CATALYST - Architecture as a catalyst for social and socio-economic value creation

Sántha, Eszter

DOI (link to publication from Publisher):
10.54337/aau588607952

Publication date:
2023

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

CATALYST

ARCHITECTURE AS A CATALYST FOR SOCIAL AND SOCIO-ECONOMIC VALUE CREATION

– Eszter Sántha –

AART ARCHITECTS | AALBORG UNIVERSITY

CATALYST

ARCHITECTURE AS A CATALYST FOR SOCIAL AND SOCIO-ECONOMIC VALUE CREATION

by

Eszter Sántha

Industrial PhD dissertation

2023

Thesis submitted: August 2023

PhD supervisors: MARIE FRIER HVEJSEL, Associate Prof. at Aalborg University (until Sept. 2022), Prof. at Arkitektskolen Aarhus (from Sept. 2022)

MICHAEL LAURING (substitute supervisor from Sept. 2022), Associate Prof. at Aalborg University

JOHANNE MOSE ENTWISTLE, Head of Impact Team AART architects A/S

MIA KRUSE RASMUSSEN (substitute supervisor between Apr. 2020 – Feb. 2021), Interim Head of Impact Team at AART architects A/S in the period

PhD co-supervisors: JETTE BREDAHL JACOBSEN, Prof. at the University of Copenhagen

PhD committee: LARS BRORSON FICH, Associate Prof., Aalborg University

AINA LANDSVERK HAGEN, Research Prof. Oslo Metropolitan University

STÅLE NAVRUD, Prof., Norwegian University of Life Sciences

PhD Series: Technical Faculty of IT and Design, Aalborg University

Department: Department of Architecture, Design and Media Technology

ISSN: 2446-1628
ISBN: 978-87-7573-758-1
Printed in Denmark by Rosendahls, 2023

Published by:

Aalborg University Press
Kroghstræde 3
DK – 9220 Aalborg Ø
Phone: +45 99407140
aauf@forlag.aau.dk
forlag.aau.dk

Cover illustration by author

Funded by:

AART

Innovation Fund Denmark

Preface

This thesis is submitted as partial fulfilment of the PhD degree following the Rules and Regulations formulated by the Danish Ministerial Order on the PhD Programme at the Universities and Certain Higher Artistic Educational Institutions (PhD Order, No. 1039, 2013).

The thesis presents three years of work on a PhD project carried out between 2020-2023. The PhD project was part of an Industrial PhD programme with employment at AART architects A/S (AART) and enrollment in the Technical Doctoral School of IT and Design at Aalborg University. The research project was funded by AART and Innovation Fund Denmark (Industrial PhD grant 9065-00220B). The project was organized as a collaboration between AART, the Department of Architecture, Design, and Media Technology (CREATE) at Aalborg University, and the Department of Food and Resource Economics (IFRO) at the University of Copenhagen.

This PhD thesis is a collection of published, submitted, or drafted scientific papers reporting on the different research activities (work packages) conducted during the PhD studies. The purpose of this thesis is to outline how these publications contribute to the overall objective of the research project and to discuss them coherently.
For papers written together with co-authors, individual contributions are clarified in a "Co-author statement" approved by the Doctoral School (as of 14 January 2023) according to the Rules and Regulations in the PhD Order. References throughout the thesis are following the APA 7th, Chicago 16th, and Chicago 17th referencing systems, according to the requirements of the specific journals to which the papers comprising this dissertation have been submitted.

English Summary

There is an increasing awareness of architecture's role to create value in the social dimension of sustainability. Yet construction-related cost-efficiency is often the primary decision-making parameter for architectural design solutions within the contemporary building industry. This often limits the ability of the architect to realize what is at the core of architecture, that is the art of combining architectural instruments in a functional and aesthetical manner, thus articulating spatial gestures for social and socio-economic value creation over the lifetime of the building. The various interests, constraints, and sustainability requirements entering the architectural design process with multiple stakeholders are making the industry and thus the task of the architect increasingly complex. Within this complexity, architects are presented with the challenge to report on the value potentials of their design concepts preferably with quantified and monetary measures comparable to construction costs. However, a lack of ability to translate from immediate costs to long-term value causes a discrepancy between means and ends in architecture, thus potentially decreasing its capacity for value creation on the social dimension of sustainability.

Existing frameworks and assessment approaches within architecture have a limited capability in uncovering the potentials of social and socio-economic value creation in a long-term perspective, thus they prove to be weak at assisting in resource allocation. Consequently, there is a need for interdisciplinary strategies to inform the architectural design process on the social and socio-economic values created by architecture in the intersection of architectural, anthropological, and economic implications of construction. Addressing this need, the objective of this industrial PhD research project, initiated by the Danish architectural studio AART architects (AART), is to investigate "*How, and to what extent can we describe and valuate architectural design based on its potential for value creation on the social dimension in a sustainable urban development context?*"

The project addresses this research question by developing an interdisciplinary methodological framework departing from tectonic theory in architecture. Referring to the task of the architect as a facilitator between space and experience via constructed spatial gestures, a tectonic perspective holds the potential to critically assess the choices made in the construction of those gestures within the design process. Utilizing this potential, the proposed interdisciplinary tectonic framework within this research is tested in a post-occupancy case study of buildings designed by AART. Thereby, the project aims at investigating the relationship between

architectural design as gestures and the economic value of its qualities, depending on the choices and trade-offs people make reacting to those invitations through their experience and behaviour within and around the buildings. Unfolding this relation and calculating the value of specific design choices was done through the integration of architectural, anthropological, and economic perspectives in the interrelated analyses of spatial gestures, using both qualitative and quantitative methods within the proposed methodological framework.

The research work translated architectural quality identified from an architectural point of view into value quantified by welfare economic methods, through a qualitative exploration of the experiences and practices of end-users within the proposed interdisciplinary tectonic methodological framework. Through the discussion and evaluation of the applied framework, it was addressed, that the combined results of the analyses should be interpreted and used with caution, based on the identified limitations, and experienced challenges concerning the chosen methods, and the context of the strategically selected post-occupancy cases included in the testing. Care should also be taken considering the future application of the framework itself regarding the interdisciplinary translation challenges, due to the differences in the underlying epistemologies of architecture, anthropology, and economics. Based on the findings of this research learnings points on the interdisciplinary translation can be summarized as follows:

- Translating from architecture to anthropology, from *intended* to *lived* gestures proved to be easier. Though there is room for improvement for architects to better articulate the intended experiences, actions, and practices specifically linked to the chosen design instruments.
- The biggest challenge in the translation from *architecture* to *economics*, from *intended* to *valued* gestures proved to be the chosen level of detail for architectural design valuation. A more generalized approach for describing architectural design in 'attributes' implies the conceptualization and thus the anonymization of the inherent gestures, resulting in potential qualities to be "lost in translation".
- Lastly, the translation from anthropology to economics, from *lived* to *valued* gestures, possibly requires putting equal emphasis on both the qualitative exploration (in terms of more robust anthropological studies) and the quantification, to ensure a potentially broader understanding of the socio-spatial context behind peoples' choice behavior, thus relativizing the proposed conclusion of the economic valuation.

This finding aims to emphasize the importance of defining the WHAT (what to value), WHY (why it is needed), WHO (value to who), and HOW (what value mapping and/or valuation methods to apply) in each context before jumping into the complex exercise

of value mapping and valuation of architectural design qualities within an interdisciplinary framework. Nevertheless, the findings of the research project can contribute to narrowing the gap between means and ends by enhancing the architects' ability to justify and economically qualify their design choices for long-term value creation on the social dimension of sustainability.

Dansk Resume

Der er en øget bevidsthed om arkitekturens rolle i at skabe værdi på den sociale dimension af bæredygtighed. På trods af dette, træffes beslutninger i designprocessen ofte på baggrund af snævre anlægsøkonomiske betragtninger, hvilket begrænser arkitekten i at udøve sin kernefaglighed, der ligger i evnen til strategisk at vælge, sammenstille og bearbejde arkitektoniske virkemidler som katalysatorer for størst mulig social og økonomisk værdiskabelse gennem byggeriets levetid. Diverse interesser, begrænsninger og bæredygtighedskrav, der introduceres i den arkitektoniske designproces med flere aktører, gør branchen og dermed arkitektens opgave mere og mere kompleks. Inden for denne kompleksitet præsenteres arkitekter for udfordringen med at rapportere om værdipotentialerne i deres designkoncepter fortrinsvis med kvantificerede og monetære mål, der kan sammenstilles med byggeomkostninger. Arkitekter som rådgivere mangler dog de nødvendige tilgange til opstilling af ambitiøse mål for arkitekturens kvalitet og bidrag til bæredygtig udvikling målt på dens sociale og velfærdsøkonomiske værdi.

Eksisterende rammer og vurderingstilgange inden for arkitektur har en begrænset evne til at belyse arkitekturens potentiale i at skabe langsigtet sociale og socioøkonomiske værdier, og er derfor uegnede til at informere designprocessen i forhold til ressourceallokering. Derfor er der behov for tværfaglige strategier til at informere den arkitektoniske designproces om de sociale og socioøkonomiske værdier, der kan skabes af arkitektur ved de specifikke arkitektoniske virkemidler set fra et arkitektonisk, antropologisk, og økonomisk perspektiv. Igangsat af den danske tegnestue AART architects (AART), er det erhvervs-ph.d. forskningsprojektets mål at undersøge "*Hvorvidt og hvordan vi kan vurdere arkitektonisk kvalitet på baggrund af social og velfærdsøkonomisk værdiskabelse i en byudviklingskontekst".*

For at belyse ovenstående problemformulering udvikles der i projektet en metodologisk ramme til en hidtil uudforsket interdisciplinær kobling af arkitektur, antropologi og økonomi. I projektet gøres denne interne afhængighed til omdrejningspunkt for opbygningen af et fælles værdibegreb fra tektonisk teori på tværs af disciplinerne ved at beskrive interaktionen imellem arkitektur og mennesker som en rumlig dialog, i form af udveksling af 'rumlige gestus'. Hermed trækker projektet på tektonisk teoris potentiale for anvendelse som en kritisk tilgang til at vurdere de valg, der træffes i designprocessen. Udnyttelse af dette potentiale sker via en afprøvning af den udviklede tektoniske metodologisk ramme i *post-occupancy* casestudier, som involverer to bygninger designet af AART.

Derved sigter projektet mod at undersøge sammenhængen mellem arkitektonisk design (i form af rumlige gestusser) og den velfærdsøkonomiske værdi af disse kvaliteter. For projektet betyder det, at værdien af arkitektur afhænger af mennesker som fortolkende mellemled, der bevidst og ubevidst oplever og interagerer med arkitekturen og tillægger den værdi, som kommer til udtryk i valg og fravalg. Udfoldelse af denne relation og beregning af værdien af specifikke designvalg er sket gennem arkitektoniske, antropologiske og økonomiske analyser af rumlige gestus. Analyserne anvender både kvalitative og kvantitative metoder inden for den foreslåede tektonisk metodologiske ramme.

Forskningsprojektet oversætter arkitektonisk kvalitet identificeret fra et arkitektonisk perspektiv til værdi kvantificeret ved velfærdsøkonomiske metoder gennem en kvalitativ udforskning af slutbrugernes oplevelser og praksis inden for den foreslåede tværfaglige tektoniske metodologiske ramme. Gennem diskussionen og evalueringen af den anvendte ramme adresseres, at de kombinerede resultater af analyserne skal fortolkes og anvendes med forsigtighed baseret på de identificerede begrænsninger og oplevede udfordringer vedrørende de valgte metoder, og konteksten for de strategisk udvalgte *post-occupancy* sager, der indgår i projektet. I den fremtidige anvendelse af rammen bør der også tages hensyn til de identificerede udfordringer ved de tværfaglige oversættelser, der skyldes forskellene i de underliggende epistemologi inden for arkitektur, antropologi og økonomi. Baseret på resultaterne af denne forskning kan læringspunkter om den tværfaglige oversættelse opsummeres som følger:

- At oversætte fra arkitektur til antropologi, fra *intended* til *lived* gestus viste sig at være lettere. Selvom der er plads til forbedring for arkitekter til bedre at formulere de tilsigtede oplevelser, handlinger og praksis, der specifikt er knyttet til de valgte designinstrumenter.
- Den største udfordring i oversættelsen fra arkitektur til økonomi, fra *intended* til *valued* gestus viste sig at være den valgte detaljeringsgrad I forbindelse med vurderingen af det arkitektoniske design. En mere generaliseret tilgang til beskrivelsen af arkitektonisk design som 'attributter' indebærer konceptualisering og dermed anonymisering af de iboende gestusser, hvorved nogle af de kvaliteter går tabt i oversættelsen.
- Endelig kræver oversættelsen fra antropologi til økonomi, fra *lived* til *valued* gestus, muligvis at lægge lige stor vægt på både den kvalitative udforskning (i form af mere robuste antropologiske studier) og kvantificeringen for at sikre en potentielt bredere forståelse af den socio-rumlige kontekst bag folks valgadfærd, hvilket vil relativisere udsigelseskraften af konklusionerne fra den økonomiske værdisætning.

Denne indsigt har til formål at understrege vigtigheden af at definere HVAD (hvad det er der skal værdisættes), HVORFOR (hvorfor det er nødvendigt), HVEM (værdi for hvem), og HVORDAN (hvilke evaluerings eller/og værdisætningsmetoder er relevante at anvende) i hver sammenhæng, før man begynder den komplekse øvelse udi værdikortlægning og værdisættelse af arkitektoniske designkvaliteter inden for en tværfaglig ramme. Ikke desto mindre kan resultaterne af forskningsprojektet bidrage til at mindske afstanden mellem *mål og middel* ved at forbedre arkitekternes evne til at økonomisk begrunde og kvalificere deres designvalg til langsigtet værdiskabelse på bæredygtighedens sociale dimension.

Personal profile, positioning, and motivation

The PhD research work presented in this dissertation is about the built environment, the people experiencing them, and their value of it. Architecture is therefore investigated from an interdisciplinary perspective, combining knowledge and skills from the disciplines of architecture, anthropology, and economics. Carried out by a researcher, who is neither an architect nor an anthropologist, or an economist.

I am, in its most comprehensive sense, a landscape architect. It was not a field, a profession, that I have heard of when I was about to apply to universities. What *is* a landscape architect? – was my initial question before enrolling in the bachelor programme of landscape architecture at Corvinus University of Budapest, Hungary, in 2012. In search of what the discipline entails, I have learnt that "Landscape architects shape the world we live in […] and influence the future of our environment" through a visionary and creative approach (Room60, 2010). What I then realized during my studies, is that 'shaping the world', i.e., the task of landscape architects, as well as architects, and urban planners comes with responsibility. Having a very strong analytical mindset, my preferred approach to handling that responsibility in design has always been through working with data systematically, relying on information drawn from research, which my interdisciplinary education allowed me to explore.

The research presented in this dissertation is also about taking responsibility, testing methods, and finding new approaches in an interdisciplinary way to describe and communicate values embedded and released in and by design, thus defining its quality. Because it is not just about design itself and the art of it, but it plays a significant role in the development of our environment and everyday life.

During my study years in landscape architecture, I tested my skills in different industries in Budapest. Between 2015 and 2016 I was an intern and student helper at a small consultancy company within environmental services, where I was working on mapping and analyzing spatial data on biomass availability, within the EU-framework project "Green Energy Surveys". In between, I also did an internship at a landscape architectural design studio, where I was introduced to a variety of design activities. And budgets, stakeholder interests, suppliers, and available resources. All these constraints had to be considered in a systematic way to create designs, that both resonate well with the landscape architectural vision, and are fitting in the 'box'. These experiences gave me the realization, that I find more joy in informing the design process, and qualifying design, questioning the inherent meaning behind the 'realistic' visualizations. As a result of this realization, I carried out a small research project and

wrote a scientific article on the "Climate Change Vulnerability of Semi-natural Habitats in Hungary" and contributed to a publication entitled "Guide to Stylization of Natural Habitats" as a second author.

Following the interdisciplinary path within my special interests in research on a landscape scale, I moved to Denmark to continue my studies within natural resource management at the University of Copenhagen (UCPH) and obtained my master's degree (*cand.silv.*) in 2018. Having several research ideas in my mind, and a passion for improving my skills by exploring new ways of their application, I became a research assistant at the Department of Food and Resource Economics (IFRO), and the Department of Geosciences and Natural Resource Management (IGN) at UCPH, back and forth between 2017 and 2019. These experiences comprised assisting in various research projects on natural resource management and economics while developing research ideas and raising funds for a research project with the explicit goal to do a PhD.

Coincidentally or not, it was eventually the research project that found me than the other way around when Johanne Mose Entwistle from AART architects approached Jette Bredahl Jacobsen at IFRO with the proposal of the Industrial PhD project. Sitting at IFRO at the time, Jette introduced me to the research proposal. The idea of applying a welfare economic method in a field that is related to design, and at the same time providing the possibility to acquire new skills in qualitative survey techniques, all this within a systematic interdisciplinary framework, was an offer I gladly said yes to. Since 2020, I have been an Industrial PhD student, at the Department of Architecture, Design and Media Technology in Aalborg, AART architects in Aarhus and Copenhagen, as well as the Department of Food and Resource Economics at the University of Copenhagen.

The sustainable development and management of urban and rural landscapes, investigating the impact of design on the built and the natural environment, has been a core research interest of mine from the beginning. Accordingly, both in my bachelor's and master's thesis, I worked with multidimensional assessment methods in a sustainability context. The PhD gave me the possibility to combine my interests in both (assessment methods and sustainability) and to widen my scope within interdisciplinary research.

During my interdisciplinary journey, I have heard multiple times, that being competent in a lot of different areas means not being really competent in either of them. With the PhD research project, this – becoming an expert in multiple fields – was never the objective nor the requirement. The project was a very ambitious and complex project with a lot of opportunities for professional as well as personal growth – for which I am very grateful to this day. In fact, the PhD has taught me that there is

indeed value in 'knowing different things', i.e., to be able to understand and actively work with different world views, domains, and methods, to translate, and ultimately to find a common understanding between them.

I feel that the PhD has helped me to specialize in not specializing. To question the existing practices and continue to explore 'new territories', try to find the connection between them in a systematic way to create new knowledge, towards better informed and potentially improved practices as a strategic, yet still creative way of working with design. This also entails exploring the nature of those connections and discussing the implications of moving from one domain to another.

Based on what I have learned from this project, I believe that interdisciplinarity is a promising approach to address the increasing complexity in the industry towards responsible design that contributes to sustainability. I hope that the interdisciplinary methodological framework proposed, applied, and discussed in this PhD thesis will inspire and encourage the actors within the contemporary building industry to shape the world responsibly by continuously shaping and improving their own practices in a critical and reflective, ultimately reflexive manner.

Acknowledgments

I am grateful for the opportunity and for making this PhD project possible through the financial funding provided by AART architects A/S and Innovation Fund Denmark. Below, I would like to express my gratitude to all the people who contributed to the establishment, development, and finalization of this Industrial PhD.

First and foremost, I am extremely grateful to my three supervisors, Johanne Mose Entwistle, Marie Frier Hvejsel, and Jette Bredahl Jacobsen. You all equally played a major role in guiding and supporting my interdisciplinary research journey, full of fruitful discussions, where we all learned from each other. You helped me navigate and link not only the different theoretical viewpoints of architecture, anthropology, and economics but also those with practical considerations regarding architectural practice.

A special thanks to Mia Kruse Rasmussen at AART, who also filled the role of company supervisor between April 2020 and February 2021. Your guidance was an enormous help during the anthropological analysis of the research work and onwards as a fellow Industrial PhD researcher at AART.

I would also like to thank the partners of AART, Nanna Flintholm, Torben Skovbjerg Larsen, Anders Tyrrestrup, Anders Strange, and Mads Nygaard for your enthusiasm, dedication, and continuous belief in the research project to contribute to the strategic development of the company.

I would like to extend my sincere thanks to my closest colleagues within and in connection to the “Impact Team” at AART. Many thanks to Signe Jul Kirkegaard-Larsen for helping me distribute flyers to recruit respondents for the surveys. Thank you to Stina Rask Jensen, Mette Riisgaard Hansen, Stephanie Carr, and Nicolaj Thunbo for their participation in the testing of the choice experiment survey and their constructive feedback and input. Special thanks to my teammate, Line Scharla Løjmand for being my rock at the Copenhagen office.

In this context, I would also like to give thanks to my fellow PhD students and professors at the Department of Food and Resource Economics at the University of Copenhagen for establishing and inviting me to the Environmental Economic Valuation seminars. Having the chance to present my ongoing research multiple times during the series of this seminar you all provided important feedback on the economic analysis of the project.

I am also grateful to all the follow-group members of the project, Peter Andreas Sattrup, Marie Stender, and Toke Emil Panduro, for their supporting role in the project's development through their perspectives from architectural, anthropological, and economic nexuses, respectively. Many thanks to Ditte Bendix Lanng as well, who assessed and provided feedback for the research plan at its 1-year status seminar.

I would like to gratefully acknowledge all employees of Filmbyen and Pakhusene in Aarhus, as well as all residents of Aarhus Ø, who participated in the empirical studies and thus provided the main body of qualitative and quantitative data for the research.

Thank you to all other colleagues at AART, the Department of Architecture, Design, and Media Technology at Aalborg University, and the Department of Food and Resource Economics at the University of Copenhagen for making me feel "home" at three different institutions in three different cities.

Lastly, but most importantly, thank you to my friends and family for their continuous support. Special thanks to my husband Tibor, for his patience, humour, love, cooked meals, and for being my "colleague" for a year of home-office, during the pandemic. Warm thanks to my brother for drinking all the coffee with me, and for always cheering me up with some cat content. Finally, I am deeply grateful to my parents for always being there for me knowing exactly what it's like to do a PhD.

Thank you!

Copenhagen, January 2023

List of publications

Journal papers

The papers listed here are all published in peer-reviewed scientific journals.

Sántha, E., Hvejsel, M. F., & Rasmussen, M. K. (2022). Lost potentials? – Unpacking the tectonics of architectural cost and value. *Nordic Journal of Architectural Research,* 34 (1), 89-118.

Sántha, E., Hvejsel, M. F., & Entwistle, J. M. K. (2022). Tectonics of human well-being: Describing architecture in terms of constructed spatial gestures and their impact. *Architecture, Structures and Construction,* 1(14), 599-612.

Conference papers

The papers listed here are all published in peer-reviewed conference proceedings.

Sántha, E., Hvejsel, M. F., & Rasmussen, M. K. (2022). Intention, life, value: A multidisciplinary approach to understanding architectural quality in the city. In J. Montgomery (Ed.), *AMPS Proceedings Series 24.1 – Cities in a Changing World* (pp. 67-78). AMPS, 2021. Virtual.

Sántha, E. (2023). Transforming the Harbour – The Role of Architecture in Creating Urban Life. In F. Neuhaus (Ed.) *AMPS Proceedings Series 30 – Cultures, Communities, and Design* (pp. 296-307*)*. AMPS, 2022. Calgary, Canada.

Manuscripts

The papers listed here are to be submitted to peer-reviewed scientific journals.

Sántha, E., & Jacobsen, J. B. (). Office employees' architectural preferences for workplace and workspace: a stated choice experiment. To be submitted to: *Architectural Science Review*.

Sántha, E., & Jacobsen, J. B. (). Residents' Willingness-To-Pay for Architectural Design Solutions in a High-Density, Mixed-Use Neighborhood. To be submitted to: *Journal of Housing and the Built Environment*.

Table of contents

Glossary of key terms

Architectural quality: here defined by the potential to create social and socio-economic value for the different end-user groups of the buildings, through their everyday life, i.e., through the interactions with, and the experiences of the architectural end-product comprising the built reality.

Building performance: "how specific design and construction decisions have affected mechanical and electrical performance" (Vischer, 2009, p. 241).

Embedded design (research): is "a mixed methods [research] design in which one data set provides a supportive, secondary role in a study based primarily on the other data type" (Creswell & Creswell, 2017, p.67)

Evidence-based Design (EBD): "the conscientious and judicious use of current best evidence related to the physical environment's effects on wellbeing, and its critical interpretation, to make significant design decisions based on sound hypotheses (concepts) related to measurable outcomes, for each unique project" (Salvatore, 2006).

Human performance: "how users' behaviour is enhanced and supported by the spaces designed for it" (Vischer, 2009, p. 241).

Impact: here understood as the impact of architectural design, that is the direct effect of the outcomes (Watson & Whitley, 2016).

Interdisciplinarity: accommodates the differences between the various disciplines in an attempt to integrate and synthesize perspectives from them. Consequently, "it implies a variety of boundary transgressions in which the disciplinary rules and subjectivities given by existing knowledge corpuses are put aside or superseded" (Barry et al., 2008, p. 21).

Knowledge: the accumulated information derived from feedback and collected systematically from building users (Vischer, 2009).

Mode 2 research: here referred to as "industrial research", which is carried out in the form of cooperative (or collaborative) research between the architectural design studio, and the two university institutes as academic partners.

Outcomes: here understood from a socio-economic perspective regarding architectural design, that is "the changes experienced by the end-users through the

intervention [in an architectural context: the design and construction of buildings]" (Watson & Whitley, 2016, p. 5).

Post-Occupancy Evaluation (POE): regards "any activity that originates out of an interest in learning how a building performs once it is built – if and how it has met expectations – and how satisfied building users are with the environment that has been created" (FFC & NRC, 2002).

Research Informed Design (RID): "the process of applying credible research in integration with project-, client-, or population-specific empirical inquiry to inform the creation of environmental design and achieve project objectives" (Peavy & Vander, 2017).

Social sustainability (or the social domain of sustainability): here approached from a social perspective in terms of understanding what is of value to end-users, i.e. by accounting for the needs and preferences of building users (comprising the social value of architectural design).

Social value in the project was referred to as "understanding the relative importance that people place on changes to their wellbeing and using the insights we gain from this to make better decisions" (Social Value International). Thus, the social value of architectural design can be assessed "in terms of the improvement it brings to [the well-being of] users and society at large" (Vischer, 2009, p. 241).

Socio-economic value: here refers to the socio-economic understanding of value, which "builds on the foundation of economic value creation by attempting to quantify and incorporate certain elements of social value" (Emerson et al., 2001).

Spatial gesture: a central notion used in the proposed methodological framework of the present research, where it is defined as means of communication between architects and end-users in a spatial dialogue. The notion is applied to focus on the relationship between the physical design instruments as "carriers" of these gestures and their eventual social value to end-users defined by their preferences, through the perception and experience of those gestures within the built reality.

Sustainability: here, concerning the building industry, is therefore understood as designing buildings that can "serve" multiple generations, without having to significantly re- or fully deconstruct them.

Sustainable development: "seeks to meet the needs and aspirations of the present without compromising the ability to meet those of the future" (Brundtland, 1987).

Tectonics: "describes those expressive qualities of the visual result that has an effect on us beyond mere aesthetics, that cannot be described by structure or construction alone" (Sekler, 1964).

Travelling concept: a way to circulate knowledge between the different disciplinary domains, and perspectives (Darbellay, 2012).

Utilitarianism: an approach applied here on *value*, which assumes that people themselves know what makes them "better of" and they make choices accordingly on the market as rational consumers aiming to maximize their own individual well-being (utility).

Chapter 1 | INTRODUCTION

Architectural quality, value creation, and sustainability

The present research is situated within the wider academic discussion on improving existing frameworks and assessment approaches for evaluating architectural design based on the outcomes of design decisions within the social dimension of sustainable urban development (section 1.1 'Background'). This need derives from the challenge, experienced by practicing architects, to translate from immediate construction costs to long-term value potentials in the design process, which often causes a discrepancy between means and ends in architecture. Thus, potentially decreasing the capacity for value creation on the social dimension of sustainability (subsection 1.1.1 'Means versus ends'). Addressing this challenge entails acquiring information on how buildings are used, perceived, and valued by the building users after their occupancy (subsection 1.1.2 'Existing approaches for bridging the gap: from POE to RID'). Thereby moving towards describing quality based on the potential of architectural design as a catalyst for social and socio-economic value creation. In doing so, the research work comprises the development of an alternative methodological framework from tectonic theory (section 1.2 'Architectural theoretical approach') and its testing in a post-occupancy case study of buildings designed by AART. The project aims at investigating the relationship between quality and value through architectural, anthropological, and economic perspectives (section 1.3 'Hypothesis, research questions, and objectives'), using both qualitative and quantitative methods within the proposed methodological framework (Chapter 2). Unfolding this relation and quantifying the value of design in monetary terms as a result of the specific design choices in the selected cases could potentially provide better assistance in future design decision-making (section 1.4 'Overall contributions and significance'). Thereby also facilitating the development of the current architectural practice towards a 'Research Informed Design' practice intended to ensure the sustainability of building projects in terms of enhanced quality and thus value to end-users, determining the attractiveness and eventually the long-term use of buildings.

1.1 Background

Of the 17 Sustainable Development Goals defined by the United Nations, Goal 11 calls for the development of 'Sustainable Cities and Communities' (UN, 2018). This entails

understanding and documenting the long-term consequences and values of products and production approaches (Webster, 2017) on multiple – economic, social, and environmental – dimensions (Litman, 2010). Sustainable development "seeks to meet the needs and aspirations of the present without compromising the ability to meet those of the future" (Brundtland, 1987). As construction consumes a significant amount of resources (Broch et al., 2017), creating a piece of architecture comes with the responsibility of using those resources wisely, shaping our built environment with respect to nature and society, and ensuring its sustainability in the long run. Sustainability here, concerning the building industry, is therefore understood as designing buildings that can "serve" multiple generations, without having to significantly re- or fully deconstruct them. Within the industry, sustainability has recently become the "ultimate goal" of planning activities, thus forming a new problem field in architecture as well (see e.g. Mossin et al., 2018).

On a global scale, policies and international standards have been developed since the 1990s to drive sustainability in architectural design and construction (Li et al., 2018). The first Green Building Council (GBC) to promote the mission of 'sustainability-focused practices' in the construction and building industry was born in 1993 in the United States (worldgbc.org; 2023.04.28). To promote the establishment of GBCs around the world and unite them, the World GBC (WGBC) was officially formed in 2002 (worldgbc.org; 2023.04.28). The GBC in Denmark (DK-GBC) was founded relatively late, in 2010, as a non-profit organization to "attract and engage stakeholders to create sustainable solutions that provide commercial sense" (stateofgreen.com; 2023.04.28). To do so, GBCs around the world, have been focusing on the development and application of methodologies and tools for assessing and benchmarking buildings, primarily in the form of 'green building certification systems' (Li et al., 2018), which are based on several 'performance indicators' of the different topics within the three dimensions of sustainability. Since these evaluations are mostly used in the design phase, they primarily describe the *theoretical* performance of buildings, whereas the *actual* performance in relation to the initial design intentions is only addressed by a few (Li et al., 2018). Consequently, the actual building performance often does not match the theoretical (or potential) performance, based on which the buildings have been – before their occupancy and operation – certified as 'green' and 'sustainable'. Due to this 'performance gap', a criticism of the contemporary building industry has been, that it is often of poor quality (in terms of performance) and is unable to improve (Hay et al., 2018) to better meet public or client expectations and sustainability goals.

Consequently, an increasing interest in the design quality of the built environment (Watson & Whitley, 2016) to address the gap between "intended and actual

performance" (Hay et al., 2018, p. 698) has led to many Post-Occupancy Evaluation (POE) approaches to capture feedback from users of the buildings (Watson & Whitley, 2016) thereby enhancing the "capability [of the actors within the building industry] to learn from and improve on previous projects" (Hay et al., 2018, p. 698). Parallel to POE methodologies a variety of 'social impact valuation' methods have been developed to acquire user feedback on building design (post-occupancy) in a "more meaningful and transferable way" (Watson & Whitley, 2016, p. 2). That is, by focusing on the impact of design decisions, thereby potentially improving the existing POE methods to ultimately "facilitate the translation of knowledge in the learning loops of design" (Watson & Whitley, 2016, p. 2) in architectural practice.

Moreover, existing approaches in evaluating the design quality of buildings place different weights on the different – social, environmental, and economic – aspects of sustainability (Jensen & Troelsen, 2017). In their study, Hay et al. (2018), have identified "an appetite" for "more holistic evaluation measures that move beyond the current preoccupation with energy efficiency to consider other aspects of building performance, and thereby sustainability, in a wider value framework" (p. 698). Beyond building performance, this agenda – addressing sustainability in a wider value framework – would however require considering other aspects of a "theory of feedback from buildings in use", i.e. 'human performance' and 'social value' (Vischer 2009, p. 241). Hence, the evaluation of design quality in architecture – and thus the future development of POE methodologies – ultimately requires shifting away from building performance towards mapping and assessing outcomes, e.g. in terms of value created through design, as experienced by the end-users (Watson & Whitley, 2016). While building performance in this context refers to "how specific design and construction decisions have affected mechanical and electrical performance" (Vischer, 2009, p. 241), human performance describes "how users' behaviour is enhanced and supported by the spaces designed for it" (Vischer, 2009, p. 241). Thus, it focuses more on the social aspect of design by looking at the user-space relationship as well as the user-user interaction within the space. Ultimately, by considering buildings as products, the social value of architectural design can be assessed "in terms of the improvement it brings to [the well-being of] users and society at large" (Vischer, 2009, p. 241). This also involves moving away from describing and defining quality in architectural design based on building performance (a more technical/engineering perspective), towards outcomes from a socio-economic perspective, that is "the changes experienced by the end-users through the intervention [in an architectural context: the design and construction of buildings]" (Watson & Whitley, 2016, p. 5). More broadly speaking, it entails acquiring a wider range of information (or knowledge, or intelligence) on the impact of design (Watson & Whitley, 2016), that is the direct effect of the outcomes, as well as strategies to

apply and integrate them into architectural practice (Vischer, 2009; Peavey & Vander, 2017).

The industrial research, that this PhD dissertation reports, is focusing on the often underweighted, yet equally important social dimension of design quality in relation to sustainability in the built environment. In doing so, the research is engaged towards evaluating architectural design based on the outcomes, as experienced by the end-users of the buildings, through an account of the social and socio-economic value of design qualities resulting from the decisions made in the design process regarding the specific architectural instruments as parts of the design solution. Thereby the research applies an overall socio-economic understanding of value, which "builds on the foundation of economic value creation by attempting to quantify and incorporate certain elements of social value" (Emerson et al., 2001). Accordingly, architectural quality in the project is defined based on the potential of architectural design as a catalyst for social and socio-economic value creation. The problem is, that in practice, this often remains a core potential of what architecture *can*, but eventually *forgets* to *do* (Landon, 2016), in order to improve the way, we – as end-users of the buildings – live, work, and learn. The upcoming subsections elaborate further on how this discrepancy is understood in the research and on the need for improving the above-outlined frameworks and assessment methodologies for evaluating architectural design quality through a review of the state-of-the-art and state-of-the-practice.

1.1.1 Means versus ends

The discrepancy between what architecture *is* (means) and what it *does* (ends) is investigated in the industrial PhD project by looking at architecture from a dual, academic and industrial, perspective. On one hand, architecture is understood here as an artistic discipline, a creative process, where the quality of an architectural work is defined through its ability to offer a new, unique *experience* to users via *meaningful* design (Fabian, 2016). As such, an architectural task is ideally approached from an aesthetical, structural, and constructional perspective with a high level of design integrity, which allows the architect to think outside of the box of given constraints and exterior interests that may be present in the contemporary building industry. On the other hand, architecture is also seen here as a business, a service offered within the contemporary building industry, where demands for cost-efficiency or political interests may have a significant influence on the architectural process and its outcome (Broch et al., 2017), for better or worse. The clarity of architectural intentions to offer an experience through meaningful design can become blurrier, and thus its quality may diminish, as the objective becomes to meet those demands. Thus, architectural practice rather becomes the "art" of maximizing value potentials within the given constraints by prioritizing and optimizing architectural design solutions in

collaboration with other stakeholders in the design process. This inevitably comes with trade-offs and compromises, but the value potential, released through the realized design, should clearly reflect the initial intentions regarding the improvement of the well-being of end-users, to achieve the desired impacts after the building is taken into use. Ideally.

However, this becomes problematic, when demands motivated by short-term financial or economic considerations are overweighted in the decision-making and become the main driver for the development of buildings and cities for gaining or increasing 'return on investment' (Christensen, 2020). These considerations often only include the tangible features of a building as a marketed good (reflected in the market value) without taking into account the value of its intangible qualities (reflected in the social and socio-economic value), which are not directly marketed (Mulgan et al., 2006). Consequently, compromises made on the qualities of architectural design in such a process may result in a significant loss of value potential. From an architectural perspective, this means losing the architectural specificity (*meaning*) integrated into the nuances of design through its construction (Sántha, Hvejsel, & Rasmussen, 2022). The various interests and constraints inevitably make the industry and thus the task of the architect more and more complex. Within this complexity, architects in practice are continuously challenged to explicitly articulate the value potentials of their design concepts (Broch et al., 2017; Hvejsel & Beim, 2019; Sattrup, 2020) in such ways, that match the logic of economic demands (Christensen, 2020). Consequently, it has been argued, that demonstrating and quantifying the benefits of architectural quality as 'added value' to the investment can promote their realization (Rouse, 2004; Macmillan, 2006). Architectural quality in the contemporary building industry may therefore be only achieved if it enters the "number game", i.e. describe and present the value creation potentials in a quantified and monetary matter to the other stakeholders in the design process (Sattrup, 2020). Accordingly, there is a need for methodological frameworks with quantified measures that shape the contemporary building culture significantly, without suppressing the qualitative dimensions of architecture, i.e. that allow architects to activate their field-specific knowledge to find the "*appropriate solutions*" (Rönn, 2011, p. 242) within the given constraints. This entails the description and documentation of social and socio-economic value created by architecture to inform the practice and thus provide support in the design decision-making process regarding the specific architectural instruments as parts of the design solution. Thus, linking the value of these instruments back to the construction and thereby to the resources applied. As a point of departure in developing such methodologies, the following section provides a

review of existing approaches for acquiring information on how buildings are used, perceived, and valued by the building users after occupancy to provide knowledge for better-informed design decision-making.

1.1.2 Existing approaches for bridging the gap: from POE to RID

State-of-the-art

Post-Occupancy Evaluation (POE)

Founded on the need to address the performance gap (as a measure of quality), the practice of POE emerged and has been around since the '60s (Li et al., 2018). The definition of POE however is "highly contested" (Hay et al., 2018, p. 698), and both the concept and its methodologies are continuously developing and changing.

Originally, POE was defined as "the process of evaluating buildings in a systematic and rigorous manner after they have been built and occupied for some time" (Preiser et al., 1988:2015, p. 3). After the sustainability agenda entered the planning and design process, with the foundation of GBCs, POE was proposed to be one of the six internal 'learning loops' (Watson, 2016) or 'review loops' (Li et al., 2018) within a wider Building Performance Evaluation (BPE) framework (Preiser, 2005), reviewing a building's lifetime (Figure 1). Within the integrated framework of BPE, POE is considered the link between design and programming in an environment of continuous learning to gradually improve the design thereby closing the performance gap (Vischer, 2009). Thus, according to the definition accepted by the industry in the US, POE regards "any activity that originates out of an interest in learning how a building performs once it is built – if and how it has met expectations – and how satisfied building users are with the environment that has been created" (FFC & NRC, 2002).

Despite the need to bridge the gap between theoretical and actual performance, from the more than 150 tools and methodologies worldwide to assess the design quality of buildings in relation to sustainability (mostly certification schemes, e.g. LEED, BREEM, DGNB, WELL), only a few incorporate POE (e.g. WELL) to address performance in practice (Li et al., 2018). In most cases, POE is an optional "tick box exercise", a "luxury, rather than a necessity" (Hay et al., 2018, p. 703).

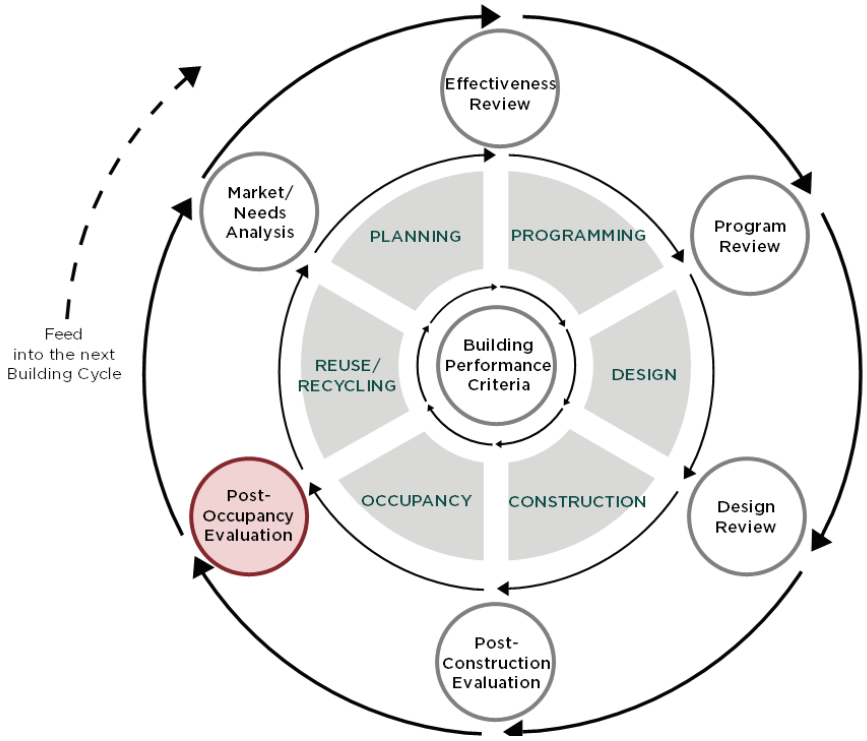


Figure 1. Post-Occupancy Evaluation within the Building Performance Evaluation (BPE) process model (Preiser, 2005).

Due to the plasticity of the concept of POE, there are a wide range of applied POE methodologies (or protocols) (e.g. Probe, DQI, VALiD, AEDET, ASPECT, PLACE) developed for different building typologies in the US (Li et al., 2018) and in the UK (Hay et al., 2018). The most commonly evaluated building typologies are residential, office, as well as educational, and healthcare facilities (Li et al., 2018), for which POEs differ greatly, both in terms of purpose and methodology, hereby of applied evaluation methods (Li et al., 2018). These evaluation techniques were categorized by Li et al. (2018) into subjective methods (such as surveys, interviews, and walkthroughs) and physical measurements (e.g. indoor climate), from which the previous was found to be more commonly applied. In fact, it is the occupant surveys, that make the core element of the majority of POE protocols, such as the BUS survey within Probe, which is the most widely applied standardized occupant survey in the UK (Li et al., 2018). In an earlier, comprehensive review by Mulgan et al. (2006), DQI and VALiD, along with welfare economics-based methods (stated and revealed preference studies, used primarily in environmental fields), were reviewed as value mapping techniques in the built urban environment for design decision-making.

Identified in later reviews (Watson & Whitley, 2016; Hay et al., 2018; Li et al., 2018) as POE methodologies, DQI and VALiD (along with many of the other existing post-occupancy surveys and assessment tools) are based on weighting and scoring (also known as Multi-Criteria Analysis (MCA)), which is "the most common technique used to compare unvalued cost and benefits" (Mulgan et al., 2006, p. 48) for decision making, i.e. decision making based on information (or knowledge or intelligence (Vischer, 2009)). At the same time, the potential of preference studies, i.e. surveys based on welfare economics to quantify the monetary value of the benefits from increased architectural quality through design from the occupants' (as end-users) perspective, as an alternative method to evaluate the design and inform design decisions, has not been widely explored (for an example see Ossokina et al., 2020).

This is despite the multiple weaknesses and problems with POE and its current methodologies, that have been highlighted in the cited literature, and suggesting a range of developments from methodological improvements to complete paradigm shifts. On one hand, the criticism of POE is due to its unilateral preoccupation with performance, i.e. its tradition of narrowing user feedback into satisfaction along a pre-defined system of criteria in relation to building performance (Vischer, 2009). Hence, existing POE protocols with their standardized surveys fail to establish a dialogue between the stakeholders within the design process, making it more difficult to effectively integrate the knowledge gained from a previous project into the next (Vischer, 2009). Therefore, its results often lack transferability (Watson & Whitley, 2016). On the other hand, POE methodologies have been criticized for the way the user feedback is gathered, i.e. using MCA-based evaluation methods. Criticizing these techniques, Vischer (2009) emphasizes, that the "likes and dislikes" on a scale, do not provide information about the effectiveness of design decisions in relation to the outcomes, thus, according to Watson & Whitley (2016), failing to integrate feedback into the learning loops of design practice. Simultaneously, Mulgan et al. (2006) articulate, that the weakness of these MCA-based evaluation models is, that they do not offer any kind of monetary valuation, thereby being powerless to assist in the allocation of resources and thus lacking relatability for decision-making, which is predominantly based on economic considerations.

Based on these weaknesses, suggested directions for developing POE and its methodologies in the scientific literature have been to focus on the continuity of learning for better integration in the learning loops of design (Hay et al., 2018; Li et al., 2018; Watson & Whitley, 2016); to allow room for dialogue with stakeholders on identifying the evaluation criteria in each context (Hay et al., 2018; Li et al., 2018; Mulgan et al., 2006); to include a wider range of social impacts and values (Hay et al., 2018) such as well-being or sense of community besides satisfaction, and thus give greater attention to the internal dynamics between users and the building (Watson &

Whitley, 2016); and finally to improve the methods of quantification in a way, i.e. through valuation (Mulgan et al., 2006; Watson & Whitley, 2016), that provides a basis to assess the effectiveness of design decision (Vischer, 2009) and thus better support decision making in the design process based on economic considerations (Hay et al., 2018). Following these suggestions, the objectives of the present research include investigating the relationship between architectural design and value, through the quantification and economic valuation of its qualities identified by the different end-user groups (occupants). In doing so, a stated preference method-based survey is applied as an alternative to MCA-based user surveys, suggested in the review by Mulgan et al. (2006). That is because MCA-based techniques not only oversimplify user experience but also "disconnect" the investigated facilities or design elements/features/instruments from evaluating architecture as a whole, in which these parts interrelatedly create the contextual experience. Hence, preference towards a part is relative to the other parts, and thus to the whole. Architectural design can be evaluated based on the experiences of end-users in relation to a "baseline" constructed by their previous experiences. These experiences form their preferences, which can be quantified (as a measure of the value of design elements and the different constellations of those) through the perception of end-users as a relational system of evaluation (based on experiences) where trade-offs are made.

Besides reviewing POE and suggesting developing its concept and improving its methodologies, other academics propose a paradigm shift from POE/BPE to other frameworks for acquiring and integrating knowledge on post-occupancy building use and user experience/behaviour into the design as a basis for design decision-making (Vischer, 2009; Peavey & Wander, 2017). These frameworks are Evidence-based Design (EBD) and more recently Research Informed Design (RID).

Research Informed Design (RID)

Among practitioners within the building industry, the potential to close the learning loop between design and use (Whyte & Gann, 2001) in a 'POE-PROGRAMMING' cycle (Figure 1) is the recognized value of POE (Vischer, 2009), through which the long-term quality of the built environment can be ensured (Hay et al., 2018). However, even in the US and UK, where POE activities have the longest tradition, it has a low take-up among practitioners, due to various industry-related issues (Hay et al., 2018; Li et al., 2018). In the reality of the contemporary building industry, the integration of knowledge from user feedback into the design practice often does not happen (Vischer, 2009).

Vischer (2009) argues that a cause of this 'research-practice gap' (Moslehian et al., 2021) in POE is due to the weakness of the applied (MCA-based) evaluation methods, and a paradigm shift from POE to EBD is needed for bridging the gap. As the name

suggests, knowledge (as the accumulated information derived from feedback and collected systematically from building users (Vischer, 2009)) in EBD is based on *evidence* from *research*, i.e. 'predicated proof' of "how building users are affected by features of the physical environments they occupy" (Vischer, 2009, p. 241). One of the innovations of EBD is considered to be the "variety of behavioural outcomes that serve as measures of building performance and building effectiveness" (Vischer, 2009, p. 242) not only in terms of the technical parameters but in relation to human performance. Moreover, in an EBD approach, the design teams have the opportunity to identify what evidence is needed from research to be applied in the given project, i.e. to "locate the research problem in the context of the design problem and construct the study specifically to yield results that will solve the problem" (Vischer, 2009, p. 244). In comparison to a traditional POE, it is argued that the EBD approach depends on a more scientific paradigm, as it requires the formulation and testing of hypotheses regarding the relationship between design and use/experience/behaviour (Vischer, 2009). Accordingly, Evidence-based Design is defined as "the conscientious and judicious use of current best evidence related to the physical environment's effects on wellbeing, and its critical interpretation, to make significant design decisions based on sound hypotheses (concepts) related to measurable outcomes, for each unique project" (Salvatore, 2006). Due to the underlying system of inquiry in EBD research, which originally was developed from evidence-based medicine, it is not surprising, that it has been mainly adopted in the design of healthcare facilities, applying knowledge from areas of research such as environmental psychology (e.g. Groat, 1982) and the combined field of neuroscience and architecture (e.g. Djebbara et al., 2022 or Fich et al., 2014). While POE studies seldom provide *evidence* due to the lack of demonstrating the relation between elements of design and use/behaviour/experience, it does *generate* knowledge through research, as opposed to the EBD approach, which relies on existing knowledge databases (Peavey & Vander, 2017).

Besides the obvious, that EBD only works if the required evidence exists, the approach has been critiqued for its rigidity and misuse (Peavey & Vander, 2017). Consequently, practitioners have started moving towards RID, as they believe it more accurately describes their practice of acquiring and integrating knowledge into their design practice (Peavey & Vander, 2017). Instead of proposing an alternative to POE, the notion of RID incorporates POE in a wider integrated design framework as an alternative to BPE (Figure 2). Research Informed Design is "the process of applying credible research in integration with project-, client-, or population-specific empirical inquiry to inform the creation of environmental design and achieve project objectives" (Peavey & Vander, 2017). While RID shares considerable overlap with the concept of EBD in terms of its purpose to support design decisions with information, an essential difference is, that the RID approach does not limit the source of

knowledge to evidence from existing research but incorporates the process of new knowledge generation (defined as research in its name) (Peavey & Vander, 2017). Furthermore, the system of inquiry in an EBD approach is inherently deductive (hypothesis identification and testing), while RID provides room for other types of knowledge inquiry.

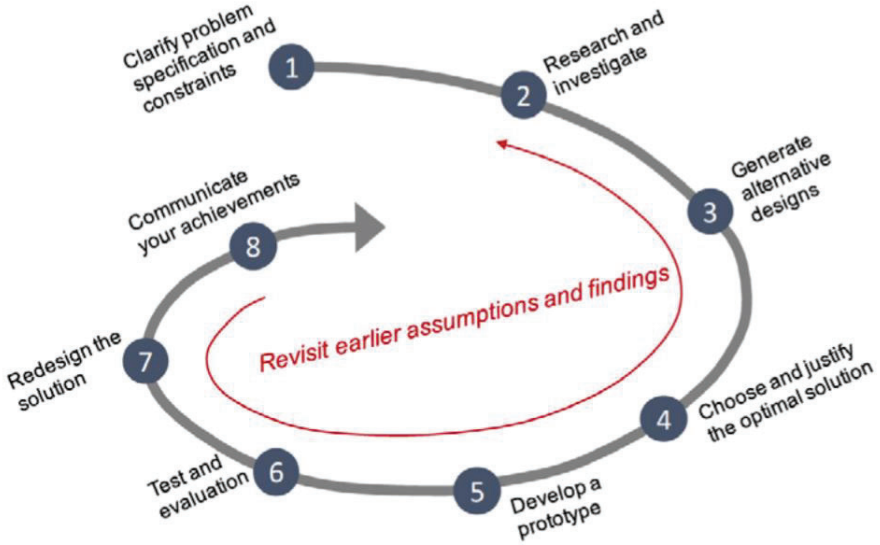


Figure 2. (Research) Informed Design Process (Source: Strimel et al., 2019, p. 34).

