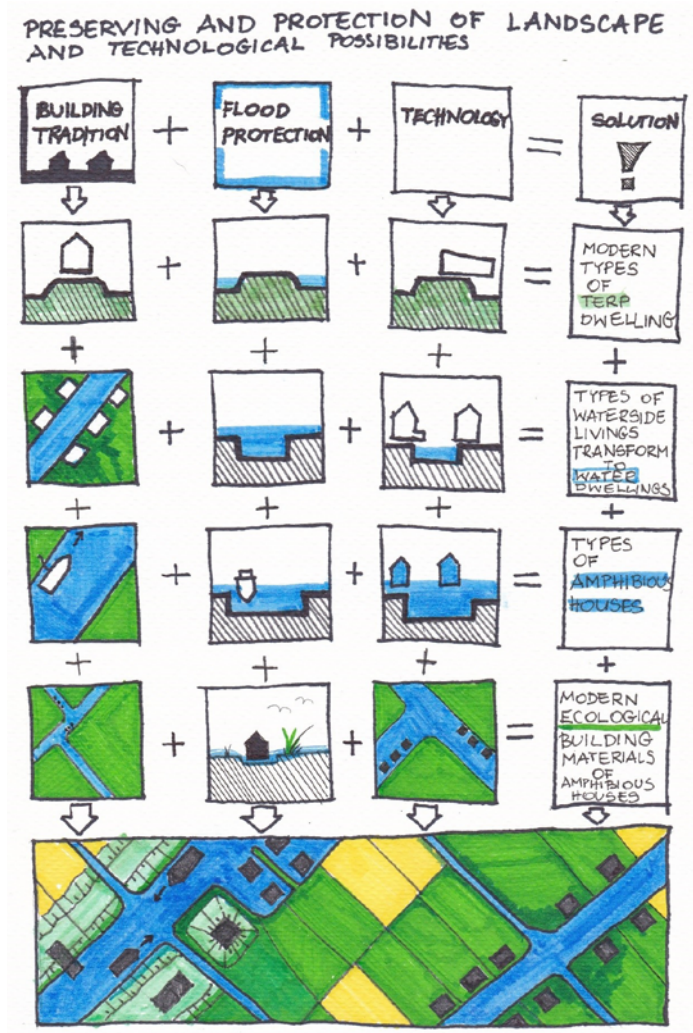


Figure 4: Typology of landscape solution for preserving its values in design by research methodology [Rubczak]

5. Dutch waterways and polder systems as a source of inspiration for preserving cultural landscape

What are the connections in the way of thinking about space and solutions in the field of water-related construction? Depending on the scale of the problem, it can be said that the areas have a common denominator. Currently, the common denominator is the flood risk. The most unique about the Netherlands is the landscape, as in Poland. In the Randstad, most of it has been destroyed in the past few decades. This landscape is man-made land and defined by water. Most of Holland and Utrecht, substantial parts of Zeeland and Gelderland, and some parts of Brabant are situated in the deltas of three rivers: the Rhine, the Maas and the Schelde respectively, and lie below sea level. The same is true for the inland regions of Friesland and Groningen, except that they are separated from the

sea by a narrow band that developed as an ongoing process of give and take (Wagenaar **[12]**). Just like in the Vistula delta area, depression areas are maintained thanks to hydrotechnical devices and don't exist in their form in a natural way. Areas of depression may function in the form of land, provided that there is effective flood protection. Small flood events occur in other areas. Looking for good practices or historical sources we are able to find a better solution for rebuilding landscape harmony. Common solutions for creating spaces of water domination lead to better decision-making when it comes to shaping the built environment. Basic principles of water designing which are well known in the Netherlands can be involved in Polish building decision system. In Poland, landscape distinctions and testimonies of technical thought, such as windmills and the characteristic of the polder system, disappeared with the loss of spatial identity. When it comes to making a decision about the direction of space development and heritage preservation, a functioning polder system should be considered to investigate which system has the features of the monument and which can be transformed. In the Netherlands, tourists and inhabitants understand the system of polders and use waterways as they did in past decades. Also, the treatment in the matter of new engineering constructions, sustainable solutions for animals is a continuation of Dutch man-made landing. Trying to arrive at a balance between reconstruction of in-depth analysis of the existing qualities and the way they have evolved over time, seeking a balance between reconstruction, which always includes destruction, and the strategic use of what is generally labeled cultural heritage — a key term in Dutch urban planning and architecture since the 1990 — the government issued the Belvedere Memorandum. It includes the idea of drawing on the obvious economic potential of cultural heritage and underscoring the key role that identity can play in boosting an area of economic value, even beyond attracting tourists (Wagenaar **[12]**), (de Jong **[5]**).