It can already be seen from these developments that there is a need for evaluation frameworks that provide relevant, and preferably directly applicable, information for architects, possibly reaching over and thus expanding their field-specific knowledge. Due to the complexity of the challenge presented to architects in addressing sustainability, combining fields for evaluating architecture could be a solution to potentially provide a better (more informed) basis for design decision-making in a design process including multiple stakeholders with various interests, and different constraints. In the attempt to develop and test such an alternative *interdisciplinary* methodology for acquiring knowledge on how buildings are used, perceived, and valued by the building users after occupancy, this research exploits the potential of RID in providing an opening for more pragmatic approaches by combining perspectives (academia and industry), disciplines (architecture, anthropology, and economics), and methods (qualitative and quantitative). Such information would potentially provide richer contextual evidence for efficient design decision-making in future practices. It is however important to note, that this agenda of the present work

is more research- than practice driven, i.e., it is limited to the research and development of a new technique for knowledge generation, as an isolated approach, investigating post-occupancy cases retrospectively. This is mostly because while the academic literature on building assessment methods and informed design decision-making is moving rapidly from POE to newer and newer concepts and paradigms, in practice, POE itself is still considered an innovation (Li et al., 2018). Considering the continuous development of the concept and methodologies of POE in practice, what the academic literature nowadays calls RID, may be easily still called POE in the future in practice. As it is articulated in the POE review of Hay et al. (2018) a focus on the wider impacts, embracing both quantitative and qualitative data-based knowledge on not only the technical but also the sociocultural aspects in relation to the use of space is what is seen as "the unique contribution of architects in developing the POE agenda" (p. 706). Expanding the concept of POE in this way (closer to RID) is expected to be a better fit for the experimental and creative nature of the architectural practice.

While the present research does not focus on the dynamics of design decision-making *per se*, i.e. how knowledge from research is integrated back into design in the current architectural practice, it is practice-oriented in terms of methodology development and testing. As an industrial research hosted by AART, and where building projects are investigated in a Danish context, it is thereby relevant to review the state-of-the-practice in Denmark and at AART, in terms of sustainability and post-occupancy evaluation in the following part.

State-of-the-practice in Denmark

Founded in 2010, the GBC in Denmark (DK-GBC) as a non-profit organization is responsible for the promotion of sustainable building practices. In doing so, they use the certification scheme DGNB (developed in Germany), as a "transformative driver", and train DGNB consultants and auditors to certify buildings as well as urban city districts (stateofgreen.com; 2023.04.28). The DGNB certification system is based on a stepwise – bronze, silver, gold, platinum – classification according to the summarized performance score upon the evaluated sustainability parameters of a project (building or urban district) (Green Building Council Denmark, rfbb.dk; 2023.04.28). Additionally, as a response to new trends within sustainability, the DGNB certification system gives extraordinary recognition 'badges' for architectural quality (DGNB 'Diamond'), in terms of the "classical architectural virtues – usability, durability, and beauty" (Green Building Council Denmark, rfbb.dk; 2023.04.28); exceptional efforts to improve health and well-being (DGNB 'Heart') in terms of indoor climate parameters and in relation to access to nature (Green Building Council Denmark, rfbb.dk; 2023.04.28); and since 2023 also for exceptional efforts in relation

to selected environmental aspects (DGNB 'Planet'), such via a Life-Cycle Analysis, a yearly updated Biodiversity Strategy, and an Energy Use Report (Green Building Council Denmark, rfbb.dk; 2023.04.28). Despite the initiative to recognize design efforts for these selected topics, they remain within the realm of design intent, i.e. evaluation based on expected performance.

Reacting to the need to document the outcome of building projects, 'best practice' approaches from the Danish architectural practice were collected by the Danish Association of Architectural Firms along with a proposal for a holistic framework for reporting the social, environmental, and economic values of architectural works (Broch et al., 2017; Sattrup, 2020). While emphasizing the importance of such evaluation practices, it is also described, that the strategic application of such approaches in practice remains a challenge (Sattrup, 2020).

As a response, DK-GBC offers POE as an online available tool (called 'POE platform') since late 2022. Inspired by the BUS survey the Danish POE questionnaire (available in Danish on the website of DK-GBC: rfbb.dk) seems to incorporate all the weaknesses of a traditional POE, which has already been criticized and identified as a barrier to its take-up in practice in the UK (Li et al., 2018), where it indeed has a much longer tradition. Since there are currently no scientific publications on the Danish POE platform project, details of its development, key findings from its testing, and the potential efforts put into its improvement based on the learning from previous POE frameworks remain unshared. This is despite a growing body of academic research in Denmark, that already showed ways to evaluate architecture from a user perspective (Johansson, 2018) and discussed the possible integration of POE into DGNB (Jensen & Troelsen, 2017; Stender & Walter, 2019), along with a range of architectural anthropological studies providing rich interdisciplinary information on the interrelation between buildings and users (e.g. Stender & Jepsen, 2021; Mechlenborg & Hauxner, 2021; or Winther, 2020).

The uneven focus on the different – social, environmental, and economic – aspects of sustainability is also reflected in the Danish building industry and potentially enhanced further by the new requirements for Life-Cycle Cost (LCC) calculations and Life-Cycle Analysis (LCA) reports of building materials. The integration of lifecycle models contributes to measuring the environmental and economic impacts via an account of the flow of materials and resources throughout a building's lifestyle, thus integrating and utilizing the concept of circular economy in practice (Webster, 2017). On the contrary, circular approaches for measuring the social and economic impacts, in the form of e.g. "social life-cycle analysis (S-LCA)" (Larsen et al., 2022) are only currently under research and development.

The practice of AART architects

As an attempt to generate knowledge on the multidimensional impacts of their design projects on the various end-user groups, AART employs a multidisciplinary team of specialists ('Impact Team'), who revisit and evaluate their buildings post-occupancy. For this, they use their own developed tool, the Impact Compass™. Differing from the multiple, already existing MCA-based tools available, the Impact Compass™ is not only an analytical but also a communication tool, that shows the relationship between architectural design instruments, user experience/behaviour, and the overall social, environmental, or economic impacts relevant to the assessed project and its context (Figure 3). The tool was first launched in 2021 (a year after this research commenced) and has been utilized since for evaluating means and ends in architectural design to qualify or justify some of the construction choices made by architects in the design phase. Following the current development directions of POE-type activities to focus on continuity, the evaluation practice of AART starts with an "architectural analysis" together with the project-leading architect. Through this exercise, in practice, the Impact Compass™ is initially used to uncover the main design intentions in relation to the chosen architectural design instruments, i.e. to elaborate on the intended or expected relationship between these instruments (design elements) and the users' experience and behaviour as specifically as possible (Figure 3). After this architectural analysis is performed, the Impact Compass™ is filled with the identified main intentions and their hypothetical (envisioned) impact (Figure 3), providing the basis for a case-specific research design for empirical data collection. When data has been collected from building users post-occupancy, the Impact Compass™ serves as a tool to analyze the empirical data (qualitative and/or quantitative) in a systematic way, i.e. in relation to the design elements. Ultimately, it is used to communicate the results both internally, and externally, to inform and improve future design toward enhanced social quality and value, as a strategic business goal.

To support this practice, AART's Impact Team also employs a group of industrial researchers, who continuously develop the methodologies applied in their 'impact practice'. In fact, the Impact Compass™ was developed simultaneously with an ongoing PhD research, starting in 2016 on promoting the well-being of inhabitants within the sustainable renovation of social housing (Jensen, 2022). In her research, Jensen explored a range of architectural strategies, from intuitive qualitative approaches (combining architecture and anthropology) to metrics intended for computer simulations (combining architecture and engineering), to inform the practice on social value, in terms of occupant well-being, within the frame of RID. Ongoing PhD research at AART involves investigating the potential of 'Social Commissioning' as an anthropological approach to and further development of POE,

focusing on the dynamics of the interrelation between buildings and users (Rasmussen et al., 2022).

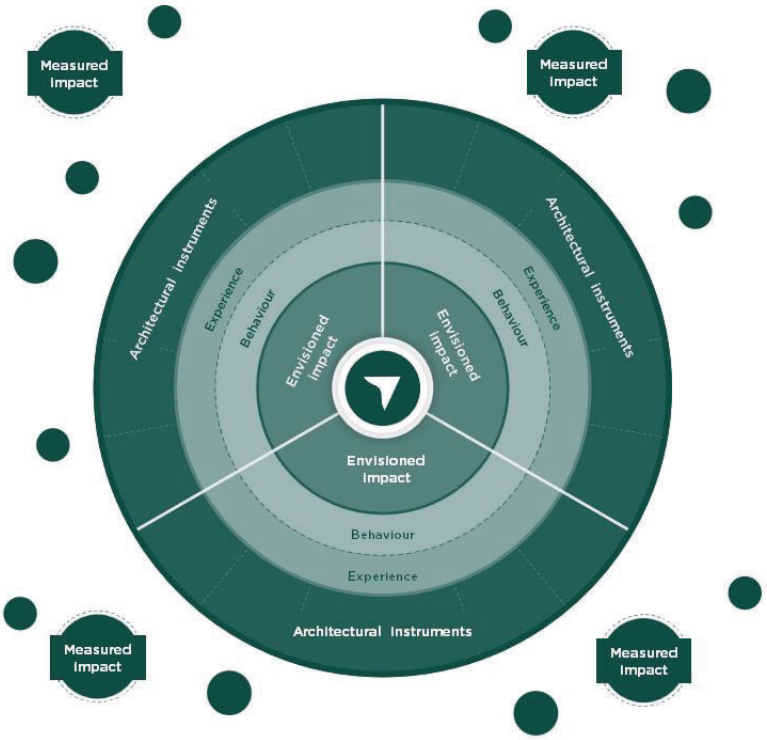


Figure 3. The Impact Compass™ developed by AART (Source: aart.dk/Effektkompas).

The present PhD research, as part of the 'impact work' of AART, is focusing on exploring new methodologies for evaluating architectural design quality in relation to value, parallel to the ongoing application and development of the Impact Compass™ by the team. Likewise, the goal of this research is to develop, test, and evaluate an alternative methodological framework to existing POE practices. The framework proposed within the present research shares some similarities with the compass, by incorporating some of the existing methodologies and methods applied regarding the architectural analysis and the consecutive exploration of the narratives of the everyday experience of end-users in selected building projects post-occupancy. In addition, the present research aims at exploring a further step towards the quantification of the social value potentials, by applying an overall socio-economic understanding of value within the impact framework. Furthermore, while the Impact

Compass™ is based on the more general theory (change theory (*forandringsteori*), Christensen & Krogstrup, 2017), the framework proposed here builds on an architectural theoretical approach, thereby potentially making it easier for architects to understand and thus integrate it into their practice in the future. The next section introduces the architectural theoretical approach, hereby an overview of the relevant architectural theories, providing the basis of the framework. Paper 1 in Chapter 2 provides further details on the development of the framework.

1.2 Architectural theoretical approach

In the late 20th century, various architectural theories, such as tectonic theory and post-modern theory, re-emerged and emerged as a critical response to modernism. The relevance of these theories in the contemporary building industry lies in addressing the desire to transfer meaning through the built form (Picon, 2013), an aspect that is considered essential for articulating and communicating value potentials as a measure of quality (Sántha, Hvejsel, & Rasmussen, 2022). A common point of departure of these theories is that they emphasize the importance of the sociocultural context and our experience of the built environment, thus rejecting the modernist idea of a single, authoritative architectural language (Groat, 1982) reducing the "experience of architecture to facts and properties" (Bhatt, 2000, p. 230). Based on this perspective, these theories have the potential to provide a conceptual basis for an alternative methodological framework for studying the interrelations between architectural design and the experiences of end-users, post-occupancy. The present section discusses the potential of tectonic theory in this regard, through its historical development across stylistic periods, in comparison to other architectural theories emerging in the post-modern era (post-modern theories).

As critical means for analysis, the notion of tectonics has been continuously developed and used to analyze the expressive qualities, i.e. value potentials of architectural works released by the specific design choices made on the nuances of their construction throughout stylistic periods (Hvejsel, 2018). The phrase 'tectonic' originates from the ancient Greek *tekton* (later *architekton*) describing the complex task of combining technique and aesthetics, a task deeply founding the profession of architecture (Frampton, 1995). Hence, the concept was developed in an attempt to arrive at a general architectural theory (independent of stylistic or technological eras and paradigms) in the 19th century (Bötticher, 1844; Semper, 1989) with the objective to understand classical Greek architectural expressions in relation to the design intent, i.e. the meaning, carried in those as a correspondence between form and construction (Hvejsel, 2018). Starting from the late era of modernism in the mid-20th century, many architects, philosophers, and historians were engaged in the

reconciliation of the meaning and the embodied experience of space as a criticism of the "functional determinism" of the modern movement (Bhatt, 2000). Proponents of a phenomenological approach in architecture all emphasized the importance of experience engendered by architecture through our emotional response to its visible and sensible structure (Bachelard, 1994; Lefebvre, 1991; Norberg-Schultz, 1979; Pallasmaa, 2012). The concept of tectonics reemerged with the rise of the phenomenological movement influencing the development of tectonic theories. In his seminal essay "Structure, Construction, Tectonics", Eduard F. Sekler (1964) provided a phenomenological exploration of the potential of tectonics in transferring meaning through 'gesturing forms'. According to Sekler (1964), the term tectonics describes those expressive qualities of the visual result that has an effect on us beyond mere aesthetics, that cannot be described by structure or construction alone. Emphasizing the expressive potential of building techniques and materials, i.e. the potential to transfer meaning through built form, tectonic theory was concurrently applied for analyzing the specific design choices made on the nuances of construction with the specific aim to describe their design quality from an architectural perspective (see e.g. Frampton, 1995; Frascari, 1981). Denoting tectonics as 'poetry of construction' Frampton reinforces the phenomenological understanding of the notion simultaneously aspiring to "the imagination of the architect and the perception of the inhabitant" (Hvejsel, 2018). Grasping the potential connection between architect and inhabitant through 'gesturing forms', the term tectonic gesture or spatial gesture has been denoted in interior studies to relate construction and form to the human scale (see eg. Hvejsel, 2018; Postiglione & Lupo, 2007). It can therefore be argued, that tectonics provides a way to understand architecture as a correspondence between detail and whole focusing simultaneously on the technical, ecological, and socio-cultural dimensions of its construction, allocating the physical resources to maximize the expressive capacities (Bech-Danielsen et al., 2014; Hvejsel & Beim, 2019). In doing so, tectonic theory holds the potential to investigate those correspondences not only from an architectural perspective but also in combination with the various branches of social sciences, in an integrated, i.e., interdisciplinary way.

Building on the same phenomenological ground, post-modern theories emphasize the subjective dimension of the experience of architecture, where experience is considered to be constructed through perception as a cognitive process. The key characteristic of post-modernism is the notion of 'dual coding', comprising a professional or elite code (of architects) and a layman code (of non-architects) (Jencks, 1978). Coding is based on a set of socio-cultural factors by which people construct meaning, and thus perceive a work of architecture. Thus, e.g. codes allow us to "hypothesize the psychological response of the people who experience those

buildings" (Groat, 1982, p. 4, referring to Jencks, 1978). Not surprisingly, this perspective has provided a basis for several environmental psychological studies within architecture (Groat, 1982). This shows that post-modern theories also hold the potential to assess and discuss architecture from an interdisciplinary perspective.
Though, to use these theories as a basis for an interdisciplinary methodological framework for evaluating architectural design quality, where quality is defined through the value it holds to the occupants, it is necessary to understand experience not only through the cognitive process of perception but also through perception as a form of evaluation to construct meaning, that comprises preferences. Hence, the present research is interested in investigating the relationship between design and value through experience in relation to the architectural decisions made on the specific architectural instruments comprising each design solution. Thus, linking the value of these instruments back to the construction and thereby to the resources applied. Therefore the problem with the postmodern theoretical perspective in this regard is not that it sheds light on the diversity of our experiences and the impact of the sociocultural context defining the construct of our preferences (which is also promoted from a tectonic perspective), but that it neglects to discuss everyday experience based on perception as a form of judgment and objective evaluation (Bhatt, 2000) of the built reality. As argued by Bhatt (2000), "such an attitude overlooks the basic evaluations inherent in our capacity to notice things, to make comparisons, to posit connections, and to see architectural forms as intelligible wholes" (p. 236). It is furthermore argued by Bhatt, that understanding perception as a form of rational evaluation to experience is elemental to architectural criticism, hence, in the context of this research, to the assessment of architectural quality.

Departing from these works and considerations, the PhD research builds on the potential of tectonic theory to facilitate a critical discussion on the choices made in the architectural design process within an interdisciplinary framework for evaluating architectural quality based on the outcomes, as experienced and thus valued by the building users. Unfolding this relationship entails an exploration of the experiences through qualitative narratives as well as quantitative and monetary expression values built on those. The present research emphasizes the phenomenological understanding of tectonics, which is considered to provide a link to explore the narratives of everyday experiences of users (an anthropological perspective) through the applied qualitative methods. Thereby addressing the need to develop POE methodologies in a way, that establishes a dialogue to define and identify what qualities, i.e. value potentials are relevant to assess in each case both from an architectural and end-user perspective. Consequently, understanding user experiences through perception, which is also a process of rational evaluation, is considered to provide a link further to quantify preferences based on those

experiences and to express their utility-based value in monetary terms, using economic valuation methods based on welfare economic principles. Thereby also addressing the need to develop existing methodologies in a way that is aligned with the economic nature of decision-making in the building industry.

1.3 Hypothesis, research questions, and objectives

The previous sections of this introductory chapter have served the purpose to situate the research within the wider academic discussion on improving existing frameworks and assessment approaches for evaluating architectural design post-occupancy to improve design quality within the social dimension of sustainable urban development. It was also presented, that in practice, the same research need derives from the challenge experienced by architects at AART in translating from immediate construction costs to long-term value potentials in the design process, which often causes a discrepancy between means and ends. Addressing this challenge entails the research and testing of new approaches for understanding, quantifying, and reporting the social value potentials of design as an indicator and measure for its quality in a systematic way and in combination with other disciplines. Hereby, investigating the choices made on the specific architectural instruments in detail within a building scale. Accordingly, the **overall research question** is:

How, and to what extent can we describe and valuate architectural design based on its potential for value creation on the social dimension in a sustainable urban development context?

The potential of tectonic theory to critically discuss the link between means and ends in design by understanding the expressive capacities as qualities released by the specific design choices has already been investigated in recent research within the disciplines of architecture (Hvejsel, 2018), landscape architecture (Dam, 2007), and urban design (Christiansen, 2020). Within the present research, this potential of tectonic theory is investigated in an *interdisciplinary* setting. Through an integrative approach, this entails a combination of perspectives from architecture, anthropology, and economics in developing a systematic methodological framework for evaluating architectural quality based on its potential to create value for end-users as part of society.

In its capacity as a spatial pronunciation of specific construction choices, it is the **overall hypothesis**, that tectonics holds the potential to relate the architecturally chosen design instruments (architectural perspective) to utility-based social value through preference (economic perspective), that is based on the diverse and subjective experience of the designed space and interrelations happening within it (anthropological perspective). Departing from tectonic theory, the task of the architect is understood as being a facilitator between objective space (structural, static) and subjective place (experience-based, dynamic) through the means of tectonic expressions via constructed *spatial gestures* (elaborated in Sántha, Hvejsel, & Entwistle, 2022). This understanding is inspired by Sekler's phenomenological exploration of the potential of tectonics in transferring meaning through 'gesturing forms' and the direct gesturing correspondence between structure and form in the notion of 'dressing' employed by Semper. Also, the term *gesture,* as a reference to the human body language, is described in interior design studies as means of "transporting atmospheres" (Albertsen, 2012) as a "nuanced spatial language" (Sántha, Hvejsel, & Rasmussen, 2022). Furthermore, it has been applied as means to describe the envisioned and experienced spatial quality of the architectural form (Hvejsel 2018, p. 402). Building on these works, the term gesture in this research is understood as means for communicating the meaning, i.e. the envisioned experience and use of space, through the specific choices made on the design features (architectural instruments).

Using the term gesture as a 'traveling concept' (an interdisciplinary "language" (Darbellay, 2012)) across architecture, anthropology, and economics (Figure 4), the **objective** of the research is to develop an interdisciplinary methodological framework for acquiring knowledge of the relationship between architectural quality and value, through the practices and experiences of different end-user groups. This entails the application of tectonic theory in testing the framework in a post-occupancy case study of buildings designed by AART. Thereby, and specifically through the notion of gesture, the aim is to link tectonics directly to the "human scale", enhancing its potential to emphasize the socio-spatial context of design and form, rather than its technical details alone, from an exclusively architectural perspective.

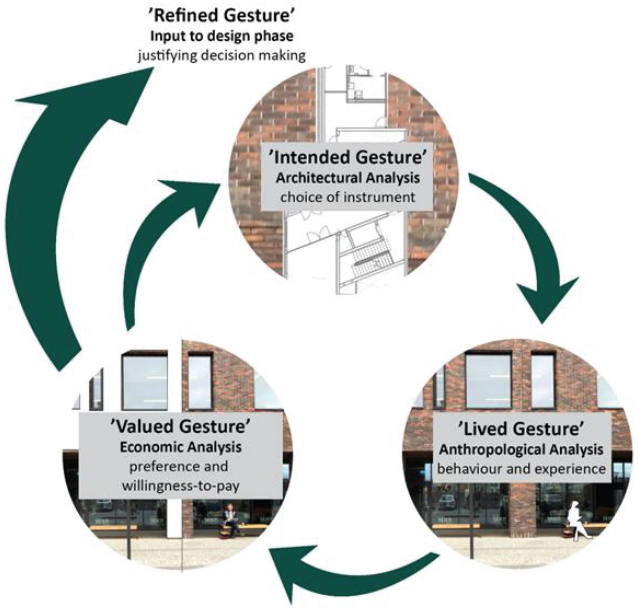


Figure 4. 'Gesture' as a traveling concept across the disciplines of architecture, anthropology, and economics in the first draft of the framework (illustration made by Marie Frier Hvejsel).

Accordingly, a hypothesis within the proposed tectonic methodological framework is, that there is a demonstrable link between architectural design (architecture) and the economic value of its qualities (welfare economics), but also leaving room to unfold the context (anthropology) of this relation. Based on an integrative interdisciplinary approach, the framework is tested through three interrelated studies (analyses), corresponding to each of the – architectural, anthropological, and economic – perspectives. To address the overall research question and hypothesis outlined above, these studies seek to answer the following three sub-research questions:

1. How and to what extent architects have worked explicitly with the construction of spatial gestures to generate value for different user groups in the design process? (Architectural analysis)
2. How do people react to the intended architectural gestures within and around the building; what and why do they value in the design? (Anthropological analysis)
3. How can we translate users' reactions to those gestures into economic value through their behaviour? (Economic analysis)

Following sub-research question 1, the objective of the "architectural analysis" is to map how architects have worked with 'intended gestures' and how they intended to create value by a set of architectural instruments, through a formulation and spatial communication of these gestures in each of the two cases included in the research. Then, according to sub-research question 2, the objective of the "anthropological analysis" is to map the 'lived gestures', i.e. to unfold whether and how the gestures intended by architects, in a given context of the built reality, perceived and experienced by the end-users, and thus potentially translate to value. Finally, addressing sub-research question 3, the objective of the "economic analysis" is to express the monetary value of those gestures, in the form of 'valued gestures', measured by the end-users 'willingness-to-pay', based on their preferences from experience, considering the trade-offs between the different design elements, and the price.

1.4 Overall contributions and significance

The PhD research project contributes to the existing research in architectural quality and its social and socio-economic value in an urban development context by scaling down to analyze and valuate architectural design details within a building scale. In doing so, the research focuses on the spatial gestures communicated by the architects and perceived by the end-user via the specific design, rather than on the built form, and its details alone. The research is a case study of two building projects designed by AART, describing, modelling, and quantifying their potential social value created by the specific architectural instruments chosen in their design process after the buildings have been taken into use for some years. The project takes an interdisciplinary approach and combines perspectives from architecture, anthropology, and economics. Hence, the project translates architectural quality identified from an architectural point of view into value quantified by welfare economic methods, through a qualitative exploration of the experiences and practices of end-users.

Thus, the project contributed to academic research by developing and extending the existing knowledge and application of tectonic theory in architecture towards a potential "tectonics of cost and value". Furthermore, the application of the framework within economics provides insights into the future design of discrete choice experiments, aiming to quantify end-user preferences for architectural design solutions as measured by their willingness-to-pay. By combining both qualitative and quantitative methods in a systematic way of linking quality to value, the project promotes research collaboration between the disciplines of architecture and anthropology, as well as of anthropology and economics on architecture as a topic.

The project furthermore contributes to the development of the current architectural practice at AART by describing architecture at the intersection of what it is and what it does, challenging the tendency to define the value of design primarily based on its aesthetical qualities (form) and in relation to its short-term construction costs. Combining the results of the analyses provides a new interdisciplinary strategy to inform the practice on the social and socio-economic value of architectural design in an urban development context, which can be applied strategically in architectural consulting and thereby supporting and improving the current decision-making process. This also provides a direction for the architects at AART to retain a continuous critical practice within the contemporary building industry, by critically investigating, documenting, and consequently re-evaluating the choices made in the construction, based on their impact on different end-users. Through the discussion and evaluation of the applied framework, it was also addressed, that the combined results of the analyses should be interpreted and used with caution, based on the identified limitations, and experienced challenges concerning the chosen methods, scale, level of detail, and the context of the strategically selected post-occupancy cases included in the study. Nevertheless, using a systematic and interdisciplinary methodological framework with qualitative evidence and quantified measures the architects can experiment with different design concepts to see what constellation of architectural instruments (constructed as spatial gestures) works in reality, and what does not. This conscious focus on the nuances of design, studying the potential effect of small incremental adjustments, can potentially clarify the arguments for specific design solutions and thus may expand architects' scope of action in the design process. While on a broader perspective, this may contribute to shaping the contemporary building culture significantly, without suppressing the qualitative dimensions of architecture in the long run. Thus, potentially narrows the gap between means and ends by enhancing the architects' ability to translate from cost to value in architecture, to justify and qualify design choices, potentially securing architecture's capacity for contextual value creation on the social dimension of sustainability over time.

References

Albertsen, N. (2012). Gesturing atmospheres. Paper presented at the *Congress on Ambiances, Montreal,* 2012. Montreal, Canada.

Bachelard, G. (1994). *The poetics of space*. Beacon Press.

Bech-Danielsen, C., Beim, A., & Madsen, U. S. (2014). *Towards an ecology of tectonics: The need for rethinking construction in architecture*. Edition Axel Menges.

Bhatt, R. (2000) The Significance of the Aesthetic in Postmodern Architectural Theory. *Journal of Architectural Education*, 53(4), 229-238.

Bötticher, C. G. W. (1844). The principles of the Hellenic and Germanic ways of building with the regard to their application to our present way of building. In H. F. Mallgrave (Ed.), *In what style should we build? The German debate on architectural style* (pp. 147-167). Getty Publications.

Broch, N. R., Sattrup, P. A., & Sejr, K. (2017). In K. Sejr (Ed.), *Architecture creates value*. Danish Association of Architectural Firms.

Brundtland, G.H. (1987) *Our Common Future: Report of the World Commission on Environment and Development*. Geneva, UN-Document A/42/427.

Christensen, N. L. S., & Krogstrup, H. K. (2017). At arbejde med forandringsteori: Praktikeres guide til brug af forandringsteori i projektudvikling og evaluering (2nd ed.). Aalborg University.

Christiansen, E. M. (2020). *Tectonics and the city: In search of a critical perspective on assembling the city.* Aalborg University Press.

Dam, T. (2007). Does tectonics make meaning in landscape architecture? Paper presented at the *Tectonics Making Meaning Conference*, 2007. Eindhoven, Netherlands.

Darbellay, F. (2012). The circulation of knowledge as an interdisciplinary process: Travelling Concepts, Analogies and Metaphors. *Issues in Integrative Studies*, 30, 1-18.

Denmark Green Building Council. Retrieved April 2023, from https://www.rfbb.dk.

Djebbara, Z., Jensen, O. B., Parada, F. J., & Gramann, K. (2022). Neuroscience and architecture: Modulating behavior through sensorimotor responses to the built environment. *Neuroscience & Biobehavioral Reviews,* 138.

Emerson, J., Wachowicz, J., & Chun, S. (2001). Social Return on Investment (SROI): Exploring Aspects of Value Creation. *Working Knowledge: Business Research for Business Leaders* (Archive). Harvard Business School. Available at: https://hbswk.hbs.edu/archive/social-return-on-investment-sroi-exploring-aspects-of-value-creation#3.

Fabian, L. (2016). The spatial, the social and the architectural. In B. B. Jensen, & K. L. Weiss (Eds.) *Art of many, the right to space: The Danish pavilion - Bienniale Architettura 2016* (pp. 189). DAC, The Danish Architectural Press.

Federal Facilities Council (FFC) & National Research Council (NRC). (2002). *Learning from our buildings: A state-of-the-practice summary of post-occupancy evaluation*. Technical Report No. 145. National Academies Press.

Fich, L. B., Jönsson, P., Kirkegaard, P. H., Wallergård, M., Garde, A. H., & Hansen, Å. (2014). Can architectural design alter the physiological reaction to psychosocial stress? A virtual TSST experiment. *Physiology & Behavior,* 135, 91-97. DOI:10.1016/j.physbeh.2014.05.034.

Frampton, K. (1983). Towards a critical regionalism: Six points for an architecture of resistance. In H. Foster (Ed.), *The anti-aesthetic. Essays on postmodern culture*. Bay Press.

Frascari, M. (1981). The tell-the-tale detail. In G. R. Owens, & E. K. Katić (Eds.), *Semiotics: The proceedings of the semiotic society of America* (pp. 325-336). Philosophy Documentation Center.

Groat, L. (1982). Meaning in post-modern architecture: An examination using the multiple sorting task. *Journal of Environmental Psychology*, 2(1), 3-22. DOI:10.1016/S0272-4944(82)80002-9.

Groat, L. N., & Wang, D. (2013). *Architectural research methods* (2nd ed.). Wiley.

Hay, R., Samuel, F., Watson, K. J., & Bradbury, S. (2018). Post-occupancy evaluation in architecture: Experiences and perspectives from UK practice. *Building Research and Information: The International Journal of Research, Development and Demonstration,* 46(6), 698-710. DOI:10.1080/09613218.2017.1314692.

Hvejsel, M. F. & Beim, A. (2019). Circular tectonics? – A critical discussion of how the architectural discipline can drive ecological continuity. Paper presented at the *Fourth International Conference on Structures and Architecture,* ICSA2019*,* Lisbon, Portugal.

Hvejsel, M. F. (2018). Gesture & principle: Tectonics as critical method in architecture. In I. W. Foged, & M. F. Hvejsel (Eds.), *Reader: Tectonics in architecture* (pp. 395-409). Aalborg University Press.

Jencks, C. (1978). Post-Modern history. *Architectural Design*, 1 (78), 13-58.

Jensen, M. B. V., & Troelsen, M. (2017). *Adding value to the social dimension of sustainable building.* Aalborg University Press.

Jensen, S. R. (2022). *Architectural strategies for promoting well-being in sustainable renovation of social housing*. Aarhus University Press.

Johansson, J. (2018). *Evaluering og arkitektur: Brugere, interview, analyse og fænomenologi* (1st ed.). RUM.

Landon, R. (2016). *Aravena's "reporting from the front" is nothing like koolhaas' 2014 Biennale – But it's equally as good.* ArchDaily. Retrieved 7 Apr 2020, from https://www.archdaily.com/789409/aravenas-reporting-from-the-front-is-nothing-like-koolhaas-2014-biennale-but-its-equally-as-good.

Larsen, V. G., Tollin, N., Sattrup, P. A., Birkved, M., & Holmboe, T. (2022). What are the challenges in assessing circular economy for the built environment? A literature review on integrating LCA, LCC and S-LCA in life cycle sustainability assessment, LCSA. *Journal of Building Engineering,* 50.

Lefebvre, H., & Nicholson-Smith, D. (1991). *The production of space*. Oxford Blackwell.

Li, P., Froese, T. M., & Brager, G. (2018). Post-occupancy evaluation: State-of-the-art analysis and state-of-the-practice review. *Building and Environment* (Preprint). DOI:10.1016/j.buildenv.2018.02.024.

Litman, T. (2010). *Sustainability and livability: Summary of definitions, goals, objectives and performance indicators*.

Macmillan, S. (2006). Added value of good design. *Building Research & Information*, 34(3), 257-271. DOI:10.1080/09613210600590074.

Mechlenborg, M., & Hauxner, K. (2021). Boligliv i højden: Ny viden om boligmiljø og socialt liv i de danske højhuse. Aalborg University Press.

Moslehian, A. S., Kocaturk, T. & Tucker, R. (2021). An integral view of innovation in hospital building design: understanding the context of the research/practice gap. *Building Research & Information*, 49(3), 265-280. DOI:10.1080/09613218.2020.1740577.

Mossin, N., Stilling, S., Bøjstrup, T., Larsen, V. G., Blegvad, A., Lotz, M., & Rose, L. (2018). *An architecture guide to the UN 17 sustainable development goals*. KADK. Available at: https://kadk.dk/sites/default/files/downloads/article/un17_guidebook_single_page_low.pdf.

Mulgan, G., Potts, G., Audsley, J., Carmona, M., De Magalhaes, C., Sieh, L., & Sharpe, C. (2006). *Mapping value in the built urban environment*. The Young Foundation.

Norberg-Schulz, C. (2019). Genius loci: Towards a phenomenology of architecture (1979). *Historic Cities: Issues in Urban Conservation,* 8, 31.

Ossokina, I. V., Arentze, T. A., van Gameren, D., & van den Heuvel, D. (2020). Best living concepts for elderly homeowners: Combining a stated choice experiment with architectural design. *Journal of Housing and the Built Environment,* 35(3), 847-865.

Pallasmaa, J. (2012). *The eyes of the skin* (3rd ed.). Wiley.

Peavey, E., & Vander K. B. W. (2017). Evidence-Based Design and Research-Informed Design: What's the Difference? Conceptual Definitions and Comparative Analysis. *Health Environments Research & Design Journal*, 10(5), 143-156.

Picon, A. (2013). Architecture, Innovation, and Tradition. *Architectural Design*, 83, 128-133. DOI:10.1002/ad.1535.

Postiglione, G., & Lupo, E. (2007). The architecture of interiors as re-writing of space: Centrality of gesture. In J. Gigli (Ed.), *Thinking inside the box: A reader in interiors for the 21st century* (pp. 145-154). Middlesex University Press.

Preiser, W. F. E. (2005). Building Performance Assessment: From POE to BPE – A Personal Perspective. *Architectural Science Review*, 48, 201-204. DOI:10.3763/asre.2005.4826.

Preiser, W. F. E., White, E., & Rabinowitz, H. (1988:2015) *Post-Occupancy Evaluation* (Routledge Revivals, 1st ed.). Routledge.

Rasmussen, M. K., Entwistle, J. M. K., Stender, M., & Petersen, S. (2022) Wellbeing at the office: An anthropological approach to POE. Paper presented at *5th International Conference on Structures and Architecture*, ICSA2022 July. Aalborg, Denmark. Available at: https://www.icsa2022.create.aau.dk/digitalAssets/1162/1162340_icsa2022_full-program_27-june-2022-final.pdf.

Rönn, M. (2011) Quality in Architecture – A Disputed Concept. Paper presented at *Considering Research: Reflecting upon current themes in Architecture Research*, ARCC2011, April. Detroit, United States. Available at: https://www.researchgate.net/publication/277744433.

Room60. (2010, July 29). *I want to be a landscape architect...* [Video]. YouTube. https://www.youtube.com/watch?v=zbx3FDDNeQM.

Rouse, R. (2004) Measuring value or only cost: the need for new valuation methods. In S. Macmillan (Ed.): *Designing Better Buildings* (pp. 55-71). E&FN Spon.

Salvatore, A. (2006). Evidence-based design development update. Paper presented at *Healthcare Design*. Available at: https://www.healthdesign.org/education/conf/.

Sántha, E., Hvejsel, M. F., & Entwistle, J. M. K. (2022). Tectonics of human well-being: Describing architecture in terms of constructed spatial gestures and their impact. *Architecture, Structures and Construction,* 1(14), 599-612.

Sántha, E., Hvejsel, M. F., & Rasmussen, M. K. (2022). Lost potentials? – Unpacking the tectonics of architectural cost and value. *Nordic Journal of Architectural Research,* 34 (1), 89-118.

Sattrup, P. A. (2020). Documenting value creation: A business opportunity for architects, their clients, and society. *Architectural Design,* 90(4), 22-29. DOI:10.1002/ad.2586.

Sekler, E. F. (1964). Structure, construction, tectonics. In G. Kepes (Ed.), *Structure in art and in science* (pp. 89-95). Studio Vista.

Semper, G. (1989). *The four elements of architecture* (2nd ed.). Cambridge University Press.

State of Green. Retrieved April 2023, from https://www.stateofgreen.com.

Stender, M., & Jepsen, M. B. (2021). An outdoor living room: Balconies and blurring boundaries. *Architectural anthropology*, 48-61. Routledge.

Stender, M., & Walter, A. (2019). The role of social sustainability in building assessment. *Building Research and Information: The International Journal of Research, Development and Demonstration,* 47(5), 598-610. DOI:10.1080/09613218.2018.1468057.

Strimel, G. J., Kim, E., Bosman, L. (2019). Informed Design through the Integration of Entrepreneurial Thinking in Secondary Engineering Programs. *Journal of STEM Education*, 19(5), 32-39.

United Nations. (2018). *The 2030 Agenda and the Sustainable Development Goals: An opportunity for Latin America and the Caribbean.* UN document LC/G.2681-P/Rev.3. ECLAC.

Vischer, J. C. (2009). Applying knowledge on building performance: From evidence to intelligence. *Intelligent Buildings International*, 1(4), 239-248. DOI:10.3763/inbi.2009.SI02.

Watson, K. (2016). Learning Loops in Sustainable Design: Applying Social Return on Investment (SROI) to Buildings. University of Manchester.

Watson, K. J., Evans, J., Karvonen, A., & Whitley, T. (2016). Capturing the social value of buildings: The promise of social return on investment (SROI). *Building and Environment,* 103, 289-301.

Webster, K. (2017). *The circular economy* (2nd ed.). Ellen MacArthur Foundation Publishing.

Whyte, J., & Gann, D. M. (2001). Closing the loop between design and use: post-occupancy evaluation. *Building Research and Information*, 29(6), 460-462. DOI:10.1080/09613210110072683.

Winther, A. H. (2021). Urban compact living: Making home in the city: An ethnographic case study of compact living in an urban Danish context.

World Green Building Council. Retrieved April 2023, from https://www.worldgbc.org.

Chapter 2 | RESEARCH STRATEGY

Developing an interdisciplinary methodological framework

This chapter presents and discusses the strategy applied in the research related to its complexity as a cross-disciplinary project conducted within an industrial setting (section 2.1 'Research mode'). In pursuing the objective according to the overall research question outlined in Chapter 1, an interdisciplinary methodological framework is introduced (section 2.2). The way it is developed by using gesture as a 'traveling concept' and interdisciplinary "language" to combine architectural, anthropological, and economic perspectives in an integrative way is introduced in the section, and elaborated in Paper 1, as part of this chapter. According to the industrial and interdisciplinary research mode, the philosophy of this research relies on pragmatism (section 2.3 'Research philosophy'), combining the two traditional research paradigms, positivism, and constructivism, in an intersubjective way. In correspondence with this pragmatic approach, the research employs abductive reasoning in hypothesis development and testing within the framework (and thus testing the framework itself), mixing qualitative and quantitative methods, based on what fits best to the specific studies (analysis) (section 2.4 Research design). A discussion of the potential strengths and limitations of these methodological choices is included and touched upon in Paper 1. Eventual reflections on this, along with an evaluation of the tested framework, are in Chapter 4.

2.1 Research mode

As stated in Chapter 1, the research aimed to explore approaches and methods to account for the social and socio-economic values potentially created by architectural instruments chosen in the design process. Thereby proposing and testing an alternative way of assessing architectural design quality from an end-user perspective providing a basis for potentially better-informed design decision-making in the future. For this, the work presented in this dissertation constitutes research in the intersection of academia and industry ("industrial research"), as well as of three different disciplines, that is architecture, anthropology, and economics ("interdisciplinary research").

2.1.1 Industrial research

In the knowledge-based economy of the present, universities are encouraged to engage actively in the innovation process, through collaborations with both the industry and the government in a so-called triple helix model (Dooley & Kirk, 2007). This model is applied to the Industrial PhD-programme, funded by Innovation Fund Denmark co-funding the present research project.

To differentiate between perspectives on research, the term "mode 1" and "mode 2" is adopted in the work of Dooley & Kirk (2007). In their study on innovation and research systems, "mode 1" refers to viewing the university as an institution for education and for research driven by curiosity ("basic research"), where knowledge as the outcome is a public good. In a "mode 2" perspective the importance of interaction and alignment between academic and industrial institutions are highlighted to also carry out research, that is market-driven and to integrate its outcome (knowledge) into practice ("applied research") (Dooley & Kirk, 2007). Given the funding frame of the present research, this "mode 2" perspective is applied and referred to as "industrial research", which is carried out in the form of cooperative (or collaborative) research between the architectural design studio, and the two university institutes as academic partners. The collaborative form of university-industry interaction is considered best suited for mode 2 operations (Dooley & Kirk, 2007), compared to the others, such as research support, technology transfer, and knowledge transfer (Santoro, 2000). This is because cooperative research results in "further knowledge development, that increases the maturity of the technology being transferred and deepen relations between university and industry researchers which enhance the capability to exchange knowledge more effectively" (Dooley & Kirk, 2007, p. 331). Though this depends on the effectiveness of the collaboration itself, which can be ensured by co-creative knowledge generation guided by synergetic goals achieved via the complementary competencies of the different research partners (Dooley & Kirk, 2007).

Initiated by AART, the present research project is considered an important step in strengthening their competencies within architectural consultancy in articulating and expressing the impact of design choices as an indicator of its quality. As part of the work within the Impact Team, the research was carried out parallel to the ongoing development and practice of POE at AART, i.e. the systematic documentation of the impact of their design projects. Consequently, the present work is industrial research (or theoretically informed applied research) with immediate relevance to practice and potentially to the building industry. As such, it is a combination of market-driven and curiosity-driven research, mirrored in the dual perspective (Chapter 1, subsection 1.1.1 Means versus ends) applied to the pre-defined research topic (architecture) and research problem (architectural design quality in relation to value). This however also

posits a general challenge in terms of adapting to the different research cultures in the institutional environments of university and industry, deriving from the unalike understanding of the term "research" itself (Valentin, 2000), e.g. in terms of time perspectives (long-term in academia, and short-term in practice) (Dooley & Kirk, 2007).

Given the complexity of the research problem, that reaches over the specific competencies of architects, multiple disciplinary perspectives were involved in the research project from the beginning. Establishing a collaborative research approach fitting to its complexity required setting up synergetic goals (reflected by the research questions outlined in Chapter 1) as well as finding the right competencies to achieve those goals. To begin with, AART was interested in the exploration and testing of economic methods for expressing the monetary value of specific architectural instruments chosen in the design process, building on, and thus utilizing their existing evaluation practice at the time (in 2019) from an anthropological background. The industrial research interest of AART was consequently matched with the architectural research competencies at AAU-CREATE (academic host institute), whose interest laid in uncovering the challenges and potentials of such a method within the wider problem field of sustainable development. Hence, the idea and curiosity in exploring the potential of tectonic theory to facilitate a critical discussion on the choices made on architectural instruments in the design process in relation to the value potentials. To quantify the economic value of the outcome resulting from the architectural choices as experienced by end-users, academic competencies within economics were further sought at UCPH-IFRO (academic project partner) in applying welfare economic valuation techniques to the built environment.

However, as the project comprised not three (according to each discipline represented in the research) but only one (short-term) PhD research, competencies, and disciplines had to be combined in the form of interdisciplinary industrial research. As one can hardly have an academic background and industrial experience in architecture, anthropology, and economics as well, the project involved multiple academic knowledge partners and industry advisors to guide the research work, thus comprising the key stakeholders, outlined in the following subsection.

Stakeholders

In accordance with their level of knowledge of the project's details and their degree of involvement in it, stakeholders can be categorized into internal and external (Schmeer, 1999). For the present research project, the most important group of internal stakeholders from the industry was the company supervisor (Head of the Impact Team) and co-supervisors (Head of AART+) at AART, co-hosting the research. As the project was initiated by AART and springs from the long-term business strategy

and vision of the company, the founding partners of the company (Partner Group) are also one of the most important internal stakeholders defining the research topic, and the project's desired outcome and impact considering the strategic business goals.

Two groups of key internal stakeholders were identified from two academic research institutes, one as the co-host and the other as academic partner of the research project. Firstly, this includes the main university supervisor (Associate Professor in Architecture) and co-supervisor (Head of Department) from the co-hosting institute, Aalborg University's Department of Architecture, Design and Media Technology (AAU-CREATE). Their role in the project was to guide the PhD student, ensuring to meet academic expectations concerning research quality within the field of architecture, which is the central topic of the research. As the underlying goal of the project was to express the value of architectural design in monetary terms, the university co-supervisor (Professor in Environmental Economics) from the academic partner institute, the University of Copenhagen's Department of Food and Resource Economics (UCPH-IFRO) was another internal key stakeholder, sharing the role of academic supervision, being responsible for guidance and advice within the field of economics.

Besides the above-described key internal stakeholders, a group of key external stakeholders were identified within the project. This group also comprised people both from industry and academia, as well as from within the fields of architecture, anthropology, and economics. As network and knowledge partners, these stakeholders were involved in the research as a "follow-group" (FG) supporting and validating the research through a series of meetings. From the industry, representing the architectural field, the key external stakeholder was considered the Chief Consultant in Sustainability from the Association of Danish Architectural Companies (Danske Arkitekvirksomheder). From academia, external stakeholders included a Senior Researcher in Architectural Anthropology at AAU's Department of Built Environment (AAU-BUILD) and a Senior Researcher in Environmental Economics at Aarhus University's Department of Environmental Science (AU-ENVS).

For the PhD student, being responsible for carrying out the research, this meant continuous management of a multi-stakeholder research project. The management entailed regular meetings with both the internal and external key stakeholders (Table 1). The purpose of these meetings in general was, on one hand, to align expectations and thus ensure an effective collaboration through a continuous mediation of the diverging priorities and disciplinary perspectives of the multiple stakeholders. On the other hand, the purpose was to validate the research, thus ensuring its quality, based on regular dissemination activities in an academia-industry matrix.

Table 1. Meeting schedule with the different stakeholders in the research project, referred to as 'stakeholder action plan'.

WHAT	WHY	WHEN	WITH WHOM
PhD "touch base" meeting	to provide updates on the PhD project; to discuss tasks, personal matters, and decisions to be made	weekly on Mondays	company supervisor and university supervisor/co-supervisor (depending on project phase)
Team meeting (AART)	keep teammates updated on the project; discuss news, and opportunities	weekly on Mondays	Impact team members at AART
AART PhD meeting	discuss our research projects with the other PhD students at AART; knowledge and experience sharing	bi-weekly on Mondays	PhD students at AART
Copenhagen office meeting (AART)	keep the design teams (architects and engineers) updated on the PhD project	weekly on Fridays (joining in irregularly)	employees of AART based in the Copenhagen office
PhD status meeting	present and discuss progress, tasks, collaboration, and decisions to be made	3-monthly	university supervisor, university co-supervisor and company supervisor
Follow Group meeting	discuss research methods, partial results, potential collaborations and other opportunities	approx. in every 3 months	members of the external follow group
Presentation to strategic leader group (AART)	keep the strategic leaders up to date on the project's progress; involve them in the project via workshops	approx. yearly	AARTs strategic leader group
1:1 meeting	discuss personal development, challenges, stress, future carrier plans, etc.	based on need	Head of PhD programme at AAU / PhD coach at AAU / Supervisors
Communication meeting	communicating the impact of the project on So-Me sites (branding)	irregularly	Head of Communications at AART

2.1.2 Interdisciplinary research

As a result of the initial, multidisciplinary university-industry collaboration (between AART, AAU-CREATE, and UCPH-IFRO), the foundation of this research, the idea of a framework, built around the notion of gesture, was laid to unfold the social and socio-economic value potentials of architectural design, across architecture, anthropology, and economics. In a multidisciplinary approach, several disciplines cooperate in researching the same problem to then relate to and thus link the findings from each. Multidisciplinary research thus remains homogeneous, where disciplines are bounded by and stay within their disciplinary framings (Barry et al., 2008).

However, due to the setup of the research project (as one, short-term industrial PhD research) and the complexity of the research problem it ought to address, an interdisciplinary approach was found fitting for further development and testing of the proposed framework. In contrast to multidisciplinarity, interdisciplinarity accommodates the differences between the various disciplines in an attempt to integrate and synthesize perspectives from them. Consequently, "it implies a variety of boundary transgressions in which the disciplinary rules and subjectivities given by existing knowledge corpuses are put aside or superseded" (Barry et al., 2008, p. 21). For the present research, an interdisciplinary approach namely meant focusing on relating the disciplines of architecture, anthropology, and economics in an integrative way through three interrelated studies (analyses). These analyses relate to and are based on the synergetic goals defined via a university-industry collaboration that is reflected in the sub-research questions (Chapter 1). Integrating the perspective from the different disciplines via these interrelated analyses inherently implies crossing the traditional disciplinary rules of each, though to a different extent according to the researcher's profile. Having an educational background in landscape architecture and additional insight into welfare economic methods (cf. 'Personal profile, positioning, and motivation') both the architectural and anthropological analysis were more significantly transformed from what is regarded as a traditional architectural and anthropological analysis within their own disciplinary boundaries (elaborated in the next section). Such openness by an interdisciplinary approach is however important to transform the existing disciplinary forms, methods, and research practice of architecture and the evaluation of its design quality, which have significant limitations in informing decision-making in practice, as outlined in the review of existing approaches in Chapter 1.

Interdisciplinarity *per se* is not a novel approach, but it is considered to provide a solution to a series of contemporary problems (e.g. climate change), especially in light of the need to foster innovation in the present knowledge economy (Barry et al., 2008). Though, while Nowotny et al. (2001) consider interdisciplinarity as part of the shift from mode 1 to mode 2 knowledge production based on its purpose to facilitate

innovation, Barry et al. (2008) argue for other possible 'logics' of interdisciplinarity as well. In their study, emphasizing the heterogeneity of interdisciplinarity, they draw attention to the significance of a potential ontological logic, that is, to drive or effect ontological change (Barry et al., 2008). In the present research, this logic is manifested in the intention to challenge and potentially change the way of thinking about architecture and its design quality (via the proposed and tested interdisciplinary methodological framework), as well as the relationship between practicing architects and researchers from other fields. For the research, this meant continuous alignment, and mediation, not only between the different stakeholders (perspectives from academia and practice) but also between the different disciplinary perspectives.

Interdisciplinarity and interdisciplinary research have been problematized and criticized since it has become widespread in the 1960s (Barry et al., 2008), due to its heterogeneity, while others view its "disunified heterogenous assemblage of the subcultures of science" as its unique coherence and strength (Galison, 1996, p. 13). Furthermore, it is argued, that disciplines themselves are often inherently interdisciplinary (Barry et al., 2008), such as architecture (Groat & Wang, 2013), which can be, for example, seen as a combination of art and engineering (craftmanship). Contributing to the evolution of disciplinary boundaries, interdisciplinarity is considered an important part of research development, transforming the ways of thinking about knowledge production needed to address contemporary complex challenges (Barry et al., 2008).

Considered industrial and interdisciplinary research, the work presented in this dissertation is delimited to the development, testing, and evaluation of a proposed methodological framework built around the notion of gesture with the application of tectonic theory, for describing architectural quality based on the potential to create social and socio-economic value. In doing so, the emphasis is put on the interdisciplinary discussion of the framework and its potential integration into the architectural practice, rather than on an architectural theory development.

2.2 Interdisciplinary methodological framework

According to the main problem field, the central topic of the present research is architecture, which is considered to justify the choice of using an architectural theory as a basis for the framework. Yet, the format and the complexity of the challenge addressed by the research require the investigation of architecture from multiple disciplinary perspectives through an integrative approach, as described in the previous section.

In doing so, the first phase of pursuing the research comprised a review of the different perspectives on how design quality and social value are or can be addressed

in architecture, anthropology, and economics. This is presented in Paper 1, within this chapter, to inform and consequently develop a cross-disciplinary methodological framework, using the method for developing methodological frameworks by McMeekin et al. (2020). Departing from tectonic theory and its application in an interdisciplinary setting, the potential of such a framework as a "complex valuation exercise to improve the quality of the built environment" as well as "critical means to facilitate a cross-disciplinary dialogue and as a tool for prioritizing and allocating resources" is also highlighted (Sántha et al., 2022a, p. 73).

Apart from what is highlighted in Paper 1 and described in Chapter 1, a unique potential of tectonic theory to provide a basis for an *inter*disciplinary framework lies in its reference to a holistic 'pre-specialization' of the disciplines, i.e. before the disciplinary boundaries were defined, in relation to planning and construction (Holst, 2017), through a more complex understanding of the built environment in its socio-cultural context. In this way, tectonic theory holds the potential for architects to collaborate with other fields to inform design decisions on complex problems from multiple disciplinary perspectives. This potential is explored within the present research.

Indicating that it was first (before the project commenced) thought of as multidisciplinary, Paper 1 presents the proposed methodological framework. To do so, architecture, anthropology, and economics are being related within the framework by using the notion of 'gesture'. Thus, linking architectural design (architectural perspective) to value creation (economic perspective) based on the various and subjective experiences of end-users (anthropological perspective) via their encounters with and within the built environment. Pursuing an interdisciplinary approach throughout the research, the term gesture within the framework is considered as a 'travelling concept', a way to circulate knowledge between the different domains, and perspectives (Darbellay, 2012). Starting from an architectural view, *gesture* refers to the meaning of the design intended by architects (*intended* gesture), i.e. the value potential articulated through the architectural instruments chosen in the design process. After construction and occupancy, these gestures can be reviewed from an anthropological perspective by revealing the experience of the different user groups through their narratives (*lived* gesture). Finally, the initial design decisions made by architects can be evaluated from an economic perspective, which first requires quantifying and valuating the potential benefits gained by the gesture for end-users (*valued* gesture), thereby defining its quality (Sántha et al., 2022a).

However, as discussed in Paper 1 (ref. as Sántha et al., 2022a), testing the proposed methodological framework through an interdisciplinary process combining perspectives from three different disciplines posits some challenges in just doing so. Combining the sometimes very different underlying epistemologies into a common

frame toward a joint objective does not come without conflicts and compromises. These are mediated through the applied research philosophy and corresponding research design. Implications of these methodological choices in relation to an interdisciplinary approach are discussed in Chapter 4.

2.3 Research philosophy

Considering the industrial and interdisciplinary mode of the present research, a pragmatic research philosophy (or system of inquiry) is applied here from the continuum of research paradigms (Groat & Wang, 2013) (Figure 5). Pragmatism draws from multiple worldviews and the combination of those leads to a more comprehensive understanding and eventually a solution for the identified problem, based on a real-world situation ("Understanding Pragmatic Research", n.d.). By combining the two traditional research paradigms, positivism (traditionally applied within economics) and constructivism (traditionally applied within anthropology), the pragmatic approach allows approaching the research problem based on the underlying principle that 'theories can be both contextual and generalizable by analyzing them for transferability to another situation' (Creswell 2009, p. 4).

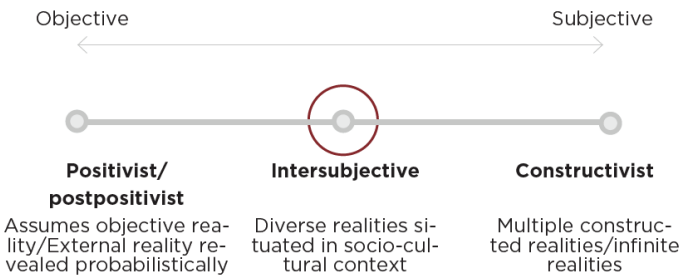


Figure 5. The research paradigm continuum by Groat and Wang (2013). The underlying research philosophy of the present research is pragmatism, which allows to draw from and combine the paradigms of positivism and constructivism in an intersubjective way (red circle). (Source: Jensen, 2022, p. 45).

A pragmatic research philosophy for the present research is chosen as a strategy to mediate the differences between the multiple disciplinary perspectives it intends to integrate, especially in relation to the anthropological and economic ones, which are traditionally very far from each other on the continuum of paradigms. As pragmatic research, perspectives of both philosophies are acknowledged in the present research and used strategically to cross-validate and thus strengthen the findings from the

different studies included in the testing of the framework, corresponding to the multiple perspectives (architecture, anthropology, and economics) combined within it.

2.4 Research design

Under the proposed methodological framework, the research is structured by three interrelated studies (analyses) in a case study setting, investigating two building projects post-occupancy. Both projects are a mixed-use complex designed by AART and located in Aarhus, Denmark. The 'Film City' complex comprises an office building for media-related enterprises as well as a (film) cultural and (media) educational centre with publicly accessible facilities, such as a café and an 'urban terrace', both providing space for gathering and hosting cultural events. The 'Warehouses' complex comprises altogether five buildings, of which three are primarily commercial office buildings, and two are residential ones, with apartments. These building typologies (residential and office) are among the most commonly evaluated building typologies in POE studies (Li et al., 2018). Thus, the mixed-use complexes not only combine different building typologies but accordingly accommodate various end-user groups. This poses "particular demands on the building's ability to create spatial gestures in the transition between building and urban spaces" (Sántha et al., 2022b). The specific cases were selected based on an 'information-oriented selection' (Flyvbjerg, 2010) strategy to ensure that data collected from the single cases are adequate to use in the studies, both in terms of quantity and quality. Furthermore, the cases were selected along the hypothesis, that the strategic choices made by the architects in the design process (in terms of the spatial gestures intended) have resulted in an overall positive impact on the end-users, e.g. by improving their everyday life. In the present research, this means, that the cases selected are "most-likely cases" (Flyvbjerg, 2010), which "often reveal more information because they activate more actors and more basic mechanisms in the situation studied" (Flyvbjerg, 2010, p. 229), thereby enhancing the understanding of the studied phenomenon and its effects in those "extreme" cases. This means here, that within the selected cases, the identification of benefits for end-users gained from the specific architectural design solutions (in the form of enhanced well-being) is 'most-likely', so the quantified social value of the architectural design instruments are expected to be positive.

In carrying out the analyses to test the proposed framework, the research employs a mixed-method approach guided by the pragmatic research philosophy. Such an approach entails the application of both qualitative and quantitative methods, inductive and deductive knowledge acquisition, chosen to best enable answering the sub-research questions corresponding to the three analyses, step-by-step integrating

the different perspectives (architectural, anthropological, and economic) and relating the findings across them. Data from qualitative and quantitative inquiries are combined in an 'embedded' design, "a mixed methods design in which one data set provides a supportive, secondary role in a study based primarily on the other data type" (Creswell & Creswell, 2017, p. 67) (Figure 6). In the design of the present research, the emphasis is on the quantitative data collection within the economic dimension as the "final stage" of translating architectural quality into monetary value, through qualitative data collection as an empirical link for providing richer information on the socio-spatial context of value, through user experience.

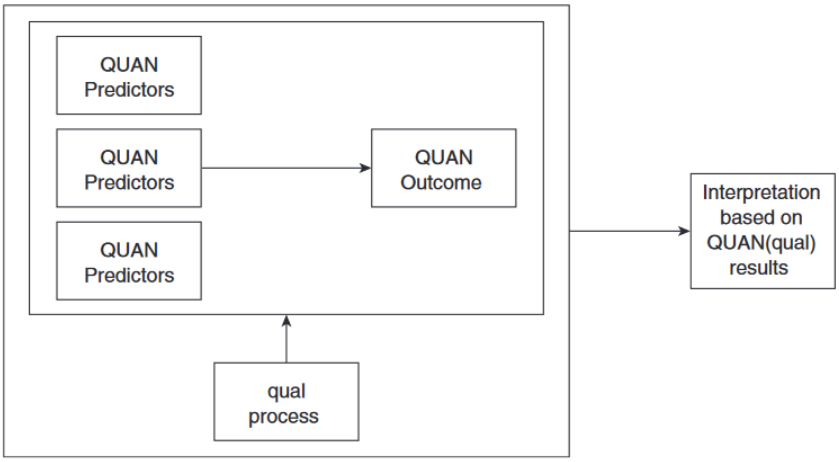


Figure 6. Embedded design. The 'Embedded Correlational Model' by Creswell and Creswell (2017). This model is a type of embedded design, in which qualitative data is embedded within a quantitative design, so they can be reported separately to answer different research questions, but eventually combined to interpret the results (Creswell & Creswell, 2017). (Source: Creswell & Creswell, 2017, p. 68).

This decision derives from the initiating industrial research need from considering the general tendency and characteristics of the contemporary building industry to rely on quantified and monetary arguments for decision-making, which often makes the application of exhaustive qualitative empirical findings to achieve the desired architectural goals challenging. The embedded design is furthermore aligned to the specific interdisciplinary approach delimited by the profile and competencies of the researcher. The external follow-group (see under sub-section 'Industrial research') was involved in the research project to continuously qualify the research through a discussion of each work package, comprising the analyses of the project in testing the

proposed framework. The figure below (Figure 7) presents the overall research design including the mixing of methods in each of the analyses, based on an integrative approach, addressing the sub-research questions of the project.

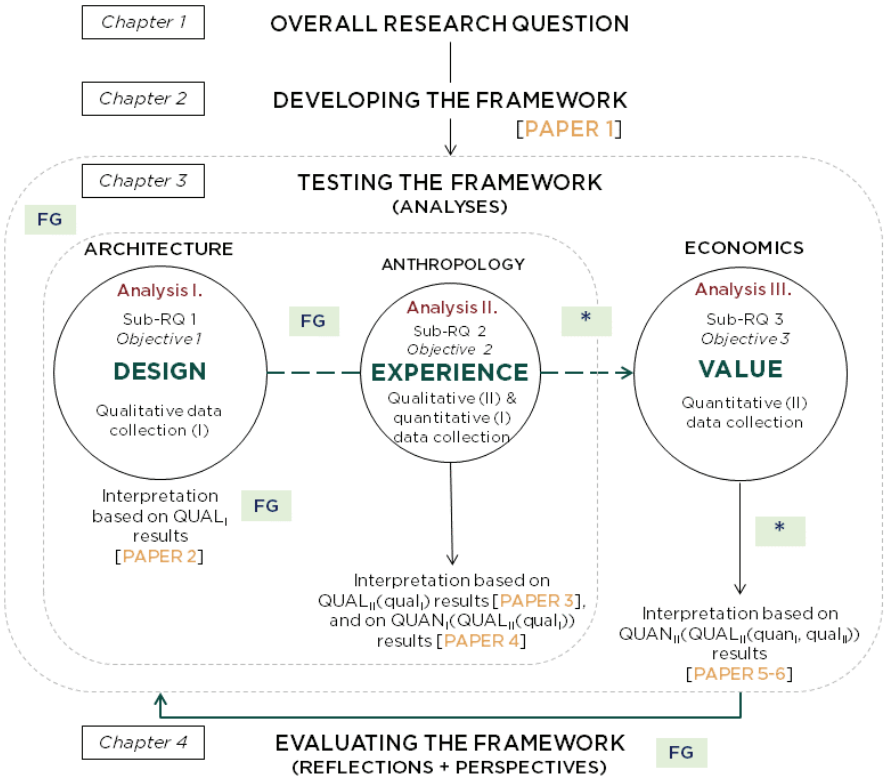


Figure 7. The multi-level embedded (correlational) design of the present research work. It shows how the framework was tested via the interrelated analyses combining architectural, anthropological, and economic perspectives, including the type of data collected, interpreted, and reported in the publications as part of this dissertation. The figure furthermore shows when the follow-group (FG) meetings with external experts took place to qualify the research. The asterisk (*) here marks, that the specific work package (regarding the economic dimension) was qualified via research seminars held at KU-IFRO, amongst researchers within economics. Input and feedback were also received here via workshops with the strategic leader group and the Impact Team of AART.

The analysis for investigating the architectural perspective (**architectural analysis**) on value creation (in terms of the formulation and spatial communication of intended spatial gestures) was carried out through an analytical review of the architectural presentation materials (technical drawings and description of the concept and design), and through semi-structured interviews (face-to-face and walk-and-talk) with the project responsible architect in each case. Here, the tectonic framework was used for describing architectural quality by re-establishing the relation between the notions of 'gesture' and 'principle' (Hvejsel, 2018), where the latter is understood here as a design concept (DESIGN) referring to the specific architectural instruments applied. During the architectural analysis (Paper 2), three key spatial gestures (intended) were identified on three different scales (upon approaching the complex, arriving at the buildings, and within the buildings). These were described through the narratives of the architects on their concrete design choices and the set of architectural instruments used to communicate those gestures (both spatially and literally) in each case. Qualitative data collected in the architectural analysis also served as a point of departure in designing the studies, comprising anthropological perspectives, thus relating the gestures *intended* by architects (DESIGN), to those potentially *lived* by the end-users (EXPERIENCE).

Unfolding the anthropological perspective (**anthropological analysis**) of gestures (how they are perceived and experienced by the end-users) thus entailed a field study in each case, using in-depth semi-structured interviews (Kvale & Brinkmann, 2009) and walk-and-talk interview techniques (Clark & Emmel, 2010; Kinney, 2017) for documenting the experience and practices of end-users (Paper 3 and partly Paper 4). Qualitative data of their narratives were furthermore accompanied by photos and field notes made by the researcher. These interviews covered the experiences (EXPERIENCE) of the built environment on various scales, i.e. their office/apartment, their building, the other buildings within the complex, the urban public area around and in between the complexes' buildings, as well as the neighbourhood. As the anthropological analysis within this research did not equal to an in-depth anthropological fieldwork (as clarified in the section 'Interdisciplinary research' of this chapter), observations (as understood within the anthropological discipline, which is also considered the main method applied within anthropological fieldworks) on the practices of end-users within these spaces were not conducted. Instead, direct observation methods (from a landscape architectural/urban design perspective) were applied in the form of 'urban life records' (Gehl & Svarre, 2013) for documenting the use of buildings' immediate surroundings and the urban public space in between them within the complexes (Paper 4). Quantitative data obtained this way were recorded in registration notebooks and maps. While the data obtained this way is not from an anthropological perspective (as it *of* and not *with* the users of the space), it was combined and thus jointly analyzed with the walk-and-talk interviews conducted

beforehand to incorporate the rich, contextual insights gained from the talks of their subjective experiences balancing out their objectification during the quantitative data collection. Results of these studies provide useful insight into whether and how the architects' 'intended gestures' become 'lived gestures' through the users' experiences and their choices made on the market (housing or job). The same choices can be investigated in a hypothetical market setting, to quantify preferences for architectural design instruments, based on their potential to increase the well-being of end-users, thus forming the basis for expressing the monetary value (VALUE) of those in a socio-economic sense (social value).

The economic quantification of social value (economic analysis), in the form of 'valued gestures', was done by using welfare-economics methods, as some of the qualities carried by the design solution (comprising their value potential) are not directly marketed (such as the view from the window). While it would be possible to quantify the value of these qualities indirectly through an analysis of choices made on the market (via revealed preference methods (Freeman et al., 2014), direct valuation methods (Freeman et al., 2014) were used. These methods are considered more flexible, given that they can handle both *ex ante* and *ex post* changes, tangible and less tangible estimates, as well as effects on small-scale. The specific method applied within this research was 'stated preference surveys' (including a 'choice experiment') for two different end-user groups (employees and residents) of the two most often evaluated building typologies, commercial office and residential (Paper 5 and Paper 6, respectively). To ensure validity, a deep understanding of what is potentially valued is necessary (Johnston et al., 2017), i.e. to identify which architectural design elements are relevant for investigating the preferences of end-users. This is where the architectural and anthropological analyses provided a validated basis for the development and conduction of a choice experiment, that shows the trade-offs people are willing to make in relation to the identified architectural gestures. The choice experiment, as part of the survey, contains a number of choice sets, where architectural gestures in the form of architectural instruments (here: 'attributes' or 'characteristics') are combined so that their relative value can be estimated through econometric modelling (Train, 2009), and expressed in monetary terms by the welfare measure, 'willingness-to-pay'.

The applied methods within the analyses are described and discussed further in detail within the individual papers reporting the studies.

References

Barry, A., Born, G., & Weszkalnys, G. (2008). Logics of interdisciplinarity. *Economy and Society*, 37(1), 20-49. DOI:10.1080/03085140701760841.

Clark, A., & Emmel, N. (2010). *Using walking interviews*. Morgan Centre, University of Manchester.

Creswell, J. W. (2009). Mapping the field of mixed methods research [editorial]. *Journal of Mixed Methods Research,* 3(2), 95-108.

Creswell, J. W., & Creswell, J. D. (2017). *Research design: Qualitative, quantitative, and mixed methods approaches*. SAGE Publications.

Darbellay, F. (2012). The circulation of knowledge as an interdisciplinary process: Travelling Concepts, Analogies and Metaphors. *Issues in Integrative Studies*, 30, 1-18.

Dooley, L., & Kirk, D. (2007). University-industry collaboration – Grafting the entrepreneurial paradigm onto academic structures. *European Journal of Innovation Management*, 10(3), 316-332. DOI:10.1108/14601060710776734.

Flyvbjerg, B. (2006). Five Misunderstandings About Case-Study Research. *Qualitative Inquiry*, 12(2), 219-245. DOI:10.1177/1077800405284363.

Freeman, A. M., Herriges, J. A., & Kling, C. L. (2014). *The measurement of environmental and resource values: Theory and methods*. RFF Press.

Galison, P. (1996). Introduction: The context of disunity. In P. Galison, and D. Stump (Eds.), *The disunity of science: Boundaries, contexts, and power*. Stanford University Press.

Gehl, J., & Svarre, B. (2013). *How to study public life*. Birkhäuser Boston. DOI:10.5822/978-1-61091-525-0.

Groat, L. N., & Wang, D. (2013). *Architectural research methods* (2nd ed.). Wiley.

Holst, J. (2017). The Fall of the Tektōn and The Rise of the Architect: On The Greek Origins of Architectural Craftsmanship. *Architectural Histories*, 5(1), 1-12. DOI:10.5334/ah.239.

Hvejsel, M. F. (2018). Gesture & principle: Tectonics as critical method in architecture. In I. W. Foged, & M. F. Hvejsel (Eds.), *Reader: Tectonics in architecture* (pp. 395-409). Aalborg University Press.

Jensen, S. R. (2022). Architectural strategies for promoting well-being in sustainable renovation of social housing. Aarhus University Press.

Johnston, R. J., Boyle, K. J., Adamowicz, W., Bennett, J., Brouwer, R., Cameron, T. A., Hanemann, W. M., Hanley, N., Ryan, M., Scarpa, R., Tourangeau, R., & Vossler, C. A. (2017). Contemporary guidance for stated preference studies. *Journal of the Association of Environmental and Resource Economists,* 4(2), 319-405. DOI:10.1086/691697.

Kinney, P. (2017). Walking interviews. *Social Research Update,* 1-4.

Kvale, S., & Brinkmann, S. (2009). *Interviews: Learning the craft of qualitative research interviewing* (2nd ed.). SAGE Publications.

Li, P., Froese, T. M., & Brager, G. (2018). Post-occupancy evaluation: State-of-the-art analysis and state-of-the-practice review. *Building and Environment* (Preprint). DOI: 10.1016/j.buildenv.2018.02.024

McMeekin, N., Wu, O., Germeni, E., & Briggs, A. (2020). How methodological frameworks are being developed: Evidence from a scoping review. *BMC Medical Research Methodology,* 20(1), 1-9.

Nowotny, H., Scott, P., & Gibbons, M. (2001). *Re-thinking science: Knowledge and the public in an age of uncertainty*. Polity.

Sántha, E., Hvejsel, M. F., & Rasmussen, M. K. (2022a). Intention, life, value: A multidisciplinary approach to understanding architectural quality in the city. In J. Montgomery (Ed.), *AMPS Proceedings Series 24.1. – Cities in a Changing World* (pp. 67-78). 2021. Virtual.

Sántha, E., Hvejsel, M. F., & Rasmussen, M. K. (2022b). Lost potentials? – Unpacking the tectonics of architectural cost and value. *Nordic Journal of Architectural Research,* 34(1), 89-118.

Santoro, M. (2000). Success breeds success: the linkage between relationship intensity and tangible outcomes in university-industry collaborative ventures. *The Journal of High Technology Management Research*, 11(2), 255-73.

Schmeer, K. (1999). Guidelines for conducting a stakeholder analysis. PHR, Abt Associates.

Train, K. E. (2009). *Discrete choice methods with simulation*. Cambridge University Press.

Understanding pragmatic research. Health E-learning and Media Team. Retrieved January 2023, from https://www.nottingham.ac.uk/helmopen/rlos/research-evidence-based-practice/designing-research/types-of-study/understanding-pragmatic-research/section10.html

Valentin, E. M. M. (2000). University-industry cooperation: a framework of benefits and obstacles. *Industry & Higher Education,* June (2000), 165-172.

Methodological framework

[1] The term 'multidisciplinary' is used to indicate that it was first (before the project commenced) thought as such, but within the project, its *inter*disciplinary potentials are highlighted and tested.

INTENTION, LIFE, VALUE: A MULTIDISCIPLINARY APPROACH TO UNDERSTANDING ARCHITECTURAL QUALITY IN THE CITY

Authors:
ESZTER SÁNTHA[1,2], MARIE FRIER HVEJSEL[1], MIA KRUSE RASMUSSEN[2]

Affiliation:
[1]AALBORG UNIVERSITY, DENMARK. [2]AART ARCHITECTS A/S, DENMARK

INTRODUCTION

According to the United Nations, the sustainable development of our planet calls for understanding the long-term, economic, environmental, and social consequences of products and services[1]. In its capacity as the central stage of human interaction, a stage, that intersects the environmental, social, and economic dimensions of our behavior, architecture holds potential in this matter[2]. Nevertheless, short-term considerations related primarily to construction costs often dominate the design process. These neglect the complex long-term social and socio-economic potentials of architectural design related to its surrounding urban setting. Consequently, architects often feel the need to compromise the spatial qualities of architecture in the design and construction process, thus limiting their potential contribution towards the sustainable development of the urban landscape[3].

Certification schemes (such as DGNB, BREEM, or WELL) currently in use as assessment strategies are limited to qualify the physical performance of building characteristics before the building is taken into use[4]. In this regard, they often fail to describe the holistic impact of the architectural space, as the social dimension is still underexposed and undeveloped in most of these models[5]. Concurrently, other existing assessment models for quality and value either forgo the comparison between costs and benefits (multi-criteria assessment models, such as Design Quality Index or VALiD) and thus prove to be weak at assisting resource allocation, or they only provide a number, based on measurement (economic valuation models), which limits the opportunity for establishing a dialogue in decision making[6]. Therefore, there is a need for multidisciplinary methodological frameworks, that can capture the relation between the "human factors, and buildings' physical capacity"[7] (seen here determining factor for quality) in relation to their social value measured in economic terms on a single-building level, utilizing both qualitative and quantitative approaches to qualify and justify design choices.

Figure 1. Zooming down to a single building level to acquire knowledge on the social value potential of a set of strategically chosen architectural instruments constructed as spatial gestures. Here, the provision of an urban meeting point by an exterior niche at the edge of an office building, designed by AART architects

This paper is part of an ongoing Ph.D. research project, entitled "CATALYST – Architecture as a catalyst for social and socio-economic value creation", guided by a pragmatic approach to best answer the overall research question: How, and to what extent can we describe and valuate architectural design based on its potential for value creation on the social dimension in a sustainable urban development context?

To address this research question, we propose a methodological framework built on tectonic theory. Tectonic theories of architecture have historically proposed approaches to describe the expressive qualities of architecture by analyzing the careful construction of key architectural works, supported by the phenomenological theory of place. Through methodological and theoretical explorations, the present paper discusses the potential of tectonic theory in describing the interaction between architecture and people as a spatial dialogue, in the form of 'gestures' (intended, lived, and valued), and applies this in the formulation of a methodological framework for describing the correspondence between architectural quality (what it is and how it is constructed) and value (what it does and how it is experienced), across the disciplines of architecture, anthropology, and economics. The present paper is limited to the development, description, and discussion of the potentials of a tectonic framework, where it is to be tested[8], evaluated, and improved in the future within the Ph.D. project.

METHOD FOR DEVELOPING METHODOLOGICAL FRAMEWORKS

A methodological framework can be broadly defined as a "structured guide to completing a process or procedure"[9]. In their work, McMeekin et al. identified and suggested three main phases, and eight different approaches for developing a framework, based on a scoping review[10]. The main phases comprise:

1. Identifying evidence or data to inform and shape the framework.
2. Developing the framework using the identified data.
3. Refining and validating the framework.

From these phases, the present paper focuses on the first two: informing and developing the framework, based on collected evidence or data, using a combined approach. The identification of

evidence to inform and shape the framework here was done through a review of existing methods, literature, and expertise from each of the three disciplines (architecture, anthropology, and economics). Accordingly, the development of the framework was done through extracting and synthesizing knowledge, through an iterative process, involving sharing professional experiences and knowledge across disciplines. In this form, we propose a multidisciplinary methodological framework, where interdisciplinary potentials are to be investigated in the future.

INFORMING THE FRAMEWORK

This section presents the results of the identification of relevant knowledge within each field to inform the framework. Each subsection represents a discipline and starts with a synthesis of what we know from the given discipline about the social quality and value of architecture, then a review of what is "missing", that can potentially be added by the other discipline(s) considered in this research.

Architecture and urban design: Intention

The complex relations between people and architecture, were both historically and nowadays studied by a range of disciplines, from philosophers[11,12] to art historians[13], urban designers, architects[14,15], and political scientists[16]. From the synthesis of these works, one can conclude, that there is an unspoken agreement, that architecture is more than merely a physical structure or form. Correspondingly, the task of the architect ("tekton", later "architekton") "goes beyond the mere pragmatic know-how", as it was described already in ancient Greece[17]. Based on a phenomenological understanding, architecture is a sort of "language", which "at its best, create a meaningful relationship and mediate between ourselves, the surrounding world and other people in it"[18]. This definition and the findings of the above-mentioned studies are therefore considered an important step towards describing architecture in terms of what it DOES in relation to and not exclusively about what it IS and how its constructed.

However, to best describe this essential relationship between architectural design and its impact on people's everyday life, we need to understand who the everyday users are, what are their experiences[19], and how do they inhabit and utilize the building[20]. Contemporary architectural researcher, Andrew Ballantyne argues, that in an everyday context, buildings themselves are rarely in the focus of our attention, rather they are the habituated background for our life, influencing us unconsciously. While the phenomenological understanding of architecture focuses on creating a range of sensory experiences through architectural means, this approach suggests a shift in focus from architecture as a sensory experience to architecture as a supporting or challenging environment for our practices in everyday life. Either way, to provide a vocabulary for describing the essential relationship between architecture and humans, one needs to explore this relationship from an anthropological perspective.

Anthropology: Life

In the twentieth century, a so-called spatial turn in the social sciences[21] has resulted in a range of studies on the entanglements of people, materials, and spaces, what it means to dwell or how notions of "home" and "place" are constituted and experiences in everyday life have been of interest for many anthropologists and sociologists[22,23,24]. As anthropologist Sara Pink argues, "approaching everyday life through practices offers the researcher a route through which to enter the complexity that everyday life is"[25]. Due to the complex nature of human behavior, it is also pointed out, that practices need to be explored in relation to other elements of the environment — materiality, technology, the senses — they are part of[26]. In her research, Pink discusses a theory of place, that enables the understanding of empirical realities of actually experienced environments, and the practices that form

a part of these, drawing on Creswell's definition: "Place is both the context for practice — we act according to more or less stable schemes of perception — and a product of practice — something that only makes sense as it is lived"[27].

Exploring practice in relation to "place" from an anthropological perspective requires an understanding of place as an abstract notion – a changing entity that is subjectively defined through individual experiences – rather than a physical location, that expresses certain qualities or pre-defined effects[28]. Understanding how people use and perceive a building, what constitutes their preferences, is essential to investigate the social value of architectural efforts. However, in order to inform and support design choices through economic arguments, one needs to relate this knowledge back to the physical characteristics of a place, that carries qualities defined by use and experience and therefore is of value to users. This relation between user-defined qualities and value can be potentially translated into a quantified, economic value (social value) of individual architectural instruments.

Welfare economics: Value

In today's consumer society, money is the means by which we realize futures, based on accepting and rejecting possible (built) realities[29]. Welfare economics is a branch of economics aiming to valuate society's well-being built on microeconomic principles. Within welfare economics, the value of products and actions is defined by the utility it provides for people[30]. Thus, social value is "the quantification of the relative importance that people place on the changes they experience in their lives"[31]. It focuses on the quantification of "soft" values, the less-tangible values, that are not directly monetized as they are non-marketed goods (eg. privacy, view from the window, or the possibility for recreation/socialization). Since utility is not a directly measurable unit, welfare economic measures, such as "willingness-to-pay", are used to express people's marginal utility in monetary terms, based on their preferences through their choices[32].

In modern (neoclassical) economics – especially in microeconomics – economic models are traditionally relying on describing human decision making, based on the theoretical model of the "economic man"[33], that is characterized by making completely rational decisions, consciously and consistently for their own good, based on relevant and full information[34]. This assumes, that the primary goal for consumers is to efficiently maximize utility by paying for goods and services up to the point that the amount they pay balances the satisfaction gained from an extra unit[35]. However, as it is demonstrated by behavioral- and neuroeconomists, choices made by humans are in fact not (or not always) rational but can be challenged by a range of "human factors" (eg. risk aversion[36], politics[37], societal influences[38], altruism[39]), arguing that these factors should be considered to model human behavior more accurately. The simplification applied in the traditional welfare economical valuation techniques is our argument to relate the quantified social value back to the architectural characteristics through anthropological perspectives and methods as an empirical link to contextually describe architectural quality in relation to its value.

Tectonic theory as a link?

To address the knowledge gap described in the introduction, we propose a methodological framework built on tectonic theory. In this regard we build on previous scholarly works, exploring tectonic theory's potential in "outlining the meaningful development of architecture in relation to its physical, technological and societal context, necessarily also addressing the more general – yet very delicate – question of architectural quality"[40] and its application in urban design[41] and landscape architecture[42].

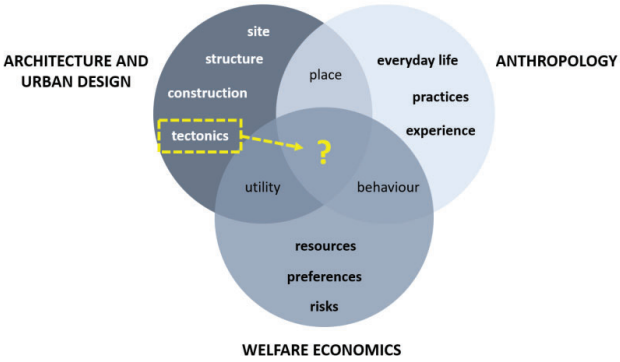


Figure 2. Synergies between some of the main concepts in the disciplines of architecture, anthropology, and economics, based on the identified knowledge from literature to inform and shape the framework

The notion of tectonics was first developed as a general architectural theory in the nineteenth century[43,44] to better understand the relationship between an architectural structure and its careful construction in ancient Greek architecture. The development of tectonic theory continued in the twentieth century with the rise of the phenomenological movement. In summary, tectonic theories of architecture have historically proposed approaches to describe not only the "technical know-how"[45], but also the expressive qualities of architecture by carefully analyzing the construction choices made in key architectural works across stylistic periods[46,47,48]. In his essay, Eduard F. Sekler differentiated the notions of structure (ordered arrangement of constituent parts), construction (specific way of realizing a structure), and tectonics, where the latter was defined as a carrier of expressive qualities, a link between the physical structure, construction, and human perception[49]. In doing so, he laid the foundation for understanding tectonics as a spatial pronunciation of specific construction choices, that carries the underlying intentions (or meaning) in the built form. The concept of tectonics thus potentially denotes an understanding of architecture as the combination of physical, cultural, ecological, and economic resources utilized in maximizing the spatial and social potential of a building[50].

DEVELOPING THE FRAMEWORK

Based on the above theoretical exploration, it is our observation that the notion of tectonics holds the potential to be developed to a framework by referring to choices in each field in correspondence with the reality of the architectural construct. Hence, we propose a methodological framework across architectural, anthropological, and economic perspectives to understand and document the relation between architectural quality (what architecture is and how it is constructed) and its value (what it does and how it is experienced). Based on the phenomenological, practice-oriented, and welfare-economical understanding, architectural quality is defined in this frame as architecture's potential to create social value for its users in a sustainable development context. This means that the value of architecture depends on the people, who consciously and unconsciously experience and interact with architecture and define its value through the choices and trade-offs they make. The project puts this relation, a cross-disciplinary link, and dependence, in the focus for setting a multidisciplinary

methodological framework for analyses from architecture to economics, through anthropology as an empirical link.

As an attempt to create a common interdisciplinary language within this framework we adopt the notion of spatial gestures. Referring to human body language, the notion has been applied within interior design studies[51,52] as a central understanding for communicating meaning through design as a nuanced spatial language. Likewise, the notion appears in Sekler's essay, describing the tectonics of architectural works as "gesturing forms"[53]. This association of the notion with tectonic theory opens a potential to investigate architectural quality – through the specific choices made on architectural instruments (such as light, disposition, material, etc.) in its construction – based on the exchange of 'gestures' (intended, lived and valued) resulting from these choices across scale.

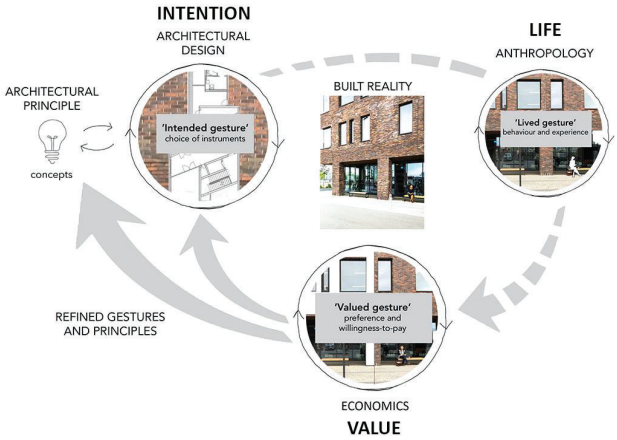


Figure 3. Intention, Life, Value. A methodological framework built on tectonic theory, using 'gesture' as a central notion across the disciplines of architecture, anthropology, and economics

From an architectural perspective, the architects' intention can be mapped in the form of "intented gestures", understood here as spatial invitations to movement, pause, socializing, etc. within, and in the connection between the building and its surrounding public space. These invitations are created in the selection, combination, and construction of a variety of architectural instruments. The resulting architectural design can be investigated further from an anthropological perspective through the narratives of "lived gestures", where it is uncovered how, and to what extent the intended gestures are perceived, experienced, and utilized by the users. Ultimately, the social value of the lived gestures can be measured from a welfare economical perspective as "valued gestures" by setting them as attributes for a choice experiment[54] that uncovers the tradeoffs, that different user groups make based on their stated preferences. These tradeoffs form the basis for translating user experience and choice into an economic value in the form of willingness-to-pay. Together, analyses from these three disciplines form a new multidisciplinary knowledge about the social value and quality of architecture in a sustainable urban development context, which can be used strategically to improve the future design (refined gestures and principles).

DISCUSSION AND CONCLUSION

Due to the complex challenge in the field of architecture, posed by the interrelated environmental, social, and economic aspects of sustainability, there is a need for multidisciplinary methodological frameworks, that allows for clarification and assessment of architecture's underexposed social quality in relation to its social value measured in economic terms on a single-building level. This dimension allows to shift the focus from the building as a whole to its key gestures/characteristics relating it simultaneously to the way they are constructed, lived, and valued. Thereby it holds the potential to support decision-making by qualifying and justifying design choices negotiated in the architectural design phase.

Methodologically, the use of frameworks, in general, has multiple benefits, as they can improve consistency, enhance the quality of the research, and help standardize approaches[55]. However, we would like to draw attention to some of the limitations and possible challenges of the proposed tectonic methodological framework. Firstly, even though the tectonic framework can potentially facilitate dialogue and thus accelerate a mutual learning process in a multidisciplinary nexus, it is, for now, uncertain how and to what degree an interdisciplinary translation will be possible between the disciplines of architecture, anthropology, and economics. Secondly, the assumed numerical and empirical causality between architectural quality and value determines how these notions are defined, explored, or assessed, and thus carries certain limitations in terms of its interpretation. Instead of the hypothesized causality, value creation in architecture can also be understood as an iterative process, a continuous "dialogue" between the building itself and its users, emphasizing the importance and the need for continuous qualitative post-occupancy evaluation strategies[56].

Nevertheless, we argue, that the proposed tectonic framework has the capacity to explore and assess design choices of key characteristics. In summary, this holds a strong potential to provide a systematic methodology for acquiring knowledge on the social quality and value of architecture. Optimally, the framework can thus be applied as a complex valuation exercise to improve the quality of the built environment, both as critical means to facilitate a cross-disciplinary dialogue and as a tool for prioritizing and allocating resources.

In this regard, it will be interesting to investigate further how the explicit formulation of gestures, focusing on both the construction and the impact of key architectural efforts can potentially improve the architects' rhetoric in a multi-stakeholder setting. Understanding tectonic spatial gestures in a multi- and possibly interdisciplinary relation can therefore be a driver for other ecological, social, and economic discussions.

This paper presented the development, description, and discussion of the potentials of a tectonic framework as part of an ongoing Ph.D. project. In the project, future steps include the testing of this framework by applying it in a case study, involving architectural, anthropological, and economic analyses of architecture's social quality and value, as well as a synthesis of these analyses and thus an evaluation and possible improvement of the framework.

NOTES

[1] "Sustainable Development Goals," United Nations, accessed July 20, 2021. https://www.un.org/sustainabledevelopment/sustainable-development-goals/
[2] Marie F. Hvejsel and Anne Beim, " Circular Tectonics? – A Critical Discussion of how the Architectural Discipline can Drive Ecological Continuity," in *Structures and Architecture: Bridging the Gap and Crossing Borders,* ed. Pablo J. Cruz (London: CRC Press, 2019), 51.
[3] Anne Beim and Marie F. Hvejsel, "Everyday Tectonics? Clarification of concepts," *Structures and Architecture: Beyond their Limits* (2016): 179.
[4] Samuel R. Hay et al. "Post-occupancy evaluation in architecture: Experiences and perspectives from UK practice," Building Research and Information: The International Journal of Research, Development and Demonstration 46, no. 6 (2018): 698-710, doi:10.1080/09613218.2017.1314692.
[5] Morten B. V. Jensen and Maria Troelsen, *Adding Value to the Social Dimension of Sustainable Building*. (Aalborg: Aalborg University, 2017), 77.
[6] "Mapping Value in the Built Environment," Commission for Architecture and the Built Environment (CABE), accessed July 20, 2021. https://youngfoundation.org/wp-content/uploads/2013/06/mapping-value.pdf
[7] Jan Johansson "Circular tectonics, users, and local culture," in *Structures and Architecture: Bridging the Gap and Crossing Borders,* ed. Pablo J. Cruz (London: CRC Press, 2019), 8.
[8] see eg. Eszter Sántha et al. "Lost Potentials? – Unpacking the Tectonics of Architectural Cost and Value" Nordic Journal of Architectural Research (In Press).
[9] Nicola McMeekin et al. "How methodological frameworks are being developed: evidence from a scoping review." BMC medical research methodology 20, no. 1 (2020): 1-9. doi: 10.1186/s12874-020-01061-4.
[10] McMeekin et al., 1.
[11] Gaston Bachelard, *The Poetics of Space*, (Boston: Beacon Press, 1994).
[12] Henri Lefebvre and Donald Nicholson-Smith, "The Production of Space," *L'Homme et la Société* 15 (1974).
[13] Heinrich Wölfflin, "Prolegomena Zu Einer Psychologie Der Architektur," *Kunstgeschichte (1886).*
[14] Christian Norberg-Schulz, "Genius Loci: Towards a Phenomenology of Architecture (1979)," *Historic Cities: Issues in Urban Conservation* 8, (2019): 31.
[15] Juhani Pallasmaa, *The Eyes of the Skin*, (Chichester: Wiley, 2012).
[16] Niels Albertsen, "Gesturing atmospheres," *in Ambiances in action/Ambiances en acte (s)-International Congress on Ambiances,* (Montreal: International Ambiances Network, 2012), 69-74.
[17] Jonas Holst, "The Fall of the Tektōn and The Rise of the Architect: On The Greek Origins of Architectural Craftsmanship," Architectural Histories 5, no. 1 (2017). doi: 10.5334/ah.239/.
[18] Louise Fabian, "The Spatial, the Social and the Architectural," in *Art of Many, the Right to Space: The Danish Pavilion - Bienniale Architettura 2016*, ed. Boris B. Jensen and Kristoffer L. Weiss, (Copenhagen: The Danish Architectural Press, 2016), 189.
[19] Valerie van der Linden et al. "Tracing Architects' Fragile Knowing about Users in the Socio-Material Environment of Design Practice," Design Studies 63, (2019): 65-91. doi:10.1016/j.destud.2019.02.004.
[20] Andrew Ballantyne, "Architecture, Life, and Habit," The Journal of Aesthetics and Art Criticism 69, no. 1 (2011): 43-49. doi:10.1111/j.1540-6245.2010.01445.x.
[21] Fabian, 189.
[22] Victor Buchli, *An Anthropology of Architecture*, (London: Bloomsbury, 2013).
[23] Bruno Latour and Albena Yaneva, "Give Me a Gun and I Will make all Buildings Move': An ANT's View of Architecture," in *Explorations in Architecture: Teaching, Design, Research,* ed. Reto Geiser (Basel: Birkhauser, 2008).

[24] Marie Stender and Claus Bech-Danielsen, eds., *Architectural Anthropology: Exploring Lived Space* (London: Routledge, 2021), 31.
[25] Sarah Pink, *Situating Everyday Life*, (London: SAGE Publications, 2012), 5.
[26] Kirsten Simonsen, "Practice, spatiality and embodied emotions: An outline of a geography of practice." *Human affairs* 2 (2007): 168-181.
[27] Tim Cresswell et al, *Handbook of Cultural Geography*, (London: SAGE Publications, 2003), 26.
[28] Pink, 5.
[29] Anthony Dunne and Fiona Raby, *Speculative everything: design, fiction, and social dreaming,* (Massachusetts: MIT press, 2013).
[30] Freeman et al. *The measurement of environmental and resource values: theory and methods*, (New York: Routledge, 2014.)
[31] "What is social value?", Social Value International, accessed April 9, 2021. https://socialvalueint.org/what-is-social-value/Social Value International
[32] Freeman et al.
[33] "Homo Economicus" James Chen, accessed July 10, 2021. https://www.investopedia.com/terms/h/homoeconomicus.asp
[34] John S. Mill, "On the definition and method of political economy," *The philosophy of economics* (1836): 41-58.
[35] Dante A. Urbina and Alberto Ruiz-Villaverde, "A critical review of homo economicus from five approaches," *American Journal of Economics and Sociology* 78, no. 1 (2019): 63-93.
[36] Kahneman, Daniel and Amos Tversky, "Prospect theory: An analysis of decision under risk," in *Handbook of the fundamentals of financial decision making: Part I*, ed. Leonard C MacLean and William T Ziemba (2013), 99-127.
[37] "Homo Oeconomicus and Homo Politicus", Nature Economy, accessed July 12, 2021. http://nature-economy.de/elements/homo-politicus/
[38] "Homo economicus vs. Homo sociologicus: Do values influence actual behavior?", Social Pschology, accessed July 12, 2021. https://www.psypost.org/2014/01/homo-economicus-vs-homo-sociologicus-do-values-influence-actual-behavior-22390
[39] Bowles, Samuel and Herbert Gintis, "Homo reciprocans," *Nature* 415, no. 6868 (2002): 125-127.
[40] Marie F. Hvejsel, "Gesture and Principle: Tectonics as a critical method in architecture," in *Reader: Tectonics in Architecture,* (Aalborg: Aalborg Universitetsforlag, 2018), 22.
[41] Marie F. Hvejsel et al. "Gesture and Principle in Urban Tectonics-An Educational Case Study," Nordic Journal of Architectural Research 29, no. 1 (2017).
[42] Torben Dam, "Does tectonics make meaning in landscape architecture," in *Proceedings of the Tectonics Making Meaning Conference 2007, 10-12 December 2007*, Eindhoven, Netherlands. 2007.
[43] Carl G. W. Bötticher, "The Principles of the Hellenic and Germanic Ways of Building with the Regard to their Application to our Present Way of Building," in *In what Style should we Build?: The German Debate on Architectural Style*, ed. Harry F. Mallgrave (Santa Monica: Getty Publications, 1844.) 147-167.
[44] Gottfried Semper, *The Four Elements of Architecture*, (Cambridge: Cambridge University Press, 1989).
[45] Holst, 3.
[46] Marco Frascari, "The Tell-the-Tale Detail," in *Semiotics: The Proceedings of the Semiotic Society of America*, ed. Geoffrey R. Owens and Elvira K. Katić, (Charlottesville, Virgina: Philosophy Documentation Center, 1981), 325-336.
[47] Eduard F. Sekler, "Structure, Construction, Tectonics," in *Structure in Art and in Science*, ed. Kepes György, (London: Studio Vista, 1964), 89-95.
[48] Kenneth Frampton, *Studies in Tectonic Culture: The Poetics of Construction in Nineteenth and Twentieth Century Architecture*, (Massachussets: MIT Press, 1995).

[49] Sekler, 89.
[50] Anne Beim et al. (eds.) *Towards an Ecology of Tectonics: The Need for Rethinking Construction in Architecture,* (Stuttgart: Edition Axel Menges, 2014).
[51] Marie F. Hvejsel, *Interiority: A Critical Theory of Domestic Architecture*, (Aalborg: Aalborg University, 2011).
[52] Gennaro Postiglione and Eleonora Lupo, "The Architecture of Interiors as Re-Writing of Space: Centrality of Gesture," in *Thinking Inside the Box: A Reader in Interiors for the 21st Century*, ed. J. Gigli (London: Middlesex University Press, 2007), 145-154.
[53] Sekler, 90.
[54] Robert J. Johnston et al. "Contemporary guidance for stated preference studies," *Journal of the Association of Environmental and Resource Economists* 4, no. 2 (2017): 319-405.
[55] McMeekin, 2.
[56] Rune T. Clausen, *Værdifuld arkitektur: Et eksplorativt studie af bygningers rolle i virksomheders værdiskabelse,* (Frederiksberg: Copenhagen Business School CBS, 2011).

BIBLIOGRAPHY

Albertsen, Niels. "Gesturing atmospheres." In Ambiances in action/Ambiances en acte (s)-International Congress on Ambiances. Montreal: International Ambiances Network, 2012.

Bachelard, Gaston. The Poetics of Space. Boston: Beacon Press, 1994.

Ballantyne, Andrew. "Architecture, Life, and Habit." The Journal of Aesthetics and Art Criticism 69, no. 1 (2011): 43-49. doi:10.1111/j.1540-6245.2010.01445.x.

Beim, Anne and Marie F. Hvejsel. "Everyday Tectonics? Clarification of concepts." Structures and Architecture: Beyond their Limits (2016): 179.

Beim, Anne, Charlotte Bundgaard, Karl Christiansen, Ulrik Stylsvig Madsen (eds.) Towards an Ecology ofTectonics: The Need for Rethinking Construction in Architecture. Stuttgart: Edition Axel Menges, 2014.

Bötticher, Carl G. W. "The Principles of the Hellenic and Germanic Ways of Building with the Regard to theirApplication to our Present Way of Building." In In what Style should we Build?: The German Debate onArchitectural Style, edited by Harry F. Mallgrave. Santa Monica: Getty Publications, 1844.

Bowles, Samuel and Herbert Gintis. "Homo reciprocans." Nature 415, no. 6868 (2002): 125-127.

Buchli, Victor. An Anthropology of Architecture. London: Bloomsbury, 2013.

Chen, James. ”Homo Economicus.” Accessed July 10, 2021. https://www.investopedia.com/terms/h/homoeconomicus.asp

Clausen, Rune T. Værdifuld arkitektur: Et eksplorativt studie af bygningers rolle i virksomheders værdiskabelse. Frederiksberg: Copenhagen Business School CBS, 2011.

Commission for Architecture and the Built Environment (CABE). “Mapping Value in the Built Environment”.Accessed on July 20, 2021. https://youngfoundation.org/wp-content/uploads/2013/06/mapping-value.pdf

Cresswell, Tim, Kay Anderson, Mona Domosh, Steve Pile, and Nigel Thrift. Handbook of Cultural Geography.London: SAGE Publications, 2003.

Dam, Torben. "Does tectonics make meaning in landscape architecture." In Proceedings of the Tectonics Making Meaning Conference 2007, 10-12 December 2007, Eindhoven, Netherlands. 2007.