Figure 5: The cultural landscape of Beemsterpolder and Eilandspolder [https://en.wikipedia.org/wiki/Beemster#/media/File:Gem-Beemster-OpenTopo.jpg]

The former country residences are the subject of archaeological and heritage investigation, with the option of making the remainders visible at one or more locations for educational purposes in the future (Adams et al **[1]**). A good example of preserving historical area is the Beemster Polder which is located north of Amsterdam and is a World Heritage property. Dating from the early 17th century, it is an exceptional example of reclaimed land in the Netherlands. It was created by the draining of Lake Beemster in 1612. Other earlier land reclamation had taken place, but technical improvements in windmill technology permitted more ambitious undertakings. The Beemster Polder was the first large project covering an area of 7,208 hectares. Today, it is a well-ordered agricultural landscape of fields, roads, canals, dykes and settlements. There is an overall development policy for the polder, based on its attributes and specific identity. That policy forms the decision-making framework for balancing the heritage qualities and the various aims and developments. Very interesting wet agricultural lands, the Eilandspolder is also a protected area. The entire Eilandspolder is open and wide in nature and is in the first instance a pasture area, very rich with grassland birds, such as curlew and godwit as well as waterfowl wigeon and plover, and reedbed birds, such as the warbler. There are also natural lakes, and wide waterways. Both areas are characterized by a high culture of preserving the heritage of architectural forms and an interesting use of waterways. The Eilandspolder area can be explored by electrical boats. The hotel chain, residential buildings are connected by water between villages. The link between Dutch polders and polders nearby Gdańsk in Poland is hidden in the same landscape code.

6. Conclusions

A new approach to water spaces according to the paradigm of life in symbiosis with the element of water may well create new development trends and revive lost spatial identity. The Żuławy agricultural region has a chance of a new settlement perspective based on the paradigm living on the water. Taking good examples and innovative, creative design solutions as an inspiration from history of Dutch influences on the Vistula delta development, it can be the starting point for further wise spatial transformation. **The most important values that should be preserved and considered as vital during the planning process and future spatial development is polder landscape heritage. New types of waterways as polder waterways are able to be revitalized in Poland.**

References

[1] Adams M., Watson D., ***Design for flooding. Architecture, Landscape, and urban design for resilience to climate change***, Hoboken, New Jersey: John Wiley & Sons, 2011.

[2] Augustowski B., ***Żuławy Wiślane***, Gdańskie Towarzystwo Naukowe, Gdańsk, 1973.

[3] Bertram H., La Baume, Kloeppel O., ***Das Weichsel-Nogat-Delta***. Gdańsk: Danziger Verlagsgesellschaft m.b.H., 1924.

[4] Cebulak K., ***Delta Wisły powyżej i poniżej poziomu morza.***, Stowarzyszenie Żuławy i Lokalna Grupa Działania Żuławy i Mierzeja, 2010.

[5] de Jong R., Kop van Zuid, Rotterdam 1999. ***Water and Industrial Heritage. The Reuse of Industrial and Port Structures in Cities on Water***, Bruttomesso R (ed.), in ***Marsilio Editori***, 1999, 66–71.

[6] Lipińska B., ***Żuławy Wiślane. Ochrona i kształtowanie zabytkowego krajobrazu.***, Stowarzyszenie Żuławy, 2011.

[7] Nillesen A. Singelenberg J., ***Amphibious housing in the Netherlands***., NAi Uitgevers/Publishers, 2011.

[8] ***Programme for the Żulawy region — to 2030. Complex for Flood Protection***

[9] Rubczak, Gdańsk 2016. ***Revitalization of the Vistula Delta Waterways as the Basis of New Settlement Vista. The Reuse of Industrial and Port Structures in Cities on Water***, Lorens P (ed.), in KPZK PAN no 264 2016, 81–99.

[10] Schmid B., ***Die Bau-und Kunstdenkmäler des Kreises Marienburg***, Kommissions-Verlag von A.W.Kafemann, Danzig, 1919.

[11] Stankiewicz J., Zabytki budownictwa i architektury na Żuławach., Gdańskie Towarzystwo Naukowe, 1958.

[12] Wagenaar C., ***Town Planning in the Netherlands since 1800.***, naio10 publishers, 2015.

[13] Zirkwitz V., ***Das Dorf um Danzig***, 1940.

SHELTERS AS AGENTS

DISASTER RESPONSE POSSIBILITIES FOR THE BALTIC SEA REGION AMIDST CLIMATE CHANGE

Veronika Petrova, Olga Popovic Larsen
— Royal Danish Academy of Fine Arts School of Architecture (KADK)

Abstract

Climate change is impacting the Baltic Sea region with extreme seasonal temperatures, resulting in hazards such as floods, landslides, drought, strong winds and forest fires. These climate-induced risks are even greater with the conjoining of violent winds. Stormy winds and hurricanes have been a rising risk in the Baltic region. This is also evident elsewhere. Severe weather patterns brought on by climate change have heightened the vulnerability of many communities throughout the world. This paper focuses on the role of shelter in disaster management, to reinforce disaster response with an ambition in becoming a recovery, mitigation and preparedness to future disasters through climatic and resourceful adaptation. To generate more effective responses to disasters, and to reinforce an interdisciplinary knowledge base, this paper uses a climate map as a method to bridge the Baltic Sea region to other global locations with an aim of learning how to build. It is suggested in this paper that recovery in communities has most success where building methods and material techniques are offered. Therefore, vernacular, building and adaptation strategies from similar disaster-prone areas are used to highlight and initiate possibilities for effective disaster response. Valuing the research and work of scientists, designers and indigenous communities, this paper indicates that solutions are found through knowledge-sharing across an international and interdisciplinary web. It is hoped that this paper will contribute to the development of innovative, site-specific and resilient disaster shelters in support of reversing climate change.

Keywords: climate change, Baltic region, shelter, disaster management, response, recovery, vernacular, resilience, resource

1. Introduction

Extreme weather patterns are the result of climate change, inducing global temperature increase, rise in sea levels, more frequent and intense floods, droughts, hurricanes and heatwaves. Catastrophic events have surged in recent years: they leave communities destroyed and distraught, with lasting impacts on infrastructure and livelihoods. There is an immediate need for shelter and assistance for people affected and displaced by disaster, as they attempt to re-establish their lives to survive and sustain themselves. Shelter and settlement strategies focus on improving the living conditions of those who seek protection, yet they cease at the response phase of disaster management. A shelter is a form of refuge, a response to disaster: it remains a temporary solution amidst the immense crises of global disasters. In reality, however, it is much worse; affected communities become stranded in disposable camps for years (some even generations), where cheap tents and lack of recovery ambition encourage the generation of slums and informal settlements. There is a need for appropriate emergency shelter, valuable in potential, and resourceful with geography. Therefore, shelters require a broader vision in their design and production to become agents within the loop of phases of disaster management. If "planning and responding to shelter needs is a contextual and dynamic process" **[6]**, how do shelters become agents in disaster risk reduction? As our resources become more finite and fragile, it is more apparent that many regions would benefit from improved strategies.

This paper focuses on the Baltic Sea region (BSR) because it is in need of adaptation management as it faces growing environmental pressures, shifts in biodiversity and human well-being as a result of climate change. Introducing a strategy, or agent, into the practice of disaster response, could lead to a more efficient process of adaptation. One example is the resourceful transitional emergency shelter described later in section 6.

2. Shelter is more

In this paper, the main critique to a shelter is that it is merely a tent. Shelter is a form of first aid, in essence: the sudden assistance given to a person to promote recovery. Due to the sudden demand for them, emergency shelters are a quick fix remedy for communities who have lost their homes. Even though they provide shelter at first stages of disaster, they are not appropriate housing for people for the long term. They are designed to be temporary and usually take shape of tents to convey their non-permanence: low-tech, low-cost, low-transport, but should resolve high demand, provide high efficiency and high positivity. However, they rarely are resourceful constructions. If a housing reconstruction or transition process is not planned after disaster (from response to recovery of communities to appropriate housing), affected communities continue living in camps for years, with no support or resources. For shelter to be an effective response in disaster management, it should transform to a "resilient" home for the affected; it must take on the lessons from vernacular architecture (a source rich with local knowledge) in order to prosper in its local setting; it should be fabricated utilizing accessible manpower and resources, efficient in fabrication, cost and time, with low impacts on the ecosystem. That way, the shelter can become an agent in disaster management.

To explain this further, Figure 1 shows that there are four phases to disaster management **[9]**: response, recovery, mitigation and preparedness; here, emergency response is the result of preparation. Response action should be taken prior, during and post-disaster; long-term recovery (to

normal routine) should follow; consequently, mitigation strategies that reduce vulnerability, or risk, from disaster in the future, follow for a holistic plan of action. By considering this cycle, and regarding the distribution of shelter as a response action, shelters are agents of response action followed by the phase of recovery. This means that the potential of the shelter goes beyond response, that it can be more than a temporary situation, that it can develop to become an effective and resourceful recovery, instead, and resilient to further disasters. For this, the climate, resources and possible risks are essential criteria [9].

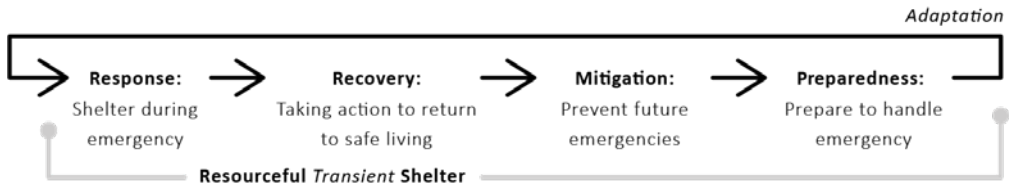


Figure 1. Stages of disaster management incorporating a resourceful transient shelter. Images adapted from [9]