Dunne, Anthony and Fiona Raby. Speculative everything: design, fiction, and social dreaming. Massachusetts: MIT press, 2013.
Eduard F. Sekler. "Structure, Construction, Tectonics." In Structure in Art and in Science, edited by Kepes, György. London: Studio Vista, 1964.
Fabian, Louise. "The Spatial, the Social and the Architectural." In Art of Many, the Right to Space: The Danish Pavilion - Bienniale Architettura 2016, edited by Boris B. Jensen and Kristoffer L. Weiss. Copenhagen: The Danish Architectural Press, 2016.
Frampton, Kenneth. Studies in Tectonic Culture: The Poetics of Construction in Nineteenth and Twentieth Century Architecture. Massachussets: MIT Press, 1995.
Freeman III, A. Myrick, Joseph A. Herriges, and Catherine L. Kling. The measurement of environmental and resource values: theory and methods. New York: Routledge, 2014.
Hay, Rowena, Flora Samuel, Kelly J. Watson, and Simon Bradbury. "Post-occupancy evaluation in architecture: experiences and perspectives from UK practice." Building Research & Information 46, no. 6 (2018): 698-710 doi:10.1080/09613218.2017.1314692
Holst, Jonas. "The Fall of the Tektōn and The Rise of the Architect: On The Greek Origins of Architectural Craftsmanship." Architectural Histories 5, no. 1 (2017). doi: 10.5334/ah.239/.
Hvejsel, Marie F. "Gesture and Principle: Tectonics as a critical method in architecture." In Reader: Tectonics in Architecture. (Aalborg: Aalborg Universitetsforlag, 2018.) 22
Hvejsel, Marie F. and Anne Beim. ”Circular Tectonics? – A Critical Discussion of how the Architectural Discipline can Drive Ecological Continuity." In Structures and Architecture: Bridging the Gap and Crossing Borders, edited by Pablo J. Cruz. London: CRC Press, 2019.
Hvejsel, Marie F. Interiority: A Critical Theory of Domestic Architecture. Aalborg: Aalborg University, 2011.
Jensen, Morten B. V. and Maria Troelsen. Adding Value to the Social Dimension of Sustainable Building. Aalborg: Aalborg University, 2017.
Johansson, Jan. "Circular tectonics, users, and local culture." In Structures and Architecture: Bridging the Gap and Crossing Borders, ed. Pablo J. Cruz. London: CRC Press, 2019.
Johnston, Robert J., Kevin J. Boyle, Wiktor Adamowicz, Jeff Bennett, Roy Brouwer, Trudy Ann Cameron, W.Michael Hanemann et al. " Journal of the Association of Environmental and Resource Economists 4, no. 2(2017): 319-405.
Kahneman, Daniel and Amos Tversky. "Prospect theory: An analysis of decision under risk." In Handbook of the fundamentals of financial decision making: Part I, ed. Leonard C MacLean and William T Ziemba (2013), 99 127.
Latour, Bruno and Albena Yaneva. "Give Me a Gun and I Will make all Buildings Move': An ANT's View of Architecture." In Explorations in Architecture: Teaching, Design, Research, edited by Reto Geiser. Basel: Birkhauser, 2008.
Lefebvre, Henri and Donald Nicholson-Smith. The Production of Space, 1991.
Marco, Frascari. "The Tell-the-Tale Detail." In Semiotics: The Proceedings of the Semiotic Society of America, edited by Geoffrey R. Owens and Elvira K. Katić. Charlottesville, Virgina, US: Philosophy Documentation Center, 1981.
Marie Frier Hvejsel et al. "Gesture and Principle in Urban Tectonics-An Educational Case Study." Nordic Journal of Architectural Research 29, no. 1 (2017).
McMeekin, Nicola, Olivia Wu, Evi Germeni, and Andrew Briggs. "How methodological frameworks are being developed: evidence from a scoping review." BMC medical research methodology 20, no. 1 (2020): 1-9. doi: 10.1186/s12874-020-01061-4.
Mill, John S. "On the definition and method of political economy." The philosophy of economics (1836): 41-58.
Nature Economy. "Homo Oeconomicus and Homo Politicus." Accessed July 12, 2021. http://natureeconomy.de/elements/homo-politicus/

Norberg-Schulz, Christian. "Genius Loci: Towards a Phenomenology of Architecture (1979)." Historic Cities: Issues in Urban Conservation 8, (2019): 31.
Pallasmaa, Juhani. The Eyes of the Skin. Chichester: Wiley, 2012.
Pink, Sarah. Situating Everyday Life. London: SAGE Publications, 2012.
Postiglione, Gennaro and Eleonora Lupo. "The Architecture of Interiors as Re-Writing of Space: Centrality of Gesture." In Thinking Inside the Box: A Reader in Interiors for the 21st Century, edited by J Gigli. London: Middlesex University Press, 2007.
Sántha, Eszter, Marie F. Hvejsel, and Mia K. Rasmussen. "Lost Potentials? – Unpacking the Tectonics of Architectural Cost and Value". Nordic Journal of Architectural Research (In Press).
Semper, Gottfried. The Four Elements of Architecture. Cambridge: Cambridge University Press, 1989.
Simonsen, Kirsten. "Practice, spatiality and embodied emotions: An outline of a geography of practice." Human affairs 2 (2007): 168-181.
Social Pschology. "Homo economicus vs. Homo sociologicus: Do values influence actual behavior?" Accessed July 12, 2021.
https://www.psypost.org/2014/01/homo-economicus-vs-homo-sociologicus-do-values-influence-actual-behavior-22390
Social Value International. “What is social value?” Accessed on April 9, 2021. https://socialvalueint.org/what-is-social-value/Social Value International
Stender, Marie and Claus Bech-Danielsen. "Home, walls, and boundaries." Architectural Anthropology: Exploring Lived Space 31. London: Routledge, 2021.
United Nations. “Sustainable Development Goals.” Accessed July 20, 2021. https://www.un.org/sustainabledevelopment/sustainable-development-goals/
Urbina, Dante A. and Alberto Ruiz-Villaverde. "A critical review of homo economicus from five approaches." American Journal of Economics and Sociology 78, no. 1 (2019): 63-93.
Van der Linden, Valerie, Hua Dong, and Ann Heylighen. "Tracing Architects' Fragile Knowing about Users in the Socio-Material Environment of Design Practice." Design Studies 63, (2019): 65-91. doi:10.1016/j.destud.2019.02.004.
Wölfflin, Heinrich. "Prolegomena Zu Einer Psychologie Der Architektur". Kunstgeschichte, 1886.

Chapter 3 | ANALYSES

This chapter comprises the testing of the developed methodological framework in Paper 1 (Chapter 2) by applying it through a number of interrelated analyses (corresponding to each of the represented – architectural, anthropological, and economic – perspectives), investigating two building complexes designed by AART as cases. Through the analyses within the proposed tectonic framework, design characteristics as key spatial gestures are investigated in relation to how they are *intended*, *lived*, and *valued*.

Analysis I. Intended Gestures

The first section in Chapter 3 is devoted to the first analysis integrating the architectural perspective. The analysis is reported by Paper 2, and is guided by the sub-research question "*How and to what extent architects have worked explicitly with the construction of spatial gestures to generate value for different user groups in the design process"*. The paper investigates the architectural dimension of gestures applied in the construction of the two cases, through the analysis of the project descriptions, and a series of qualitative interviews with the project's leading architects. The study is a retrospective, exploratory study, to gain a deeper understanding of the meaning, meant to be incorporated into the design by the architects. As well as to discuss to what extent they think they succeeded in their realization.

Analysis II. Lived Gestures

Building on the findings from Analysis I, Analysis II aims to unfold the anthropological dimension of gestures by addressing the sub-research question "*How do people react to the intended architectural gestures within and around the building,* i.e. to identify *what and why they value in the architectural design"*. Thus, Papers 3 and 4 are devoted to unfolding the relation between intended gestures by architects and lived gestures by people experiencing the built environment as it was realized. Paper 3 is engaged with the overall experiences and practices of the different end-users of the buildings, providing a qualitative assessment of the impact of construction choices on human well-being, through a phenomenological approach. Paper 4 is focusing on urban life, as a specific aspect of social value creation by architectural design, using a mixed-method approach, combining qualitative data from interviews and quantitative data from urban recordings.

Analysis III. Valued Gestures

The last analysis comprises the economic dimension of gestures. The findings of Papers 2-4 of Analysis I and II serve as an important input to the design of the applied stated preference method (choice experiment survey), studying *"How we can translate users' reactions to spatial gestures into economic value through their behaviour"*. Accordingly, the goal of the economic studies in Analysis III is to quantify end-users' architectural preferences – identified through the narratives of intended and lived gestures – and translate them into value expressed in monetary terms, in the form of *valued gestures.* Paper 5 and Paper 6 thus report the marginal value of specific architectural design solutions, derived from their relative importance to two different end-user groups (employees and residents, respectively), through their observed and modelled choice behaviour in a hypothetical market setting. Studies in Analysis III are representing a more objectivist approach to derive generalized knowledge on the social and socio-economic value potentials of architecture within this pragmatic research. Thus forming the last piece towards a critical discussion on design choices in relation to quality and value, investigated by the application of the proposed tectonic framework, in which a "common language" is established through the integration of perspectives from the disciplines of architecture, anthropology, and economics.

Analysis I. Intended Gestures

NORDISK ARKITEKTURFORSKNING
NORDIC JOURNAL OF ARCHITECTURAL RESEARCH

LOST POTENTIALS? UNPACKING THE TECTONICS OF ARCHITECTURAL COST AND VALUE

ESZTER SÁNTHA, MARIE FRIER HVEJSEL AND MIA KRUSE RASMUSSEN

Abstract

Despite increased awareness of architecture's potential to create social value by improving people's quality of life, demands for reduction of construction costs still dominate the contemporary building industry. Consequently, there is a discrepancy in the translation from cost to value in architecture, possibly counteracting vital potentials for social value generation. This problem requires a clarification of the link between the construction of architecture as detailed spatial invitations (gestures) and their potential social value, depending on users' responses to these invitations. Understood as a spatial pronunciation of specific construction choices, the present article tests architectural tectonic theory's potential, towards establishing such clarity.

This potential is tested via post-construction interviews on two, strategically selected works by AART Architects. Using a methodological framework built on tectonic theory to identify the value intended by the architects in the form of key "intended spatial gestures", the interviews clarify how the actual construction seeks to impart this value to the users in the two cases. In conclusion, the article demonstrates how these intended spatial gestures reveal the trade-offs negotiated in the design process at a detailed level, hereby unfolding a critical tool for increasing social value potentials otherwise lost in the translation from cost to value.

Keywords:
Rethinking architectural practice,
Cost and value, Tectonics,
Intended gestures, Case study

Introduction

In a world of ever-increasing interests from multiple stakeholders, the contemporary building industry becomes more and more complex. This presents architects with the constantly evolving challenge of maximizing, communicating and releasing the value potential of architecture within this complexity (Broch, Sattrup, & Sejr, 2017; Hvejsel & Beim, 2019; Sattrup, 2020). However, despite increased awareness of the potential of architecture on the generation of combined economic, social and environmental value over time, focus on processes, efficiency and short-term demands for reduction of construction costs still dominate the building industry (Broch et al., 2017). This discrepancy is reflected in architectural practice, where architects often find themselves limited by the overarching pressure to reduce construction costs. From the architects' point of view, this potentially counteracts the spatial capacities of architecture to create social value by "contributing to the long-term wellbeing and resilience of individuals, communities and society in general" (Social Value Portal, 2017). As defined by Social Value International, social value is "the [economic] quantification of the relative importance that people place on the changes they experience in their lives" (Social Value International, n.d.), and so it is about the "preferences that people have about their lives and their environment, and how an investment into a program or activity can change that" (SIMNA, 2018). The problem is that decisions made during the design process do not always correspond with the architects' field-specific knowledge of how to design for added social value, created throughout a building's lifetime. And there is a risk that this possibly causes vital potentials for social value creation to be lost. Hence, there is a need to understand, quantify and report on this social value, to improve the decision-making process (SIMNA, 2018). This is supported by a growing body of research focused on the urban scale, showing how physical surroundings affect people's well-being (Fich et al., 2014; Ulrich, 1984) and overall quality of life (Bjørn, 2014; Siren, Grønfeldt, Andreasen, & Bukhave, 2019). This knowledge can potentially be translated into social value, quantified through monetary measures, based on welfare economic principles (Lundhede et al., 2013). In their booklet titled 'Architecture creates value', The Danish Association of Architectural Firms proposes a general and simplified framework and methodology for documenting the – social, environmental and economic – value of architecture, based on a collection of "best practices" (Broch et al., 2017). However, the challenge remains to activate this knowledge at a detailed and strategic level in the architectural design process (Sattrup, 2020). Hence, there is still a lack of methodology and research to document the impact of individual architectural instruments (such as materials, disposition, light, etc.) – constructed as spatial invitations ("gestures") – on social quality and value on a single building level, enabling such activation (Sántha, Hvejsel, & Rasmussen, 2021).

As it is evident from UN's Sustainable Development Goal 11, sustainable development of the built environment entails a complex juxtaposition of economic, social and environmental aspects that cannot be met without a qualified understanding of the long-term impact of products and practices (Mossin et al., 2018). Thus, under the constant pressure to reduce construction costs, architects risk failing to qualify their contribution towards sustainable development of the urban landscape as a whole, because they cannot translate from the immediate construction cost of architecture to the value of the social qualities embedded in the spatial capacities of this construction (Fabian, 2016; Jensen & Troelsen, 2017). This social value potential is defined through the choices and trade-offs people make, based on their experiences and behaviour (Freeman, Herriges, & Kling, 2014; Johnston et al., 2017). Thus, the latter can be used to identify the value of architectural gestures from a user perspective, in the ways that users consciously and unconsciously react to those spatial invitations. The task of unpacking this relation entails a combination of architectural, anthropological and economic descriptions of architecture. A combination whereby the choices of specific architectural instruments, applied in the design process and the value of their social qualities, can be analysed in combination, based on the users' responses to those choices via their experience and behaviour (Sántha et al., 2021). Understood as a spatial pronunciation of specific constructive choices, the present article tests the potential of a tectonic methodology – built on tectonic theory – in establishing such clarity on the architectural dimension of cost and value. Historically, tectonic theories of architecture have paved the way for comparative analyses of key works of architecture across stylistic periods. This was done by documenting the comprehensive spatial value resulting from choices applied in the minutest details of their construction, as a common denominator for describing their quality (Frampton, 1995; Frascari, 1981; Sekler, 1964; Semper, 1989). In continuation hereof, recent research, to which this article adds, has outlined a critical potential for the development of tectonic approaches for linking ecology and economy in the current architectural practice (Bech-Danielsen, Beim, & Madsen, 2014; Hvejsel & Beim, 2019).

This study is part of an ongoing Ph.D. research project that seeks to methodologically juxtapose architectural, anthropological and economic analyses, using tectonics as an interdisciplinary methodological framework, for acquiring knowledge on the social value potential of a set of strategically chosen architectural instruments. In this framework, we adopt and use the notion of gesture from tectonic theory as a central concept to describe the interaction between architecture and people, hereby stressing the core potential of architecture to "invite" and "encourage" a certain behaviour through its form that ultimately translates to social value. This article presents the sub-study related to the architectural dimension, focusing on the first step towards social value creation. In this matter, the article applies the notion of "intend-

ed spatial gestures" in the formulation and investigation of the aforementioned methodological framework for clarifying the translation from cost to value in architecture. This investigation is done through the architectural practice of the Danish architectural studio, AART Architects (AART), together with the architects themselves, guided by the following research question:

How and to what extent have the architects worked strategically with the formulation of spatial gestures to create value and negotiate their specific choices of architectural instruments in the design process?

The article investigates this potential through a set of post-construction interviews with the lead architects of two selected mixed-use projects, located in Aarhus, Denmark, and designed by AART. Here, tectonic theory is applied to identify the specific value intended by the architects, in the form of key intended spatial gestures. Hence, as the first step towards potential social value creation, the interviews clarify how the actual construction choices seek to impart this intended value in a series of spatial gestures addressing users approaching to, arriving at, working and living in, as well as visiting the two building complexes included as cases in this study. The first part of the article describes the theoretical approach (elaborated in Sántha et al., 2021) based on a (re) interpretation and extension of the existing body of knowledge within tectonic theory (Christiansen, 2020; Dam, 2007; Frampton, 1995; Hvejsel, 2018; Sekler, 1964), moving towards a "tectonics of cost and value" applicable as critical means in contemporary architectural practice. The next section presents a method for the application of this theory in the two cases, including an introduction to the two projects. Hereafter, the article reports an account for the empirical data collected through the interviews and, finally, an analysis of the empirical findings stemming from these. In conclusion, the article demonstrates and discusses how these intended spatial gestures are constructed, communicated and negotiated in the design process. The findings of this article form a critical foundation for the following studies of the Ph.D. research project, where the architect's perspective will be supplemented with anthropological and economic perspectives respectively. This will potentially enable us to move towards the establishment of a common language, aiming to describe the social qualities and values of architecture. However, there is no "guarantee" that these values will actually be accounted for in future construction budgets or decision-making processes in the architectural design phase. Nevertheless, clarifying the relation between individual architectural instruments and their potential social value will hopefully provide a deeper understanding of the architectural profession itself, towards a more conscious and reflexive practice, allowing the improvement of future design.

Tectonics of cost and value

Originating in ancient Greece, where it described the task of the Greek *tekton* (master builder, later *architekton*) as a unification of aesthetics and technique through construction, tectonics has evolved as a general architectural theory, referring simultaneously to the architectural work itself and to the task of creating it (Bötticher, 1844; Hvejsel, 2018; Semper, 1989). When considering the above-mentioned challenges facing the architectural discipline, the notion of tectonics opens a potential for the architect to engage in a process of change, focused simultaneously on the improvement of the physical products of architecture (design) and their service as advisors (communication). This "critical lens" facilitates the opportunity to move towards a critical, creative design approach (Dunne & Raby, 2013) within architecture as well. In 1964, Eduard F. Sekler outlined a foundation for further exploration of this potential in architectural practice with his seminal essay "Structure, Construction, Tectonics", investigating analogies between the written/spoken language and the spatial language of architecture. In the essay, Sekler argues that the ability to communicate the guiding principles behind a work of architecture is vital to the architect. He argues that "indeed an artist may feel that there is no place at all for verbal formulations in architecture and the visual arts; yet he will not be able to create without guidance from certain principles, which he once acquired or formulated and which are in themselves not visual but conceptual" (Sekler, 1964, p. 89). Below, we investigate this potential further by connecting the history of tectonic architectural theory with current research into tectonics, related to the pressing challenge of clarifying the translation from cost to value in architecture.

Interdisciplinary communication of field-specific knowledge

In summarising the application of tectonic theory in architecture across architectural history, it can be observed that the notion of tectonics has paved the way for comparative analysis of key works of architecture across stylistic periods. These analyses have identified and documented the comprehensive spatial value resulting from choices applied in the minutest details of the construction of these key works, as a common denominator for describing their quality and indisputable value to the history of architecture from an architectural point of view (Fabian, 2016; Frampton, 1995; Frascari, 1981; Sekler, 1964). Hence, in its point of departure, the notion of tectonics implies an understanding of architecture as a constructed cultural, ecological and economic correspondence between detail and whole, exploiting the physical resources applied in architecture to maximize its spatial capacities (Bech-Danielsen et al., 2014; Christiansen, 2020; Frampton, 1995; Frascari, 1981; Hvejsel & Beim, 2019). In continuation hereof, it is our observation that the notion of tectonics simultaneously implies a critical potential for referring the correspondence between the cost and value of architecture to the specific choices made in the design process. This is of significant importance when

considering the aforementioned challenges confronting the architectural discipline (Sántha et al., 2021).

As argued by architect Lino Bianco, the problem is that "architecture is often considered in terms of elevations and architectural elements, thereby failing to address its 'essence'" (Bianco, 2018 p. 93); its impact on the everyday life and value for its users (articulated here through the notion of spatial gestures), which are not efficiently addressed in either the design itself or its communication, leading to a discrepancy between means and ends. One may argue that, since the "meaning" of design can be understood as something that springs from the imagination of the architect, it is often implicit, which means that it is something architects have, consciously or unconsciously, control over but might find it hard to describe in words (van der Linden, Dong, & Heylighen, 2019). In fact, the implicit documentation of value created by architecture seems to be understood as the built project itself, through the "architects' own account of design intentions and the project documentation by drawing, renderings and beautiful photographs" (Sattrup, 2020, p. 24). In this regard, we argue that the explicit articulation of spatial gestures can provide a bridge between means and ends, architect and user. This allows the architect to return to the "essence" of architecture, while still maintaining a critical awareness of its construction in a complex building industry, where communication is key when making arguments and decisions during the design process. Correspondingly, the development and application of tectonic methodology in architectural practice represent critical means for architects to strategically activate their field-specific knowledge within an interdisciplinary context (Sántha et al., 2021). Tectonic thinking in architecture facilitates an opportunity to escape the classical description of architectural quality, located within the domain of aesthetics and focused on what architecture "is". Instead, tectonics implies an interdisciplinary description of architectural quality and value reaching beyond itself; focused on the contextual understanding of what architecture "does" (here through spatial gestures), related critically to "how it does it" (Hvejsel, 2018 p. 403) (here through construction principles). This, however, does not mean that it will "do" exactly and create the same value as it was intended by the architect, but the formulation and the communication of this value potential are understood here as a first step toward the process of social value creation. As Sekler describes, it is the tectonic choices that provide architects room to manoeuvre; "Among our three related concepts [structure, construction, tectonics], tectonics is the one most autonomously architectural; which is to say the architect may not be able to control the conditions or structure and construction as completely as he would like to, but he is the undisputed master of tectonic expression" (Sekler, 1964, p. 94).

It is our observation that tectonics hereby also represents an opportunity to expand and qualify this manoeuvring, if applied critically in unpacking the specific choices made in the design process (Sántha et al., 2021). Hence, with this research, we add to the existing body of knowledge on tectonics in architecture by applying the proposed tectonic theory as an interdisciplinary methodological framework for establishing a common language of analysis across architectural, anthropological and economic perspectives (Figure 1) (Sántha et al., 2021). The framework is built on the notion of spatial gestures, applied in interior studies (Hvejsel, 2011; Postiglione & Lupo, 2007; Sekler, 1964). The concept was used by Sekler in his account for the tectonic expression: "Obviously what matters, apart from other factors which are outside the scope of the present essay, is the tectonic statement: the noble gesture which makes visible a play of forces, of load and support in column and entablature, calling forth our empathetic participation in the experience" (Sekler, 1964, p. 93). Referring to human body language, the notion of spatial gestures helps to describe the interaction between architecture and people as a spatial dialogue, hereby stressing the core potential of architecture to "invite" and "encourage" a certain behaviour through its form that ultimately translates to value, depending on the users consciously or unconsciously accepting or rejecting those gestures.

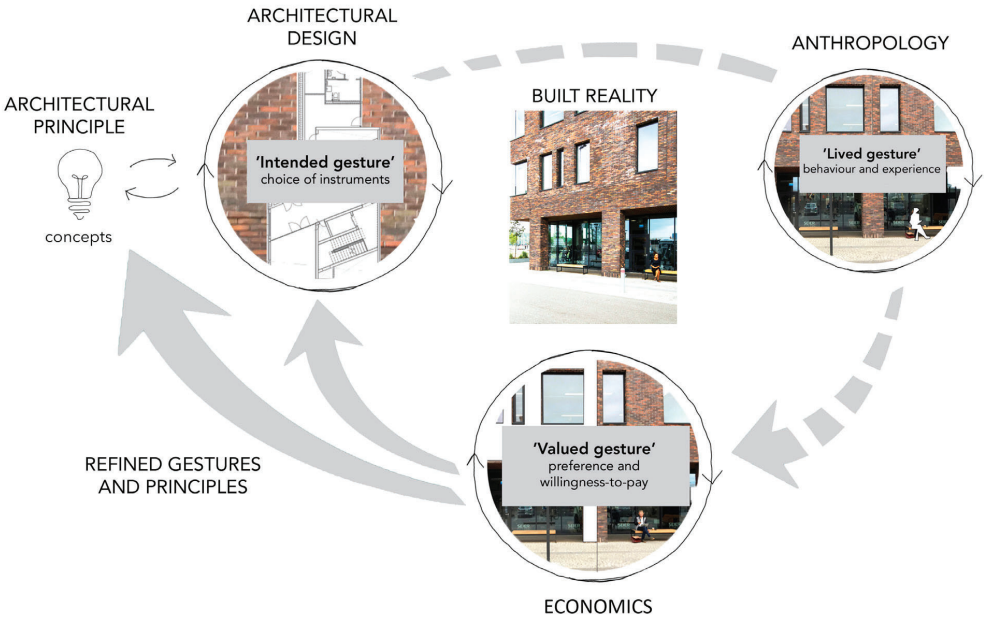


Figure 1
Tectonic methodology by Sántha et al. (2021). **An interdisciplinary methodological framework** for acquiring knowledge on how a set of architectural instruments as intended architectural gestures – that are chosen based on predefined concepts (principle) in the architectural design phase and result in a visible and tangible form (built reality) – translate to economic value, depending on users who consciously and unconsciously react to the architects' intended gestures and define its value (valued gestures) through the choices and trade-offs they make (preferences), effectuated via their experience and behaviour of the architectural space itself (lived gesture). Ultimately, this knowledge can be used to inform and improve decision-making in future architectural design processes (refined gestures and principles).

This article presents the first study of the ongoing Ph.D. research project, representing the architectural dimension, where the proposed tectonic methodology is applied to identify the value intended by the architects, in the form of key spatial gestures within the specific choices negotiated in the architectural design process. The following presents how the method is specifically applied in this article, focusing on intended spatial gestures (architectural dimension), based on two selected mixed-use projects, located in Aarhus, Denmark, and designed by AART.

Application

Data collection was carried out from August to October 2020 in the form of qualitative interviews with the lead architects, in two rounds in each of the cases respectively. Project leading architects were chosen based on the assumption that they hold a key influence on the design and the decisions made in the process of development. As a further elaboration of this study, it could be interesting to investigate whether and how the understandings of key gestures differ amongst the different members of the design process; however, this is outside of the scope of this article.

The first round of interviews was conducted as semi-structured, individual, "face-to-face" interviews (Johansson, 2018; Wadel, 1991) at the company headquarters in Aarhus. These 1,5-hour interviews were focused on the identification of key intended spatial gestures, related to the overall "architectural vision" of each project, based on the material in the project's respective folder. At the beginning of each interview, a definition of the term "gesture" was provided to ensure the use of the same terminology and to keep the interview targeted. Supported by a loosely structured thematic interview guide (based on a prior review of project materials), open-ended questions were asked regarding the specific architectural instruments chosen to provide the identified key gestures addressing users "approaching" (urban dimension), "arriving" (site dimension) and "working-living-visiting" (interior dimension). This was done to systematically unfold these projects' potential in creating value – through their gesturing forms – not only as single buildings, but also as integrated parts of their respective urban environment. Finally, the interview ended in questions motivating the respective project's leading architect to consider whether and how they would have improved these gestures, in an "ideal" situation where there were no constraints in the construction economy. This was done to uncover potentials that might have been lost due to such constraints.

After the semi-structured interview, an on-site, "walk-and-talk" interview was conducted in each case to experience the gestures together with the architects, to discuss in greater depth how those gestures were constructed and how they work in practice. A walk-and-talk interview is an interview conducted on the move, where the researcher and partici-

pant(s) are talking while walking together in a specific location (Clark & Emmel, 2010; Kinney, 2017). "Walking interviews are a valuable means of deepening understandings of lived experiences in particular places" by providing rich, multisensory and detailed data (King & Woodroffe, 2017, p. 1). The walk-and-talk interviews took place on 29 October 2020 at the location of each case with the respective project's leading architect. Within a timeframe of approximately one hour, informants were asked to show the key spatial gestures they identified in the semi-structured interviews by taking a tour around and within the building in each case. Simultaneously, the walk and talk interviews opened a "forum" between us, researchers in architecture and practicing architects, for a critical discussion on the built reality and into further considerations as to whether and how they would have improved the key intended gestures had there been no constraints.

All the interviews were audio-recorded and photo-documented, then semi-transcribed and coded using the qualitative data analysing software NVivo Pro (version 12.6.0.959). The following sections present the findings from the interviews and the review of project materials from the two cases, through the above introduced tectonic lens.

Two cases unpacked

Both cases studied here are post-construction and post-occupation, mixed-use buildings designed by AART. The mixed-use typology is chosen in this study because it places particular demands on the building's ability to create spatial gestures in the transition between building and urban spaces. This is due to its complexity in application and user groups, in relation to social and socio-economic value creation. The cases have been selected based on the hypothesis that strategic choices made during the design process – in the form of intended gestures – have resulted in a number of social qualities improving the users' everyday life and sense of community. As such, an information-oriented, selection strategy was applied to maximize the utility of data collected from single cases (Flyvbjerg, 2010). Hence, the selected cases can be characterized as "critical, most likely cases". They provide access to rich information, and thereby enhance our understanding of the underlying causes of a phenomenon (here social qualities of architectural design) and its effects (here economic value creation for users) (Flyvbjerg, 2010).

Both projects can be found in the Danish city of Aarhus, which is located on the east coast of the Jutland peninsula, in the geometrical centre of Denmark, with a total area of 468 km^2 (Aarhus Kommune, 2020). Since the 20th century, Aarhus is the second biggest and the second fastest-growing city in Denmark. For centuries, the primary driver of growth was the maritime trade of agricultural crops. Today, Aarhus has become the largest centre for culture, trade, services, industry, tourism, research and

education in the region, while still holding its important trading role by being the country's industrial port for container handling and shipping. The port lies in Aarhus Bay (*Aarhus Bugt*), and along with the connecting Peri-Urban Harbour Areas (*De Bynære Havnarealer*), which not only historically, but also nowadays hold strategic importance in terms of urban development (Aarhus Kommune & Aarhus Havn, 2003; Aarhus Kommune & Planlægning og Byggeri, 2006). The rapid urbanization in Aarhus since the early 2000s, which is expected to continue until at least 2030, challenges the development of the city (Aarhus Kommune, 2020). In order to accommodate growth and create space for the many new inhabitants in a well-connected and sustainable way, Aarhus has seen an extraordinary building boom of new institutions, infrastructure projects, neighbourhoods and urban recreational areas since the turn of the millennium (Aarhus Kommune, 2020). Starting in 2008, the re-development of the Aarhus Bay harbourfront has been a key area in the accommodation of the growing urban population, guided by the vision of transforming the former industrial dockland to a new, vibrant, mixed-use urbanite, while functionally linking the city and the bay, thereby changing both the skyline and the land use of the inner city (Aarhus Kommune & Aarhus Havn, 2003; Aarhus Kommune & Planlægning og Byggeri, 2006). The area is still undergoing heavy development, but once fully finished it will provide a home for more than 12,000 and a workplace for more than 10,000 people, which makes the project among Europe's largest waterfront developments (Willacy, 2020). However, given its sheer size and scale, the development has also been undergoing some critique with regards to the gestures communicated on an urban dimension (Christiansen, 2020).

"The Warehouses" (*Pakhusene*) are located in the Northern part of the Peri-urban Harbour Areas, called Aarhus Docklands (*Aarhus Ø*) on Pier 4. It is a 40.000 m² complex (Figure 2), consisting of five mixed-use buildings, three with office units and two with residential units on the upper floors, and in both cases retail shops (bakery, furniture store), common facilities (barbershop, fitness centre, yoga studio, restaurant, meeting rooms, sauna) on the lower floors and parking spaces both above and below ground, thereby considered a pure mixed-use, walkable urban cluster. Of the three buildings with primarily office functions, two are 8/10-storey 9300 m² buildings and one is 9300 m² with 10/12 floors. The complex's two other, primarily residential, buildings have 9 and 13 floors, with an area of approximately 4600 m² for apartment units and 1850 m² for non-residential functions (Figure 2). The complex has an approx. 9750 m² underground and an approx. 1550 m² above-ground parking area with a 400 m² courtyard. The complex was designed by AART in collaboration with MOE engineers as a private assignment. The first phase – including one office building and the two residential buildings – was completed in 2016, developed by real estate developers Domis Ejendomme and Kilden & Hindby. Shortly afterwards, PFA Ejendomme invested and bought the office part of the complex, including the one completed, and the right

to develop the two others in the second phase, which finished in 2020. The project was designed with the involvement of future tenants of the office units, among others AART themselves. The project was led by Anders Tyrrestrup, architect and founding partner at AART.

As the first building on Aarhus Docklands, the Warehouses received a DGNB Gold certification for sustainability, including environmental, social and economic aspects. However, these kinds of certification schemes cannot realistically reflect the contribution of the architectural space itself towards sustainable development on the social dimension, as they are based on assessments of the building pre-occupancy, reflecting a theoretical performance, and not how the building actually performs in practice (Hay, Samuel, Watson, & Bradbury, 2018; Jensen & Troelsen, 2017; Stender & Walter, 2019). This ongoing research addresses this issue by proposing the above-described tectonic methodology, as a strategic framework for systematic documentation of architecture's social qualities, measured by the social and socio-economic value that they create in practice to allow a translation from cost to value.

The new media office building is part of the existing media cluster in the district called "Film City" (*Filmby*) located between Aarhus Docklands and the South Harbour Quarter (*Sydhavnskvarteret*), within the Peri-Urban Harbour areas. It is a 6-storey, vertical, mixed-use building with an area of 4400 m^2 (Figure 2) that has office units on the upper floors, called "Tower" and public functions on the lower levels, called "Base". The Base comprises elements such as a café/restaurant with a production kitchen, shared meeting rooms, flexible working niches and an urban "plaza", which is a public space on top of the Base, with an open-air cinema provided by the media-façade of the Tower. The building was designed by AART, in collaboration with Rambøll engineers and SLA landscape architects, as a winning proposal in a tender competition, "The extension of Film City", in 2015. The building is developed and owned by the Municipality of Aarhus. The project was led by Karsten Sinning, architect, partner and team leader at AART.

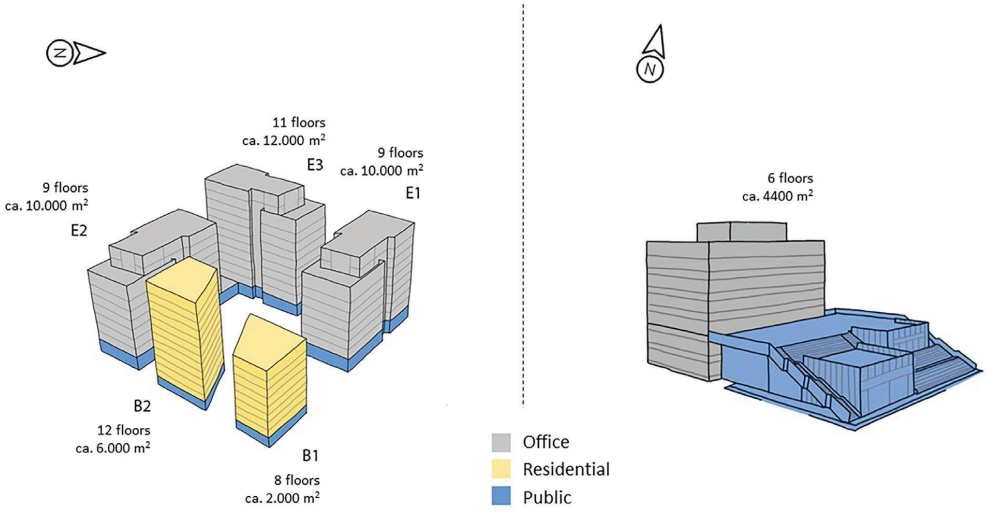


Figure 2
Overview of selected cases. The complex of "The Warehouses" (on the left) and the new media office building (on the right). Colours indicate main functions/units.
FIGURE MADE BY ESZTER SÁNTHA

Unpacking the potentials

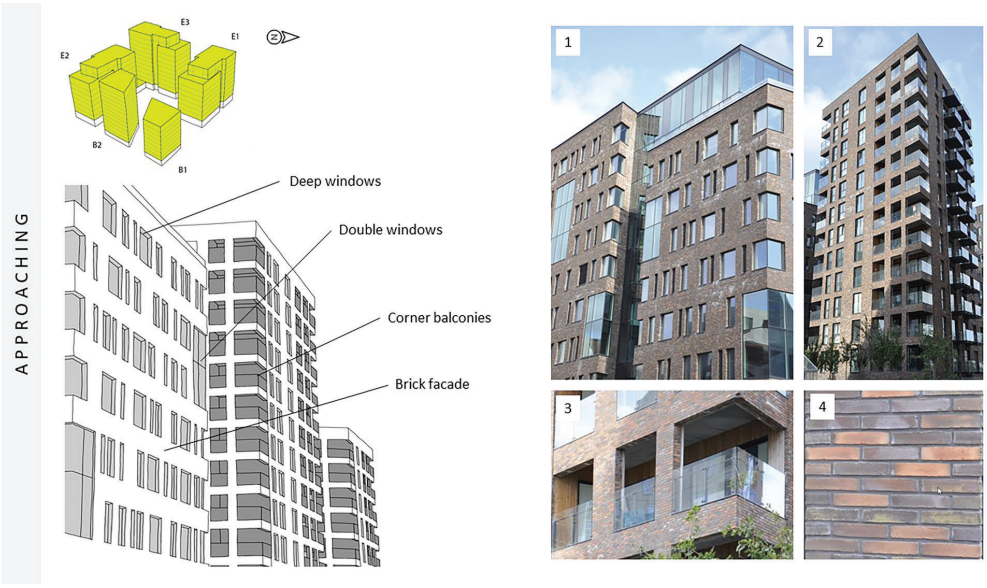
The following section presents the empirical findings of the interviews, focusing on how the architects articulated, constructed and identified the key intended gestures in their respective cases as a means for materializing potentials for social value creation. In this section, we unpack how the actual construction choices seek to communicate the intended value in each of the key intended gestures addressing users approaching (urban dimension), arriving (site dimension) and working-living-visiting (interior dimension), as identified by the leading project architects in the interviews in each of the two cases.

The Warehouses

Approaching

The key gesture addressing users approaching The Warehouses (Figure 3), identified by the architect, was to create a rough, heavy-looking warehouse (hence the name) that simultaneously has "sensible qualities". These sensible qualities are communicated firstly by breaking the volume of the buildings' mass with recessed windows of different sizes and covered corner balconies (also comprises the intention of providing a shield from the wind and thereby offer a more comfortable outdoor experience for residents). Secondly, the sensitivity is articulated by the choice of material on the façade, which is a high-quality, multi-coloured brick that provides warmth, a sense of familiarity and a feeling of home. This choice is based on the architect's field-specific knowledge, arguing that this type of brick is something Danish people can traditionally relate to because it reminds them of the "good old" architecture.

As Anders Tyrrestrup, the project's leading architect emphasizes: "The brick also attracts people, we know that. It has the warmth and the idea of home in many people, and it is another quality than concrete buildings". The intended value potential of these sensible qualities, identified by the architect, was to attract future tenants and apartment buyers, which has been an explicit focus in the project.



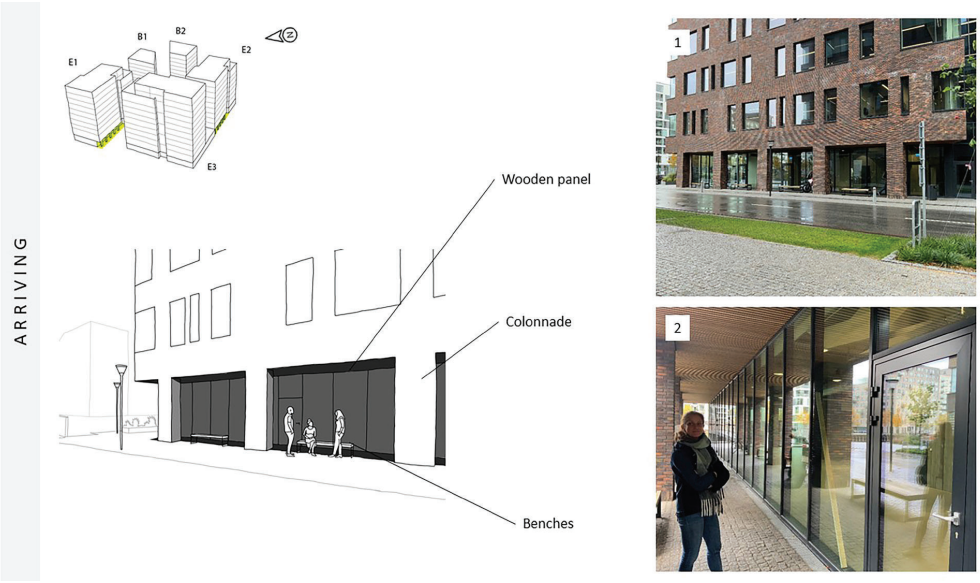
Arriving

The key gesture addressing users arriving at The Warehouses (Figure 4) was identified by the architect as inviting the public in by creating an "edge zone", a recessed exterior niche with a colonnade, wooden panels on this exterior "ceiling" and wooden benches, which welcomes people, provides a cosy space to meet and leads to the entrance, thereby signalling "I'm approachable day and night". This is furthermore enhanced by the open ground floor itself, displaying the activity happening inside the building. As Tyrrestrup describes it:

> *A good example of the purpose of an edge zone as a meeting point/ waiting area is today: it's raining, but we can still stand here and talk. In a huge complex like this, such an area, acting also as a welcome area can make it softer, more accessible, more inviting – otherwise, you would never stop here. It was a trade-off between this gesture and more rentable space. We really argued that this is the way to welcome this building.*

Figure 3
Visualization of key intended spatial gestures and corresponding architectural instruments addressing users approaching The Warehouses. Overview (top-left), a sketch of the architectural vision (bottom-left) and photos of the "built reality" showing: the façade of the office units (1) and the residential units (2), the covered corner balconies (3) and the multi-coloured brick (4) used on the façades.
PHOTOS WERE TAKEN BY ESZTER SÁNTHA ON 9 SEPTEMBER 2020. SKETCHES WERE MADE BY ESZTER SÁNTHA.

The intended value creation here, identified by the architect, was to stage the visibility of movement and activity, which invites to interact with space around and ultimately within the building, which is "important for any business".



Working, living and visiting

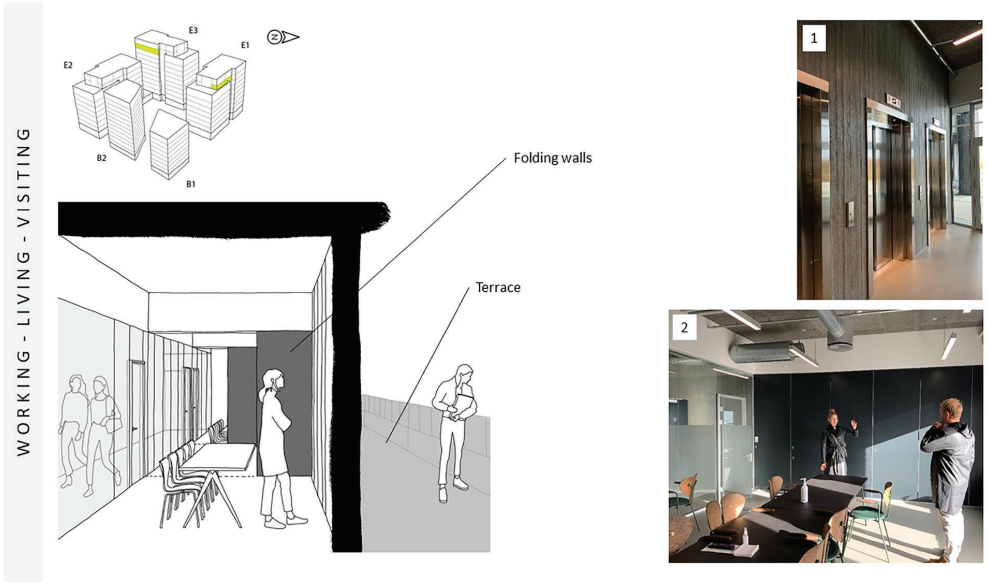
The key gesture addressing users' everyday life (Figure 5) identified by the architect was to promote a sense of community on "many levels" by a number of architectural instruments. Firstly, by providing an open ground floor with small shops and businesses that offers a range of "decent" services (e.g., bakery, fitness centre, restaurants) within walkable distance, which are considered "add-ons" to everyday life. And secondly, by providing flexible office spaces and multifunctional shared spaces (e.g., meeting rooms, terrace, cantina, lounge), which are intended to be used by both the companies and residents of the Warehouses. Therefore, it aims not only to create a community among companies of different sizes but also bridging between the office and apartment units. Regarding the interior of these shared spaces, the same identity is communicated inside as outside, viz. an industrial look with visible installations, but also playing with the senses by introducing warmth with rough wooden furniture, wooden panels and a mix of wooden patterned and plain visible concrete walls in most common areas. As argued by the project's leading architect:

Figure 4
Visualization of key intended spatial gestures and corresponding architectural instruments addressing users arriving at The Warehouses. Overview (top-left), a sketch of the architectural vision (bottom-left) and photos of the "built reality" showing: the edge zone from a distance (1) and standing within its niche (2).

PHOTOS WERE TAKEN BY ESZTER SÁNTHA ON 9 SEPTEMBER 2020 WITH THE PERMISSION OF PEOPLE APPEARING ON THE PHOTOS. SKETCHES WERE MADE BY ESZTER SÁNTHA.

The flexibility really has proven its worth, also to the community; the gaining by sharing areas […]. I think it also comes down to some very basic design decisions that make it work, like the concrete cores that have this surface with the wooden boards. Everyone who comes here touches it. It is a beautiful concrete structure and that affects people. It is a rough house, but it also has its sensible qualities that people react to.

The intended value here, as identified by the architect, is to define and maintain a delicate balance between the ratio of shared and owned spaces and the idea of gaining more by owning less and investing in flexible common facilities with sensible interior qualities.



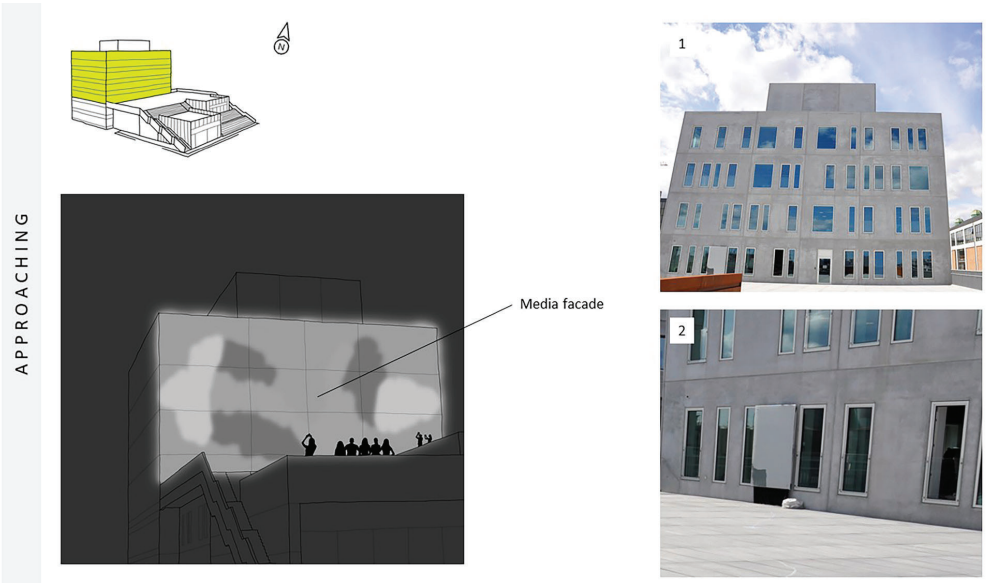
The new media office building in the Film City cluster

Approaching

The key gesture addressing users approaching the Film City complex (Figure 6) identified by the architect was, on one hand, to "blend" the new building into the existing complex, urban fabric and history of the neighbourhood; and on the other hand, to invite daily users and visitors by elevating the site to a new, modern level. Being a centre for media activity, the concept was to create a vibrant, modern, digital atmosphere. Guided by this principle, the gesture was to signal creativity and thereby arouse curiosity from a distance, while keeping the building authentic to its existing surrounding. These gestures are communicated through

Figure 5
Visualization of key intended spatial gestures and corresponding architectural instruments addressing users "working-living-visiting" The Warehouses. Overview (top-left), a sketch of the architectural vision (bottom-left) and photos of the "built reality" showing: the interior "core" of the buildings with wooden patterned visible concrete walls (1) and the interior of the shared meeting rooms (2).
PHOTOS WERE TAKEN BY ESZTER SÁNTHA ON 9 SEPTEMBER 2020 WITH THE PERMISSION OF PEOPLE APPEARING ON THE PHOTOS. SKETCHES WERE MADE BY ESZTER SÁNTHA.

the materials used, described by the architect as: "local, honest materials", meaning materials that match the existing use of materials on the site (Corten steel, glass, concrete), with solutions that create a cinematic atmosphere. These solutions entail a so-called "media-façade" that consists of LED panels behind the glass façade. As explained by Karsten Sinning, the leading project architect of "The Extension of Film City", the original intention of this solution was to "show the building inside out" and to showcase the different kinds of work produced within the media office building. However, due to economic constraints, this had to be financed externally, with a new intention to use the façade as an exclusive display for an art project using film and media technology to communicate a range of visual narratives. The intended value potential of these qualities identified by the architect is to attract talent, media companies and people from all over the world.



Arriving

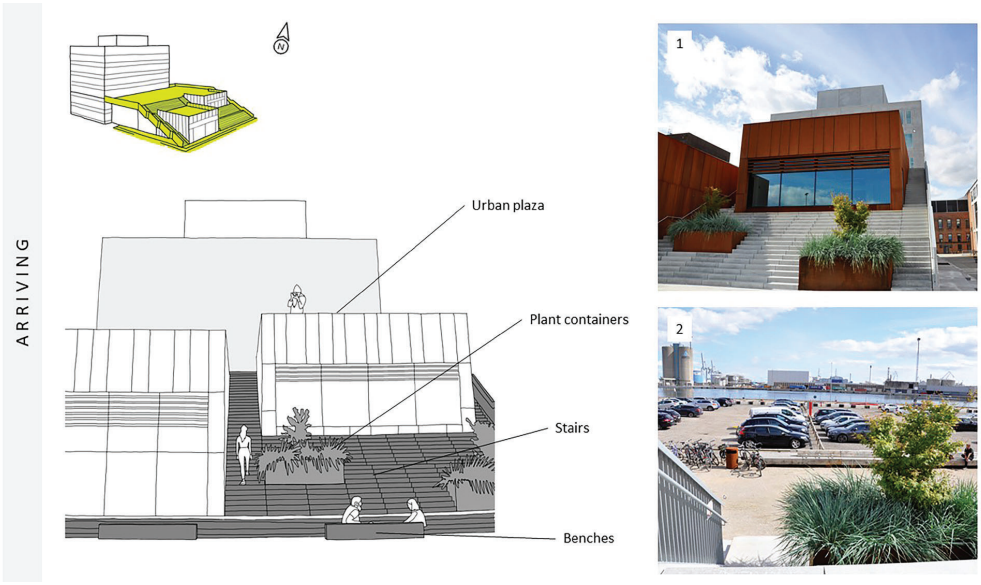
The key gesture addressing users arriving at Film City (Figure 7) identified by the architect was to provide a meeting place for the locals by creating an urban plaza, an elevated public space with a staircase, enriched with green elements (plant containers) and benches leading up to the media façade. A space that invites people to stop and look around by providing a cosy space to meet, have a coffee, engage with culture and be inspired by others through discussions in a creative setting. This "generosity" towards the public is furthermore enhanced by the open ground floor itself, which was a concept adopted from the case of the Warehouses. In-

Figure 6
Visualization of key intended spatial gestures and corresponding architectural instruments addressing users approaching Film City. Overview (top-left), a sketch of the architectural vision (bottom-left) and photos of the "built reality" showing: the media façade under development (1) and its first piece (2).
PHOTOS WERE TAKEN BY ESZTER SÁNTHA ON 9 SEPTEMBER 2020. SKETCHES WERE MADE BY ESZTER SÁNTHA.

troducing this new media office building as a mixed-use type was based on the advantages of this typology and the positive experiences gained from the Warehouses project. This concept was described by Sinning as follows:

> *The concept was to make this plateau with these stairs […]. [In this way] this building becomes actually a public space to the city. It is not so much about making a new building only for itself, it's actually about giving back to the city.*

The intended value identified by the architect is the open ground floor and public functions inviting people to meet and interact with the space around, and ultimately within the building.