3. Climate change in the Baltic

The Baltic region is getting warmer as a result of global climate change. This reduces the number of frost days, giving rise to sea and river water levels, potential threats such as heatwaves and storms, and worsening coastal erosion of the Baltic Sea as a consequence of flooding and sediment loss [23]. From recordings, storms, flooding and high wind events have caused most damage for Baltic states. Major events of the last two decades have struck greatly not only to damage the infrastructure but to affect over a million people, taking many lives [16]. It is the nature of the hemiboreal climate (known for boreal forest characteristics) that such events are likely but with temperatures on the rise at an accelerating rate, climate change reveals an undoubtable rise to more vicious events more frequently [16]. Put climatically, the global hydrological cycle alters marine systems that affect the pattern of precipitation to change, where the implication gives way to heatwaves and other hydrometeorogical hazards, known as hazards exacerbated by those of climatic origins (floods and therefore landslides, drought and forest fires). These risks are even greater with higher wind speeds but regretfully, the Baltic region has already seen an increase in wind velocity since the mid-1900s [16]. Globally, uneven distribution of solar radiation results in variations of temperature and air density: it causes a difference it atmospheric pressure, affecting the global wind system, linking global warming to wind [10].

It is not doubted that the BSR is prone to earthquakes: the region endured over 500 earthquakes between 2000 and 2010 alone [16]. However, issues of a seismic nature have been excluded from this paper; Instead, the paper puts climate-related disasters into focus. Despite ongoing research, seismic and volcanic activity in Europe has not yet been proven to link to global climate change, but so far, it is foreseen that climate-induced threats have. The Baltic region continues to face threats of climatic disasters and thus, should target to prepare and respond with an innovative plan that has potential to develop with the users.

4. Shelter as agent

Settlement post-disaster assistance is developing with valuable changes as disaster relief organizations adjust guidelines to overcome emerging challenges of climate change to prepare for unexpected disasters more readily. However, climate-appropriate relief action with a sustainable future still needs more research. Interdisciplinary efforts and collaboration have more potential to develop more practical and sustainable shelter systems [18]. Therefore, it is important to include architects, engineers and those from other fields, such as material science and environmental control, to consider all the relevant issues.

Shelters can act as mediums that promote valuable change for people and the environment: resilient in disaster and resourceful in reversing the effects of climate change. In some ways, “transient” shelters show resourcefulness because they are “designed to facilitate the transition to more durable shelter” [24]. As agents in disaster management, shelters can be created to enable communities to return to self-management, towards their own “resilience,” understood as “the ability to adapt and to continue functioning during and after difficult conditions” [13]. In transitional shelter projects, shelter design is incredibly important as engineering efforts are saturated at the beginning phase of the project to overcome many foreseen challenges regarding fabrication, assembly, practicality and lifecycle [19]. Even though temporary shelters can become transient if they either offer up materials to new constructions, become permanent settlements themselves, or are reused, their reuse does not offer as much potential as their transformation would if recovery, mitigation and preparedness were taken into account. A resourceful shelter transforms through transition. It is the agent that braces the loop in disaster management, builds-on limits of bioclimatic factors for resources, obstructing the current negative trend of global warming with opposing, positive and healthy solutions. Vernacular architecture, built by generations of communities using traditional tools and materials at hand, carry many attributes that are currently sought in sustainability within research concerning the demands of our climate-change era [12]. Still today, indigenous communities build from geological and plant-based materials, inspiring much of what is considered “traditional” and “resilient” today and this should not be disregarded. Their low-tech strategies expand on their immediate relationship to site and local conditions, and by nature, their vernacular constructions remain efficient, resourceful and highly practical: as the architecture of the people, vernacular constructions grant their example for sheltering solutions that signify people. Essentially, a shelter should be well-designed and rational. It should reduce dependency on humanitarian aid towards self-resilience, overcoming resource challenges more efficiently, with resourceful interventions for the local climate. “An emergency shelter should sustain life” [1] and with that in mind, as it roots from its climatic setting and provides no further cause towards climate change, and puts into practice traditional knowledge, the shelter becomes an agent that pursues the bigger picture: disaster risk reduction.

5. The Baltic region climate

In this paper, the Köppen-Geiger (KG) map is offered as a resource to bridge the Baltic Sea region to the rest of the globe through categorized climate. The Baltic region is globally classified as a temperate oceanic climate (Cfb) though more specifically, the more northern, the more it is inclined to heavy winters, becoming more hemiboreal (Dfb). These code abbreviations are climatic classifications in the KG system, where “moist mid-latitude with mild winters” is ***C*** and “moist mid-latitude with cold

winters" is D. A diagram with these climates is shown in Figure 2. The map shows the regions where similar climates to the Baltic region can be found in the world and it has been adapted and simplified from the original KG world map to put emphasis for the context of this paper. The last decade has seen the temperate region of the BSR grow much colder in winter, evolving into a continental climate beside the warming summers. It is evident from reading the KG classification map how rapidly the state of this climate is changing [21]. The KG climate classification matrix can be an efficient tool in understanding regions and biosystems. It is essentially a vegetation-based climate map, constructed on the basis of five groups *A–E* that divide the globe into distinguished climates where soil and weather, length of day and night and the seasons are compared [14]. Each type of major climate is subdivided to accommodate special and more specific regional characteristics, translating *fb* of the Baltic Sea climate as *fully humid* with *warm summer*.