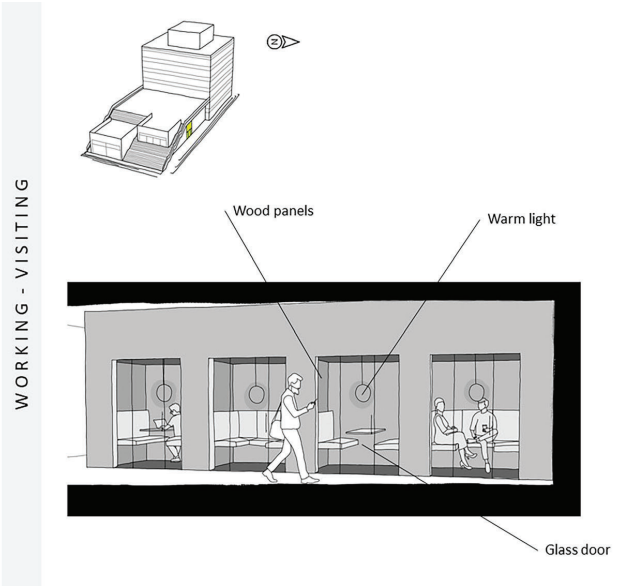


Working and visiting

The key gesture addressing users working in and visiting the new media office building (Figure 8) identified by the architect was to create a creative community among the companies located in the Film City complex by a number of architectural instruments. Firstly, by providing an open ground floor, the Base, with common facilities (e.g., cafe, cinema) that serves as a hub and a new urban place to meet within the city; and secondly by providing flexible office spaces and a number of shared facilities (e.g., meeting rooms, rooftop terrace, cantina, semi-private flexible workspaces – the meeting niches). In the interior dimension of these spaces, the same identity and atmosphere is articulated by an industrial

Figure 7
Visualization of key intended spatial gestures and corresponding architectural instruments addressing users arriving at the new media office building in Film City. Overview (top-left), a sketch of the architectural vision (bottom-left) and photos of the "built reality" showing: the staircase leading up to the "urban plaza" (1) and view from sitting on this staircase (2).
PHOTOS WERE TAKEN BY ESZTER SÁNTHA ON 9 SEPTEMBER 2020. SKETCHES WERE MADE BY ESZTER SÁNTHA.

look with visible installations, dark colours, with sensible qualities by introducing warmth with rough wooden furniture, warm light, wooden panels, Corten steel, green wall and visible concrete walls in these common areas. As in the case of The Warehouses, the intended value here identified by the architect is to define and maintain a delicate balance between the ratio of shared and owned spaces. The idea is of gaining more by owning less and investing in flexible common facilities with sensible interior qualities, creating a cinematic atmosphere.



Discussion

In this study, we examined how and to what extent the architects have worked strategically with formulating intended gestures, as well as what corresponding constructive principles, they have specifically applied to negotiate choices related to these gestures in the design process. This was done by questioning how these intended spatial gestures are constructed and communicated in the design process, focusing on the underlying intentions of specific design choices, including the reasoning behind those decisions. Moreover, it was done by discussing whether and how architects would have imagined improving these gestures via the construction of further or different instruments in a possible "ideal" situation, where there are no construction-related economic constraints. This is reflecting a scenario where no design trade-offs have to be made due to budget restrictions.

Figure 8
Visualization of key intended spatial gestures and corresponding architectural instruments addressing users working and visiting the building. Overview (top-left), a sketch of the architectural vision (bottom-left) and photos of the "built reality" showing: the canteen with the meeting niches in the background (1) and the meeting niches (2) under development.
PHOTOS WERE TAKEN BY ESZTER SÁNTHA ON 9 SEPTEMBER 2020. SKETCHES WERE MADE BY ESZTER SÁNTHA.

Lost potentials: the neglected interior

Through a deeper understanding of the construction of spatial gestures in architectural design, the interviews uncovered the deliberate work by the architects to develop the potential for value creation. However, in addition to the identified intended gestures, they also revealed how these potentials in certain cases were lost due to construction-related, economic considerations aiming to reduce costs, resulting in solutions that did not correspond with the original architectural idea ("non-gestures").

Our findings show that it is especially in the interior dimension that spatial gestures intended by architects failed to be realised, thus possibly limiting architecture's potential to address its essence; to create value for its users from an architectural perspective. For example, in the Warehouses' shared meeting rooms, where – from the architect's perspective – the space visibly loses from its roughness, as the partitioning walls are white-painted plaster walls, the furniture is softer and plain and the door frames are plastic. These non-gestures leave the space as a quite poor, sensible experience – without interiority – that is, in the words of Anders Tyrrestrup, "struggling" with the whole architectural idea of the building's main identity. The same was experienced in the case of the new media office building. For example, in the meeting niches, where the intended gestures can hardly be traced. They are "overwritten" by a series of non-gestures, leaving the space – from the architect's perspective – a quite uninspiring space for working or even meeting, which questions its overall purpose and usability. This relates to the part-whole discussion, amplifying how these details are indeed the essential building blocks of "meaning" (value creation) in a piece of architecture (Frascari, 1981). In agreement with Frascari, it can be argued here, that the construction and formulation of spatial gestures (what he calls "careful detailing") – the complex art of combining architectural instruments (materials, components, building parts, etc.) in a functional and aesthetical manner – is "one of the most important means for avoiding building failure, on both dimensions of the architectural profession: the ethical and the aesthetic" (Frascari, 1981, p. 24). Hence, the construction and formulation of spatial gestures as careful detailing should not be underestimated when it comes to decision-making in the architectural design process.

Negotiating gestures

Parallel to the research on tectonic theories of architecture, our empirical findings in both cases showed how activating the architects' field-specific knowledge on the careful construction of spatial gestures is crucial in defining the goals for social quality and social value of an architectural project on several dimensions (urban, site and interior). As these construction choices are negotiated in the design process, a successful design also requires a very high degree of empathy and collaborative skills from all parties involved in the process. In this regard, the

notion of spatial gestures helps to communicate goals strategically in the design process. As Karsten Sinning stresses:

> *[…] they have to use our knowledge to make a COMPLETE design for the building, for everything to fit together. It is a part of the good points in the discussion between the architect, the client and the engineer on what is the final project and the key elements of gaining those goals for the complete design.*

This opens the discussion on the design process itself and the nature of collaboration between parties involved in the design process. The two investigated cases were designed by the same studio, hence with the same architectural approach, yet design choices on the construction of spatial gestures to create value for future users of the buildings were more successfully negotiated in one case than in the other. This is what Frascari defines as the complexity of this task: that a detail (here, a gesture) "performing satisfactorily in one building may fail in another for very subtle reasons" (Frascari, 1981, p. 24). As a response to the question regarding the reasons behind the successfully negotiated gestures in the Warehouses project, Anders Tyrrestrup said that it "takes a strong developer" and a good collaboration to build with social quality and value. The architect also pointed out here that the unique opportunity for future tenants to become a part of the design process from the beginning, and to have the opportunity to influence design decisions relating to their new office, also resulted in a more balanced discussion on cost and values between the developer and future user, with the architects as mediators and "creators" in this process. This is where the "design turns into the art of negotiating realities through built form" (Postiglione & Lupo, 2007, p. 150) when gestures are considered in relation to their context to address the user perspective. In this case, AART was not only the architect but also one of the future users. This opened a unique opportunity for AART to learn about co-creative approaches when negotiating cost and value. Here, the application of a tectonic approach, focusing on the explicit use of spatial gestures and their construction as an argument for value creation, can enable them to have the same discussion in a more qualified manner in future projects. The "lesson learned" was described by Tyrrestrup as follows:

> *It was also a learning process for us, because when we said we want that brick they could say, okay, so how much higher rent do you want to pay for that – then we learned we have to balance and prioritize and weigh the qualities, because if we all the time pick from the most expensive shelf, it doesn't connect, or would be too expensive [from a user and thereby from a developer perspective as well].*

In this realisation, it is also reflected that one simply cannot avoid making choices and trade-offs, whether it is conscious or unconscious,

neither from an architect nor from a user perspective. However, these choices remain intangible until they are "unpacked" – critically explored and discussed – and their corresponding value presumably remains "unseen"– unaccounted for – until they are expressed in monetary terms, reflecting the underlying preferences when making those choices. Therefore, spatial gestures need to be further explored from other (anthropological, economic) dimensions.

Future perspectives on the tectonics of cost and value

This study showed how, and to what extent, the application of a tectonic re-conception of architectural cost and value on the architectural dimension allows architects to materialise critical thoughts through design (in practice). This offers an alternative language to engage people in a spatial dialogue and to strategically activate their field-specific knowledge within an interdisciplinary context to create value. Doing this through critical awareness and a critical (co-) creative approach to architectural design (Dunne & Raby, 2013; Kleis, 2020), challenges the status quo assumptions on the role of architecture as a product in people's everyday life (through spatial gestures), while maintaining a critical awareness of its construction when negotiating choices in the design process. Tectonic thinking in architecture is thereby providing an opportunity for the architect to engage in a process of change, focused simultaneously on the improvement of the physical products of architecture as well as their service as advisors/collaborators in the design process. However, tectonic thinking as a critical approach to design is ultimately a "positive and idealistic" approach, as it is believed that the change is in fact possible (Dunne & Raby, 2013), in this context, that architectural practice can improve and move towards a more sustainable and human-centred direction, allowing for the maximisation of its social quality and value.

The architectural projects selected for investigation in this study were critical, most-likely cases. It was assumed that spatial gestures constructed and formulated by architects in these cases had resulted in buildings with high social quality and value. However, even empirical results have shown that there are unexploited potentials for creating social value from an architectural perspective. Strategic communication and formulation of spatial gestures can succeed in cases where the value of these gestures is mutually recognized by parties involved in the design process but might fail in others. It is the hypothesis of the Ph.D. project that this may be due to the lack of economic arguments expressing the exact economic value of those gestures. In a consumer society like ours, it is through the exchange of money we realize futures, based on accepting and rejecting – whether it is conscious or not – possible (built) realities (Dunne & Raby, 2013). This emphasizes the need for expanding tectonic thinking beyond architecture itself, towards an interdisciplinary description of architectural quality and value, where architects' field-specific

knowledge on social value creation provides a point of departure for further "translation".

The present article thereby outlines a first step towards the establishment of a common language, which allows for future conjoined analysis, supplementing the architect's perspective (architectural dimension) presented here, with anthropological and economic perspectives. The economic valuation, however, is dependent on an understanding of the user's perspective, i.e., knowledge about how these identified spatial gestures are experienced and lived when the building has been taken into use. The three key intended spatial gestures identified in this study thus establish the "context" (Postiglione & Lupo, 2007, p. 150) for future studies superimposing the dimensions of anthropology – investigating whether and how these intended gestures translate to social qualities, and investigating through daily practice – and economics – how the intended gestures translate to economic value through the choices users make, based on their experience and behaviour.

Conclusion

Based on two cases, this study examines how and to what extent project-leading architects at AART have worked strategically with formulating intended gestures, and what corresponding constructive principles they have specifically applied and used to negotiate choices related to these gestures in the design process.

Our findings show that it is especially in the interior dimension where spatial gestures intended by architects failed to be realised, possibly limiting architecture's potential to address its essence; to create value for its users. In both of the cases, the key intended gestures articulated by the architects were significant identifications of the spatial capacities of the building's exterior in addressing users approaching and arriving (urban and site dimension, respectively), whereas the interviews uncovered multiple "non-gestures" in the interior dimension that the architects would have liked to develop differently. This is despite the information-oriented, case selection strategy applied in this study, where critical most-likely cases were investigated with the underlying assumption that spatial gestures constructed and formulated by architects had resulted in a number of social qualities and values. Yet empirical results have shown that even these projects have unexploited potentials to be unpacked. The explicit communication and formulation of spatial gestures can succeed in cases where the value of these gestures is mutually recognized by parties involved in the design process but can fail in others. An important reason for this may be due to the lack of economic arguments, expressing the economic value of those gestures. This emphasizes the need for expanding tectonic thinking beyond architecture itself, towards an interdisciplinary description of architectural quality

and value, where architects' field-specific knowledge on social value creation provides a point of departure for further "translation".

In conclusion, this article demonstrated how these intended spatial gestures reveal the trade-offs negotiated in the design process at a detailed level, hereby unfolding a critical tool for increasing value potentials otherwise lost in the translation from cost to value. The findings of this article thereby form a critical foundation for the following studies of the Ph.D. research project, where the architect's perspective will be supplemented with anthropological and economic perspectives, towards the establishment of a common language to describe the social qualities and values of architecture.

Acknowledgements

This article is part of an ongoing Ph.D. research project at the Department of Architecture, Design & Media Technology at Aalborg University and the architectural studio AART Architects A/S, in collaboration with the Department of Food and Resource Economics at the University of Copenhagen, in Denmark. The work is funded by AART Architects A/S and Innovation Fund Denmark (Industrial Ph.D. grant 9065-00220B). The authors would like to thank the architects, Anders Tyrrestrup and Karsten Sinning for their continuous collaboration and engagement in the research project. The authors would like to furthermore thank all members of the Ph.D. project's follow-up group: Marie Stender (senior researcher at AAU-BUILD), Peter Andreas Sattrup (chief sustainability consultant at DanskeArk) and Toke Emil Panduro (senior researcher at AU-ENVS) for their engagement in a critical discussion on the topic. Finally, the authors would like to thank the two anonymous reviewers whose comments/suggestions helped improve and clarify this manuscript.

References

Aarhus Kommune. (2020). Aarhus i tal. Retrieved from https://ledelsesinformation.aarhuskommune.dk/aarhus-i-tal/default.aspx?doc=vfs://Global/AARHUS-I-TAL/Hjem.xview

Aarhus Kommune, & Aarhus Havn. (2003). *Helhedsplan for de bynære havnearealer*. Aarhus: Aarhus Kommune. Retrieved from https://www.aarhus.dk/media/5498/helhedsplan-for-de-bynaere-havnearealer.pdf

Aarhus Kommune, & Planlægning og Byggeri. (2006). *De bynære havnearealer – dispositionsplan for de nordlige områder*. Aarhus: Aarhus Kommune. Retrieved from https://aarhusoe.dk/media/5502/dispositionsplan.pdf

Bech-Danielsen, C., Beim, A., & Madsen, U. S. (2014). *Towards an ecology of tectonics: The need for rethinking construction in architecture*. Stuttgart: Edition Axel Menges.

Bianco, L. (2018). Architecture, values and perception: Between rhetoric and reality. *Frontiers of Architectural Research, 7*(1), 92-99. doi:10.1016/j.foar.2017.11.003

Bjørn, N. (2014). *Evidens for sociale effekter af fysiske indsatser i udsatte boligområder. Review af 27 effektstudier fra ni lande.* (). København: Københavns Kommune. Retrieved from http://www.nielsbjorn.dk/evidens-sociale-effekter-af-fysiske-indsatser-i-udsatte-omr%C3%A5der

Bötticher, C. G. W. (1844). The principles of the Hellenic and Germanic ways of building with the regard to their application to our present way of building. In H. F. Mallgrave (Ed.), *In what style should we build? The German debate on architectural style* (pp. 147-167). Santa Monica: Getty Publications.

Broch, N. R., Sattrup, P. A., & Sejr, K. (2017). In Sejr K. (Ed.), *Architecture creates value*. Copenhagen: Danish Association of Architectural Firms. Retrieved from www.danskeark.dk/en/content/architecture-creates-value

Christiansen, E. M. (2020). *Tectonics and the city: In search of a critical perspective on assembling the city*

Clark, A., & Emmel, N. (2010). *Using walking interviews*. Manchester: Morgan Centre, University of Manchester.

Dam, T. (2007). Does tectonics make meaning in landscape architecture? Paper presented at the *Tectonics Making Meaning Conference,* Eindhoven, Netherlands.

Dunne, A., & Raby, F. (2013). *Speculative everything: Design, fiction, and social dreaming*. Cambridge: The MIT Press.

Fabian, L. (2016). The spatial, the social and the architectural. In B. B. Jensen, & K. L. Weiss (Eds.), *Art of many, the right to space: The Danish pavilion – bienniale architettura 2016* (pp. 189). Copenhagen: DAC & The Danish Architectural Press.

Fich, L. B., Jönsson, P., Kirkegaard, P. H., Wallergård, M., Garde, A. H., & Hansen, Å. (2014). Can architectural design alter the physiological reaction to psychosocial stress? A virtual TSST experiment. *Physiology & Behavior; Physiol Behav, 135*, 91-97. Doi: 10.1016/j.physbeh.2014.05.034

Flyvbjerg, B. (2010). Five misunderstandings about case-study research. *SAGE qualitative research methods* (pp. 219-245). Thousand Oaks: SAGE Publications, Inc. doi:10.1177/1077800405284363 Retrieved from https://dx.doi.org/10.1177/1077800405284363

Frampton, K. (1995). *Studies in tectonic culture: The poetics of construction in nineteenth and twentieth century architecture*. Massachusetts: MIT Press.

Frascari, M. (1981). The tell-the-tale detail. In G. R. Owens, & E. K. Katić (Eds.), *Semiotics: The proceedings of the semiotic society of America* (pp. 325-336). Charlottesville, Virginia, US: Philosophy Documentation Center. Retrieved from https://www.pdcnet.org/pdc/bvdb.nsf/purchase?openform&fp=philosophin&id=cpsem_1981_0325_0336

Freeman, A. M., Herriges, J. A., & Kling, C. L. (2014). *The measurement of environmental and resource values: Theory and methods*. New York: RFF Press.

Hay, R., Samuel, F., Watson, K. J., & Bradbury, S. (2018). Post-occupancy evaluation in architecture: Experiences and perspectives from UK practice. *Building Research and Information: The International Journal of Research, Development and Demonstration, 46*(6), 698-710. doi:10.1080/09613218.2017.1314692

Hvejsel, M. F. (2011). *INTERIORITY: A critical theory of domestic architecture*

Hvejsel, M. F. (2018). Gesture & principle: Tectonics as critical method

in architecture. In I. W. Foged, & M. F. Hvejsel (Eds.), *Reader: Tectonics in architecture* (pp. 395-409). Aalborg: Aalborg Universitetsforlag.

Hvejsel, & Beim. (2019). Circular tectonics? – A critical discussion of how the architectural discipline can drive ecological continuity. Paper presented at the *Fourth International Conference on Structures and Architecture (ICSA 2019),* Lisbon, Portugal.

Jensen, M. B. V., & Troelsen, M. (2017). *Adding value to the social dimension of sustainable building*

Johansson, J. (2018). *Evaluering og arkitektur: Brugere, interview, analyse og fænomenologi* (1st ed.). Hørsholm: RUM.

Johnston, R. J., Boyle, K. J., Adamowicz, W., Bennett, J., Brouwer, R., Cameron, T. A., . . . Vossler, C. A. (2017). Contemporary guidance for stated preference studies. *Journal of the Association of Environmental and Resource Economists, 4*(2), 319-405. doi:10.1086/691697

King, A. C., & Woodroffe, J. (2017). Walking interviews. In P. Liamputtong (Ed.), *Handbook of research methods in health social sciences* (pp. 1-22). Singapore: Springer Singapore. doi:10.1007/978-981-10-2779-6_28-1 Retrieved from https://doi.org/10.1007/978-981-10-2779-6_28-1

Kinney, P. (2017, summer). Walking interviews. *Social Research Update,,* 1-4. Retrieved from https://sru.soc.surrey.ac.uk/SRU67.pdf

Kleis, B. (Ed.). (2020). *Co-creating architecture - EFFEKT*. Copenhagen: 10 · Grafisk Design & Forlag.

Lundhede, T. H., Panduro, T. E., Kummel, L., Ståhle, A., Heyman, A., & Thorsen, B. J. (2013). *Værdisætning af bykvaliteter-fra hovedstad til provins.* (). København: Institut for Fødevare-og Ressourceøkonomi, København Universitet.

Mossin, N., Stilling, S., Bøjstrup, T., Larsen, V. G., Blegvad, A., Lotz, M., & Rose, L. (2018). *An architecture guide to the UN 17 sustainable development goals.* (). København: KADK. Retrieved from https://kadk.dk/sites/default/files/downloads/article/un17_guidebook_single_page_low.pdf

Postiglione, G., & Lupo, E. (2007). The architecture of interiors as re-writing of space: Centrality of gesture. In J. Gigli (Ed.), *Thinking inside the box: A reader in interiors for the 21st century* (pp. 145-154). London, England: Middlesex University Press.

Sántha, E., Hvejsel, M. F., & Rasmussen, M. K. (2021). Intention, life, value: A multidisciplinary approach to understanding architectural quality in the city [conference presentation abstract]. Paper presented at the *Cities in a Changing World: Question of Culture, Climate and Design,* New York City, NY, US.

Sattrup, P. A. (2020). Documenting value creation: A business opportunity for architects, their clients and society. *Architectural Design, 90*(4), 22-29. doi:10.1002/ad.2586

Sekler, E. F. (1964). Structure, construction, tectonics. In G. Kepes (Ed.), *Structure in art and in science* (pp. 89-95). London: Studio Vista.

Semper, G. (1989). *The four elements of architecture* (2nd ed.). Cambridge, UK: Cambridge University Press.

SIMNA. (2018, February 20). Social value international: Accounting for value. Retrieved from https://simna.com.au/social-value-international-accounting-for-value/

Siren, A., Grønfeldt, S. T., Andreasen, A. G., & Bukhave, S. F. (2019). *Sociale mursten: En forskningskortlægning af fysiske rammers betydning i velfærdsindsatser.* (). København: Realdania. Retrieved from https://realdania.dk/publikationer/faglige-publikationer/sociale-mursten-en-forskningskortlaegning-af-fysiske-rammers-betydning-i-velfaerdsindsatser

Social Value International. (n.d.). What is social value? Retrieved from https://socialvalueint.org/what-is-social-value/

Social Value Portal. (2017, August 1). What is social value? Retrieved from https://socialvalueportal.com/what-is-social-value/

Stender, M., & Walter, A. (2019). The role of social sustainability in building assessment. *Building Research and Information: The International Journal of Research, Development and Demonstration, 47*(5), 598-610. doi:10.1080/09613218.2018.1468057

Ulrich, R. S. (1984). View through a window may influence recovery from surgery. *Science, 224*(4647), 420-421. doi:10.1126/science.6143402

van der Linden, V., Dong, H., & Heylighen, A. (2019). Tracing architects' fragile knowing about users in the socio-material environment of design practice. *Design Studies, 63*, 65-91. doi:https://doi-org.zorac.aub.aau.dk/10.1016/j.destud.2019.02.004

Wadel, C. (1991). *Feltarbeid i egen kultur: En innføring i kvalitativt orientert samfunnsforskning* Seek.

Willacy, S. (2020). Aarhus Ø. Retrieved

from https://aarhusoe.dk/media/44511/20200716_folder_aarhusoe_engelsk-m-foto.pdf

Analysis II. Lived Gestures

Architecture, Structures and Construction (2022) 2:599–612
https://doi.org/10.1007/s44150-022-00047-8

ORIGINAL PAPER

Tectonics of human well-being: describing architecture in terms of constructed spatial gestures and their impact

Eszter Sántha[1,2] · Marie Frier Hvejsel[1] · Johanne Mose Krämer Entwistle[2]

Received: 25 November 2021 / Accepted: 8 April 2022 / Published online: 28 April 2022

Abstract
Understanding the long-term consequences of architecture on human well-being is essential to inform the underexposed social dimension of sustainability. In this context, architects are generally required to maximize the spatial capacities of architecture towards enhanced social quality and value. Consequently, we need to improve our methods for describing the impact of architecture across disciplines. It is our hypothesis, that tectonic theory provides a potential framework towards such interdisciplinary description by implying a critical discussion of the interrelations between architecture's impact on people's well-being by means of spatial gestures and the detailed prioritisation of resources in construction. As part of a research project investigating the social and socio-economic value of architecture by juxtaposing architectural, anthropological, and economic analysis, this paper investigates the anthropological dimension of those gestures. Using anthropological analysis, the paper critically evaluates whether and how the key *intended spatial gestures* identified by the architects (in our previous analysis of the architectural dimension) are experienced by the occupants of the building in the form of *lived spatial gestures*. Data collection involved 8 semi-structured interviews with the occupants of a mixed-use building complex in Denmark. In conclusion, the paper contributes to the understanding of architecture's role and impact on human well-being, through the discussion of a tectonic framework describing the interaction between architecture and people as a spatial dialogue, in the form of constructed 'gestures' across the disciplines of architecture and anthropology. Hereby paving the way for positioning the question of human well-being related to the economic prioritisation of resources in construction.

Keywords Tectonics · Spatial gestures · Impact · Value · Well-being

Introduction

As entailed within the United Nation's call for the sustainable development of cities and communities, the contemporary building industry is challenged to identify the complex interrelations between the environmental, social, and economic dimensions of sustainability [1]. In this matter, understanding the long-term consequences of the built environment on well-being is of key importance to inform the underexposed social dimension and its potential as a driver towards sustainable development [2]. These consequences and causalities are captured by the concept of liveability [3], implying a call for a localized, yet interdisciplinary perspective on the interaction between people and their environment within the social domain of sustainability [3]. This paper addresses this call at a methodological level, focusing on the role and responsibility of architecture and the architect in this matter.

Within this context of uncovering the long-term consequences of the built environment, architects are generally required to maximize the spatial capacities of architecture as an integrated pronunciation of the structures applied in its construction towards enhanced social quality and value, "contributing to the long-term wellbeing and resilience of individuals, communities, and society in general" [4]. However, we often feel limited in applying our knowledge to fulfill this task within the design- and development processes, as it is dominated largely by a demand for construction-related cost reduction [5]. In these processes, we are limited in articulating and refining the spatial capacities of architecture through construction towards increased liveability

✉ Eszter Sántha
essa@create.aau.dk

[1] Department of Architecture, Design and Media Technology, Aalborg University, Aalborg, Denmark

[2] AART architects, Aarhus, Denmark

according to the trajectory of architectural history and theory upon which our field-specific knowledge is built [6]. This is despite a growing body of research documenting the impact of the physical surroundings on people's well-being [7] and quality of life [8, 9]. Thus, from the point of view of the architect, there is currently a discrepancy between the intentions articulated through constructed gestures and the built reality, possibly limiting the extend of architecture's contribution towards a liveable and sustainable urban development in a long-term perspective. Consequently, we need to improve our methods to describe architecture in terms of its impact on people's everyday life and well-being across disciplines by clarifying the link between the space, experience, and behaviour that allows for a translation to social quality and ultimately social value. This entails a contextual and interdisciplinary understanding of how people interact with the building and its immediate, as well as greater surroundings [9–11]. It is our hypothesis, that tectonic theory provides a potential framework for establishing such interdisciplinary description by implying a critical discussion of the interrelations between architecture's impact on people's well-being and the prioritisation of resources in construction through the articulation and interpretation of constructed spatial gestures [12]. Throughout architectural history, tectonic theory has been used as a critical mean to analyse key works of architecture by 'deconstructing' them in order to interpret and document the comprehensive spatial value possibly resulting from conscious choices in the construction of structures to the smallest detail [13–16].

This research is a part of an ongoing research project, which attempts at developing and situating this 'deconstruction' potential of tectonics as a methodological framework for systemically analysing the specific choices made in construction as spatial gestures and their social impact and value across the disciplines of architecture, anthropology, and economics. The research project investigates this capacity of tectonics in relation to the potential social and socio-economic value of architecture by juxtaposing analyses of the architecturally *intended,* anthropologically *lived*, and economically *valued* dimensions of specific constructed spatial gestures as a case study, involving two mixed-use building complexes designed by AART architects (AART) in Denmark. Unfolding the anthropological dimension in this paper, it is our idea, that such gestures open a potential to zoom in on the consequences of the choices made in construction paving the way for positioning of the question of human well-being related to the economic prioritisation of resources in construction. Hence, this second part builds upon the first study of the research project, where the value creation potentials in architectural design were investigated from an architectural perspective in both cases, through an interview with the project-leading architects on the key *intended spatial gestures* in their works [17]. Together with the architects, the current paper critically evaluates whether and how the specific spatial gestures *intended* by the architects (identified in the first study) are experienced by the users of the buildings in practice, and thus translate to *lived spatial gestures*.

The paper answers this question by investigating one of the two mixed-use building cases included in the research project. Data collection involved 8 qualitative interviews with occupants experiencing and engaging with architecture in practice. Findings were then compared and analyzed related to the spatial gestures *intended* by the architects on three complementary scales (*approaching*, *arriving*, and *working-living-visiting*). In this matter, this paper contributes to the discussion of the potential of tectonics as an interdisciplinary framework towards describing the interaction between architecture and people as a dialogue mediated by constructed spatial gestures across the disciplines of architecture and anthropology. Hereby paving the way for positioning of the question of human well-being related to the economic prioritisation of resources in construction, through the definition of social value.

Tectonics of human well-being

Departing from the World Health Organization (WHO)'s definition of health, human well-being can be defined as a complete state of physical, mental, and social health [18]. As such, it is a major concern for the broad notion of sustainable development [19] and a determinant of liveability within the social domain of sustainability. In this context, the present paper investigates the relationship between the built environment and the life it sustains using architectural anthropological methods, through a tectonic lens, focusing on human well-being.

Originating from ancient Greece, tectonics re-emerged as a general architectural theory in the nineteenth century that aimed at clarifying the role and responsibility of architecture and the architect towards cultivating the spatial capacities of the built environment by means of construction [13, 16]. Throughout architectural history, tectonic theories have been used as critical means to analyse key works by 'deconstructing' them to the minutest details to interpret and document the comprehensive potential spatial value resulting from construction choices to describe their expressive qualities [13–16]. As stated by Eduard Sekler in his seminal essay 'Structure, Construction Tectonics', among these three concepts "tectonics is the one most autonomously architectural; which is to say the architect may not be able to control the conditions or structure and construction as completely as he would like to, but he is the undisputed master of tectonic expression" [15], p. 94]. In his account for this "tectonic statement"

Sekler describes "the noble gesture which makes visible a play of forces, of load and support in column and entablature, calling forth our empathetic participation in the experience" [15], p. 94]. Hence, we build on the interpretation, that Sekler uses the notion of tectonics to identify the task of the architect in the formulation of spatial gestures pronounced as integral choices made in construction. Thus, he differentiates the field-specific knowledge/task of architecture (by means of its gesturing value potential addressing human well-being) from mere construction (as a practical matter).

In our research, rereading the trajectory of tectonic theory related to the current state of architectural practice [20], we have found a potential to develop [12] and apply [17] tectonic theory as a critical framework to scrutinize the processes, motivations, and choices characterising architectural practices and for studying the implications of these choices through such spatial gestures. We have found that these gestures can be identified as key expressions/statements, stressing the core potential of architecture to facilitate human well-being through its form, which potentially translates to social value, depending on the users' preference and response to those gestures through everyday practice [12]. These key gestures provide a point of departure in the tectonic methodological framework of the research project, which this study is a part of, to document and analyse the impact and value of the architects' specific choices made in the construction across the disciplines of architecture and anthropology, and ultimately economics in the third part of the research [Fig. 1]. Thus, our research aims to add to the state-of-the-art knowledge on the potential for developing tectonic approaches towards and ecology of tectonics [21], circular tectonics [22], urban tectonics [23], and tectonics in interior design [24, 25] as means for describing 'good practice'.

Building on the first study of the research project, which aimed to identify and describe key *intended spatial gestures* investigated from an architectural perspective, this second study is focusing on the 'translation' of spatial gestures from architecture to anthropology through the narratives of *lived gestures*. *Lived gestures* comprise the complex process of experience and engagement with architecture (here a mixed-use building) through the people's (here the occupants of the building) everyday life and practices as a contextual response to the key *intended spatial gestures* identified by the architects (here the project-leading architect). In search of a way to explain and discuss this 'translation' across disciplines, we apply an architectural anthropological approach adjusted to the research objective.

Architectural anthropology is an emerging interdisciplinary field, induced by a so-called spatial turn in social sciences and a corresponding social turn in architecture, interested in understanding architectural space and its ability to "collect, contain and situate life" [26], p. 190]. The field is seeking to establish a dialogue/bridge between architects/architecture and anthropologists/anthropology, similarly to design anthropology, where various practices of co-design [27] are already utilized. Like product design, architecture, as a field, is engaged with the construction of something new by materializing creative ideas, and solutions, through an architectural design process ending with a finished product [28]. Architects are therefore trained to look forward and seek concrete solutions defined in terms of walls, structures, objects, materials [29], delimited in a clearly defined 3-dimensional space. However, as the history of the field shows, architecture is not merely about a

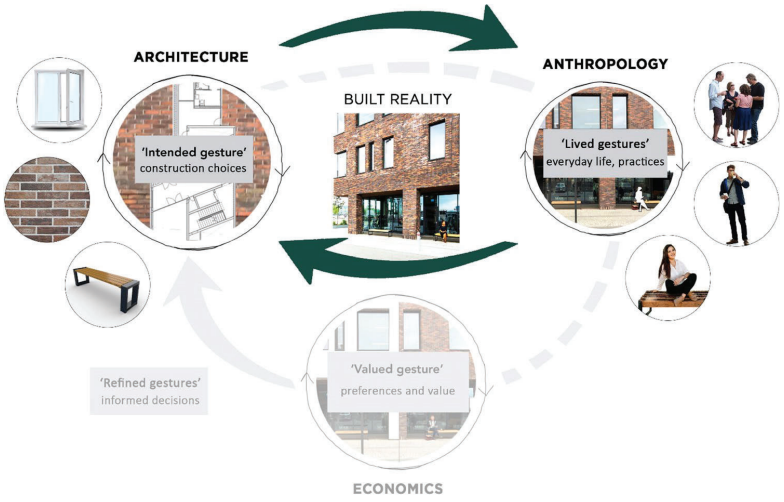


Fig. 1 A tectonic methodology presented in Sántha et al. [12]. The figure shows the exchange of gestures in the nexus of architecture, anthropology, and economics, from which the present paper focuses primarily on the anthropological dimension (*lived gestures*), and discusses them concerning the architectural choices made in their construction (*intended gestures*)

physically constructed structure or form, but "the ultimate meaning of any building is beyond architecture; it directs our consciousness back to the world and towards our own sense of self and being. Significant architecture makes us experience ourselves as complete embodied and spiritual beings" [30], p. 11]. The importance of *lived* experience is emphasized in Henri Lefebvre's most influential work *'La production de l'espace'* (1974) [31], where space is defined as a "social space, where the practical, symbolic, and imaginary are contained" [26], p. 189]. The role of architecture in creating such a "consciousness" by the production of social space, is built on the phenomenological tradition characterized by intentionality [26], resulting from a comprehensive understanding of the complex relations between human exitance and place [32]. Despite this historical trajectory of architecture, proponents of architectural anthropology, share the argument, that one of the problems is that the representation of buildings is too static [29, 33, 34]. Anthropologists working with architecture see "lived lives and local realities" [29] or as Ingold calls it, the "dwelling perspective" [35] in a 4-dimensional space, where *place* is understood as an abstract notion without clear physical boundaries, as the building and its dweller(s) age and co-evolve [33, 35]. Thereby, space should be understood as an integrated part of our everyday lives (practices and processes), where the task is to unfold the complex relationship between human beings and the built environments as a dynamic matrix [9, 26, 29]. Thus, in the nexus of architecture and anthropology, qualitative anthropological approaches can contribute to increasing the positive impact of contemporary architecture on society's well-being, while anthropologists can learn the architects' understanding of the spatial and material surroundings [28, 29].

However, the challenge to apply this knowledge in architectural design practice remains, as it needs to be referred back to the specific construction choices made by the architects in order to effectively improve the future design. To address this challenge, we apply an architectural anthropological approach with a semi-deductive qualitative inquiry in this study. The inquiry is deductive in a sense, that we build on the hypothesis, that there is a correspondence between intended spatial gestures (of the architects) and lived experiences (of the users). However, the specific interview method applied in this study allow for a more traditional anthropological inductive knowledge generation, which critically challenges and unfolds our initial hypothesis.

In its capacity to facilitate a critical discussion on the impact of construction choices made in the architectural design process on human well-being after the building has been taken into use, it is our observation, that tectonics opens a potential here to integrate architectural anthropology in architectural practice. By using an architectural anthropological approach within a tectonic methodological frame, this paper explores the entanglements of the built environment (as a result of carefully constructed *intended spatial gestures*) and the life it sustains, through everyday practices (in the form of *lived spatial gestures*) in a case study.

Case study

The case studied here is one of the two post-construction and post-occupation mixed-use building complexes included in the research project. Cases were selected from the portfolio of the Danish architectural design studio, AART architects. The typology was chosen as a 'critical most likely case' based on an information-oriented selection strategy [36] hypothesizing, that strategic choices on the construction of *intended spatial gestures* made during the design process have enhanced the users' everyday life and sense of community [17]. The case selected in this study is 'The Warehouses' complex, due to the abundance and diversity of data collected, compared to the other case involved in the research project.

'The warehouses' complex

'The Warehouses' (*Pakhusene*) complex is located in the Northern part of the Peri-urban Harbour Area (*De Bynære Havnarealer*) within Aarhus, Denmark [37, 38]. A neighbourhood, which has become strategically important for urban development as a response to the rapid urbanization, that the city of Aarhus has experienced since the early 2000s [39]. The urban development project is considered one of Europe's largest waterfront developments, that is expected to provide accommodation for at least 12,000 and a workplace for at least 10,000 people [40].

As a mixed-use building, 'The Warehouses' complex aims to address this issue and contribute to the well-being of the citizens of Aarhus Ø by providing space for restaurants, shops, and facilities (eg. fitness centre) [Fig. 2]. The complex was developed by Kilden & Hindby as well as Domis and designed in collaboration with MOE engineers. It was built in two phases, completed in 2016 and 2020 respectively, and ultimately bought by the Danish pension fund, PFA.

The 40,000 sqm complex consists of five buildings, that can be grouped into an office and a residential unit. The office unit of The Warehouses consists of three buildings of varying heights [Fig. 2]. All of them have the same parallelogram-shaped floorplan with a skewed middle axis, creating a central hallway for each floor with multiple elevators. The rentable area – excluding the hallway – on a single floor is 1000 sqm from which the smallest rentable unit is 250 sqm. Each rentable unit has a flexible office space layout and is equipped with a kitchen, toilets, and meeting rooms. The ground floor and the two top floors in each building have

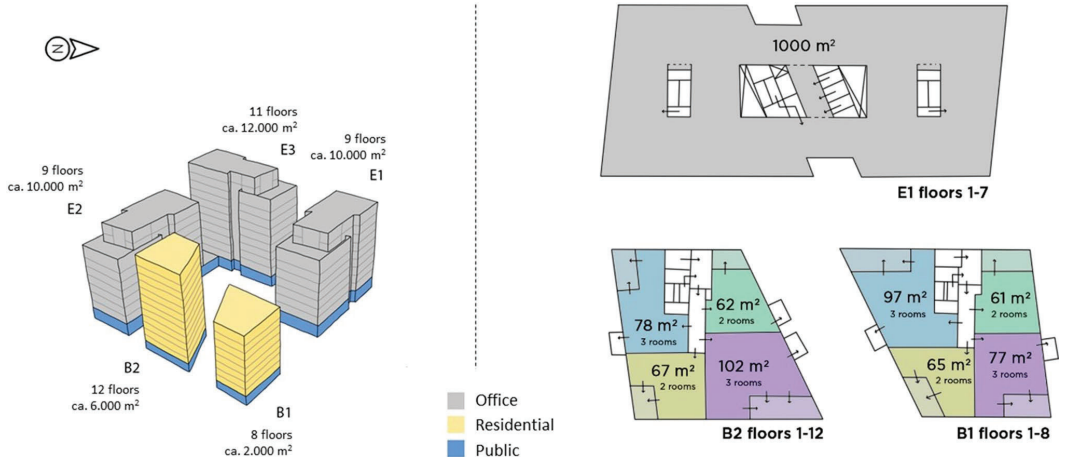


Fig. 2 Overview of The Warehouses' office units (on the left) and residential units (on the right) [Figures made by Eszter Sántha, based on Google Maps 3D model (on the left) and floorplans of the Warehouses designed by AART architects (on the right)]

less rentable areas, due to the recessed exterior niches ('edge zone') and the rooftop terraces, respectively. The residential unit of the complex consist of two buildings of varying heights [Fig. 2]. The basic shape of the unit is the same, but here the parallelogram is divided along the skewed middle axis creating two separate buildings, with a road in between the two. Each residential building has four types of apartments distributed on 300 sqm (B1 on the figure), as well as 309 sqm (B2 on the figure) per floor. Sizes of the apartments vary from 61–97 sqm and 62–102 sqm, respectively, and all has an entry, a bathroom, an open-plan kitchen (where the kitchen, dining, and lounge spaces are combined), at least one balcony (recessed), and a storage unit in the basement. Both residential buildings have an elevator. The five buildings of the whole complex are placed relative to each other in a way to create a semi-closed urban public space in between the buildings with exterior niches, and parking lots for both cars and bicycles. All buildings of the complex are connected below-ground by a shared parking area.

In the first study of the research project, discussed in the paper 'Lost Potentials? – Unpacking the Tectonics of Architectural Cost and Value', we investigated the value creation potentials in architectural design from an architectural perspective in two cases (one of them is the Warehouses), through an interview with the project-leading architects on the key *intended spatial gestures* in their works on three complementary scales (*approaching*, *arriving*, and *working-living-visiting*) [17]. In this first study, we found, that the key *intended* gesture identified by the project-leading architect on the urban scale (*approaching*) was to create a robust and classy building with "sensible qualities", that people can "traditionally relate to" [17] and thus potentially create value by attracting future tenants and apartment buyers. These gestures are articulated by recessed windows of varying sizes, recessed balconies, and high-quality multi-colored brick as a choice of material on the façade of the buildings. On the site dimension (*arriving*), findings showed, that the *key intended spatial gesture* was to create a "welcoming" building, that "invites to interact with space around and ultimately within the building" [17]. According to the architect, the gesture here is articulated by the construction of exterior niches and by the overall mixed-used concept, that is to provide space for small shops, businesses, and facilities within walkable distance, as a valuable addition to everyday life [17]. On the interior scale (*working-living-visiting*), we found, that the key *intended spatial gesture* was, on one hand, to create a "sense of community on many levels" by designing the office spaces and shared spaces (e.g. meeting rooms, terrace, cantina, lounge, sauna), based on the concepts of flexibility, visibility, and mixed-use guided by the principle of "gaining more by owning less" [17]. On the other hand, a key *intended gesture* regarding the interior was to articulate the same "identity" that is authentic to the external appearance of the building. Here, the "roughness" is articulated by an industrial interior look with visible installations, while the "sensible qualities" are expressed through the use of wood in the interior design [17].

Data collection

To explore the anthropological dimension (user perspective) of spatial gestures, qualitative data had been collected

for two weeks between June and July 2021 in the form of physical interviews with the occupants (office space renters and residents) of the complex. In total, 10 people were interviewed, 3 company representatives (office space renters), and 7 residents (2–2 from the same household). Informants' ages vary from 20–68, and among them 60% are male and 40% are female. A contact person from all companies who rent office space in the complex was contacted via e-mail, while residents were recruited by mail (flyers distributed to their post boxes). The interviews were conducted as a combination of a semi-structured 'face-to-face' [41, 42] and an on-site 'walk-and-talk' interview [43, 44] with informants as individuals, or in some cases of residents, as a couple. These interviews were scheduled for an hour and were focused on how the occupants experience and use the building and its surrounding urban areas. Each interview started with a brief introduction to the research project and to the interview itself and continued with open-ended questions supported by a semi-structured thematic interview guide based on the key *intended gestures* identified by the architect in our first study. This was done to systematically unfold how and to what extent constructed spatial gestures *intended* by architects are experienced by the occupants both within and around the building (public, semi-public and private space). Subsequently, informants were asked to walk the interviewer around, like a 'house tour', depending on the participants' free choice of route. This walking interview part was added as they are considered "a valuable means of deepening understandings of *lived* experiences in particular places" by providing rich, multisensory, and detailed data [45], p. 1]. Finally, the interview ended in questions motivating the occupants to clearly state their preferences and to emphasize what's important to them, thereby making it easier to identify the key *lived gestures*.

Data analysis

All interviews were audio-recorded and photo-documented according to the participants' consent to these. Audio materials were then semi-transcribed and coded manually, using the qualitative data analysing software NVivo Pro (version 12.6.0.959). The coded qualitative data (i.e., labelled and organized interview transcripts) is used to examine relations and identify common themes and concepts as part of a thematic analysis aiming to understand what the data represent [42]. The following sections present the identified *lived gestures*, as a result of this analysis, through the above introduced tectonic lens. These results, describing experience and practice, are then compared to the findings of our previous study on the architect's formulation, construction, and communication of *intended gestures* and their *intended value* (hypothetical impact) according to the architectural concept and corresponding architectural instruments.

Results

Below our empirical findings, grouped into four main themes, on how these occupants describe the building complex, based on their perception, and everyday practices of 'dwelling' in both the office and the residential units. Findings are summarized by analysing how and to what extent these experiences and practices related to the gestures *intended* by architects on three scales and thus potentially translate to *lived spatial gestures*.

Architectural identity: a sense of authenticity and quality

Based on the *intended* gestures identified by the architects addressing users *approaching* the building (urban dimension) [Fig. 3], our analytical questions here included how do occupants of the building feel about the appearance of the building, and whether this influenced their choice on renting an office space or buying an apartment here, instead of any other building on Aarhus Ø, assuming that neither the renting fee nor the selling prices are cheaper than elsewhere within the neighborhood.

We have found that occupants experience, that the building looks exclusive, representative, and high-quality. When describing, they used words like "desirable", "charming", "beautiful", "classic", "neutral in a good way". Some referred to the building complex as something that has its own identity, its own "personality". As for their everyday practice, this means that they are proud to talk about the building they work or live in in a positive way. One of the residents from the Warehouses even mentioned that they normally use the name of the complex, 'The Warehouses', instead of using their address when referring to where they live, and they experience that people do recognize it by name. Based on the interviews with the residents, it seems that what they value in the appearance of the building is the authenticity, both in relation to what is considered a "traditional Danish building" and material quality. As a resident described:

> "It looks like a building, that requires its space, […] like having its own personality, it's robust and nice. […] Not that concrete-like" (A resident of the Warehouses)

One of the residents has even suggested that one way to improve this gesture, would be to alternate the connecting brick façade panels to hide the visible line between panels [Fig. 3], which reminds them that they are actually living in a concrete building. This implies that some individuals engage in a spatial dialogue to a greater degree than

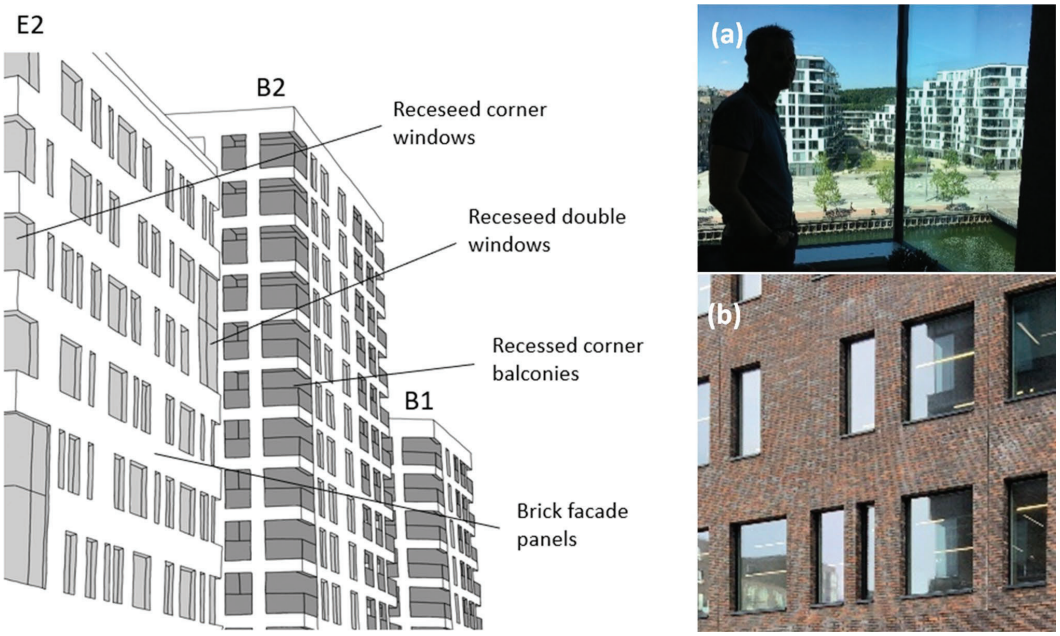


Fig. 3 Main architectural instruments applied in the construction of key intended spatial gestures by the architects of the Warehouses on an urban dimension, identified in Sántha et al. [17] (on the left) and photos illustrating some of the lived gestures by the occupants (on the right): (**a**) view from one of the recessed corner windows of the office unit (**b**) brick panels on the façade [Photos taken by Eszter Sántha]

others, by addressing the meaning of the gesture *intended* and their potential refinement at a detailed level.

For tenants of the office unit, the appearance of the building also meant, that the employees of the companies are motivated to come to work here because it implies that it is a good place to be [Fig. 3]. This gesture seems to be *lived* to a certain degree by non-employees as well. For example, one of the residents noted, during the walk-n-talk interview, that:

> "I followed the construction process [of the office buildings built in the second phase] […]. The fact, that they used money and time on corner windows makes a difference. Try to look up there and see the corner offices there. How cool that must be to be there. It is top-notch, a very different character [presumably compared to other office buildings]." (A resident of the Warehouses)

Findings also revealed, that even though the appearance of the building plays an important role in identifying the Warehouses' own identity, it is not among the primary reasons for their choice of either renting an office space or buying an apartment here.

Urban life: the warehouses as an urban experience

Based on the *intended gestures* identified by the architects addressing users *approaching* the Warehouses [Fig. 4], our analytical questions comprised how and to what extent do people use the urban niche, created by the buildings relative disposition to each other, what does the mixed-use concept mean and how does it affect occupants' business/life.

The majority of company representatives described, that one of the Warehouses' virtues is the possibility to "offer an experience" for their clients, and employees, both within and around the building, due to the typology of the complex and its urban surroundings. This entails the various facilities and services the buildings of the Warehouses provide space for, and the community areas (canteen, rooftop terrace, meeting rooms), designed to be shared among the different user groups of the building.

> "It's not only about the meeting itself, coming and going. It is about giving an experience to clients and partners who visit us here. [For example] When I took one of them up here [rooftop terrace] and we gazed over Djursland [landscape surrounding the city] and

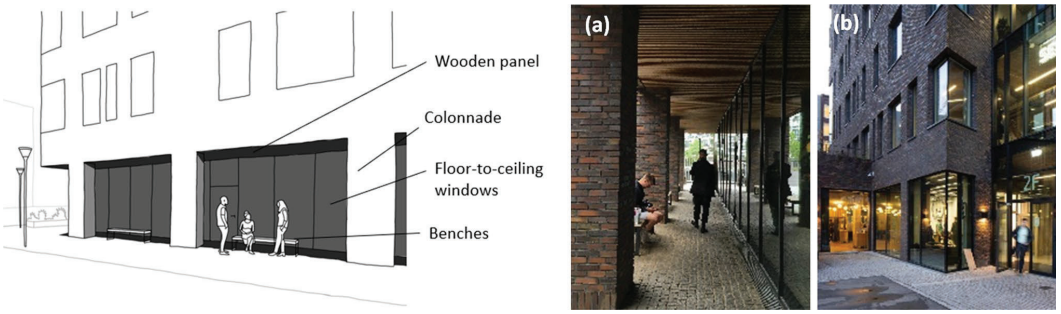


Fig. 4 Main architectural instruments applied in the construction of key intended spatial gestures by the architects of the Warehouses on a site dimension, identified in Sántha et al. [17] (on the left) and photos illustrating some of the lived gestures by the occupants of the buildings (on the right): (**a**) the 'edge zone' as an exterior meeting niche [Photo taken by Eszter Sántha] (**b**) the "open" ground-floor, accommodating a wide range of businesses [Photo: aart.dk/en/projects/pakhusene]

> the city, that was an experience. There are also some super nice restaurants [in the office unit of the Warehouses] so it is easier to get lunch […]." (A tenant of the Warehouses' office unit)

The possibility to offer these as an employer was described as an advantage both in terms of business relations and for employee well-being. As one of the other tenants of the Warehouses' office unit has described, having these in-house services means that "one is happy to come to work", which in relation to employee well-being and work productivity is of key importance for their business, as they rely on their employees' "knowhow and willingness to come to work".