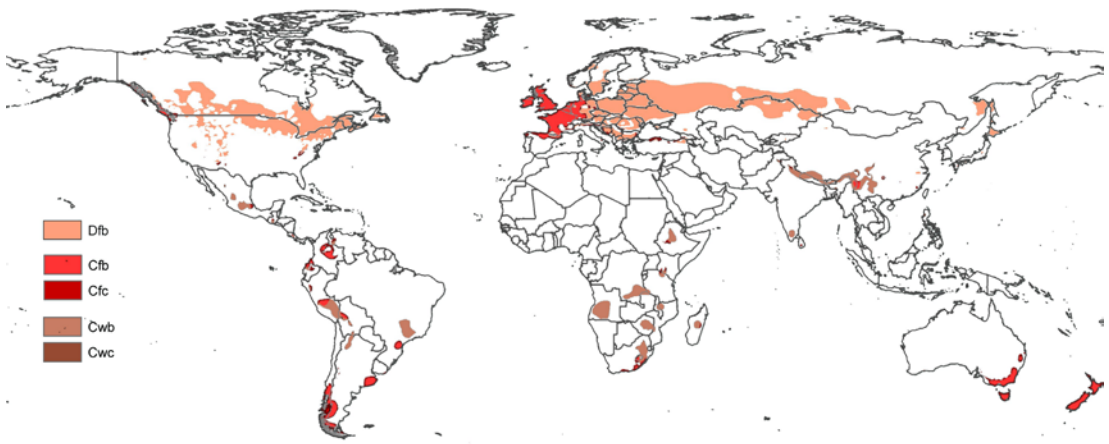


Figure 2. Temperate "oceanic" and "hemiboreal" climates classified by Köppen, relevant to the Baltic region

In mountainous regions, there is an extended class *H* since sharp changes in climate can be brought on by rapidly changing weather [22]. In the instant where altitudinal zonation requires for a perpendicular axis, the classification categorizes the layers of ecosystem according to height, including more specific values and depths to the data [21]. It is portrayed simply (a shaded map of the world) to communicate the work from climatologists to practitioners in other disciplines. Since it derives from a botanist standpoint, it can serve as an effective tool to resemble geographical locations through native vegetation, landscapes and ecological matter, so it is concisely a map of regional geodiversity.

It can be proclaimed that climate greatly influences the resources available in a region as well as the building materials used in construction [22]. This is why vernacular architecture is so important; people have built shelter for generations, and it is their traditional methods that ensure adequate shelter [2]. In order to provide resilience from weather, elements and climate, constructions have adapted and developed with the richness of local knowledge to remain relevant examples for shelter today.

The Köppen-Geiger classification is supported by the progression of vernacular architecture. Altogether, the classification of climate drives the sustainable architecture movement that links good (or what can be described as resourceful) architecture to the climatic conditions of site. Climate is key

for the built environment and can be regarded as a resource for innovation: building styles, settlement patterns and methods of construction have all developed in response to climate in order to provide shelter or to create microclimates, respectively. "Concerns about changing climates at local, regional and global scales have served to focus greater attention on climate-sensitive architecture and design, as a strategy for both climate mitigation and adaptation" [22].

"If we can build, or rebuild, connections to each other, to the land, and to the systems that support us, we can contribute to a growing worldwide web of interrelationships" [13]. Regarding this statement as a seed, the mapping method of this paper practices the KG climate classification by way in which local knowledge and discoveries are shared and nurture other global regions to grow and develop. Through this process, a new variety of examples can uncover adaptation strategies that are more compatible than the current approaches because, amongst the different community-based adaptations of disaster risk reduction, many are incompatible solutions; it is through cross-country ties to other regions where the right answers could be uncovered [5]. Whether this sharing strategies is the answer to better possibilities or not, this method can still pose potential to new outcomes.

By relating the Baltic region to other areas, more precedents are revealed which can serve the region a scope of good cases for current issues. For example, elsewhere in the world, with resources native to the BSR, may have solutions to similar challenges. Finding these examples, one can uncover techniques. On another hand, development strategies from other areas can also be useful to overcome disaster threats where climatically similar contexts endure similar predictions or have already experienced disaster from climate change. Thus, precedent studies can expand beyond "same analogous kind" but rather contribute as lessons of many aspects: history, events or livelihoods of people and their built environment in other contexts can become significant for the Baltic region. Mitigation strategies are precedents and can be shared between resourcefully-similar areas to improve performance for needed shelters and future settlements. However, it is crucial to understand that "local factors should generate different architectural responses" [8] and although many different nations can be related through a warm low-range climate supporting similar ecosystems, these areas do not share equal threats from disasters. It is suggested by this paper that climate is not the only deciding factor for shelter strategies; Disaster type, topography, altitude and culture, are some of the others.