In-house facilities and services at the time of the study comprised a bakery, restaurants, a fitness center, sauna, and various shops, that along with the direct access to the waterfront seemed to attract people in practice and thus potentially create a vibrant urban life. This was confirmed by the findings from resident interviews, where all informants described the area as "urban-like" referring to the thriving urban life they experience throughout the day, week, and the year, comparing it to the life of the city center [Fig. 4].

> "I love the area, I feel like I'm on vacation every day. The water [the North Sea], the nature [nearby forest], the coziness, and that there are always people around. […] It is in the city yet out of the city. Close enough [to the center] without living next to a nightclub." (A resident of the Warehouses)

For residents, the active urban life facilitated by the design of the complex as a key *intended* and *lived gesture*, along with the view at the surrounding diverse landscape, seem to 'compensate' them for living further away from the city center, even if it's a trade-off with good public transportation connection, which was described as a challenge by both company representatives and residents.

Sense of community: the importance of shared community areas

Based on the gestures *intended* identified by the architects in addressing users *working* and *living* in the Warehouses [Fig. 5], the analytical questions of this study included how the occupants relate to each other within and across the units of the complex as well as how do they potentially function as a community and to what extent do the physical surroundings support that within and around the buildings.

Findings revealed that interactions happen mostly between tenants of the office unit, nurtured by the range of shared areas designed in all three office buildings. Both the interviews and observations verified that these spaces are used for various social and professional activities. One of the frequently mentioned shared areas in relation to social interactions, by the tenants of the office unit, were the canteens, the flexible shared meeting rooms, and the rooftop terraces, which were described as places for eating lunch together, holding informal meetings, or company events, and in the case of the terraces, to take a break and get some fresh air during the workday [Fig. 5]. Apart from the canteens and the rooftop terraces, ad-hoc social encounters are likely to happen in the elevator or at the outside niche under the arcades, according to the informants. When asked about their relationship to other tenants within the building and the unit, company representatives described, that they may not know everyone who works in the same building (or unit) but "there is good energy" and they use each other for professional networking and to build partnerships both within and across office buildings.

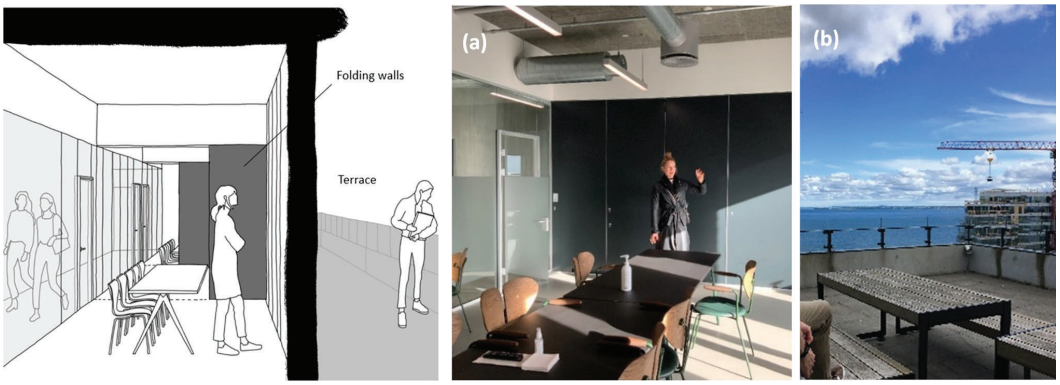


Fig. 5 Main architectural instruments applied in the construction of key intended spatial gestures by the architects of the Warehouses on an interior dimension, identified in Sántha et al. [17] (on the left) and photos illustrating some of the lived gestures by the occupants of the buildings (on the right): the flexible use of the shared meeting room and its connecting terrace on the 8th floor of building C as a place for a mid-workday break [Photos taken by Eszter Sántha]

> "It's nice that even though there are not so many of us here [physically present in their rented office space on a daily basis], we are a part of a larger community. Or at least we feel that way. We don't know everyone, but there is good energy, and one feels that they are part of something." (A tenant of the Warehouses' office unit)

The way the building creates a sense of community with all the facilities and the way tenants' functions as a community was also described as a kind of "ecosystem" by one of the company representatives, indicating a good symbiosis between the physical environment and sense of community in the office unit of the Warehouses. Being a part of this multi-tenant office community is also binding to a certain degree, concerning shared expenses and the responsibility to maintain the common areas, which is why there are regular meetings of the tenant association, where each company is represented. Whereas this concept might not be appealing for some, companies who rent office space here share the value of having such a community, that is worth the price.

Regarding the residents, interviews revealed, that their relation to each other generally entails greetings and occasional small talks, that are likely to take place in the elevator, hallways, or across the balconies. It was also found that the depth of their relation to each other deteriorates by the relative distance between the apartments, meaning that they build stronger relations (eg. lending equipment to each other or trusting them with a spare key) to immediate neighbors and fellow residents living on the same floor. The community of residents living in the Warehouses was described as quite diverse regarding both age and civil status. As the Warehouses offer apartments for sale, residents living here are mainly those who own them. This was described as a factor determining one's attitude towards the community of residents and increasing their sense of responsibility, which potentially makes their cohabitual relationship better and solves their eventual conflicts smoother. For this purpose, they also have multiple forums, including regular homeowner association meetings, and a Facebook group. However, in contrast to the tenants of the office unit, who all spoke enthusiastically about their shared areas almost as a sort of incubator for their community, residents explicitly and emotionally expressed their need for similar spaces for gatherings, that would support socializing and thereby enhance their sense of community, according to them. As one of the residents has described:

> "One could meet each other in a different way if there are common areas for that. We miss something [a designated space] where we can gather. The possibility to enjoy each other's company without having to book an event venue. […] Because we'd want to…take care of a common space together and be a part of a community in that way."

This is despite the existing play court (basket- and football) in the public space between the buildings of the Warehouses, the so-called greenhouses with benches and tables inside in the park next to the residential unit, and the possibility to rent the canteen area of the office unit for private events. Nevertheless, it seems, that these areas are not sufficient to fulfill the needs of the resident to build and maintain their residential community. The reason is, that these existing common areas are either unsuitable for accommodating larger gatherings due to their size, purpose, or prices and rules, according to the informants.

Interior quality: a combination of experienced atmosphere and functionality

Analytical questions based on the *intended* gesture of "sensible interior quality", comprised what the experienced atmosphere is, how and to what extent do people experience the interior, and how does that potentially relate to their choice of buying an apartment or renting an office space in the Warehouses.

Interviews with company representatives revealed, that the overall interior identity gestured by the architects is experienced in different ways. Some may enjoy it while others may be intimidated by the roughness of the "raw" concrete walls and floor, the visible installations (ventilation and cable system) on the ceiling, or the wooden panels on the wall [Fig. 6]. When asked about the interior atmosphere of the rooms, informants emphasized indoor comfort and functionality, including the view provided by the floor-to-ceiling windows, that allows one to gaze and thus clear their head, the calmness due to the efficient soundproofing (undisturbed working conditions), and the practicalities related to the choice of materials, size, and design of the rooms. These practicalities included the appreciation of "good quality" materials, that do not require regular maintenance, and the possibility to personalize the interior space of the offices, due to the flexible solutions, providing the "freedom of choice" to the companies to express their own identity. Relating the interior with functionality was also discussed in relation to the use of shared meeting rooms. Interviews revealed, that even though the size of the shared meeting rooms are roughly the same in all buildings (fitting 10–15 people), people prefer to book the one in building C (E1), as they experience it more spacious and brighter, due to the connecting rooftop terrasse, despite that they feel that the indoor temperature gets warmer here during the summer. This might be also in connection with the opportunity to provide an experience, as these meeting rooms were described to be used especially for meetings with external partners and clients.

A similar experience was described by the interviewed residents. Regardless of the actual size of their apartment, they experience it spacious and light, due to the open-plan kitchen and the recessed balcony connected with a double door, which not only visually but also functionally extends the living room.

> "At first, I was a little skeptical about the covered [recessed] balcony – how light is supposed to come in – but then it has a function, I mean we use it much more often than the other one [the other balcony]. It is because it's like a room, and the wind does not blow in so much either here. It's like an outdoor room" (A resident of the Warehouses)

In contrast to the companies, where the interior of their physical work environment seems to be experienced on different levels depending on the individual, residents seemed to experience the gestured identity with sensible qualities on an interior level to a greater degree and it seems to play an important role in their decision on buying an apartment in the Warehouses. For all interviewed residents the dark, wooden kitchen furniture and the integrated oak panels on one of the walls of the recessed balcony made the apartment more "cozy" and "warm" and thus potentially more valuable, compared to other newly built, "standard" apartments in Denmark, that they characterize as "cold", "concrete/plastic-like" and "sterile". This entails not only the architect's choice of the material and material quality but also the careful detailing of those

Fig. 6 Photos illustrating some of the details of construction in the Warehouses: (**a**) wooden-patterned concrete wall in the central hall of each floor in the office unit (**b**) visible installations on the ceiling in the office unit (**c**, **f**) wooden panels on the walls of the offices and recessed balconies (**d**) engraving of floor numbers in the residential unit by the elevator (**e**) an example of a wooden kitchen cabinet in one of the apartments of the residential unit. [Photos: (**a**, **c**-**f**) by Eszter Sántha, (**b**) linkedin.com/AART]

gestures (colors and textures) and how it fits the overall identity of the building [Fig. 6].

Discussion

In this study, we examined whether and how key *intended spatial gestures* identified by the project-leading architects at AART are experienced in the form of *lived spatial gestures* by the occupants of the Warehouses in Aarhus. This was done by interviewing company representatives and residents about their everyday practices in relation to the physical surroundings, followed by a comparative analysis of the spatial gestures *intended* versus *lived*. Through the development and application of a tectonic framework for studying these gestures, we have herein aimed to provide for a critical discussion of the interrelations between architecture's impact on people's well-being and the prioritisation of resources in construction.

Lived spatial gestures: a result of meaningful spatial dialogue?

Findings revealed that the extent to which the gestures *intended* by the architects translate into *lived gestures* vary among the different user groups and in some cases even from individual to individual, depending on the clarity of the gesture, entailing both the details of its construction and its recipient subject. The different patterns were observed in relation to the themes 'sense of community' and 'interior quality', relating to the *intended gestures* identified on the interior dimension by the architects in the first study of the research project. Findings of this first study showed, that it is primarily on the interior dimension, where choices relating to the construction of these spatial gestures in the design process proved to be challenging for the architects to negotiate and thereby realize, resulting in a mix of *intended gestures* and *non-gestures* [17], making it harder for the users to understand the intended *meaning* or use. Empirical findings of this second study thus supported, that there are lost potentials in that sense on the interior dimension, limiting the success of translation from *intended* to *lived* gestures in a meaningful way and thereby the social value creation potential of architecture as a contribution to human well-being. Potential challenges also include that, even though architects were able to clarify why they made certain choices regarding the construction of spatial gestures on different scales, it is difficult for the users to relate their experience and practice to a single, specific gesture. This means, that *lived gestures* often cannot be categorized into the same three scales as *intended gestures* as experiences and practices show complex interrelations between the dimensions, which could potentially be explored by more elaborate architectural anthropological studies using observation methods [46] in the future. As argued by Postiglione and Lupo, it is especially a unique characteristic of the architecture of the interior, that it "overcomes the concepts of dimension, context, and building typology: no matter whether you are inside or outside, in an open or closed space, in a room or in a shopping mall – these are all considered a "place of the gesture", produced and signified by the action of inhabitating" [25], p. 147]. And as such, the interior as a place is, where gestures are inseparable from the subject. Consequently, a potential reason for failing the translation from *intended* to *lived* gestures on an interior dimension could be, because the gestures, that should connect the building with the life it contains are unclear, meaning that they cannot specifically reflect the needs and desires of the people for whom they have been designed and realized.

It is also a general critique of the overall concept of liveability, that is despite its widespread use, it is in most literature only defined implicitly and even where it is more explicit, it still has a diverse range of meanings, "with ideas of what makes a community livable varying between groups and individuals according to different and shifting perceptions, values and desires" [19], p. 11, 47]. Thus, the literature suggests, that due to the subjective and relative nature of the term livability [47], its WHAT (what is good), and WHO (for whom) must be specified for each context [48]. Accordingly, the notion of spatial gesture, as an alternative language to engage people in a spatial dialogue, must also be defined both in relation to its construction and its 'human response' in each context. Consequently, meaningfully translated (*lived*) spatial gestures are defined by the architectural affordances in our lives, that reflect the experiences and practices that the architect *intended* to describe, with "the evidence of human presence" [25] in the design process. Thus maximizing "the capability of the project to show existing relationships with the space – what we prefer to call place, gesture, use, and meaning" [25], pp. 145–146] as a fundamental parameter for addressing human well-being in design.

Thus, we propose, that spatial gestures need to be addressed to specific user groups to allow architects to strategically activate their field-specific knowledge within an interdisciplinary context to contribute to well-being by creating social value. In this context, the building is not an end-product but a tool of communicating ideas through gesturing forms as a result of the continuous learning process on users' everyday practices and experiences to identify and address their needs, even if they cannot explicitly describe it themselves. Therefore, constructing and articulating gestures in a very specific and explicit way provide a site of experimentation to study the possible impact of small-scale gradual changes (detailing [14]) towards clarifying and possibly expanding the field of action of the architect in improving

the spatial dialogue and thus exploit the contextual social value potentials in future design. Accordingly, the role of the architect can be described as a mediator between the static structure of the building (engineer perspective), comprising objective space and the dynamic reality of life (dwelling perspective), contained by subjective place by the means of constructed spatial gestures as tectonic expressions. An approach, rooted in the ancient task of the *architecton*, as a pre-specialization [6], comprising the essential skills of tectonics: articulating and refining the spatial capacities of architecture through construction, as tectonics of human well-being, towards increased social quality.

In this regard, the practice of architectural design has to recognize and actively learn about the "subjective dimension of life", to carry out projects in a "correct" way, involving "use and gesture, objects and subjects, defining/describing places" [25], p. 146] in an interdisciplinary way. This calls for interdisciplinary approaches to describe architecture to maintain critical awareness and to facilitate a critical (co-)creative approaches [27] in architectural design practice, where the knowledge obtained from the different scientific fields are subsequently linked back to the architects' field of action: the choices on architectural instruments made regarding the construction of spatial gestures. As found in the first study, a tectonic approach, focusing on the construction and articulation of spatial gestures, in architecture practice thus provides "an opportunity for the architect to engage in a process of change focused simultaneously on the improvement of the physical products of architecture as well as their service as advisors/collaboration in the design process" [17]. By applying and integrating such a tectonic approach in architectural practice, it is our expectation to move towards a systematic, eventually, dialog-based evaluation of building projects post-occupancy [28, 49], focused on the contextual understanding of architecture's impact on well-being in relation to the specific construction choices applied in its design and thus enable a potentially improved, researched-informed design in the future.

Future perspectives

In this paper, we applied and discussed a tectonic methodology in the nexus of architecture and anthropology to describe architecture in terms of its impact on people's everyday life and well-being by clarifying the link between the space, experience, and behaviour that allows for a translation to social quality and ultimately social value. Our case study here, and the qualitative methods applied, do not comprise a comprehensive anthropological study and thus some of the deeper discussion on the individual themes, emerging from some of the patterns among the empirical findings are not addressed in this paper. Yet, the insights gained on the occupant's perspective serve as an empirical link for further translation of spatial gestures from architecture to economics, which is an explicit aim of our research. "Understanding how people use and perceive a building, what constitutes their preferences, is essential to investigate the social value of architectural efforts" [12]. In order to position the question of human well-being related to the economic prioritisation of resources in construction due to a limited budget, it is thus important to identify who will pay for what in order to best prioritise the right architectural instruments and gestures to the right users. This opens the discussion, relating to the economic aspects with regards to architecture, emphasizing that architecture as an art form is often exposed to other interests since a building is not only a piece of art but also a commercial product [26]. Our findings have already shown that residents living in the Warehouses' apartments seem to prioritise and 'trade' some of the social qualities for the price, suggesting that gestures are *valued* differently, and for some, they would be willing to pay a higher price. The findings of this paper thereby provide a point of departure for designing a future economic study on user preferences and the social value of spatial gestures, and to help interpret the quantitative results of the economic analysis as *valued gestures*.

In our study, we investigated and discussed how the physical surroundings – as constructed spatial gestures – support or counteract well-being. However, within the same context, the role of social and organizational structures and their impact on *lived gestures* can also be researched. This opens the potential to go into a deeper discussion on the identified themes, uncovering how the building and its users "co-evolve", throughout the social life cycle of buildings, investigated by the process of social commissioning [28].

Hereby, this paper contributes to and provides a basis for further studies to inform and improve architectural design practices, moving towards an interdisciplinary description of architecture required to address the complexity of sustainability.

Conclusion

Based on a case study, involving a mixed-use building complex in Denmark, this paper critically evaluated whether and how key *intended spatial gestures* by the project-leading architects at AART are experienced in the form of *lived spatial gestures* by the occupants of the building complex (tenants and residents). Through the development and application of a tectonic framework for studying these gestures, we have herein discussed the impact of constructed spatial gestures on people's well-being and the implications on future design as well as on architectural practice.

Our findings showed that the extent to which the gestures *intended* by the architects translate into *lived gestures* vary among the different user groups, depending on the clarity of the gesture, entailing both the details of its construction and

its recipient subject. Accordingly, the notion of spatial gesture, as an alternative language to engage people in a spatial dialogue, must be defined both in relation to its construction and its 'human response' in order to meaningfully translate from *intended* to *lived* gesture. Thus, we propose, that spatial gestures need to be addressed to specific user groups in relation to the *intended* use or experience to allow architects to strategically activate their field-specific knowledge within an interdisciplinary context to contribute to well-being by creating social value, moving towards an application and integration of the tectonics of human well-being in architectural practice to improve the future design.

In conclusion, this paper contributes to the understanding of architecture's role and impact on human well-being, through the discussion of tectonics as an interdisciplinary framework towards describing the interaction between architecture and people as a spatial dialogue, in the form of constructed 'gestures' across the disciplines of architecture and anthropology. The findings of this paper thereby create a basis for the following studies on positioning the question of human well-being related to the economic prioritisation of resources in construction.

Acknowledgements This paper is part of an ongoing Ph.D. research project at the Department of Architecture, Design & Media Technology at Aalborg University and the architectural studio AART Architects A/S in collaboration with the Department of Food and Resource Economics at the University of Copenhagen, in Denmark. The work is funded by AART Architects A/S and Innovation's Fund Denmark (Industrial Ph.D. grant 9065-00220B). The authors would like to thank all the anonymous users of the case buildings, who volunteered to participate in the interviews.

Funding The work is funded by AART Architects A/S and Innovation's Fund Denmark (Industrial Ph.D. grant 9065-00220B).

Declarations

Consent for publishing Authors have signed consent for publishing an extended abstract of the work in the conference proceedings of the 5th International Conference on Structures & Architecture, 2022.

Conflict of interests Authors would like to declare, that Marie Frier Hvejsel is co-chairing the 5th International Conference on Structures and Architecture, is an associate editor of the journal 'Architecture, Structures and Construction', and is a guest editor of the journal's special issue 'Structures & Architecture – Joining forces' as potential conflicts of interest.

Data transparency The qualitative data that support the findings of this study are not publicly available as their containing information might compromise the privacy of research participants, but are available from the corresponding author upon reasonable request.

GDPR Authors declare that they followed the guidelines of the General Data Protection Regulation in relation to data collection, handling, and storage. Transcribed data has been anonymized, and a signed consent form was obtained from all informants for participating in the interviews and publishing its results.

References

1. Mossin N (2018) An Architectural Guide to the UN 17 Sustainable Development Goals. KADK, Copenhagen
2. Troelsen M, Jensen MBV (2017) Adding Value to the Social Dimension of Sustainable Building. Aalborg University, Aalborg
3. Litman T (2011) Sustainability and Livability - Summary of Definitions, Goals, Objectives and Performance Indicators. Victoria Transport Policy Institute, Victoria
4. "Social Value Portal. What is social value?," 1 August 2021. [Online]. Available: https://socialvalueint.org/what-is-social-value/. [Accessed 15 March 2020]
5. Sattrup PA (2018) Dokumenter din værdiskabelse. Danish Association of Architectural Firms, Copenhagen
6. Holst J (2017) The fall of the Tektōn and the rise of the architect: on the greek origins of architectural craftsmanship. Archit Hist 5(1):5
7. Ulrich RS (1984) View through a window may influence recovery from surgery. Science 224(4647):420–421
8. Bjørn N (2014) "Evidens for sociale effekter af fysiske indsatser i udsatte boligområder. Revieq af 27 effektstudier fra ni lande". Københavns Kommune, København
9. Pink S (2012) Situating Everyday Life - Practices and Places. Sage Publications
10. Ballantyne A (2011) Architecture, life, habit. J Aesthet Art Critic 69(1):43–49
11. Karvouni M (1996) Tectonics of the Human Body and Architectural Embodiements. In: *ACSA European Conference*, Copenhagen
12. Sántha E, Hvejsel MF, Rasmussen MK (2022a) Intention, life, value: A multidisciplinary approach to understanding architectural quality in the city. In: Montgomery J (ed), AMPS Proceedings Series 24.1. Cities in a Changing World, Virtual. 16 – 18 June (2021). pp 67–78
13. Frampton K (1983) Towards a Critical Regionalism: Six Points for an Architecture of Resistance. In: The Anti-Aesthetic. Essays on Postmodern Culture. Seattle, Bay Press
14. Frascari M (1981/1984) The Tell-the-Tale Detail, 2 edn. MIT Press, Cambridge, vol. 7, pp. 23–37
15. Sekler EF (1964) Structure, Construction, Tectonics. In: Kepes G (ed) Structure in Art and in Science. Studio Vista, London, pp 89–95
16. Semper G (1861/2004) Style in the Technical and Tectonic Arts; or, Practical Aesthetics, 2 edn. Getty Publications, Los Angeles
17. Sántha E, Hvejsel MF, Rasmussen MK (2022b) Lost potentials? – Unpacking the tectonics of architectural cost and value. Nordic Journal of Architectural Research [In Press]
18. "Closing the gap in a generation: health equity through action on the social determinants of health. Final Report of the Commission on Social Determinants of Health," World Health Organisation, Geneva, 2008
19. Lowe M, Whitzman C, Badland H, Davern M, Hes D, Aye L, Butterworth I, Giles-Corti B (2013) Liveable, healthy, sustainable: What are the key indicators for Melbourne neighbourhoods? University of Melbourne, Melbourne
20. Hvejsel MF (2018) Gesture and Principle - Tectonics as a critical method in architecture. In: Reader on Tectonics in Architecture. AAU, Aalborg, pp. 395–409
21. Bech-Danielsen C, Beim A, Madsen US (2014) Towards an ecology of tectonics : the need for rethinking construction in architecture. Edition Axel Menges, Stuttgart
22. Beimog A, Hvejsel MF (2016) The Ecology of Urban Tectonics: Studied in everyday building culture of Hans Christian

Hansen,« i Structures and Architecture: Beyond their Limits, P. J. da Sousa Cruz, Red., London, Taylor & Frances, pp. 242–249
23. Christiansen EM (2020) Tectonics and the City: In search of a critical perspective on assembling the city. Aalborg Universitetsforlag, Aalborg
24. Hvejsel MF (2011). INTERIORITY: A Critical Theory of Domestic Architecture. AAU, Aalborg
25. Postiglione G, Lupo E (2007) The Architecture of Interiors as Re-writing of Space: Centrality of Gesture. In: Thinking Inside the Box: a reader in interiors for the 21st century, Middlesex University Press, London, England, pp. 145-154
26. Fabian L (2016) The Spatial, The Social and The Architectural. In: Jensen BB, Weiss KL (eds) Art of Many, The Right to Space: the Danish Pavilion - Bienniale Architettura 2016. DAC & The Danish Architectural Press, Copenhagen, p 189
27. Dunne A, Raby F (2013) Speculative Everything: Design, Fiction, and Social Dreaming. The MIT Press, Cambridge
28. Entwistle JMK, Rasmussen MK (2021) Fra indsigt til forandring, *Jordens Folk,* pp. 121–131
29. Stender M (2017) Towards an architectural anthropology—what architects can learn from anthropology and vice versa. Archit Theory Rev 21(1):27–43
30. Pallasmaa J (1986/2005) The eyes of the skin: Architecture and the senses, 2 edn. Wiley Academic and Hobken, Chichester
31. Lefebvre H (1974/1991) The production of space, 2 edn. Blackwell, Oxford
32. Norberg-Schulz C (1980) Genius Loci, Towards a Phenomenology of Architecture. Rizzoli, New York
33. Latour B, Yaneva A (2008) Give Me a Gun and I will Make All Buildings Move': An ANT's view of Architecture, In: Explorations in Architecture: Teaching, Design, Research. Birkhausel, Basel
34. Ingold T (2013) Designing Environments for Life. In: Anthropology and Nature. Routledge, p. 14
35. Ingold T (2000) The perception of the environment: Essays on livelihood, dwelling and skill. Routledge, New York
36. Flyvbjerg B (2006) Five misunderstandings about case-study research. Qual Inq 12(2):219–245
37. "Aarhus Kommune. Helhedsplan for De Bynære Havnearealer," 2003. [Online]. Available: www.aarhus.dk. [Accessed 10 March 2021]
38. "Aarhus Kommune. De Bynære Havnearealer - Dispositionsplan for de nordlige områder," 2006. [Online]. Available: aarhusoe.dk. [Accessed 10 March 2021]
39. "Aarhus i tal," Aarhus Kommune, 2020. [Online]. Available: ledelsesinformation.aarhuskommune.dk. [Accessed 10 March 2021]
40. Willacy S, Aarhus Ø (2020) [Online]. Available: aarhusoe.dk. [Accessed 10 March 2021]
41. Wadel C (1991) Feltarbeid i egen kultur: en innføring i kvalitativt orientert samfunnsforskning. SEEK, Flekkefjord
42. Johannson J (2018) Evaluering og Arkitektur: Brugere, interview, analyse og fænomenologi. RUM, Hørsholm
43. Clark A, Emmel N (2010) Using walking interviews. Morgan Centre, University of Manchester, Manchester
44. Kinney P (2017) Walking interviews. Soc Res Update 67:1–4
45. King AC, Woodroffe J (2017) Walking Interviews. In: Handbook of Research Methods in Health Social Sciences. Springer Singapore, Singapore, pp. 1–22
46. Stender M, Jepsen BM (2021) An outdoor living room - Balconies and blurring boundaries. In: Architectural Anthropology. Routledge, p. 14
47. de Chazal J (2010) A systems approach to livability and sustainability: defining terms and mapping relationships to link desires with ecological opportunities and constraints. Syst Res Behav Sci 27(5):585–597
48. Weiss KL (2019) Kritisk By/Critical City. The Danish Architectural Press, Copenhagen
49. Hay R, Samuel F, Watson KJ, Bradbury S (2018) Post-occupancy evaluation in architecture: experiences and perspectives from UK practice. Build Res Inform 46(6):698–710

TRANSFORMING THE HARBOUR – THE ROLE OF ARCHITECTURE IN CREATING URBAN LIFE

Author:
ESZTER SÁNTHA

Affiliation:
AALBORG UNIVERSITY, DENEMARK. AART ARCHITECTS, DENEMARK

INTRODUCTION

Global challenges related to urbanization call for the sustainable development of cities.[1] Transforming and building urban areas to be compact, mixed-use, and integrated to minimize the negative social, economic, and environmental consequences of urbanization has been a leading concept in the last 30 years.[2] However, creating sustainable compact cities on multiple dimensions can be characterized as a wicked problem, a complex task, that requires multidisciplinary efforts to tackle the underlying challenges.[3] Thus, in practice, they rarely succeed to focus on all three dimensions of sustainability equally. Emphasis is often put on the environmental and economic dimensions, while the social is less addressed.[4]

This study is concerned with the underexposed social dimension of sustainable urban development, discussing the role and potential of architecture in creating urban life seen as a social value contributing to the well-being of citizens living in compact neighbourhoods. This value potential is investigated through the interrelations between the design of the built environment and practice, primarily from a user perspective. In this paper, urban life is studied in relation to the urban public space created by a mixed-use building complex, as part of the large-scale harbourfront redevelopment in Aarhus Bay, Denmark. While the study discusses the role of architecture in the matter, it is important to note, that architecture in itself is not enough to develop these interactions. However, if it's designed correctly, it can certainly act as a catalyst.[5] These entanglements between design, practice, and value on an urban scale in Scandinavia were studied by urbanist architects,[6] anthropologists,[7] and economists[8] too.

Present study applies a multidisciplinary methodological framework built on tectonic theory described in Sántha et al.[9] to critically discuss the social value potential of architectural efforts in creating urban life. Through a mixed-method inquiry, the study aims to better understand how urban public spaces in densely built neighbourhoods are used and to open a discussion on the role of architecture in creating urban life as a social value.

TECTONIC METHODOLOGY

The physical built environment as a "framework" can be designed to either encourage or discourage certain activities and social interactions; to limit or offer possibilities, that allow for a broader range of narratives to unfold through the dynamic interactions between social processes and buildings.[10] However, in search of the potential of architecture to catalyze these processes, it is also pointed out, that architects and urban planners tend to focus one-sidedly on space (e.g. Ståhle et al.[11]), while it

should always be studied in connection to life.[12] Urban space should be considered as a forum for these interactions and thus the focus should be on "all the versatile imperceptible flows that run through a city",[13] instead of the classical topics of urban theory, dividing between subjective and objective interpretations of the city.[14]

This mindset however would not be a new approach in architecture and urban design. In fact, it is rooted in the ancient task of the *architecton*, as a pre-specialization,[15] comprising the essential skills of tectonics; the careful articulation of the spatial gestures by architecture, through structure, and construction,[16] as a way of non-verbal communication between architect and experiencer, the user.[17]

In the past century, tectonic theory has re-emerged as means to explicitly describe and discuss the expressive quality of architectural works[18] and was applied on different scales from the interior[19] to urban design[20] in recent research. The study also builds on most recent findings that tectonic theory has the potential to provide a basis for a multidisciplinary methodological framework,[21] and it can be applied to identify and analyze spatial gestures as "key expressions/statements, stressing the core potential of architecture to facilitate human well-being through its form, which potentially translates to social value, depending on the users' preference and response to those gestures through everyday practice"[22] (Figure 1).

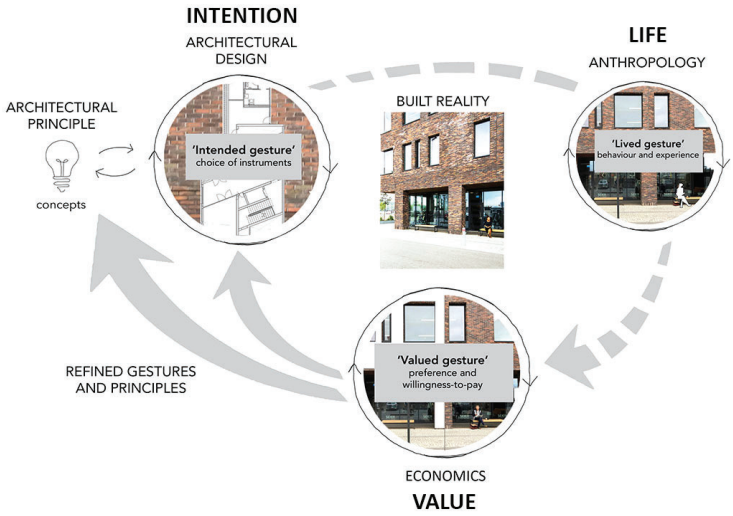


Figure 10. The tectonic methodology by Sántha et al. (2022a) describes the relation between design (intention), practice (life), and value

Emerging from previous studies focusing holistically on the "translation" of gestures from architecture to anthropology through the narratives of 'intended'[23] and 'lived' spatial gestures,[24] the objective of this current study is to unfold and discuss the role and potential of architecture in creating urban life as a social value in a mixed-use building complex.

'THE WAREHOUSES' COMPLEX IN AARHUS

Initiating a redevelopment project by the city council in 1997, the harbourfront of Aarhus Bay has been an area of key importance in accommodating the growing urban population of the Danish city.[25] The project was guided by the sustainable compact city model, with a high potential to create social value for its citizens by making it a "desirable place to live".[26]

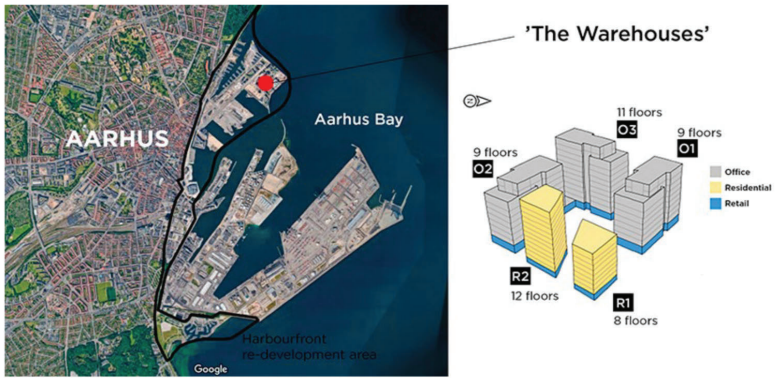


Figure 11. The map on the left shows the location of The Warehouses within the harbourfront redevelopment area in Aarhus. The figure to the right shows the buildings of the complex and their primary function. Color coding: grey = office, yellow = residential, blue = retail. The complex of approx. 45.000 sqm was built in two phases in 2016 and 2020. It was developed by Kilden og Hindby and designed by AART architects A/S in collaboration with MOE A/S engineers

This study investigates the building project of 'The Warehouses' complex, built as part of the harbourfront redevelopment on Pier 4 of the northern part of the former dockland (Figure 2). The mixed-use complex of 'The Warehouses', as a case, to investigate is chosen because it places particular demands on the building's ability to articulate spatial gestures in the transition between building and urban spaces due to its complexity in application and user groups (businesses and residents). Thus, it provides a good basis for investigating the role and potential of architecture to create urban life as a social value, focusing on the interactions and flows in a selected urban public area. In its broadest sense, public space is understood as, the space between the buildings, including the streets, parking lot, etc. as part of the built environment.[27] In this study, the urban area of interest comprised the space between the buildings of the complex (Figure 3).

Figure 12. The investigated urban public space between the buildings of 'The Warehouses'. Photos are taken by the author in September 2020 (1-2) and June 2021 (3)

This is a more or less enclosed space, containing a parking lot, and a couple of urban niches at the bottom of the buildings. The area is quite poor in green elements; only a couple of trees and some grass in between the hollowed concrete tiles used as pavement for the parking area. At least half of the

space is mostly in shade during the day, and the main road crossing the space is often windswept, due to the tall buildings surrounding the space.

Based on the empirical evidence found in Sántha et al. (2022b), architecturally intended key spatial gestures to create urban life through a number of architectural tools are summarized in Figure 4. Apart from the inherently good intentions by the developer on the mixed-use concept, it is indeed the role and responsibility of the architect to realize those potentials the best way it's possible, given the constraints by the spatial gestures articulated through a number of architectural solutions.[28]

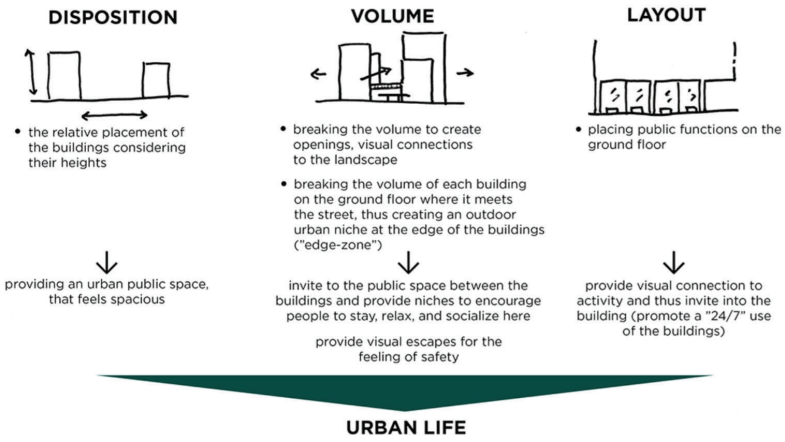


Figure 13. Architecturally intended key spatial gestures[29] to create urban life as a potential social value added to the citizens of the neighborhood by architectural instruments (disposition, volume, and layout)

How and to what extent some of these 'intended' spatial gestures translate to 'lived' spatial gestures is explored through a mixed-method inquiry, studying the urban public space between the buildings of the mixed-use complex, through the experiences and observed activities of the different user groups.

METHODS FOR STUDYING URBAN LIFE

Qualitative data on the spatial experiences and practices had been collected in the form of audio-recorded on-site 'walk-and-talk' interviews,[30] with the occupants of the complex. These types of interviews are considered a "valuable means of deepening understandings of lived experiences in particular places",[31] thus an adequate method to collect detailed qualitative data for studying the topic of urban life in this context. The interviews were conducted in a semi-structured discussion format along the participants' free choice of route. Research questions investigated by this method and further details on data collection are shown and summarized in table 1.

Quantitative data had been collected using a selection of direct observation methods (counting, mapping, and tracing),[32] as a primary tool to study urban public life. Here, user groups are understood in a broad sense, comprising both the different occupant groups of the buildings as well as inhabitants of the neighborhood, visitors from another part of the city, tourists, etc. Direct observation methods do not actively involve participants, rather they become the object of the study, by mapping their activities and behavior to gain insight into how public spaces are used according to user preferences and needs.[33] While public life generally should be understood in the broadest sense, comprising all that is happening outside of closed walls,[34] activities counted, traced, and mapped were narrowed down to a list of selected movement types and stationary activities. To grasp a more "normal"

distribution, two workdays in the middle of the week were selected for data sampling. Based on the same consideration, sampling times were selected strategically to avoid morning and afternoon rush hours. Research questions investigated by this method and further details on data collection are shown and summarized in table 1.

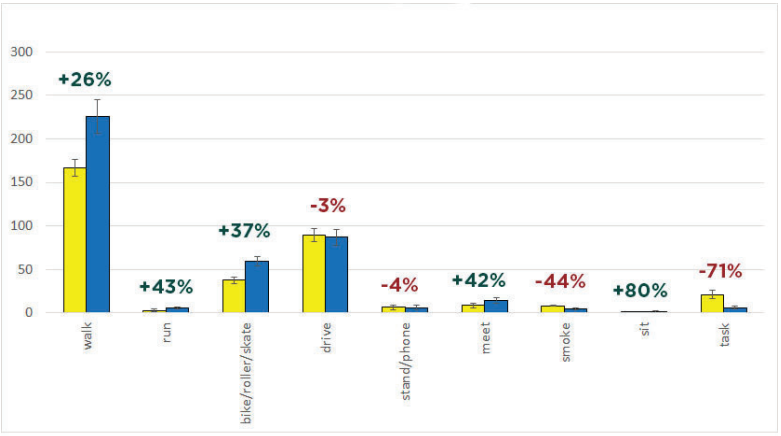
	INTERVIEWS	URBAN LIFE RECORDS
Inquiry	Qualitative	Quantitative
Specific method	Walk'n'talk	Counting, mapping, and tracing
Research questions	- How do users perceive traffic - How do they describe urban life - How do they use the buildings - What does mixed-use mean to them	- How many (within-day variation) - Where - What (activity)
Data collection	June-July, 2021	June-July, 2021
Data sample	10 informants of 2 user groups: 3 office building occupants and 7 residents Age group: 20-68 years 60% Male, 40% Female	Counting and mapping: 4 days (Wednesday-Thursday)/2 weeks - Within office hours: 10-11 AM; - After office hours: 6-7 PM Tracing and mapping: 3 days (Wednesday-Thursday)/2 weeks - Within office hours: 11-12 AM; - After office hours: 7-8 PM

Table 1. Summary of the details regarding the mixed-method inquiry applied in this study

In terms of data analysis methods, qualitative data were transcribed and coded thematically using NVivo Pro. The primary quantitative data were logged manually on paper and were subsequently entered into a digital spreadsheet. Statistical analysis of the data from counting was carried out in MS Excel, while the tracing data were analyzed visually in aggregated form by overlaying them in Adobe Photoshop.

URBAN LIFE BETWEEN THE BUILDINGS OF THE COMPLEX

The overall average traffic within the hours 10-11 AM and 6-7 PM of the sampled days was 376, in absolute terms. Traffic in general on weekdays, during office hours, was described by informants as busy, and heavy on transit traffic, but not disturbing, in relative terms. Based on the registrations, traffic during the after-office hour was on average 17% higher than during the office hour (Figure 5). Yet, perceived traffic during these hours was described as "calm", "nice", and "busy in a good way" for the same area.



Weather conditions

Date of data collection	Temperature °C	Humidity %	Wind m/s	Precipitation mm	Sunshine min
23 June 2021	18,8	75,3	2,5	0,0	13,5
24 June 2021	18,9	61,6	2,0	0,0	40,3
30 June 2021	18,9	83,4	2,5	0,3	1,8
01 July 2021	19,6	70,7	3,6	0,0	19,2

"Office hour" 10-11 AM

"After-office hour" 6-7 PM

Figure 14. Average traffic in the space between the buildings. As the data on urban life recordings is dependent on the weather conditions, a summary of key measures is also included

This is probably explained by a shift in the type of activities taking place in this space. Pedestrians traffic is still dominating in the after-office hours with an increase of 26% for walking, and 43% for running, along with a 37% increase in human-powered land vehicle traffic (Figure 5), but the transit traffic, referring to the number of people crossing the space doing a task (e.g. deliveries) combined with the number of cars coming and going, is significantly less by a total of 71% (Figure 5). This is also supported by the noticeable fewer cars parking above-ground, which is also reflected in the walk path pattern shown by tracing data (Figure 6). Pedestrian traffic comprises people walking around with different water sports equipment and accessories, as well as gym bags (indication for water sport and fitness activity) all day round, whereas in the evening there was a number of formally dressed people presumably attending an arrangement or going to one of the restaurants in the buildings. Having meeting rooms and a cantina to be shared by all the companies renting an office space in the complex also creates a significant traffic in the space between the buildings during office hours, especially around lunch time. These flows to and from the buildings and the dynamics changing between them are represented well by tracing data (Figure 6). The shift in the character of stationary activities resembles the same dynamics. From within office hours to after office hours, there is 44% less smoking, while there is 42% more meeting and 80% more sitting (Figure 5), as the space transfers from being a space for phone calls, coffee breaks, and smoking for employees to an ad-hoc meeting and resting point for people. Data also shows, that on average 36% of all stationary activities happen in the “edge zone” of office building “O1” (to the bottom right on Figure 6), indicating a slight preference towards it.

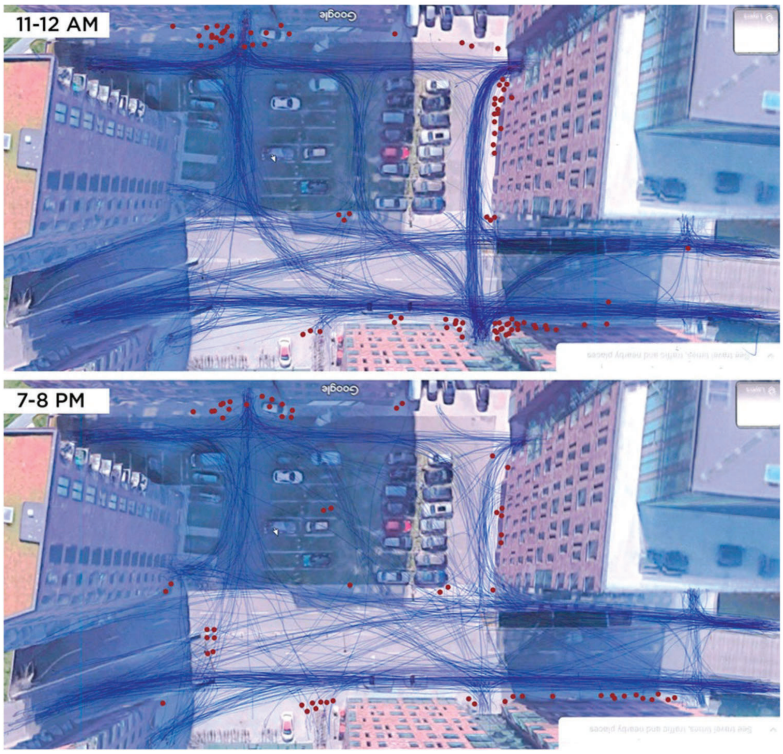


Figure 15. Results of tracing, showing pedestrian flow and stationary activities. Each line represents the path of a pedestrian (movement) and each dot represents a registered stationary activity

The synthesis of the quantitative and qualitative data unfolds the dynamic flow of the studied mixed-use neighborhood. The analysis of the synthesized data revealed what factors play a role in creating urban life. Key potentials to create urban life by architecture on a building level were found to lie in the abundance and quality of outdoor niches, the presence of good and affordable public services and functions within a walkable distance, as well as the characteristics of the landscape, and how the green-blue infrastructure is integrated into the space between the buildings.

Connection to the landscape

Empirical findings of this paper show, that the space itself studied here does not provide an adequate amount of green area. This is to a certain degree compensated by the provided visual connection and access to the nearby urban green area and water bodies (canals and the sea), which gives a "good business" of the space between the buildings, as the informants described its traffic. However, it was also explicitly expressed by the interviewed residents, that there would be a need for more of these (green) urban niches between buildings, where "life" could truly unfold in a more "relaxed" setting, especially in this compact urban fabric with dense, high-rise buildings.

Building edges as important outdoor niches for urban life

Findings also show that building edges, when designed as functional outdoor niches, have a high potential to be a scene for activities and a driver for urban life. Investigating the spatial gestures in these niches it becomes very clear, that it is mostly at the edge zone of "O1", where those kinds of

activities are welcomed and encouraged; where the space is inviting the public to sit down or stand by the benches and catch the evening sunlight, or just find shelter from wind or rain. Even though in principle, space is available for the same activities in the other edge zones, there you find designated parking spots, no benches, and they are mostly in shade during the day. These spaces could easily be just as inviting as the one at "O1", and as the data on registered stationary activities showed, there is demand for it.

The presence of good and affordable public services and functions within a walkable distance

The case studied here can be characterized as a 'pure mixed-use walkable area', which provides both horizontally and vertically mixed spaces to accommodate the personal and professional needs of the different user groups, where all functions are reachable from the core activities within an approximately 10-minute walking distance. The contribution of architecture in this context to creating urban life is through the spatial gesture of inviting the public into the building, thus utilizing it "24/7", through the "activation of the ground floor" by consideration regarding layout and materials.[35] Results of the present study showed how these services and functions can act as a driver for pedestrian flow between the buildings. This was also explained by an occupant of the office building, that it is not enough to simply introduce an office building to an otherwise residential neighborhood in an attempt to make it a lively mixed-use area. The informant pointed out, making a comparison to a similar harbourfront development project in Copenhagen, the importance of the placement of these public functions and services to have "more life" in and around its buildings.

DISCUSSION AND CONCLUSIONS

Based on the findings of this study, the role of architecture in creating urban life as a social value is through careful detailing, and well-articulated intended gestures. The case studied here is a good example of architectural efforts put into social value creation through the intended gestures regarding creating urban life, comprising the design and integration of green-blue areas, outdoor niches, as well as public services and functions within a walkable distance.

However, the study also showed that there is still room for improvement when it comes to the nuances of gestures, especially those regarding the design of outdoor niches. These could have been more elaborate, more inclusive, and more inviting in general. More focus should have also been put on the provision of green areas. The right to space, and the right to green space echo in the current discourses as one of the key elements of social sustainability in sustainable urban development. This entails the fair distribution of urban public spaces, regarding both their quantity and quality in terms of ecological, social, and health promotion services.[36] The responsibility of architecture in this context is to focus on the different needs of different user groups. This could potentially be improved first by establishing democracy in urban planning processes, where all individuals, have the right to get involved in the development, implementation, and enforcement of policies.[37] However, one critique of participatory planning processes includes, that people don't always know what they want exactly.[38] Also, considering the delicate balance between the multiple dimensions of sustainability the greener is not necessarily the better. Urban green areas and waterbodies as key neighborhood amenities often have a great influence on housing prices.[39] This raises the issue of affordability, potentially conflicting with the original notion to have the right to green space, and poses a risk for other socio-economic issues, e.g. gentrification.[40]

Another challenge of creating urban life is the provision of privacy considering the increased traffic and activities close to the residential areas. Urban life is not inherently "good" or desirable. Urban public spaces, as open spatial invitations are also attractive for unwanted, and in some cases even

illegal activities. As there were a couple of intended gestures focusing on the feeling of safety through the creation of visual escapes or connection to activity by breaking the volume (Figure 4), future studies on this case can be focused on the investigation of this relationship and how to improve privacy and safety, while nurturing urban life in mixed-use neighbourhoods.

To sum up, the findings of this study revealed the dynamic flow of urban public space in a mixed-use neighborhood through a mixed-method inquiry on urban life. The study contributes to closing the gap between subjective and objective interpretations of urban spaces, by focusing on both the construction of the built environment and the vibrant complex flows running through them. Thus, it provides input to the multidisciplinary efforts needed to create functional and livable compact cities in the future.

NOTES

[1] "Sustainable Development Goals." . Accessed July 20, 2021. https://www.un.org/sustainabledevelopment/sustainable-development-goals/.
[2] Simon Elias Bibri, John Krogstie, and Mattias Kärrholm. "Compact City Planning and Development: Emerging Practices and Strategies for Achieving the Goals of Sustainability." *Developments in the Built Environment* 4, (Nov, 2020): 100021. doi:10.1016/j.dibe.2020.100021.
[3] Horst W. Rittel and Melvin M. Webber. "Wicked problems." *Man-made Futures* 26, no. 1 (1974): 272-280.
[4] Bibri et al., "Compact City Planning and Development"
[5] Jan Gehl. *Life between Buildings: Using Public Space*. 3rd ed. Washington DC: Island Press, 2011.
[6] Gehl, *Life between Buildings*; Elias Melvin Christiansen. *Tectonics and the City: In Search of a Critical Perspective on Assembling the City*. Aalborg: Aalborg University, 2020; Alexander Ståhle, Helena L. Kleberg, Ida Wezelius, Eva Minoura, Moa Rydell, and Stina Gjertsen. *City Measures - A Guide for Research Driven Urban Design*. Stockholm: SPACESCAPE, 2018.
[7] Mette Mechlenborg and Katinka Hauxner. *Boligliv i Højden: Ny Viden Om Boligmiljø Og Socialt Liv i De Danske Højhuse*. Aalborg: BUILD, Aalborg University, 2021; Marie Stender and Marie Blomgren Jepsen. "An Outdoor Living Room: Balconies and Blurring Boundaries." In *Architectural Anthropology*, 48-61: Routledge, 2021.
[8] Thomas Hedemark Lundhede, Toke E. Panduro, Linda Kummel, Alexander Ståhle, Axel Heyman, and Bo Jellesmark Thorsen. *Værdisætning Af Bykvaliteter-Fra Hovedstad Til Provins*. København: Institut for Fødevare- og Ressourceøkonomi, København Universitet, 2013; Marie Lautrup. *Valuing the World Outside Your Doorstep*. Copenhagen: University of Copenhagen, 2022.
[9] Eszter Sántha, Marie Frier Hvejsel, and Mia Kruse Rasmussen. "Intention, Life, Value: A Multidisciplinary Approach to Understanding Architectural Quality in the City." In *AMPS Extended Proceedings: Cities in A Changing World: Questions of Culture, Climate and Design*. City Tech, New York City, New York, USA, June 16-18, 2021.
[10] Gehl, *Life between Buildings*
[11] Ståhle et al., *City Measures*
[12] Jan Gehl and Birgitte Svarre. *How to Study Public Life*. Washington, DC: Birkhäuser Boston, 2013. doi:10.5822/978-1-61091-525-0.
[13] Albena Yaneva. "The Happy City: An Actor-Network-Theory Manifesto." In *Ecologies Design*, 181-187: Routledge, 2020, p. 21
[14] Yaneva, "The Happy City"
[15] Jonas Holst. "The Fall of the Tektōn and the Rise of the Architect: On the Greek Origins of Architectural Craftsmanship." *Architectural Histories* 5, no. 1 (2017).
[16] Eduard Franz Sekler. "Structure, Construction, Tectonics." In *Structure in Art and in Science*, edited by György Kepes, 89-95. London: Studio Vista, 1964.
[17] Sántha et al., "Intention, Life, Value"
[18] Marco Frascari. "The Tell-the-Tale Detail." In *Semiotics: The Proceedings of the Semiotic Society of America*, edited by Geoffrey R. Owens and Elvira K. Katić, 325-336. Charlottesville, Virgina, US: Philosophy Documentation Center, 1981; Kenneth Frampton. *Studies in Tectonic Culture: The Poetics of Construction in Nineteenth and Twentieth Century Architecture*. Massachussets: MIT Press, 1995; Marie Frier Hvejsel. "Gesture & Principle: Tectonics as Critical Method in Architecture." In *Reader : Tectonics in Architecture*, edited by Isak Worre Foged and Marie Frier Hvejsel, 395-409. Aalborg: Aalborg Universitetsforlag, 2018.
[19] Gennaro Postiglione and Eleonora Lupo. "The Architecture of Interiors as Re-Writing of Space: Centrality of Gesture." In *Thinking Inside the Box: A Reader in Interiors for the 21st Century*, edited by Gigli, J., 145-154. London, England: Middlesex University Press, 2007; Marie Frier Hvejsel. *INTERIORITY: A Critical Theory of Domestic Architecture*. Aalborg: Aalborg University, 2011
[20] Christiansen, *Tectonics and the City*
[21] Sántha et al., "Intention, Life, Value"
[22] Eszter Sántha, Marie Frier Hvejsel, and Johanne Mose Krämer Entwistle. "Tectonics of Human Well-being: Describing Architecture in Terms of Constructed Spatial Gestures and their Impact." *Architecture, Structures and Construction* (2022a): 1-14., p. 4
[23] Eszter Sántha, Marie Frier Hvejsel, and Mia Kruse Rasmussen. "Lost Potentials? – Unpacking the Tectonics of Architectural Cost and Value." *Nordic Journal of Architectural Research* (2022b).
[24] Sántha et al., "Tectonics of Human Well-being"

[25] Aarhus Kommune and Aarhus Havn. *Helhedsplan for De Bynære Havnearealer*. Aarhus: Aarhus Kommune, 2003.
[26] Christiansen, *Tectonics and the City*
[27] Gehl and Svarre, *How to Study Public Life*
[28] Sántha et al., ”Lost Potentials”
[29] Sántha et al., ”Lost Potentials”
[30] Andrew Clark and Nick Emmel. *Using Walking Interviews*. Manchester: Morgan Centre, University of Manchester, 2010; Penelope Kinney. "Walking Interviews." *Social Research Update*, summer, 2017, 1-4.
[31] Alexandra C. King and Jessica Woodroffe. "Walking Interviews." In *Handbook of Research Methods in Health Social Sciences*, edited by Pranee Liamputtong, 1-22. Singapore: Springer Singapore, 2017. doi:10.1007/978-981-10-2779-6_28-1., p1.
[32] Gehl and Svarre, *How to Study Public Life*
[33] Gehl and Svarre, *How to Study Public Life*
[34] Gehl, *Life between Buildings*
[35] Sántha et al., ”Lost Potentials”
[36] Diogo Guedes Vidal, Rui Leandro Maia, Helena Vilaça, Nelson Barros, and Gisela Oliveira. *Green Spaces and Human Rights: To an Environmental Justice in Urban Space*. Porto: Universidade do Porto, Faculdade de Letras, 2018.
[37] Bill E. Lawson. "The Value of Environmental Justice." *Environmental Justice* 1, no. 3 (2008): 155-158.
[38] Nicholas Kamols, Marcus Foth, and Mirko Guaralda. "Beyond engagement theatre: challenging institutional constraints of participatory planning practice." *Australian Planner* 57, no. 1 (2021): 23-35.
[39] Lundhede et al., *Værdisætning Af Bykvaliteter*; Lautrup, *Valuing the World Outside Your Doorstep*.
[40] Isabelle Anguelovski, James J. T. Connolly, Melissa Garcia-Lamarca, Helen Cole, and Hamil Pearsall. "New Scholarly Pathways on Green Gentrification: What does the Urban ‘green Turn’mean and Where is it Going?" *Progress in Human Geography* 43, no. 6 (2019): 1064-1086; Susannah Bunce. “Developing Sustainability: Sustainability Policy and Gentrification on Toronto's Waterfront." *Local Environment* 14, no. 7 (2009): 651-667; Mick Lennon. "Green Space and the Compact City: Planning Issues for a ‘new Normal’." *Cities & Health* 5, no. sup1 (2021): S212-S215.

BIBLIOGRAPHY

"Sustainable Development Goals". Accessed July 20, 2021. https://www.un.org/sustainabledevelopment/sustainable-development-goals/.

Aarhus Kommune and Aarhus Havn. *Helhedsplan for De Bynære Havnearealer*. Aarhus: Aarhus Kommune, 2003.

Anguelovski, Isabelle, James J. T. Connolly, Melissa Garcia-Lamarca, Helen Cole, and Hamil Pearsall. "New Scholarly Pathways on Green Gentrification: What does the Urban ‘green Turn’mean and Where is it Going?" *Progress in Human Geography* 43, no. 6 (2019): 1064-1086.

Bibri, Simon Elias, John Krogstie, and Mattias Kärrholm. "Compact City Planning and Development: Emerging Practices and Strategies for Achieving the Goals of Sustainability." *Developments in the Built Environment* 4, (Nov, 2020): 100021. doi:10.1016/j.dibe.2020.100021.

Bunce, Susannah. "Developing Sustainability: Sustainability Policy and Gentrification on Toronto's Waterfront." *Local Environment* 14, no. 7 (2009): 651-667.

Christiansen, Elias Melvin. *Tectonics and the City: In Search of a Critical Perspective on Assembling the City*. Aalborg: Aalborg University, 2020.

Clark, Andrew and Nick Emmel. *Using Walking Interviews*. Manchester: Morgan Centre, University of Manchester, 2010.

Frampton, Kenneth. *Studies in Tectonic Culture: The Poetics of Construction in Nineteenth and Twentieth Century Architecture*. Massachussets: MIT Press, 1995.

Frascari, Marco. "The Tell-the-Tale Detail." In *Semiotics: The Proceedings of the Semiotic Society of America*, edited by Owens, Geoffrey R. and Elvira K. Katić, 325-336. Charlottesville, Virgina, US: Philosophy Documentation Center, 1981.

Gehl, Jan. *Life between Buildings: Using Public Space*. 3rd ed. Washington DC: Island Press, 2011.

Gehl, Jan and Birgitte Svarre. *How to Study Public Life*. Washington, DC: Birkhäuser Boston, 2013.

doi:10.5822/978-1-61091-525-0.
Holst, Jonas. "The Fall of the Tektōn and the Rise of the Architect: On the Greek Origins of Architectural Craftsmanship." *Architectural Histories* 5, no. 1 (2017).
Hvejsel, Marie Frier. "Gesture & Principle: Tectonics as Critical Method in Architecture." In *Reader : Tectonics in Architecture*, edited by Foged, Isak Worre and Marie Frier Hvejsel, 395-409. Aalborg: Aalborg Universitetsforlag, 2018.
Hvejsel, Marie Frier. *INTERIORITY: A Critical Theory of Domestic Architecture*. Aalborg: Aalborg University, 2011.
Kamols, Nicholas, Marcus Foth, and Mirko Guaralda. "Beyond engagement theatre: challenging institutional constraints of participatory planning practice." *Australian Planner* 57, no. 1 (2021): 23-35.
King, Alexandra C. and Jessica Woodroffe. "Walking Interviews." In *Handbook of Research Methods in Health Social Sciences*, edited by Liamputtong, Pranee, 1-22. Singapore: Springer Singapore, 2017. doi:10.1007/978-981-10-2779-6_28-1.
Kinney, Penelope. "Walking Interviews." *Social Research Update,* summer, 2017, 1-4.
Lautrup, Marie. *Valuing the World Outside Your Doorstep*. Copenhagen: University of Copenhagen, 2022.
Lawson, Bill E. "The Value of Environmental Justice." *Environmental Justice* 1, no. 3 (2008): 155-158.
Lennon, Mick. "Green Space and the Compact City: Planning Issues for a 'new Normal'." *Cities & Health* 5, no. sup1 (2021): S212-S215.
Lundhede, Thomas Hedemark, Toke Emil Panduro, Linda Kummel, Alexander Ståhle, Axel Heyman, and Bo Jellesmark Thorsen. *Værdisætning Af Bykvaliteter-Fra Hovedstad Til Provins*. København: Institut for Fødevare-og Ressourceøkonomi, København Universitet, 2013.
Mechlenborg, Mette and Katinka Hauxner. "Boligliv i Højden: Ny Viden Om Boligmiljø Og Socialt Liv i De Danske Højhuse." (2021).
Postiglione, Gennaro and Eleonora Lupo. "The Architecture of Interiors as Re-Writing of Space: Centrality of Gesture." In *Thinking Inside the Box: A Reader in Interiors for the 21st Century*, edited by Gigli, J., 145-154. London, England: Middlesex University Press, 2007.
Rittel, Horst W. and Melvin M. Webber. "Wicked problems." *Man-made Futures* 26, no. 1 (1974): 272-280.
Sántha, Eszter, Marie Frier Hvejsel, and Johanne Mose Krämer Entwistle. "Tectonics of Human Well-being: Describing Architecture in Terms of Constructed Spatial Gestures and their Impact." *Architecture, Structures and Construction* (2022): 1-14.
Sántha, Eszter, Marie Frier Hvejsel, and Mia Kruse Rasmussen. "Intention, Life, Value: A Multidisciplinary Approach to Understanding Architectural Quality in the City." In *AMPS Extended Proceedings: Cities in A Changing World: Questions of Culture, Climate and Design. City Tech, New York City, New York, USA, June 16-18, 2021.*, 2021.
Sántha, Eszter, Marie Frier Hvejsel, and Mia Kruse Rasmussen. "Lost Potentials?–Unpacking the Tectonics of Architectural Cost and Value." *Nordic Journal of Architectural Research* (2022).
Sekler, Eduard Franz. "Structure, Construction, Tectonics." In *Structure in Art and in Science*, edited by Kepes, György, 89-95. London: Studio Vista, 1964.
Ståhle, Alexander, Helena L. Kleberg, Ida Wezelius, Eva Minoura, Moa Rydell, and Stina Gjertsen. *City Measures - A Guide for Research Driven Urban Design*. Stockholm: SPACESCAPE, 2018.
Stender, Marie and Marie Blomgren Jepsen. "An Outdoor Living Room: Balconies and Blurring Boundaries." In *Architectural Anthropology*, 48-61: Routledge, 2021.
Vidal, Diogo Guedes, Rui Leandro Maia, Helena Vilaça, Nelson Barros, and Gisela Oliveira. *Green Spaces and Human Rights: To an Environmental Justice in Urban Space*. Porto: Universidade do Porto, Faculdade de Letras, 2018.
Yaneva, Albena. "The Happy City: An Actor-Network-Theory Manifesto." In *Ecologies Design*, 181-187: Routledge, 2020.

Analysis III. Valued Gestures

To be submitted to:
ARCHITECTURAL SCIENCE REVIEW

FIRST DRAFT

Office employees' architectural preferences for workplace and workspace: a stated choice experiment

Eszter Sántha[a,b] and Jette Bredahl Jacobsen[c]

[a]Department of Architecture, Design and Media Technology, Aalborg University, Aalborg, Denmark; [b]AART architects, architectural design studio, Aarhus, Denmark; [c]Department of Food and Resource Economics, University of Copenhagen, Copenhagen, Denmark

ABSTRACT

This paper presents discrete choice models based on data from two stated choice experiments to translate end-user preferences for architectural design of workplace and workspace into quantified social value (user-value). As a case study, data were collected in an online survey among the employees of two different office complexes in Denmark. Data were analyzed using a mixed multinomial logit model. Via travel time to work as the payment vehicle, we derived willingness-to-travel for architectural attributes to investigate their relative importance for employees. Finally, we convert willingness-to-travel to willingness-to-pay to express user-value monetarily. We find that characteristics such as the availability of shared facilities in the building, and attributes influencing natural daylight conditions (window size and door panel transparency) contribute significantly to the attractiveness and thus to the value of workplaces and workspaces, respectively. Furthermore, we collected some learning points about the application of the method itself on building scales, within architecture.

STATUS

To be submitted

KEYWORDS (6-8)

Employees;
user value;
architectural design;
commercial office building;
stated preferences;
choice experiment;
discrete choice modelling

Introduction

It has been argued that multidisciplinary approaches are required to address the social, economic, and environmental challenges in our built environment toward sustainable development (Mossin et al. 2018). The multidimensionality of sustainability and increasing interests from multiple stakeholders result in an elevated complexity in the contemporary building industry. Within this complexity, the social dimension of sustainability is often neglected in favour of the environmental and economic aspects (Bibri et al. 2020). Nevertheless, understanding the preferences, needs, and practices of different end-user groups of buildings are essential in improving their well-being both to inform the underexposed social dimension of sustainable development (Jensen and Troelsen 2017) and in terms of efficient resource allocation. Thus, architects are challenged to maximize and communicate the social value-creation potential of their architectural work (Broch et al. 2017; Hvejsel and Beim 2019; Sattrup 2020). According to Social Value International (SIMNA 2018), "social value is about understanding the relative importance that people place on changes to their wellbeing and using the insights we gain from this to make better decisions".

However, in practice, architects are also continuously faced with construction budget constraints, which often form the basis for decision-making in the design process. Without a clear link to the benefit (social value) perceived by the end-users, it can be difficult for architects to argue for specific architectural instruments with potential value-creation capacity along the same line as e.g. construction cost (Broch et al. 2017; Sattrup 2020). This may result in architectural products, that ignore the end users and their preferences or only consider them to a limited extent.

For companies occupying office space in commercial office buildings, attracting the best staff is important. For employees, aspects of well-being at work and travel distance to their workplace, among others, matter in addition to salary and work content (Haworth 2004). It is supported by a growing body of literature, that the physical (built) work environment in general plays a significant role in office employees' well-being at work (Castaldo et al. 2017; Chafi et al. 2020; Elmahadi et al. 2011; Lusa et al. 2019; Ridoutt et al. 2002; Roetzel et al. 2020; Suckley and Dobson 2014; Tuzcuoğlu et al. 2021). Thus, understanding the preferences of end-users for the workplace and workspace characteristics is important for developers to ensure client satisfaction and thus secure a return on the investment in the long run. Consequently, architects, as creative mediators between developers and end-users, need methods and tools to understand, quantify, and report on social value in a potentially more successful manner during the design decision-making process towards a more human-centric design.

According to the review of value-mapping approaches in the built urban environment by the European Commission in 2006 (reported in Mulgan et al. [2006]), existing post-occupancy evaluation approaches forgo the *valuation* of the specific architectural design solutions and thus prove to be weak at supporting architectural design decision-making dominated by economic considerations. In their report, it is highlighted, that preference studies based on welfare-economic principles hold the potential to quantify and translate user preferences into value expressed in monetary terms (Mulgan et al. 2006). Yet, the literature on utilizing this potential and applying these methods in architecture is quite narrow. One of the few studies is Turan et al. (2020), where the effect of daylight on office rent prices was investigated using the revealed preference method (hedonic pricing) of office buildings based in Manhattan, New York. Studies applying the stated preference method (choice experiment) are e.g. Appel-Meulenbroek et al. (2022), where workplace characteristics (both architectural and environmental) were compared between the office building and home settings for different work activity scenarios. In their study, Cha et al. (2017)

modelled building users' spatial choice behaviour to improve the accuracy of space-use predictions of workspace in higher educational buildings. While the two latter studies provide a sophisticated way of quantifying employees' preferences for the workplace and -space based on selected architectural characteristics, they do not *valuate* these characteristics, which is considered the primary advantage of using these methods (Mulgan et al. 2006).

The present study aims to identify and discuss office employees' preferences and their choice behaviour for both workplace and workspace, based on a number of architectural design characteristics. Thus, this study tests the application of the choice experiment method as an economic approach in architecture to translate end-user preferences for architectural design into quantified social value (user-value) expressed in monetary terms. Accordingly, collect some of the learning points about the application of the method itself on building scales, within the field of architecture. The welfare economic valuation results can contribute to a more human-centric workplace and -space design, that considers end-user preferences as an indicator of their well-being by assisting architects in the design decision-making process, which is primarily driven by economic considerations.

Measuring and modelling preferences

According to the research need identified in the introduction, this study aims to apply a method, that is based on welfare-economic principles. Departing from the social value definition given in the introduction, we assume that the architectural goods described in this study, are components of employees' utility. The main objective of measuring and modelling preferences is to obtain a monetary measure of the change in an individual's welfare (level of indirect utility) derived from changes in the provision of goods (as referred to by Hanemann [1984] in Mariel et al. [2021]). Preferences can therefore be studied based on real market choice behaviour (revealed preferences) or hypothetical market choice behaviour (stated preferences). The study aims to quantify social value by the stated preferences method, choice experiment (CE). In doing so we apply a welfare economic approach in architecture to translate end-user preferences for architectural design into quantified social value (user-value) expressed in monetary terms.

CE as a direct valuation method was chosen because it allows the investigation of design scenarios with architectural characteristics that potentially have not been realized. Thereby it is possible to estimate the marginal value of both conceptual and realized architectural design characteristics that potentially create value for end-users. The method also allows us to cover a wider range of architectural characteristics of varying levels, which could prove to be more useful in terms of design evaluation in planning and designing future workplaces and workspaces. Compared to other stated preference methods (such as contingent valuation, contingent ranking or contingent rating), CE was applied, because choosing a preferred option from a number of offered alternatives is considered to be an easier task, i.e. less of a cognitive burden to respondents (Louviere et al. 2000). Thereby it better resembles real consumer behaviour. On the other hand, if too many attributes and levels are included, it may become too complex (Mariel et al. 2021). Just like other stated preference methods, CE has been criticized due to its potential hypothetical bias, which refers to the difference between respondents' choice behaviour in surveys (hypothetical market setting) and real life (in a real market situation), knowing that there are no real consequences of their choice in terms of actual payment (Mariel et al. 2021). The hypothetical bias can arise from several reasons (e.g. uncertainty, or social desirability as discussed in Ehmke et al. [2008]) and can be tested by comparing

stated and revealed preference methods, though only for goods that are already on the market (i.e. a building that is already built and taken into use). There are a number of strategies to minimize hypothetical bias (Fifer et al. 2014). In our study, we manage the hypothetical bias by:

- investigating office buildings as private goods,
- asking people to state their willingness-to-pay (in the form of willingness-to-travel),
- using a realistic payment vehicle based on travel time from home to work, that is familiar to employees,
- and lastly, only employees of the selected office case buildings are invited to participate as respondents to ensure that they have experience with the building.

The identification of preferences through Discrete Choice Modelling using data collected from stated CEs rely on McFadden's Random Utility Maximization (RUM) framework (McFadden 1973) and Lancaster's demand theory (Lancaster 1966). Within the theoretical model of RUM, an individual's utility is obtained through a choice situation where individual *n* is asked to choose from *K* alternatives in *T* repeated choice occasions. According to the utility maximization rule, the individual *n* chooses alternative *i* over alternative *j* in choice occasion *t* if the derived utility (*U*) from alternative *i* is higher than from alternative *j* ($U_{nit} > U_{njt}, \forall j \neq i$). However, measuring the direct utility of individuals based on a deterministic choice with certainty is unrealistic, and thus indirect utility is described based on a probabilistic choice, i.e., $Pr\ (U_{nit} > U_{njt}, \forall j \neq i)$. Within RUM, utility obtained from an alternative is formulated as:

$$U_{njt} = V_{njt} + \varepsilon_{njt} = V\left(X_{nj}, \beta_{nj}, S_{nj}\right) + \varepsilon\left(X_{nj}, S_{nj}\right) = X_{njt} \cdot \beta + \varepsilon_{njt} \qquad (1)$$

where only the deterministic utility component (*V*) of an individual is observed, which is based on a vector of known and relevant attributes (*X*) of the good relating to alternative *j*, a set of their coefficients (β) to be estimated, and some characteristics of the individual (*S*). The unobserved component is the random utility component (ε), which represents uncertainty due to unknown or excluded factors influencing an individual's utility.

Experimental design of the stated choice experiment

Our discrete choice study consists of two stated choice experiments, designed to elicit workplace and workspace preferences, respectively, in multi-tenant commercial office complexes.

In our experimental design, respondents were offered to choose from two alternatives in both experiments. In each choice set, respondents could also choose their 'Current building' in the first experiment (workplace) and 'Current office' in the second (workspace), as a valid option. This provided them with the possibility of opting out, thus allowing us to estimate an alternative specific constant (ASC) (Determann 2019), which represents the likelihood of respondents choosing their status quo, as their preferred option over the two alternatives (van der Berg et al. 2022) 'New building' or 'New office' offered in the experiments.

In the first experiment, the alternative buildings were represented by icons and text, while alternative offices in the second were visualized as a layered drawing. Respondents were trained in interpreting the different icons and drawings at the beginning of the survey by selecting the characteristics of their current building and office. Nevertheless, all was explained again in a text, with a legend, under a 'Help' button accompanying all choice sets.

Respondents were asked to study the characteristics of each alternative carefully while considering all other (non-included) characteristics to be kept constant, and thus identical for all alternatives. The main task for the respondents was then to choose between the offered options (Figure 1 and 2) based on their work preferences, under the choice situation, that their employer (company) is considering moving to a new building with a new office in an urban area with similar characteristics.

PART 1 | Choice card 1/18

Would you prefer option "New building A", "New building B", or your "Current building" on the choice card below?

[Tip: To view a description of the characteristics, click on "Help" below the choice card **]**

	Current building	New building A	New building B
Shared facility in the building └ meeting room		✓	⊘
└ canteen		✓	⊘
└ terrace		✓	⊘
Floor sharing		⊘	✓
External welcome area		✓	⊘
Office layout		Open-plan	Combined
Average travel time to work	5 minutes	4 minutes	6 minutes

▸ Help

Your choice:

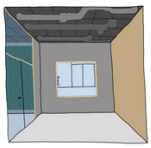
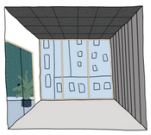
-- Choose --

Figure 1. Example of a building choice task. Screenshot from SurveyXact.

PART 2 | Choice card 10/18

Would you prefer option "New office A", "New office B", or your "Current office" on the choice card below?

[Tip: To review the illustrations of each characteristic, click on "Help" below the choice card **]**

	Current office	New office A	New office B
Office	[Your current office]		
Average travel time to work	5 minutes	2 minutes	12 minutes

▸ Help

Your choice:

-- Choose --

Figure 2. Example of an office choice task. Screenshot from SurveyXact.

Building and office alternatives in the experiments were described with seven and nine attributes, respectively (Table 1). Average travel time to work from home as a cost attribute was included in both experiments with levels pivoted around a mid-value for the four intuitively defined travel time groups (Table 1).

Table 1. Attributes and their levels included in the choice experiments.

	Attribute	Levels
	WORKPLACE	
1	Shared meeting room in the building	Yes / No
2	Shared canteen in the building	Yes / No
3	Shared terrace of the building	Yes / No
4	Floor sharing	Yes / No
5	Welcome area	Yes / No
6	Office layout	Open-plan / Divided / Combined
7	Travel time	-60% / -20% / 20% / 60% / 100% / 140%*
	WORKSPACE	
1	Interior door panel transparency	Transparent / Semi-transparent / Semi-solid / Solid**
2	Design solutions on an interior wall	Wooden wall / Wooden wall panel / Wooden patterned concrete / None**
3	Appearance of door- and window frames	Unpainted wood / Painted wood or other material**
4	Appearance of the interior walls in general	Painted / Concrete**
5	Green element(s) in the hallway	Container plant / Green wall / Both / None**
6	View	Nature / Building / Street**
7	Window size	Size 1 / Size 2 / Size 3**
8	Suspended ceiling	Yes / No**
9	Travel time	-60% / -20% / 20% / 60% / 100% / 140%*

* Relative levels pivoted around the mid-values (5, 15, 25, 45 minutes) of each segment (< 10, 10-19, 20-30, > 30 minutes). Respondents were presented with the absolute values in minutes, according to their reported current travel time

** Levels of workspace attributes were represented by drawings

Attributes and their levels were chosen based on a literature review, expert meetings with the architects (see Sántha et al. [2022a]), and interviews with company representatives occupying offices in the sampled commercial office buildings (Sántha et al. 2022b). This ensured to include only those characteristics that are potentially relevant to occupants' preferences as well as have a significant impact on architectural design choices.

A full factorial design combining seven and nine attributes with varying levels would have resulted in 576 and 27 648 different alternative building and office designs, respectively. This however would have been too many choices to make for respondents. Therefore, we applied a fractional factorial efficient design to compose the choice sets, using the software Ngene (developed by ChoiceMetrics). In addition to the mainstream orthogonal design focusing on minimizing the degree of correlation among attributes and ensuring level balance (Ryan et al. 2012), the so-called efficient design also aims to generate parameter estimates with minimized standard errors (ChoiceMetrics 2019). Choice sets were created by optimizing D-error for a simple multinomial model with main effects and estimated priors from the pilot data (Dp-error) (see, e.g., Filyushkina et al. [2017]). Because we wanted to show the average travel time from home to work for all options (including their status quo) on the choice cards, we used numerical levels in the price attribute. For this purpose, we created a homogenous pivot design with four segments based on the

current average travel time to work with equal weights (supported by the findings of the pilot study) in the optimization process. Furthermore, we accounted for the relatively strong status quo bias found in the pilot study in both experiments by setting the alternative specific constant to 1 for 'Current building' in the first experiment, and 0.5 for 'Current office' in the second. The final design contained 36 choice sets, which were then randomly divided into four blocks, to limit the cognitive burden and the duration of the survey. Thus, each respondent received nine consecutive choice sets in each experiment (workplace and workspace), resulting in altogether 18 choices per respondent in the survey.

Data collection

Data for our DCEs on workplace and workspace was collected via a structured online survey (using SurveyXact developed by Rambøll) among the employees of two commercial office complexes in Aarhus, Denmark. Both the Warehouses (*Pakhusene*) and the expansion of the media cluster in Film City (*Filmbyen*) are newly built complexes, based on modern architectural concepts, such as flexibility and shared economy, described generally in Wang et al. [2012], and case-specifically in Sántha et al. [2022a]). The building projects are designed by AART architects (read more about the projects here: aart.dk/en/projects) and have been selected as "critical, most likely cases" (Flyvbjerg 2010) to investigate in the study to test the architectural hypothesis, that the strategically selected architectural instruments in the design process of these cases have improved the users' well-being at work, thus creating value to them.

The survey was pre-tested and piloted with two focus groups and individual interviews to evaluate and accordingly improve both the design of the stated choice experiment and the structure of the survey.

Given the limited population sample for the two commercial office complexes as investigated cases, multiple recruitment strategies were applied for the main data collection including email invitations, social media posts, and on-site flyer distribution in both locations. Responses were collected from week 24 to week 34 of 2022 as it entailed the 4-week Danish summer holiday in July.

Content of the Questionnaire

On the first page, respondents were introduced to the research, the researcher, and the survey itself. The questionnaire contained five main sections. The first two sections comprised questions regarding the architectural characteristics of their current workplace, and -space as well as their average travel time to work from their present home. This served the purpose of establishing the status quo as perceived by each individual.

In sections three and four respondents were presented with the choice task, after receiving a detailed description of the choice situation and how to complete the task. The first experiment in section three aimed at capturing workplace preferences through different building alternatives, while the second in section four targeted the elicitation of workspace preference via the different office alternatives offered. Each section was followed by a series of follow-up questions regarding their choices to assess the difficulty of the task as well as to identify any potential strategic choice behaviour, including protest.

Finally, the last section assessed respondents' previous workplace experience, social behaviour at the workplace, their travel routine to work (including frequency and mode of transport), and their socio-demographic background.

At the end of the survey, they had the opportunity to leave a comment and contact the survey creator and administrator. Respondents received no financial or other compensation for completing the survey. The questionnaire was available both in Danish and English.

Data analysis

The first step of the analysis of the questionnaire data was a summary statistic on the socio-demographic information of respondents, their previous experiences, and their perception of the current design of their workplace (building) and workspace (office). Due to the limited number of respondents, we then estimate the main effects model without interaction terms for socio-demographic characteristics.

In DCE, the first step is often to analyse data by the use of a multinomial logit model (e.g. Mariel et al. 2021). This match quite well with architectural design decision-making, where different design options are compared in a process in which spaces or individual architectural solutions may be added or substituted. Accordingly, we apply a standard conditional logit model (a.k.a. multinomial logit model, MNL) as a basis for modelling, in which the error term (ε) is Independently and Identically distributed (IID), which allows for the addition and substitution of alternatives and characteristics (Train 2009) (also applied in Cha et al. [2017]). In the MNL model, the probability of individual *n* choosing alternative *i* over *j* takes the form of an **Equation** used in the model for computing the probabilistic choice of individuals.

$$P_{ni} = \frac{exp\,(V_{ni} + \varepsilon_{ni})}{\sum_j exp\,(V_{nj} + \varepsilon_{nj})} = \frac{exp\,(X_{ni} \cdot \beta + \varepsilon_{ni})}{\sum_j exp\,(X_{nj} \cdot \beta + \varepsilon_{nj})} \qquad (2)$$

The deterministic utility (*V*) of the hypothetical building/office alternatives (*i* and *j*) presented to individual respondents depend on the attribute levels (*k*) of variables *X* (architectural characteristics and travel time). Utility gained from the current building/office option is defined by the alternative specific constant and all other *X*-variables ($n_{building}$ = 1, ... 7; n_{office} = 1,…9) are equal to the reported current level of their perceived status quo. By modelling choices made between the different (building and office) options, utility parameters (β) are estimated for each attribute level (*k*) of variables *X*. In the simple MNL model, the estimated parameter $\beta_k \in \beta$ describe the relative importance of the *k*-th element of the vector *X* to individuals, i.e. represent the mean weights of the *X*-variables in the deterministic utility function (Train 2009).

All variables in connection with architectural design characteristics are categorical. Thus, in our models, attribute levels (*L*) were incorporated by means of effect coding (simple contrast), resulting in *L*-1 estimated parameters. Similar to dummy coding, it allows for estimating the non-linear relationship between attribute levels and marginal utilities (ChoiceMetrics, 2019). However, unlike dummy coding it allows us to assign a parameter value for base levels as well, which is equal to the minus sum of the parameter estimates of the remaining levels (ChoiceMetrics, 2019) derived by the applied choice model.

Building on the simple MNL model, we apply a random parameter logit model (a.k.a. mixed multinomial logit model, MMNL) to analyse respondents' stated choices in both experiments. This model is considered

more advanced than the simple MNL model as it takes into account the panel structure of the data, whereby it allows for preference heterogeneity (Mariel et al. 2021). In the mixed logit model, utility parameters (β) for each variable in connection with architectural design characteristics were randomly drawn from an assumed normal distribution, with both their mean, describing their relative importance (Mariel et al. 2021), and standard deviation, representing preference heterogeneity in the sample (Mariel et al. 2021). For the cost variable (travel time), parameters were drawn from a negative lognormal distribution (Mariel et al. 2021) for modelling workplace preferences. Since the CE for workspace preferences included more attributes and levels for the same restricted sample size, parameters for travel time were fixed. Utility parameters for all attribute levels in the choice experiment for the workplace and -space were estimated by 15.000 and 30.000 Sobol draws, respectively. Sobol draws were used according to the positive findings of Czajkowski and Budziński (2019).

Modelling was done in R environment (version 4.2.0) for Windows using the Apollo package (Hess and Palma 2019), version 0.2.8, developed specifically for choice modelling.

Then, we estimated employees' willingness-to-travel (WTT) as a measure of the change in an individual's welfare (level of indirect utility) derived from changes in the quantity or quality of the (architectural) good (Mariel et al. 2021). Therefore, WTT for each attribute level is a result of the marginal rate of substitution between the two attributes (Mariel et al. 2021) architectural characteristics and travel time from home to work. Thus, the marginal WTT for the *k*-th level of attribute *j* compared to its effect-coded reference level, expressed in time (minutes), can be calculated using the following formula:

$$mWTT_k^j = -\frac{\beta_k^j - \beta_{ref.level}^j}{\beta_{travel\ time}} \qquad (3)$$

We then convert this to willingness-to-pay (WTP), expressed in monetary terms (Danish kroners) using a fixed cost per time travelled, reported by the Center for Transport Analytics at the Technical University of Denmark (2022).

Descriptive results

There were 68 employees who responded to some form of the invitations sent out to participate in the survey. From this we excluded 31, who only partially completed the survey, leaving a total of 37 respondents. Respondents seemed to clearly understand the survey and the choice tasks, with an average of 3.03 and 3.38 difficulty scores for building and office preferences, respectively, on a 5-scale Likert-scale rating, where 3 equals 'Neither difficult, nor easy' and 4 is 'Fairly easy'.

Table 2 presents the socio-demographic information of the respondents. Genders were roughly equally distributed in the sample. The majority of respondents are full-time employees above the age of 35 with an annual personal income above 500 000 Danish kroners.

Table 2. Overview of respondents' socio-demographic information.

Characteristic	N	%	Characteristic	N	%
Age			**Employment status**		
18-24	4	10,8%	Full-time employee	27	73%
25-34	13	35,1%	Part-time employee	3	8,1%
35-44	9	24,3%	Self-employed	1	2,7%
45-54	9	24,3%	Student and employee	6	16,2%
55-64	2	5,4%		**37**	**100%**
	37	**100%**	**Personal annual income**		
Gender			300.000 – 399.999 kr.	8	21,6%
Man	16	43,2%	400.000 – 499.999 kr.	4	10,8%
Other	1	2,7%	500.000 – 749.999 kr.	14	37,8%
Woman	20	54%	750.000 – 999.999 kr.	4	10,8%
	37	**100%**	Above 1.000.000 kr.	1	2,7%
			Below 200.000 kr.	6	16,2%
				37	**100%**

Table 3. Respondents' experience with commercial office buildings.

Working in the building			
For how long	**Filmbyen**	**Pakhusene**	**Grand Total**
1-3 years	66,67%	58,06%	59,46%
6-11 months	16,67%	9,68%	10,81%
less than 6 months	16,67%	12,90%	13,51%
more than 3 years	0,00%	19,35%	16,22%
	100,00%	**100,00%**	**100,00%**

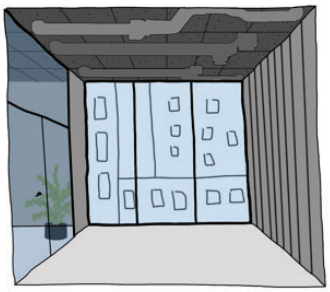
Working in an office building before	
No / Don't know	35,1%
Yes, in the city harbour area of Aarhus	8,1%
Yes, in the city outskirts of Aarhus	21,6%
Yes, in the inner city of Aarhus	21,6%
Yes, outside Aarhus	13,5%
	100%

Average time spent in the building per week		
	Hours	**Days**
Filmbyen	27,17	3,67
Pakhusene	32,61	4,41
	31,73	**4,29**

The majority (83,8%) of the respondents are employees working in one of the buildings of the Warehouses office complex. Most employees have been working in one of the two complexes for 1-3 years, where they spend 32 hours a week on average, which equals 4 workdays (Table 3).

Based on the characteristics related to the architectural design of the workplace, the majority of the respondents report, that shared facilities (meeting room, canteen, and terrace) are found in the building, where sharing a floor with another company is possible, and they have an external welcome area at the entrance of the building (Figure 3). They also report that they work in an open office. Figure 3 shows a graphical representation of the design of their current office, according to how the majority of respondents perceive it.

	Current building	st.dev
Shared facility in the building - meeting room	✓	0,35
- canteen	✓	0,00
- terrace	✓	0,16
Floor sharing	✓	0,43
External welcome area	✓	0,23
Office layout	☐	0,88
Average travel time to work	24 minutes	13,83



	stdev
Door panel transparency	0,90
Appearance of wood on 1 interior wall	0,69
Wooden frames	0,00
Appearance of interior wall	0,40
Integrated green elements	1,48
View	0,50
Window size	0,55
Suspended ceiling	0,31

Figure 3. Characteristics of current building (left) and the current office (right) as reported by the majority of respondents. **stdev** = standard deviation.

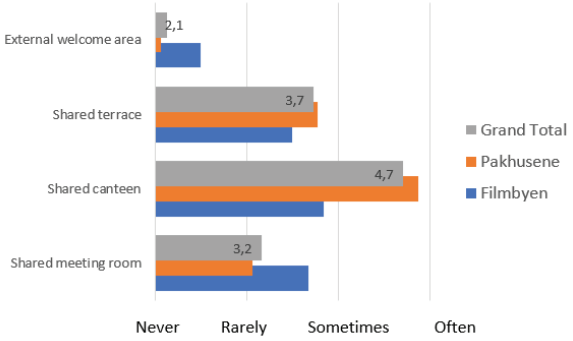


Figure 4. Use of shared facilities in the sampled commercial office building complexes.

The most used shared facilities of interest in this study by the employees were the canteen, followed by the terrace (Figure 4). This, their relation to other employees in the building (i.e., also them who work for other companies) seems to be case specific. Based on the responses on a 5-step scale from 'No interaction' to 'Professional collaboration' The Warehouses received 2.26, while the new office building in the Film City cluster received 3.17.

Many of the respondents have already experienced working in a commercial office building before, however mainly on the city outskirts or in another city (Table 3). The importance of the physical environment of the building and the office for employees' work life (performance and relations) was rated 1.9 and 1.5, respectively, on a 4-scale Likert-scale from 'Very Important' (1) to 'Not important' (4).

The average travel time from home to work of the employees who participated in the survey is 24 minutes, with approximately 78% having less than half an hour. As for their travel routine, most of them use a single transportation mode, mainly cycling, while the rest of them combines 2 or more means of transport to their workplace. Their mode of transport to work in relation to travel distance and having a car available is also shown in Table 4. As most of the respondents stated to use a single transportation mode and because we included the average of their travel time to work, we assume, that change in their mode of transport does not impact the estimated parameters in the model.

Table 4. Data on respondents' travel time, and transportation habit.

Average travel time to work from home	
10-19 minutes	35,14%
20-30 minutes	32,43%
30-40 minutes	2,70%
40-45 minutes	10,81%
50-60 minutes	8,11%
Less than 10 minutes	10,81%
	100,00%

Transportation means (matrix)

	Public transport	Car	Bike	On foot	Other	
Public transport	1					
Car	0	8				
Bike	0	2	14			
On foot	2	0	5	3		
Other	0	1	0	0	0	26
	2	**3**	**5**	**0**		**36**
Car-Bike-On foot	**1**					**37**

Those who…	Has a car available	Choose the travel mode due to distance	Their average travel time to work is
Only bike or combine it with "on foot"	68%	95%	19 minutes
Only drive	88%	75%	35 minutes
Only "on foot"	33%	100%	15 minutes
Only take the public t. or combine it with "on foot"	0%	67%	45 minutes

Estimation results

Choice models for workplace and workspace included a total of 333 observations from 37 respondents, each. Table 5 and 6 show the estimation results of MMNL models with main effects for the workplace (model 1) and workspace (model 2).

At first, levels according to the reported status quo were coded as a baseline for each attribute (i.e., characteristics of the employees' current building and current office). However, given that we selected to study cases with high architectural qualities from the perspective of the architects ("most-likely" case selection method, cf. Data collection), this yielded negative estimates for most parameters, as expected.

To make interpretation easier, we recoded the levels of each attribute in both models so that the least and second least preferred levels (depending on the number of levels) act as references. We report model performance characteristics and results based on this baseline condition.

Table 5. Estimation results of model 1.

MMNL model – 15.000 Sobol draws				
#0 ASC	**Constant**		**Mean**	**St.dev.**
	α		-0,3460	2,8089 ***
#1 a	**Shared meeting room in the building**			
	β1(0)	No (ref)		
	β1(1)	Yes	0,6614 ***	0,5944 *
#2 b	**Shared canteen in the building**			
	β2(0)	No (ref)		
	β2(1)	Yes	1,2666 ***	0,0833
#3 c	**Shared terrace of the building**			
	β3(0)	No (ref)		
	β3(1)	Yes	0,4553 **	0,0894
#4 d	**Floor sharing**			
	β4(0)	No (ref)		
	β4(1)	Yes	0,3323 *	0,3838
#5 e	**Welcome area**			
	β5(0)	No (ref)		
	β5(1)	Yes	0,3296 *	0,0809
#6 f	**Layout**			
	β6(0)	Open-plan	-0,1228	1,3793 ***
f1	β6(1)	Divided (ref)		
f2	β6(2)	Combined	0,3767	1,1469 ***
#7 g	**Travel time**			
	β7		-0,2164 ***	0,2750 ***
No. observations		333		
LL		-184,64		
Adj. pseudo-Rho^2		0,372		
AIC		405,28		
BIC		273,82		

Significance at 1% (***), 5% (**), 10% (*).

Table 6. Estimation results of model 2.

MMNL model – 30.000 Sobol draws					
#0	ASC	**Constant**		**Mean**	**St.dev.**
		α		1,3659 **	-0,9892
#1	a	**Interior door panel transparency**			
	a1	β1(0)	Solid	-0,8545 **	0,1103
	a2	β1(1)	Transparent	0,4873	-0,1726
	a3	β1(2)	Semi-transparent	0,9128 **	-0,6450
		β1(3)	Semi-solid (ref)		
#2	b	**Design solutions on an interior wall**			
	b1	β2(0)	Wooden wall	0,1022	-0,5455
	b2	β2(1)	Wooden wall panels	0,4408	-0,8183
	b3	β2(2)	None	0,1446	-0,1090
		β1(3)	Wooden patterned concrete (ref)		
#3	c	**Frame**			
		β3(0)	Unpainted wood	-0,1693	0,0300
		β3(1)	Painted wood or other material (ref)		
#4	d	**Appearance of the interior walls in general**			
		β4(0)	Painted	-0,3551	0,7322 **
		β4(1)	Concrete (ref)		
#5	e	**Green element(s) in the hallway**			
	e1	β5(0)	Container plant	-0,2033	-0,0871
	e2	β5(1)	Green wall	0,0236	-0,8438
	e3	β5(2)	Both	0,1063	0,1723
		β5(3)	None (ref)		
#6	f	**View**			
	f1	β6(0)	Nature	0,4499	1,0155 **
	f2	β6(1)	Building	-0,1966	-1,1655 ***
		β6(2)	Street (ref)		
#7	g	**Window size**			
	g1	β7(0)	Size 1	-1,8359 ***	-0,0018
	g2	β7(1)	Size 3	2,1264 ***	-0,0764
		β7(2)	Size 2 (ref)		
#8	h	**Suspended ceiling**			
		β8(0)	Yes	-0,0945	-1,0741 **
		β8(1)	No (ref)		
#9	m	**Travel time**			
		β9		-0,1563 ***	-
No. observations			333		
LL			-184,91		
Adj. pseudo-Rho^2			0,2732		
AIC			439,82		
BIC			573,11		

Significance at 1% (***), 5% (**), 10% (*).

Both models can be considered a good fit, with an adjusted pseudo-Rho^2 of 0.382 and 0.273, respectively. In the model for workplace design preferences (model 1), most parameters are statistically significant and come with the expected signs, representing the impact of the variable on individuals' utility. All significant categorical variables with two levels (yes/no) have a positive impact on building choice, while travel time effects their choices negatively. Out of the observed 333 choices, individuals chose their 'Current building' 194 times (58.26%), which could indicate a slight preference towards the status quo compared to the offered alternatives. However, in this model, the alternative specific constant of the 'Current building' option is not significant.

In the model for workspace preferences (model 2), most parameters are not statistically significant except for characteristics 'Door panel transparency', 'Window size', and travel time. Despite not being significant in terms of their mean coefficient, characteristics 'Appearance of interior wall', 'View', and 'Suspended ceiling' incorporate significant heterogeneities as measured by the standard deviation of their coefficients. Out of the observed 333 choices, individuals chose their 'Current office' 211 times (63.36%) in this experiment. Correspondingly, its ASC is significant and positive, with a standard deviation that is also significantly positive. This suggests that respondents have a relatively strong preference for their present workspace, i.e., they gained a higher utility, and thus chose the status quo option with a greater probability than one of the offered 'New office' alternatives.

Preferences for workplace and -space

Regarding workplace preferences, based on the statistically significant estimates of model 1, employees preferred all types of shared facilities in the building, from which having a canteen has the highest positive impact on their choices, followed by the meeting room and the terrace, respectively. Respondents also preferred selecting building options, where sharing a floor with another company (multi-tenant design concept) is possible, and there is an external welcome area at the entrance of the building. Despite, that the mean of the coefficients for the attribute 'Layout' are not significant, their highly significant standard deviation reflects a great heterogeneity among the preferences of respondents. This means, that some prefer to work in a workplace with an open office environment, while others prefer layouts providing more private office spaces.

Regarding workspace preferences, continuing with the architectural design characteristics of offices, we only have a few significant parameters to interpret. From these, the most important explanatory variable for employees' choice of office proved to be the size of the window as well as the transparency of door panels. For the latter, it seems, that as the transparency increases, the parameter estimates increase accordingly. For 'Window size', the larger the size, the more it is preferred by employees, as expected. Similarly, the significantly high standard deviation of coefficient for 'Appearance of interior wall', 'View', and 'Suspended ceiling' was expected. Being linked to aesthetics and perceived space they are highly subjective.

Employees' value of preferred design characteristics and scenarios

Table 7 presents the marginal utility gained from the gradual changes within each attribute, measured by employees' willingness-to-travel (WTT), which we eventually converted to willingness-to-pay (WTP). WTTs are calculated based on the estimation results of the above models using Equation 3.

Accordingly, the most valued characteristic of a workplace, for employees, presently working in modern, multi-tenant commercial office buildings, is the shared canteen. To have this facility in their building, employees are willing to travel an additional 12 minutes, which equals to 21.5 kr., every time from home to work. As for the workspace, large (floor-to-ceiling) windows prove to be of the highest value to employees, for which they are willing-to-travel an extra 15.5 minutes, equalling a marginal willingness-to-pay of 28.4 kr. per employee per travel occasion.

There was a total of eight respondents who applied a specific strategy for making their choices in the experiments. There were four and three respondents, who consecutively chose the option representing their status quo, 'Current building' and 'Current office', respectively. Consequently, their marginal WTT and WTP for all attributes in both experiments are 0. As for the underlying reason for their choice behaviour, they stated, that it is due to their satisfaction with the design of their current workplace and -space, compared to the offered alternatives in all choice sets. Furthermore, their average travel time to work is only 15 minutes and they spend more time in their building on average and reported a stronger relationship with people working in the same building than the other respondents. This tendency is the same for strategic bidders in both experiments, regarding workplace and -space. On the contrary, one and two respondents have chosen to strategically select the closest option from all building and office choice sets, respectively, explicitly because of their already too-high average travel time of 46 minutes to work. This yields an mWTT and mWTP less than zero for them. All these reasons are so-called valid responses as they have considered the options (i.e., do not count as a protest, which is to ignore the costs or the task, cf. Mariel et al. [2021]), but just not found them attractive enough.

Table 7. Marginal WTT and WTP results for workplace (left) and workspace design characteristics (right).

mWTT and mWTP				mWTT (minutes)	mWTP (kr.)
#0	ASC	**Constant**			
		α		-1,6	-2,9
#1	a	**Shared meeting room IN THE BUILDING**			
		β1(0)	No (ref)	0,0	0,0
		β1(1)	Yes	**6,1**	**11,2**
#2	b	**Shared canteen IN THE BUILDING**			
		β2(0)	No (ref)	0,0	0,0
		β2(1)	Yes	**11,7**	**21,5**
#3	c	**Shared terrace IN THE BUILDING**			
		β3(0)	No (ref)	0,0	0,0
		β3(1)	Yes	**4,2**	**7,7**
#4	d	**Floor sharing**			
		β4(0)	No (ref)	0,0	0,0
		β4(1)	Yes	**3,1**	**5,6**
#5	e	**Welcome area**			
		β5(0)	No (ref)	0,0	0,0
		β5(1)	Yes	**3,0**	**5,6**
#6	f	**Layout**			
	f1	β6(0)	Open-plan	0,6	1,1
		β6(1)	Divided (ref)	0,0	0,0
	f2	β6(2)	Combined	2,9	5,3

mWTT and mWTP				mWTT (minutes)	mWTP (kr.)
#0	ASC	**Constant**			
		α		**8,0**	**14,7**
#1	a	**Door panel transparency**			
	a1	β1(0)	Solid	**-2,0**	**-3,6**
	a2	β1(1)	Transparent	6,6	12,1
	a3	β1(2)	Semi-transparent	**9,3**	**17,1**
		β1(3)	Semi-solid (ref)	0,0	0,0
#2	b	**Appearance of wood on 1 interior wall**			
	b1	β2(0)	Wooden wall	5,1	9,3
	b2	β2(1)	Wooden wall panels	7,2	13,2
	b3	β2(2)	None	5,3	9,8
		β1(3)	Wooden patterned concrete (ref)	0,0	0,0
#3	c	**Frames**			
		β3(0)	Unpainted wood	-2,2	-4,0
		β3(1)	Painted wood or other material (ref)	0,0	0,0
#4	d	**Appearance of interior wall**			
		β4(0)	Painted	-4,5	-8,3
		β4(1)	Concrete (ref)	0,0	0,0
#5	e	**Integrated green elements**			
	e1	β5(0)	Container plant	-1,8	-3,2
	e2	β5(1)	Green wall	-0,3	-0,6
	e3	β5(2)	Both	0,2	0,4
		β5(3)	None (ref)	0,0	0,0
#6	f	**View**			
	f1	β6(0)	Nature	4,5	8,2
	f2	β6(1)	Building	0,4	0,7
		β6(2)	Street (ref)	0,0	0,0
#7	g	**Window size**			
	g1	β7(0)	Size 1	**-9,9**	**-18,1**
	g2	β7(1)	Size 3	**15,5**	**28,4**
		β7(2)	Size 2 (ref)	0,0	0,0
#8	h	**Suspended ceiling**			
		β8(0)	Yes	-1,2	-2,2
		β8(1)	No (ref)	0,0	0,0

To support decision-making in the architectural design process, different design scenarios, i.e. composition of the above characteristics can be created and studied in terms of their potential social value creation to end-users.