The Baltic climate is identified in the same group as the climate in New Zealand, western Canada, parts of Chile and Peru, and southern Iceland, especially in the southern part of the Baltic (Germany and parts of Denmark and Poland). The frostier countries like Hungary, Slovakia, northern Kazakhstan and the city of Aspen in Colorado are comparable with the northern Baltic countries (Norway, Finland, Sweden, Lithuania, Latvia, Estonia and Russia). Without a dry season and heavy cloud cover, it is highly humid throughout the year, frosty in winter and warm in the summer, when skies are clearer. Snowfall can be very heavy and in recent years, has been observed as a threat due to climate change [23]. The moisture in the air slows heat loss during the night, and the daytime-night time temperature range is significantly small compared with the arid areas of the world, such as Mongolia, southern Kazakhstan, coastal Peru and Chile. Reputably, Cfb/Dfb is the world's foggiest, rainiest and stormiest, experiencing unpredictable weather conditions associated with the polar front: winds are strongest during winter and this poses a threat to infrastructure both temporary and permanent [15].

Storms and cyclones are likely in the Baltic region [16]; research shows that the principal danger of a cyclone is its destruction on coastal areas [23]; an abnormal rise in sea level caused by "a storm surge" drowns humans, livestock and vegetation, inundates the land, destroying embankments and soil fertility. Cyclones can be categorized by intensity and wind speed near their center; they are most severe with hurricanes [25]. They cause collapse of buildings through wind movements over and around, which generates a suction on building envelopes, causing a pressure equivalent to an explosion. This negative effect can be reduced significantly by airflow through the envelope to balance the pressure. The resistance of structures in high winds is not fully dependent on the material it is built up of, but the structural manner that is used [25]. Structures that are composed of many discrete elements that are able to move between joints and dissipate energy, are reliable structures for roof and building frames in cyclonic contexts. The reciprocal frame is one example: it is a three-dimensional grillage structure, consisting of linear members which are mutually supported and interlocking, placed in a closed circuit. The inner end of each beam rests on and is supported by the adjacent beam, and at the outer end, the beams are supported by an external ring beam or column. In a multiple reciprocal frame, the reciprocal frame becomes a unit within a grid structure [20]; in the event of local failure to a single structural member within the frame, the redundancy effect of the structure allows the forces to find alternative load paths. The frame, therefore, resists collapse of the entire structure, for considerably longer, in comparison to a structural system with low built-in redundancy. The phenomena and intelligence of this structure is an esteemed example of the way in which indigenous technology that originated many centuries ago can support our built structures amidst a changing climate.

6. Lessons from the vernacular in continental and temperate climates

This section explores examples in vernacular architecture, shelter strategies and visions that show potential to the BSR. Firstly, the reciprocal frame is one example with potential because it is lightweight, easy to assemble and dismantle. It has qualities that enables individuals to build shelter quickly using a provided kit. With that in mind, it becomes very appropriate for emergency response shelters that could provide beyond the response stage, as structures with integrity and promise. With a good strategy planned, the shelter can ensure a stable home for its inhabitants after initial stages of recovery (fig. 3). To begin with, the shelter can be clad with a temporary material for a quick and simple solution, something readily at hand in the context, but after a fortnight, exchange that for better, more durable cladding for sufficiency.

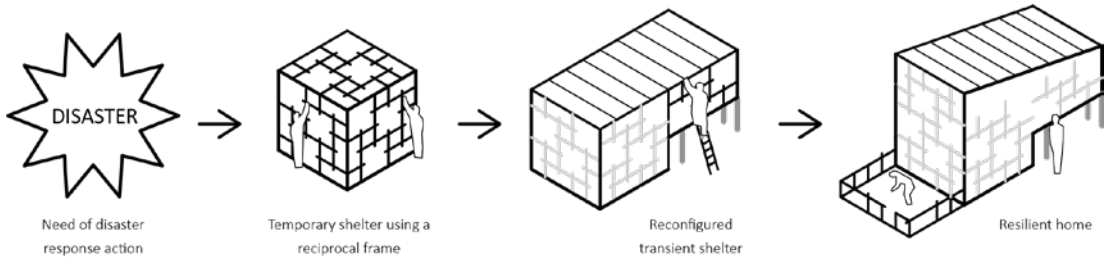


Figure 3. Three-stage disaster recovery — resourceful transient shelter. (Adapted from [17])

Creatively and architecturally repurposing shipping containers as housing has been done across Europe and Australia. Shipping containers are mobile, low cost, allow for rapid assembly and offer spacious and quiet environments. Some containers withstand cyclones and hurricanes, which is why many of them are used as disaster response. Although they can be energy-efficient or allow natural light in if an opening is designed, they remain cold in the winter and too hot in the summer: not responsive to the local climate. If too many openings are created, the structure may become unstable [19].

In Chile, on the other hand, optimal adaptation to environment using local materials is traditional amongst indigenous as well as the established communities. There, dwellings root back to simpler construction methods as they have a good historical record to tackle the variable climate and strong winds. Infill of raw earth or vegetable matter is common in half-timbered structures of the Latin American culture. Usually, thatching using palm, straw and leather is preferred for interior enclosures, and clay soils and terron (a technique involving blocks cut directly from soil) are laid thickly to control extensive diurnal temperature ranges via thermal mass. It is evident in Chile, that buildings become more compact where climates are dryer. In more mountainous regions along the coast, closely placed houses warm each other when planned within labyrinth streets [10].

Damage to the roof is listed as the most common cyclone/hurricane damage [4]. Roof recovery after disaster involves stockpiling corrugated iron (CGI) metal roofing as it is preferred for its ease of installation and durability despite the fact it rusts quickly nor provides the thermal protection that is usually needed in colder climates [7]. Uplift forces from hurricanes are greater than anticipated which means "all connections up to the roof need to be stronger than is necessary for a house with a leaf roof" [25]. However, distribution of CGI as disaster aid continues to sustain poor roof structures in hurricane-prone sites which is not a resourceful solution. Rather, roofs in such sites need more organic or plant-based reconstruction, which will serve as robust shelter in the event of disaster.

Built on contextually appropriate features, houses in New Zealand present good examples for resourceful shelters. They are well adapted to cope in disasters due to their ductility and ability to sway without collapse; their roofs, made from timber and straw, rest on wooden posts tied to wooden beams. Smaller sticks support the thatch furthermore, providing a wet storm-resistant structure. Straw bale, the construction system described here, behaves like a contemporary stressed skin panel system once plaster is applied, because plaster absorbs tensile forces where the bales can only carry building's compression loads. It serves many advantages for colder climates: if dried and bundled, straw provides an insulative layer trapping air between the stalks [7].

In Australia, emergency weather-tight shelter huts were built for hikers to seek shelter. These are constructed with Tasmanian wood which is used for boats and furniture. The huts incorporate stone as well as bark, reeds and clay for performance, and portray a durability in their construction.

Reeds are not only environmentally sustainable materials but are low-cost, abundant and are used traditionally in building within temperate climates. Reed construction can offer work for minority groups, offering a low-tech method of building that can be used in permanent or temporary shelter construction [7]. Reeds are not yet common in the Baltic region, as log construction has been at the forefront for ages; the heavy weight of logs lock to form tight connections, resisting strong winds and giving better thermal insulation than post-construction with thin board cladding. Yet for emergency

shelters this form of construction is not appropriate despite the organic nature: it is expensive and heavy and may not be necessary with other sustainable materials on offer.

With the Baltic climate changing, is it necessary to encourage reed growth in the BSR? So much has been done in architecture using reeds that they could serve a great purpose for resourceful shelters [7]. It may be a viable idea; in the past, Kazakhstan had favorable soil, biologically rich in marshes, wetlands and fauna, more continental and less arid than today [11]. To support the Soviet cotton industry in the 60s, the Aral sea region (home to Kazakhstan) was exploited for irrigation. Canals were dug to facilitate this agriculture but with high evaporation and warming in the region (from south to north), the lake tragically desiccated, and lands became salinized. Today, only ten percent of the lake remains: a body of water the size of Ireland has been lost [26]. The locals face the challenge of reviving their land by sowing Saxaul trees to form shelterbelts from wind and desertification. Native to the semi-arid climate, each plant can repair ten tons of soil. These plants thrive in dry and salty soil, settling in to the new steppe in order to reverse it. The demise of the fourth largest lake in the world resulted with a decline in felted huts in the region: their vernacular was no longer ideal. Animal fleece used to be felted for a water-resistant seasonal insulation; reeds, loess clay and fine silt, perfect for extremely hot and cold weather, were used too, but declined. Together, these materials regulated heat and humidity, but with the loss of natural resources, concrete and scrap metal now rule the construction in the region. It is hoped that the Baltic region overcomes the challenges of the changing climate, learning from Kazakhstan, but does not exploit nor cause further damage to its disaster-prone environment: “The destruction of the Aral sea is an example of how quickly environmental and humanitarian tragedy can threaten a whole region” [11].

7. Conclusion

Vernacular architecture offers a catalogue of global ideas about how best to build. Since tradition, life-style, building volume and function are very different nowadays, some aspects of foreign vernacular constructions are more useful than others. Nevertheless, with the changing of our planet, historical archetypes can offer more to the climate-conscious built environment of today, and adopting vernacular principles should continue, as it can inspire the development of resourceful disaster responses. If shelters are considered agents within disaster management, then they have potential to become more than an emergency response but a form of wholesome adaptation in the end. Although sustainable climate-appropriate relief action still needs more research, by adopting the method used in this paper, one can bridge any location to another to find resourceful materials and low-tech construction techniques that open up possibilities for disaster responses. Thus, shelters can become resourceful within their climate, ensuring that the relief strategy is also an effective form of adaptation. However, at what level or scale shelter response takes action, needs more exploration as individual action, community, regional or national level action are dependent on technicality, duration or cost of strategies.

Through the examples in this paper, we can reimagine and replace: the corrugated steel sheets, the plastic bag tents and the rigid joints, and instead innovate to support the natural ecosystem and vitality of the Baltic environment with hopeful, climate-conscious resourceful shelters in response to the rising risks of climate change induced disasters.

References

[1] Browne G., ***Shelter not Homes — Appropriate Emergency Relief. Transportable Environments***, Kronenburg R (ed.), 1998.

[2] Chruszczow T., Foreward, ***Habitat:Vernacular Architecture for a Changing Planet***, Piesik S (ed.), Thames & Hudson, 2017.

[3] Drexler H. and El khouli S., ***Holistic Housing***, Detail, 2012.

[4] ***Emergency Shelter: Principles and practice***, Oxfam GB, 2012, 3.

[5] Field C.B., Barros V., Stocker T.F., and Dahe Q., ***Managing the Risk of Extreme Events and Disaster to Advance Climate Change Adaptation***. (ed.), Cambridge University Press, 2012.

[6] ***Global Strategy for Settlement and Shelter: UNHCR Strategy 2014–2018***, UNHCR, 2014, 22.

[7] Golden E., ***Building from Tradition***, Routledge, 2018.

[8] Hensel M., ***Performance-Oriented Architecture***, Wiley, 2013.

[9] Islam, T. and Ryan, J., ***Hazard Mitigation in Emergency Management.*** Butterworth-Heinemann, 2016.

[10] Kuismanen K., ***Climate-Conscious Architecture: Design and Wind Testing Method for Climates in Change.*** OULU, 2008.

[11] Kumar R.S., ***Aral Sea: Environmental Tragedy in Central Asia***, Economic and Political Weekly, 14 September 2002.

[12] May J., ***Buildings Without Architects: A Global Guide to Everyday Architecture.*** Rizzoli, 2010.

[13] Neiger J., ***The Permaculture Promise***, Storey Publishing, 2016.

[14] Oliver J.E., ***Encyclopedia of World Climatology***. (2nd ed.), Springer, 2008.

[15] Petersen J.F., Sack D. and Gabler R.E., ***Physical Geography***. (11th ed.), Cengage Learning, 2016.

[16] Pollner J., Kryspin-Watson J., Nieuwejaar S., ***Disaster Risk Management and Climate Change Adaptation in Europe and Central Asia.*** World Bank, 2010.

[17] Popovic Larsen O., Brancart S., De Temmerman N., De Laet L., and Petrova V., ***ReciPlyDome and ReciPlySkin bending-active transformable lightweight shelters,*** Creativity in Structural Design, Proceeding of the IASS Symposium, Boston, 2018.

[18] Popovic Larsen O., Lee D. S-H., ***Interdisciplinary Research into Emergency Shelters. Architecture Humanitarian Emergencies***, Lobos J., KADK, 2013.

[19] Popovic Larsen O., Lee D. S-H., Kim S-D., and Kawaguchi K., ***Extreme conditions emergency evacuation shelters based on deployable scissor structures***, KADK, 2017.

[20] Popovic Larsen, O. ***Reciprocal Frame Architecture***, Architectural Press, 2008.

[21] Rubel R., and Kotter M., ***Observed and projected climate shifts 1901–2100 depicted by world maps of the Koppen-Geiger climate classification.*** Meteorologische Zeitschrift, Vol 19, 2, 135–141. 2010.

[22] Souch C., ***The Influence of Climate on Building Design and Materials, Habitat: Vernacular Architecture for a Changing Planet***, Piesik S (ed.), Thames & Hudson, 2017.

[23] The BACC II Author Team, ***Second Assessment of Climate Change for the Baltic Sea Basin.*** (ed.), Springer, 2015.

[24] ***Transitional shelters: Eight designs***, Geneva: International Federation of Red Cross and Red Crescent Societies, 2012.

[25] Vrolijks L., ***Disaster Resistant Housing in Pacific Island Countries,*** South Pacific Disaster Reduction Programme, 1998.

[26] Qobil R., and Harris P., ***Restoring life to the Aral Sea’s dead zone.*** BBC Uzbek, 1 June 2018.

KEYWORD REGISTER

Scientific Contributions

ISBN: 978-3-941722-91-0

HCU | HafenCity Universität Hamburg