Using only the statistically significant attributes and their levels included in our experiments (cf. Table) results in a total of 288 possible design combinations for commercial office building design, comprising both workplace (building) and workspace (office) characteristics. Using the equation below, the aggregated WTT (AWTT) can be calculated for each design proposal.

$$\mathrm{AWTT} = \mathrm{ASC} + \sum \mathrm{WTT_i} \cdot \mathrm{L_{dj \rightarrow i}} \qquad (4)$$

In the above formula, *i* represents the attributes, and L_d is a dummy for change in attribute level *L* to *i* from baseline *j*.

For example, AWTT of a commercial office building design (**Figure**) can be calculated as follows:

$$\begin{aligned}\mathrm{AWTT} = {} & \mathrm{ASC_{current\ office}} + \mathrm{WTT_{meeting}} \cdot 1_{\mathrm{no \rightarrow yes}} + \mathrm{WTT_{canteen}} \cdot 1_{\mathrm{no \rightarrow yes}} + \mathrm{WTT_{terrace}} \cdot 1_{\mathrm{no \rightarrow yes}} \\ & + \mathrm{WTT_{floor.sh}} \cdot 1_{\mathrm{no \rightarrow yes}} + \mathrm{WTT_{welc.area}} \cdot 1_{\mathrm{no \rightarrow yes}} + \mathrm{WTT_{door\ panel}} \\ & \cdot 1_{\mathrm{semi\_solid \rightarrow semi\_transp}} + \mathrm{WTT_{window}} \cdot 1_{\mathrm{size2 \rightarrow size3}}\end{aligned}$$

Such a design result in an AWTT value of 60 minutes for employees, compared to the baseline. The same design without a shared canteen in the building results in a considerably lower AWTT (48 minutes), similarly low (45 minutes), than keeping the window size on a medium level (size 2).

Logically, the more 'less preferred' levels of attributes comprise the design, the lower the AWTT value of the final design will be for employees.

The least valued design by employees would be one with none of the shared facilities or a welcome area at the entrance, without the possibility to share a floor with another company (same as in the least preferred baseline), and a workspace with solid (non-transparent) doors (compared to semi-solid) and the smallest windows size (size 1, compared to the medium level of size 2). The AWTT value of this design proposal significantly decreases to -4 minutes. This means, that employees won't be willing to travel from home to a workplace and -space designed like that.

Discussion and conclusions

In this study, we investigated office employees' preferences for architectural design characteristics on both building and office scales. In doing so, we developed two discrete choice models based on data from two stated choice experiments to translate end-user preferences for the architectural design of workplace (building) and workspace (office) into quantified social value (user-value). As such we consider our work as a study to test whether respondents consistently consider the tradeoffs between attributes and provide results that mirror some of the elements of the empirical findings of our previous post-occupancy qualitative study on the practices and experiences of the users (Sántha et al. 2022b). We applied the choice experiment method in a case study setting, collecting data among the employees of two different office complexes in Denmark via an online survey. Apart from testing consistency with the qualitative study, it also allows us to interpret the result easier, and to have some ideas about the underlying reasons

for their preferences, which is otherwise generally considered a weakness of preference quantification methods.

The contribution of this paper to the architectural literature lies in the empirical application of the choice experiment method to architectural instruments (attributes) as an economic approach for translating end-user preferences for architectural design into quantified social value (user-value) expressed in monetary terms. Based on our findings, we provide recommendations on the future application of the method itself on building scales.

Reflection on findings

Regarding workplace preferences, we found that the availability of shared facilities in the building contributes significantly to the attractiveness and thus the value of workplaces. This is in agreement with our previous qualitative findings, that shared areas are "worth the price" for companies in multi-tenant office buildings, as they provide space for semi-informal social encounters and professional networking that might facilitate the establishment of cross-company partnerships (Sántha et al. 2022b). For the employees, this provides a 'sense of community' where "*there is good energy, and one feels that they are part of something*" (an employee of 'The Warehouses' cited in Sántha et al. 2022b, p.607). Of the different shared facilities included in this study, it is the canteen that is most valued by employees of multi-tenant commercial office buildings. This aligns with the observation from the survey that it is also the most used shared facility. Its potential to 'gather' people from different companies is also reflected in the increased pedestrian flow between the office buildings of 'The Warehouses' around lunchtime (11-12 AM) shown in the study on urban life by Sántha (2023). Despite, the lower scores in the question regarding the use of facilities for the terrace and the meeting room, they were also among the top three preferred characteristics for workplace design. This suggests that in contrast to the canteen (where the value lies in its functional use), the value of these areas is largely option value, i.e. its value is linked to their availability, i.e. in the opportunity to use them in case it's needed, for example holding company events and larger meetings primarily with external partners (Sántha et al. 2022b). Since the purposes and frequency of the use of these areas are more diverse than for the canteen, it is probably why the estimation results of our model also showed a significant standard deviation (expressing preference heterogeneity) for the attribute 'Shared meeting room in the building'. For other variables that turned out to have highly significant standard deviations, such as the layout, a design implication could be to consider and define them according to the specific user groups in each context as it is suggested in Sántha et al. (2022b). If the future users are not well-known ahead, to make that decision, probably the best approach is to provide flexible solutions (e.g. folding walls to separate the meeting room into smaller units if needed) as chosen by the architects in the investigated cases (Sántha et al. (2022a)).

Regarding workspace preferences, we found that the most important explanatory variables for employees' choice of office are the size of the window as well as the transparency of door panels. Both attributes influence (directly and indirectly) the natural daylight conditions of the workspace. The importance of daylight conditions in offices for employees' well-being and work productivity is heavily researched and was shown important (see e.g. Chafi et al. [2020]). The significantly positive effect of higher daylight availability on office rental prices was also discovered by Turan et al. (2020). Another factor of the preferences toward these characteristics could be associated with the view from the window and the level of privacy provided by the transparency of the door panels. As found in the present study, preferences towards the view as such are quite heterogeneous, i.e. there is no significant preference for

having a view of nature, buildings or streets – it seems to differ between respondents. However, the window size is important, and it may capture some of the same elements. Purup et al. (2017) use the term 'view-out area' to describe the extent of the view. In our context, it would mean that the increased view-out area provided by a larger window size enhances the possibility to 'view', as in to look out and gaze to the distance (whatever the object of the view might be), as a way to "clear the head" and thus take a short mental break from work is found to be of value to employees in our previous qualitative study (Sántha et al. 2022b). Regarding the transparency of door panels, there is a preference for semi-transparent doors, a dislike of solid doors, and a somewhat mixed picture in between. The significance of the transparency of door panels can lie in their potential to provide privacy both with (in the case of a solid door) and without visual isolation (in the case of semi-transparent and transparent doors) from the larger space. Transparency can furthermore be of aesthetic value, given the diverse solutions (shapes, colours, materials, etc.) which can be applied in their design and construction. If one of these effects was dominant, we would expect a continuous increase in preferences going from solid towards transparent or vice versa. Our sample is small, so we cannot conclude that it is not so. But it would be interesting to investigate this in the future preferably in relation to different work scenarios, similar to Appel-Meulenbroek et al. (2022), to derive the value of it possibly in relation to work productivity or efficiency.

Limitations and weaknesses

While this study has provided relevant insights into office employees' preferences for architectural design characteristics on both building and office scales, there are a number of limitations and weaknesses which need to be addressed. As such, we collect some learning points about the application of the method itself on building scales, within architecture.

First of all, the application of the stated choice experiment method carries a limitation on the number of included attributes. Findings on the relative importance of architectural design characteristics are thus limited to those included in the study and how their levels were defined. A concern regarding the selection of attributes, in general, is based on how objectively they can be defined and/or represented to avoid respondents interpreting them differently. Our approach was to provide clear and precise definitions for each characteristic, although, in the choice task of workspace design, we left some room for the different perceptions of the attributes by using hand drawings as a mode of representation. Consequently, this experiment involved a certain level of abstraction, compared to other possible visualizations modes, e.g., photos, realistic 3D renderings, or virtual reality, which are potentially better options for representing reality in choice experiments (Filyushkina et al. 2017). However, valuating architectural design characteristics "as built", i.e. the specific way they are manufactured and constructed was not the aim of this study, considering the potential future application of the results in the architectural practice, whereby we allow the architects to further refine these solutions. Therefore, more abstract hand drawings were used to visualize characteristics, conceptually, to avoid respondents getting lost in the details.

Secondly, a potential weakness of the study is, that – due to the restricted sample size – we chose not to split the sample to investigate building and office choices separately. By doing so we assumed, that the different characteristics of the building, and office can independently be traded against each other.

Another weakness due to the restricted sample size and a relatively low number of respondents is that the majority of the characteristics included in the model to identify workspace preferences were not statistically significant and thus could not be included in the formula for calculating the AWTT and AWTP of different design scenarios. The underlying cause of this is the applied strategic sampling, according to

the most likely critical case selection method, i.e., choosing specific cases to increase the likelihood that end-user consider the characteristics based on their actual experiences given by the familiarity to the cases.

We would like to note, that the derived marginal willingness-to-travel (as well as willingness-to-pay) and thus the calculated AWTT values are probably overestimated.

Finally, another limitation of the study is due to the simplification made in the conversion from WTT to WTP values, as it only considers the cost of time and not the cost of travel. This is however justified by the travel routine of the respondents, which is that the majority of them use biking as the only transportation mode to work, where the time component of the overall travel cost is more relevant. Travel time to work from home as a realistic payment vehicle that is, along with the selected case buildings, familiar to employees was otherwise chosen to minimize the hypothetical bias of the stated choice experiment, which is a main criticism of the method.

Suggestions for future DCEs on architecture

Based on the lessons learned from this study by trialling the application of DCE in an exploratory manner on and within a building scale, i.e. on the architectural features, we suggest a few improvements for the future development and use of DCEs within the field of architecture.

In constructing similar DCEs, our design regarding the chosen architectural attributes of commercial office buildings and the office units within could serve as a guide in targeting relevant attributes which is otherwise a resource-heavy exercise requiring several iterations, alignments with both professionals within the building industry (here architects) and layman people occupying and using the building. Standardizing DCEs for this building typology based on the attributes included in the design could allow for a comparison of results from different building projects.

Regarding the design of the choice cards, it is our experience that using visualizations, especially abstract drawings (sketches) works well. On the one hand, it matches the way architects communicate their ideas and concepts, and on the other, it is not hard for lay people to understand as they all have seen and experienced the indoor built environment of a building before. Furthermore, it promotes imagination, which plays an important role in the perception and thus the evaluation of architecture (Bhatt, 2000). In studying the significance of aesthetics in post-modern architecture, Bhatt argues that people's perception of architecture is not merely a "socially or politically constructed experience", but a mode of rational evaluation, that requires imagination to construct 'the whole', i.e. architecture in its full (socio-cultural) context (Bhatt, 2000). Our results and experience in using images as visualizations on the choice cards to convey information are in agreement with previous findings, that they are easy to grasp, and do not take too much cognitive effort to evaluate the alternatives for respondents. While we have not tested it explicitly, experience from the choice experience design phase indicated a clearer understanding of the attributes than by using text-based choice cards. Other formats, such as video or virtual reality (Rid et al., 2018), may also work to explain the context, but since trade-offs are to be made in each choice set, it is useful that respondents can see the different attributes in a static view and thereby use the time required to make the "not so easy" tradeoffs and choices of preferences.

In terms of data collection, it is our experience, that the application of DCE as a post-occupancy evaluation exercise of architecture on a few specific building projects (2 office complexes in our study) makes the

data collection very challenging in terms of getting enough respondents for the results to be significant. It is therefore recommended for post-occupancy studies to apply DCE not on a case study, but on a typology basis, i.e. commercial office buildings as such, thereby potentially also expanding the geographical area of data sampling. Alternatively, if it is to be used on specific projects, their size should be big enough (a larger complex, or a neighbourhood development project) to increase the chances of obtaining significant estimates from the choice model. This also means that it may be better suited for generic preference studies and post-occupancy evaluation of neighbourhoods and larger development projects. The value of such studies would be to identify general tendencies in user preferences and value, which consequently can provide a point of departure in developing design concepts. In this study, we focused only on the main effects of architectural design characteristics on employees' choice of building and office, but future research could focus on investigating the relationship between the different attributes, or between attributes and socio-demographic and geographic characteristics of respondents by including interaction effects in the choice models with larger samples.

Key contributions

The findings of this study contribute to providing insight into employees' preferences for the specific architectural design solutions applied to the work environment on multiple scales, which have an impact on their well-being. The stated preference study applied in a post-occupancy stage showed to what extent employees working in modern, multi-tenant commercial office buildings value the architectural design of their workplace and -space with their time as measured by their willingness-to-travel, which was eventually converted into willingness-to-pay to express employees' user-value of significant architectural design attributes in monetary terms. The welfare economic valuation results can contribute to a more human-centric workplace and -space design, that considers end-user preferences as an indicator of their well-being by assisting architects in the design decision-making process, which is primarily driven by economic considerations.

Acknowledgements

The present paper makes a part of the Industrial PhD research project "CATALYST" at the Department of Architecture, Design & Media Technology (CREATE) at Aalborg University and the architectural studio AART Architects A/S (AART), in collaboration with the Department of Food and Resource Economics (IFRO) at the University of Copenhagen, in Denmark. The authors would like to acknowledge the assistance received from Thomas Lundhede, our college at IFRO, who provided us with an example of an R script to analyse data and model choices using the Apollo package, on which we based our coding for modelling. The authors are furthermore grateful to all other colleagues at IFRO, who participated in the economic valuation seminars and thus contributed to the improvement of the design of the choice experiments. The authors would like to furthermore thank the two main supervisors of the PhD project, Johanne Mose Entwistle (Head of Impact Team at AART), and Marie Frier Hvejsel (Professor at the Aarhus School of Architecture) for their continuous engagement and critical reflection on the work. And last, but not least, the authors appreciate every single employee, who responded to the survey and thus provided the data for our economic analysis.

Funding

The work is funded by AART Architects A/S and Innovation's Fund Denmark (Industrial PhD grant no. 9065-00220B).

References

AART architects. "Projects." AART., accessed 20 March, 2020, https://aart.dk/en/projects.

Appel-Meulenbroek, Rianne, Astrid Kemperman, Amke van de Water, Minou Weijs-Perrée, and Jan Verhaegh. 2022. "How to Attract Employees Back to the Office? A Stated Choice Study on Hybrid Working Preferences." *Journal of Environmental Psychology* 81.

Bibri, Simon Elias, John Krogstie, and Mattias Kärrholm. 2020. "Compact City Planning and Development: Emerging Practices and Strategies for Achieving the Goals of Sustainability." *Developments in the Built Environment* 4, doi:10.1016/j.dibe.2020.100021.

Bhatt, Ritu. 2000. "The Significance of the Aesthetic in Postmodern Architectural Theory". *Journal of Architectural Education*, 53(4), 229-238.

Broch, Nanna-Rose Reinevald, Peter Andreas Sattrup, and Karen Sejr. 2017. *Architecture Creates Value*, edited by Karen Sejr. Copenhagen: Danish Association of Architectural Firms.

Castaldo, Veronica Lucia, Ilaria Pigliautile, Federica Rosso, Anna Laura Pisello, and Franco Cotana. 2017. "Investigation of the Impact of Subjective and Physical Parameters on the Indoor Comfort of Occupants: A Case Study in Central Italy." *Energy Procedia* 126, 131-138.

Center for Transport Analytics. "Transportøkonomiske Enhedspriser." Technical University Denmark., last modified May, accessed 11 Sep, 2022, https://www.cta.man.dtu.dk/modelbibliotek/teresa/transportoekonomiske-enhedspriser.

Cha, Seung Hyun, Koen Steemers, and Tae Wan Kim. 2017. "Modelling Building Users' Space Preferences for Group Work: A Discrete-Choice Experiment." *Architectural Science Review* 60 (6): 460-471.

Chafi, Maral Babapour, Mette Harder, and Christina Bodin Danielsson. 2020. "Workspace Preferences and Non-Preferences in Activity-Based Flexible Offices: Two Case Studies." *Applied Ergonomics* 83:102971.

Czajkowski, Mikołaj and Wiktor Budziński. 2019. "Simulation Error in Maximum Likelihood Estimation of Discrete Choice Models." *Journal of Choice Modelling* 31, 73-85.

Determann, Domino, Dorte Gyrd-Hansen, G. Ardine de Wit, Esther W. de Bekker-Grob, Ewout W. Steyerberg, Mattijs S. Lambooij, and Line Bjørnskov Pedersen. 2019. "Designing Unforced Choice Experiments to Inform Health Care Decision Making: Implications of using Opt-Out, neither, Or Status Quo Alternatives in Discrete Choice Experiments." *Medical Decision Making* 39 (6): 681-692.

Ehmke, Mariah D, Jayson L Lusk, and John A List. 2008. "Is Hypothetical Bias a Universal Phenomenon? A Multinational Investigation." *Land Economics* 84 (3): 489-500.

Elmahadi, Tahir, Surat, Tawil, and Usman. 2011. "Effective Office Environment Architecture: Finding Ingenious Ideas in a Home to Stimulate the Office Environment." *Procedia Engineering* 20, 380-388.

Fifer, Simon, John Rose, and Stephen Greaves. 2014. "Hypothetical Bias in Stated Choice Experiments: Is it a Problem? and if so, how do we Deal with it?" *Transportation Research Part A: Policy and Practice* 61, 164-177.

Filyushkina, Anna, Fitalew Agimass, Thomas Lundhede, Niels Strange, and Jette Bredahl Jacobsen. 2017. "Preferences for Variation in Forest Characteristics: Does Diversity between Stands Matter?" *Ecological Economics* 140, 22-29.

Flyvbjerg, Bent. 2010. "Five Misunderstandings about Case-Study Research." Chap. 2, In *SAGE Qualitative Research Methods*. Vol. 12, 219-245. Thousand Oaks: SAGE Publications.

Hanemann, W. Michael. 1984. "Welfare Evaluations in Contingent Valuation Experiments with Discrete Responses." *American Journal of Agricultural Economics* 66 (3): 332-341.

Haworth, John T. 2004. "Work, Leisure and Well-Being." In *Work and Leisure*, 182-197: Routledge.

Hess, Stephane and David Palma. 2019. "Apollo: A Flexible, Powerful and Customisable Freeware Package for Choice Model Estimation and Application." *Journal of Choice Modelling* 32.

Hvejsel and Beim. 2019. "Circular Tectonics? – A Critical Discussion of how the Architectural Discipline can Drive Ecological Continuity." Lisbon, Portugal, CRC Press.

Jensen, Morten Bandholm Vinde and Maria Troelsen. 2017. "Adding Value to the Social Dimension of Sustainable Building."Aalborg University.

Lancaster, Kelvin J. 1966. "A New Approach to Consumer Theory." *Journal of Political Economy* 74 (2): 132-157.

Louviere, Jordan J., David A. Hensher, and Joffre D. Swait. 2000. *Stated Choice Methods: Analysis and Applications* Cambridge University Press.

Lusa, Sirpa, Sari Mirjami Käpykangas, Heli Ansio, Pia Houni, and Jukka Uitti. 2019. "Employee Satisfaction with Working Space and its Association with Well-Being—A Cross-Sectional Study in a Multi-Space Office." *Frontiers in Public Health* 7: 358.

Mariel, Petr, David Hoyos, Jürgen Meyerhoff, Mikolaj Czajkowski, Thijs Dekker, Klaus Glenk, Jette Bredahl Jacobsen, Ulf Liebe, Søren Bøye Olsen, and Julian Sagebiel. 2021. *Environmental Valuation with Discrete Choice Experiments: Guidance on Design, Implementation and Data Analysis* Springer Nature.

McFadden, Daniel. 1973. “Conditional logit analysis of qualitative choice behavior”. In: *Frontiers in Econometrics*, ed. P. Zarembka, New York: Academic Press, 105-42.

Metrics, Choice. 2019. "Ngene 1.2--User Manual & Reference Guide, 2018." Sydney: Choice Metrics.

Mossin, N., S. Stilling, T. Bøjstrup, V. G. Larsen, A. Blegvad, M. Lotz, and L. Rose. 2018. *An Architecture Guide to the UN 17 Sustainable Development Goals*. København: KADK.

Mulgan, Geoff, Gareth Potts, James Audsley, Matthew Carmona, Claudio De Magalhaes, Louie Sieh, and Chris Sharpe. 2006. "Mapping Value in the Built Urban Environment." London: The Young Foundation.

Purup, Pil Brix, Stina Rask Jensen, and Steffen Petersen. 2017. “Towards a Holistic Approach to Low-Energy Building Design: Consequences of Metrics for Evaluation of Spatial Quality on Design”. Paper presented at *PLEA2017 - Design to Thrive*, Edinburgh, United Kingdom. Available at: https://www.researchgate.net/publication/318317796

Rid, Wolfgang, Wolfgang Haider, Andrea Ryffel, and Ben Beardmore. 2018. “Visualisations in Choice Experiments: Comparing 3D Film-sequences and Still-images to Analyse Housing Development Alternatives”. *Ecological Economics* 146, 203–217.

Ridoutt, Bradley G., Roderick D Ball, and Shaun K Killerby. 2002. "Wood in the Interior Office Environment: Effects on Interpersonal Perception." *Forest Products Journal* 52 (9): 23.

Roetzel, Astrid, M DeKay, A Nakai Kidd, A Klas, A-M Sadick, V Whittem, and L Zinkiewicz. 2020. "Architectural, Indoor Environmental, Personal and Cultural Influences on Students' Selection of a Preferred Place to Study." *Architectural Science Review* 63 (3-4): 275-291. doi:10.1080/00038628.2019.1691971.

Ryan, M, J Kolstad, P Rockers, and C Dolea. 2012. "How to conduct a discrete choice experiment for health workforce recruitment and retention in remote and rural areas: A user guide with case studies." New York City: The World Bank.

Sántha, Eszter. 2023. “Transforming the Harbour – The Role of Architecture in Creating Urban Life”. In: *AMPS Proceedings Series 30 – Cultures, Communities, and Design*, ed. F. Neuhaus. Calgary, Canada: Amps, 296-307.

Sántha, Eszter, Marie Frier Hvejsel, and Johanne Mose Krämer Entwistle. 2022b. "Tectonics of Human Well-being: Describing Architecture in Terms of Constructed Spatial Gestures and their Impact." *Architecture, Structures and Construction* 1 (14).

Sántha, Eszter, Marie Frier Hvejsel, and Mia Kruse Rasmussen. 2022a. "Lost Potentials? – Unpacking the Tectonics of Architectural Cost and Value." *Nordic Journal of Architectural Research* 34 (1).

Sattrup, Peter Andreas. 2020. "Documenting Value Creation: A Business Opportunity for Architects, their Clients and Society." *Architectural Design* 90 (4): 22-29. doi:10.1002/ad.2586.

SIMNA. 2018. *Social Value International: Accounting for Value*. Social Impact Measurement Network Australia. https://simna.com.au/social-value-international-accounting-for-value/.

Suckley, Louise and Stephen Dobson. 2014. "Measuring Social and Spatial Relations in an Office Move". Springer.

Train, Kenneth E. 2009. *Discrete Choice Methods with Simulation*. Cambridge: Cambridge University Press.

Turan, Irmak, Andrea Chegut, Daniel Fink, and Christoph Reinhart. 2020. "The Value of Daylight in Office Spaces." *Building and Environment* 168: 106503.

Tuzcuoğlu, Deniz, Dujuan Yang, Bauke de Vries, Aslı Sungur, and Rianne Appel-Meulenbroek. 2021. "The Phases of User Experience during Relocation to a Smart Office Building: A Qualitative Case Study." *Journal of Environmental Psychology* 74:101578.

van den Berg, Pauline, Minou Weijs-Perrée, Gamze Dane, Esther van Vliet, Hui Liu, Siao Sun, and Aloys Borgers. 2022. "A comparative study of urban park preferences in China and the Netherlands." International Journal of Environmental Research and Public Health 19 (8): 4632.

Wang, Chun E. "Preliminary analysis on design principles and development trends of modern office buildings." *Applied Mechanics and Materials* 209, 141-144.

To be submitted to:
Journal of Housing and the Built Environment

FIRST DRAFT

ARTICLE to be submitted

Residents' Willingness-To-Pay for Architectural Design Solutions in a High-Density, Mixed-Use Neighborhood

Eszter Sántha[1,2] · Jette Bredahl Jacobsen[3]

Abstract

To ensure the social sustainability of urban densification projects, it is important to design residential buildings with value for the various groups of residents. However, existing research on residential preferences for architectural design characteristics of apartment buildings is thin. Quantitative studies with valuation are either focusing on urban characteristics or investigating specific user groups within the housing sector. Consequently, this study aims at investigating residents' willingness-to-pay for preferred architectural characteristics of apartment buildings. An online stated choice experiment was performed in an urban densification area in Denmark. Estimates were derived by a random parameter logit model for design-related architectural characteristics in relation to both building and apartment. Based on the model estimation results, marginal willingness-to-pay values were calculated for design solutions, which significantly influenced respondents' choice of residence. Our results showed that the most valued characteristic in a building is the availability of personal storage spaces in the basement, while in the apartment units, it is the designated entry room and the size of the window in the living room. Finally, we discuss trade-offs between all significantly influential attributes to provide insight into the social value creation potential of different design solutions on a building scale. The study operates with a relatively small sample focusing on testing the application of the method on a building scale within architecture. Such results can potentially be used by architects to obtain information on how to design more attractive and inclusive homes for residents in high-density, mixed-use neighbourhoods in future projects.

Keywords User value · Architectural design · Multi-storey housing · Stated preferences · Choice experiment · Modelling

JEL Classification D12 · R21 · R31

Eszter Sántha
essa@create.aau.dk

Jette Bredahl Jacobsen
jbj@ifro.ku.dk

[1] Department of Architecture, Design and Media Technology, Aalborg University, Aalborg, Denmark

[2] AART architects, Aarhus, Denmark

[3] Department of Food and Resource Economics, University of Copenhagen, Copenhagen, Denmark

1 Introduction

The architectural design of residential buildings within urban densification projects plays an important role in tackling several challenges on the social dimension of sustainability, including but not limited to decreased neighbourhood satisfaction and decreased personal well-being. In order to ensure the social sustainability of urban densification projects, a leading strategy to accommodate the growing urban population and to internalize the negative externalities of urbanization (Bibri et al, 2020), it is important that residential buildings are attractive (Bibri et al, 2020), i.e. they are of value to various groups of residents. Documenting everyday practices, and thus identifying the needs and preferences of residents, as end-users of the buildings are key to enhancing their personal well-being and increasing neighbourhood satisfaction within the often-overlooked social dimension (Jensen & Troelsen, 2017). This may eventually also result in a more efficient resource allocation in urban densification projects.

In this paper we investigate the social dimension of building projects, and thereby we move beyond the current preoccupation of the industry with environmental impacts within housing projects (focusing mainly on energy efficiency) to consider sustainability in a wider "value framework" (Hay et al., 2018). Within our study, the value created by a specific architectural design is defined according to Social Value International (SIMNA, 2018), as "the quantification of the relative importance that people place on the changes they experience in their lives". The preferences of residents matter for developers and decision-makers within city development (housing) projects as their needs define demand. A growing body of research has already been dedicated to studying the user-building and user-built environment affordances within the housing sector, focusing on residents' well-being (Jensen, 2018), and everyday practices (Stender & Jepsen, 2021; Winther, 2021) in high-rise buildings of high-density neighbourhoods (Mechlenborg & Hauxner, 2021). While these studies provide a detailed and better understanding of the interplay between end-users and the built environment to inform architectural design (both qualitatively and quantitatively), they can prove to be weak arguments in practice. In fact, architects often find it challenging to argue for and weigh the potential qualities of their design relative to the costs since decision-making is often exclusively driven by economic reasoning (Broch et al., 2017; Sattrup, 2020). The architects' challenge partly lies in the lack of methods and tools to understand and report on social value in a quantified manner, where value is expressed in monetary terms as a "commonly understood language" within the design decision-making process of the contemporary building industry.

A second reason why the preferences of the end-users matter are that when end-users live in the buildings, they may change their preferences as they learn how to live in buildings and what qualities matter in the longer run. Thus, there may be a time lack from the architectural design phase to the trade of the buildings and the next trades. This has led to a shift in the evaluation practice of buildings from performance measures towards describing and measuring experiences by end-users (defined as Post-Occupancy Evaluation methods in Watson et al. (2016)). Post-occupancy evaluations (POE) are widely recognized both in academia and increasingly in practice (Hay et al., 2018). POE is used as a frame to systematically learn from previous projects in order to inform and thus improve future design, that is more aligned with the needs of different stakeholders (clients, end-users, society) and the environment (Hay et al., 2018). Quantification approaches to inform the architectural practice on the social value within the architectural discipline are currently dominated by multi-criteria analysis (MCA) based assessment tools, while preference studies based on welfare economic valuation principles (i.e. knowledge from other disciplines in general) are underexplored (Mulgan et al., 2006).

Another approach, which has been emphasized by Toppinen et al. (2018) is to express the monetary value of architectural design solutions, as "the decision regarding which projects are undertaken depends on the end user and their willingness to pay for certain aspects of a building, at least from the perspective of the builder" (Toppinen et al., 2018, p. 7). Estimating willingness-to-pay has the advantage that it directly looks at the trade-offs between the multiple criteria for architectural characteristics as perceived by the end user. Thus, the weighting of different characteristics is defined directly by them, resembling their behaviour, based on their experiences. Further, it has the advantage, that it is directly usable in welfare economic analyses. Yet only very few studies exist, that use welfare economic approaches to identify residential preferences and social value in the housing sector. Heyman (2017) and Lundhede et al. (2013) investigated the value creation of urban design qualities, using revealed preference methods (hedonic pricing) of neighbourhoods of Scandinavian cities. On the building scale, we found only one similar study quantifying the value of architectural characteristics within senior housing, by investigating the preferences of elderly residents in The Netherlands (Ossokina et al., 2020).

This study aims at investigating residents' willingness-to-pay for preferred architectural characteristics of apartment buildings in an urban densification context in Denmark. In doing so, the study contributes to identifying the social value creation potential of different design solutions on a building scale. In this regard, it is considered an exploratory study for applying the welfare economic approach, stated choice experiment method within architecture.

2 Stated choice experiment

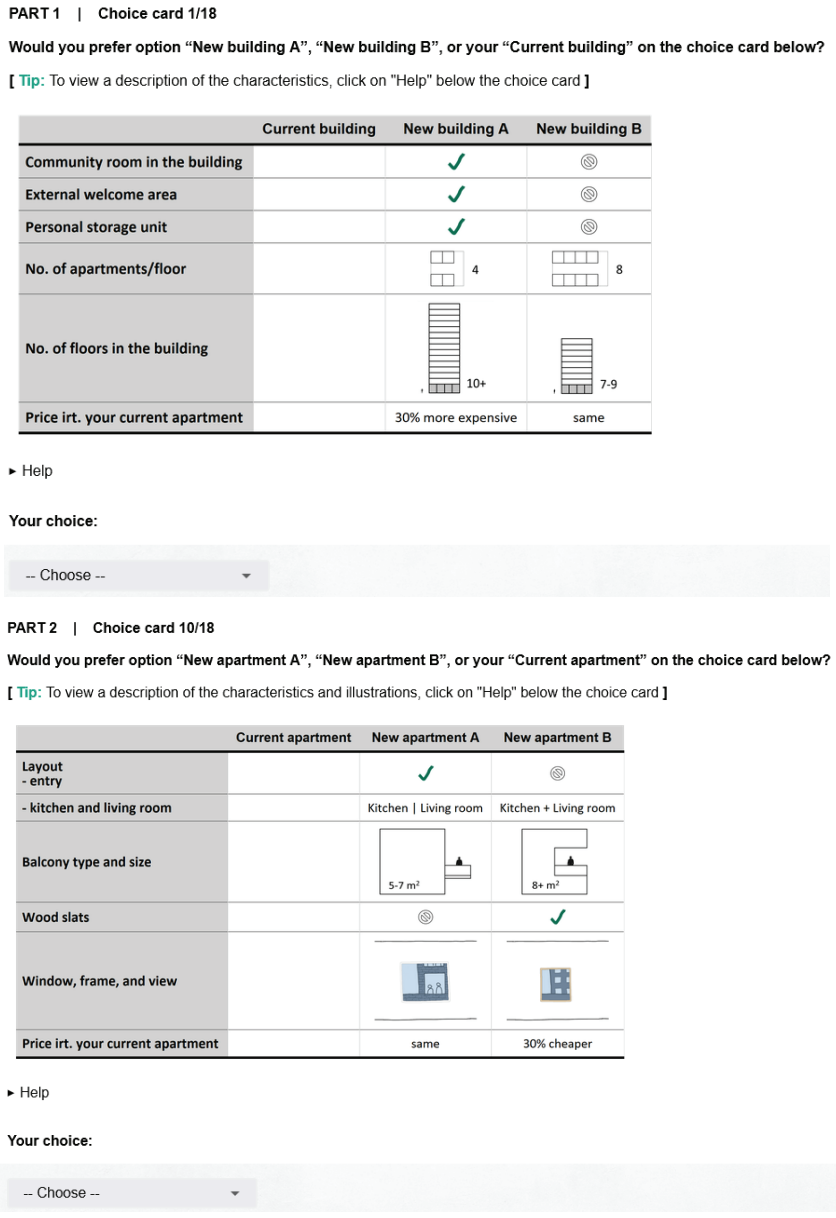
In this study, we apply choice modelling based on data from stated choice experiments (CE). Being a direct welfare-economic valuation method (Freeman et al., 2014) it was chosen due to its flexibility to capture both *ex-ante* and *ex-post* changes, tangible, and less tangible estimates, as well as effects on a small scale. Moreover, the choice task incorporated in the experiment mimics a market choice situation, and thus it is potentially easier to carry out for respondents, compared to other stated preference methods (Louviere et al., 2000), where they might need to consider each characteristic more explicitly.

2.1 Statistical design

This study comprises two choice experiments to identify, analyze and discuss residential preferences for architectural design solutions in buildings and apartments, respectively. Within the survey, each respondent was asked to answer both experiments, first the one regarding buildings, and then regarding apartments. In both experiments, respondents were asked to choose from three options, where one was their current building/apartment, and then two alternatives (Figure 1). Each experiment had nine consecutive choice sets per respondent. For each choice task, respondents were asked to consider the following choice situation: "You are offered the possibility to move to a new apartment in a new building, that is also located in a harbour area, with direct access to the waterfront and with shops and cafes nearby. Please ignore the costs and inconveniences associated with the moving itself when you make your choices!".

Characteristics of the alternative buildings and apartments were presented using a mix of short texts, icons, and drawings. To help respondents interpret the different representations, as well as for us to identify their status quo, the first parts of the survey included training questions regarding the architectural characteristics of the building and apartment they currently live in, using the same drawings

as in the choice tasks. A short explanatory description of the attributes and a legend for the graphical representations were included in a drop-down help text under each choice card.



PART 1 | Choice card 1/18

Would you prefer option "New building A", "New building B", or your "Current building" on the choice card below?

[Tip: To view a description of the characteristics, click on "Help" below the choice card **]**

	Current building	New building A	New building B
Community room in the building		✓	⊘
External welcome area		✓	⊘
Personal storage unit		✓	⊘
No. of apartments/floor		4	8
No. of floors in the building		10+	7-9
Price irt. your current apartment		30% more expensive	same

▸ Help

Your choice:

-- Choose --

PART 2 | Choice card 10/18

Would you prefer option "New apartment A", "New apartment B", or your "Current apartment" on the choice card below?

[Tip: To view a description of the characteristics and illustrations, click on "Help" below the choice card **]**

	Current apartment	New apartment A	New apartment B
Layout - entry		✓	⊘
- kitchen and living room		Kitchen | Living room	Kitchen + Living room
Balcony type and size		5-7 m²	8+ m²
Wood slats		⊘	✓
Window, frame, and view			
Price irt. your current apartment		same	30% cheaper

▸ Help

Your choice:

-- Choose --

Figure 1 Print screen of a building (top) and apartment (bottom) choice set. Each respondent was presented with 9 of these, which vary in the level of the attributes

In our experiments, we described residential building and apartment alternatives along six and nine attributes, respectively, with two or three levels each (Table 1). Selection of these attributes and their levels were determined through expert workshops with architects (Sántha, Hvejsel, & Rasmussen, 2022), in-person semi-structured interviews with residents (Sántha, Hvejsel, & Entwistle, 2022), and a literature review of similar studies. This was done to ensure, that characteristics included in the experiments are relevant for both residential and architectural choices. Follow-up questions regarding their choices were included after the choice tasks regarding perceived difficulty and reasons behind any potential strategic bid. At the end of the survey, respondents were asked about their previous residence, current living conditions, potential moving preferences, and information on their socio-economic characteristics.

Table 1 Attributes and their levels in the design of the stated choice experiment

	Attribute	Levels
	BUILDING	
1	Community room in the building	Yes / No
2	External welcome area at the entrance	Yes / No
3	Personal storage units in the basement	Yes / No
4	No. of apartments pr. floor*	2-3 / 4 / more than 4
5	No. of floors in the building*	4-6 / 7-9 / 10+
6	Price irt. current apartment	same / 30% cheaper / 30% more expensive
	APARTMENT	
1	Designated entry room	Yes / No
2	Kitchen-Dining-Lounge	"Kitchen + Living room" / "Kitchen | Living room"
3	Balcony type[a]	Recessed / Hanging
4	Balcony size[a]	2-4 sqm / 8+ sqm / 5-7 sqm
5	External wood panel	Yes / No
6	Wooden door- and window frames[b]	Unpainted wood / Painted wood or other material
7	Living room window size[b]	Size 1 / Size 2 / Size 3
8	View from living room[b]	Building close-up / Building further away / Building medium close-up
9	Price irt. current apartment	same / 30% cheaper / 30% more expensive

a Attributes were combined and presented by drawings in the choice sets
b Attributes were combined and presented by drawings in the choice sets
* Attribute levels were represented by drawings

For the statistical design of the experiments, we used a fractional factorial efficient design based on a conditional logit model with main effects by optimizing its Dp-error with priors based on best guess (refined using the model on a simulated dataset) in Ngene (ChoiceMetrics, 2019). Assuming that residents probably have a stronger preference for their status quo (given that the buildings are newly built, and the neighbourhood is newly developed), we also accounted for the preference for choosing the current dwelling by assigning a positive constant of 0.5 for both the 'Current building' and the 'Current apartment'. The final design of both experiments included 36 choice cards, allocated into four blocks in a randomized order. As a result, respondents were offered 18 (2 times 9) choice sets in the survey.

2.2 Data collection

Data from choice experiments were collected via an online survey, using the platform SurveyXact. The survey was offered to the residents of a high-density mixed-use neighbourhood, Aarhus Ø, within the Danish city of Aarhus.

Initiated by the city council, the harbourfront of Aarhus Bay has been under redevelopment since 1997, to accommodate the rapid growth of the urban population (Aarhus Kommune, 2003). The artificial peninsula of Aarhus Ø used to be a container dockland for shipping. Today, it is divided into piers with several building lots providing space for the city's new urban densification project. Residential buildings included in this study are designed by different Danish architectural offices, among others 3XN, Sahl Arkitekter, CUBO, CEBRA, C.F. Møller, AART architects, ADEPT, Arkitema, and ERIK arkitekter (Aarhus Kommune, n.d.). Based on the sustainable compact city model, the project has had high ambitions to design the new urbanite as a "desirable place to live" (Christiansen, 2020) for the citizens. Thus, it provides a good basis for investigating whether the residents' everyday life and well-being match the architectural intentions (spatial gestures), i.e., whether they, based on their experience of living there, value the architectural design solutions of those residential buildings and the apartments they contain. If the dwellings do indeed provide larger social values than others, we would expect the status quo to be preferred over other alternative options in a choice setting, thus being highly valued relative to the available alternatives.

Residents were invited to participate in the survey during the summer of 2022 through letters, social media posts (Facebook groups), and personally distributed flyers in the neighbourhood. The survey was presented both in Danish and English and did not include the opportunity to gain a gift or money upon the completion of the questionnaire.

3 Modelling approach

As a first step to estimate residential preferences and derive their willingness-to-pay, we apply the traditional conditional logit model (McFadden, 1973). In this model, the utility person *n* obtains from a dwelling *h* in choice occasion *t* is defined as:

$$U_{nht} = \alpha + V_{nht} + \varepsilon_{nht} \qquad (1)$$

where α is a constant, V is the observed utility component (dependent on variables of interests) added to the random utility component, and ε is a Gumbel-distributed error term (Train 2009). The probability of person *n* choosing alternative dwelling *h* (building or apartment) out of H available options, can be derived by the conditional logit model as:

$$P_{nh} = \frac{\exp\left(X_h \cdot \beta\right)}{\sum_{k \in H} \exp\left(X_k \cdot \beta\right)} \qquad (2)$$

Preferences are reflected in the estimated utility parameters (β), which describe the relative importance of the *k*-th element of the vector *Xh* (here, architectural design characteristics of the dwelling) to individuals (Train, 2009).

Building on the basic conditional logit model, we use a random parameter logit (RPL) model with panel specification to estimate the utility parameters in our discrete choice study (Train, 2009). Using the RPL model, we estimate both the mean and standard deviation of the utility parameter (β) for each attribute entering the estimation to detect heterogeneity in residential preferences (Mariel et al., 2021). Since each choice set included an opt-out option (Determann, 2019) offered by the "Current building" and "Current apartment" options, we also estimated preference for present living conditions in the form of an alternative specific constant (ASC).

The estimation of model parameters for building and apartment characteristics was carried out with 15.000 and 25.000 Sobol draws (Czajkowski & Budziński, 2019), respectively, using the Apollo package version 0.2.8 (Hess & Palma, 2019) in R (version 4.2.0.). Among respondents, the distribution of attributes was assumed to be normal, except for the parameter for price and the ASC (only in the first model for building choice), which were assumed to be fixed to ensure the model's convergence. Levels of all categorical variables (architectural characteristics) were simple contrast effect coded, whereas price was coded linearly. For every attribute, either the least or the second least preferred level was coded as a reference to make the interpretation of willingness-to-pay (WTP) values easier.

Finally, we calculated residents' WTP as a welfare economic measure of marginal changes in individuals' utility, derived from gradual improvements (Mariel et al. 2021) in the architectural quality of residential buildings and apartments in the sampled high-density neighbourhood.

$$mWTP_l^c = -\frac{\beta_l^c}{\beta_{price}} \qquad (3)$$

Using the selling price of the apartment as a cost factor, we calculated the residents' marginal WTP (mWTP) for each level (*l*) of an architectural design characteristic (*c*), expressed in Danish kroners, using the above formula.

Data

Initially, 108 residents responded to our invitations sent out on multiple channels to participate in the survey. Many of these responses, however, contained missing information and thus had to be excluded from the dataset. Table 2 shows the socio-demographic characteristics of the 47 respondents, who fully completed the survey. They completed the survey in 28 minutes on average and reported, that they found the experiments between "Neither difficult nor easy" and "Fairly easy".

The majority of the respondents are women, and residents aged between 18 and 35 years. According to the statistics of Aarhus (Aarhus i tal, 2022), this is somewhat representative of this neighbourhood. More than half of the respondents have less than 200 000 Danish kroners of annual personal income. Many of the respondents are students, who may work part-time in a student job.

Table 2 Socio-demographic characteristics of respondents

Characteristic	N	%	Characteristic	N	%
Age			**Employment status**		
18-24	14	29,8%	Elderly/retired	3	6,4%
25-34	18	38,3%	Full-time employee	15	31,9%
35-44	1	2,1%	Part-time employee	2	4,3%
45-54	4	8,5%	Self-employed	2	4,3%
55-64	6	12,8%	Student	11	23,4%
65+	4	8,5%	Student and employee	11	23,4%
	47	**100%**	Unemployed	3	6,4%
Gender				**47**	**100%**
Man	16	34,04%	**Personal annual income**		
Other	0	0,0%	200.000 – 299.999 kr.	4	8,5%
Woman	31	65,7%	300.000 – 399.999 kr.	5	10,6%
	47	**100%**	400.000 – 499.999 kr.	1	2,1%
			500.000 – 749.999 kr.	7	14,9%
			750.000 – 999.999 kr.	1	2,1%
			Above 1.000.000 kr.	4	8,5%
			Below 200.000 kr.	25	53,2%
				47	**100%**

The distribution of respondents based on their residence is shown in Table 3. The average size of respondents' current apartment is 75 m^2 (standard deviation: 42), with an average household size of 1,7 (standard deviation: 1). The majority of the respondents have moved in within the past 2 years, while 34% lives in their current apartment for more than 3 years. Previously, 43% of them lived in a house, while the rest lived in an apartment within the same harbour area (5%) or elsewhere in or out of the city (52%). These are shown in Table 4.

Table 3 Respondents distribution among the sampled residential buildings

Residence	
Generationernes Hus	8,51%
Havneholmen	4,26%
Havnehusene	19,15%
Isbjerget	4,26%
Kanalhusene	2,13%
Pakhusene	8,51%
SHiP	2,13%
Ungdomsboligerne (Marina House, Grundfos Kollegiet, Vulkanen, Det store Havnehus)	29,79%
Z-huset	17,02%
AARhus	4,26%
Grand Total	**100,00%**

Based on the reported size, we estimated the approximate price of their apartment by multiplying it by the average price per m^2 of 43 848 kr. (approx. 5 895 €) for central Aarhus in the second quartile of 2022 (Boliga, n.d.). Corresponding to the average size, the average price of the respondents' apartment is 3.24M kr., with a standard deviation of 1.81M kr. In the student housing buildings (Marina House,

Grundfos Kollegiet, Vulkanen, Det store Havnehus), where almost 30% of the respondents live, the average price of their apartment is 1.69M kr., while in Z-huset – home for 17% of respondents – it is 5.74M kr.

As for the characteristics of their status quo, the majority of respondents live in a building with a community room, and a personal storage unit in the basement, but no external welcome area at the entrance of the building. Furthermore, it has more than 10 floors and more than 4 apartment units per floor. Surprisingly, the apartment of the majority of respondents does not have a designated entry room, probably because they have a combined kitchen-dining-lounge area (where usually the kitchen and the living room is one undivided space). Most respondents live in an apartment that has a hanging balcony of 8+ m2, which is considered large, without any wooden panels on the external side of the wall towards the balcony. In the apartment of most respondents, the door and window frames are of painted wood or other material. Lastly, in most cases, they reported having a 'Size 3' (illustrated as a large, floor-to-ceiling) window in their living room, which provides a medium close-up view towards the nearest building.

To acquire more information about residents' experience of their current dwelling, we have included some background questions about their perceived privacy (Figure 2) and the impact of the physical environment of their residential building and apartment on their quality of life. The latter was based on a 5-level Likert-scale rating, ranging from 'Very important' (1) to 'Not at all' (5). Respondents found that both the physical environment of building (2.09) and apartment (1.70) have an impact on their quality of life.

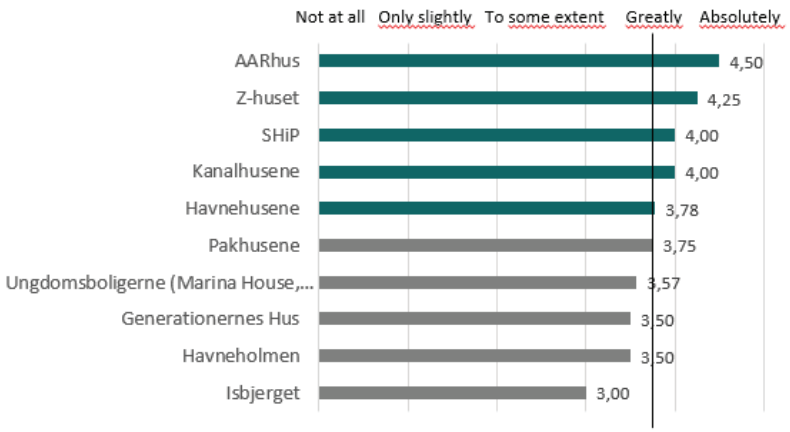


Figure 2 Sense of privacy experienced by the respondents

Finally, we also asked respondents' opinions regarding the suitability of their current dwelling. Responses were quite balanced with 36% stating that it is suitable for long-term (in the next 5-10 years), 30% considering medium-term (2-4 years) suitability, and 34% planning to move out within the next 2 years.

Table 4 Data on the housing situation of respondents

Move-in	
1-2 years	40,43%
3-6 years	34,04%
6-11 months	12,77%
less than 6 months	12,77%
Grand Total	**100,00%**

Housing history	
No, I lived in a house or other form of housing	42,55%
Yes, in the city harbour area of Aarhus	4,26%
Yes, in the city outskirts of Aarhus	23,40%
Yes, in the inner city of Aarhus	21,28%
Yes, outside Aarhus	8,51%
Grand Total	**100,00%**

Average size of current apartment (m2)	
Generationernes Hus	65
Havneholmen	88
Havnehusene	64
Isbjerget	90
Kanalhusene	88
Pakhusene	73
SHiP	85
Ungdomsboligerne (Marina House, Grundfos Kollegiet, Vulkanen, Det store Havnehus)	39
Z-huset	135
AARhus	123
Grand Total (average)	**75**
St.dev	**42**

Average of Houshold size	
Generationernes Hus	1,5
Havneholmen	2,0
Havnehusene	1,7
Isbjerget	2,5
Kanalhusene	2,0
Pakhusene	1,5
SHiP	1,0
Ungdomsboligerne (Marina House, Grundfos Kollegiet, Vulkanen, Det store Havnehus)	1,4
Z-huset	2,1
AARhus	1,5
Grand Total (average)	**1,7**
St.dev	**1**

Suitability of current residence

Pr. residential building	Short-term (up to max. 2 years)	Medium-term (in the next 2-4 years)	Long-term (in the next 5-10 years)	
Generationernes Hus	0,00%	50,00%	50,00%	
Havneholmen	50,00%	50,00%	0,00%	
Havnehusene	44,44%	11,11%	44,44%	
Isbjerget	50,00%	0,00%	50,00%	
Kanalhusene	0,00%	100,00%	0,00%	
Pakhusene	25,00%	50,00%	25,00%	
SHiP	0,00%	0,00%	100,00%	
Ungdomsboligerne (Marina House, Grundfos Kollegiet, Vulkanen, Det store Havnehus)	57,14%	42,86%	0,00%	
Z-huset	12,50%	12,50%	75,00%	
AARhus	0,00%	0,00%	100,00%	
Grand Total	**34,04%**	**29,79%**	**36,17%**	**100,00%**

Written comments left at the end of the survey either emphasize the difficulty of the task (1), explain choice behaviour (2), or emphasize their preferences, satisfaction/dissatisfaction (5).

4 Results

4.1 Model estimation results

The results of the models are shown in **Table 5 and 6** and present the estimated coefficients and performance indicators of the RPL models. Parameter estimates for the effect-coded variables are relative to the baseline attribute.

In the final discrete choice models, a total of 495 and 441 observations from 55 and 49 respondents were included to elicit preferences for residential buildings (model 1) and apartments (model 2), respectively. On top of the 47 complete responses, this includes some respondents, who despite partially completing the survey, fully completed the choice tasks and questions regarding the current design of their building and apartment. From the 495 choices respondents made for buildings, the 'Current building' option was preferred by 52.7%, resulting in a highly significant, positive, and relatively large value of its ASC in model 1. This corresponds to our expectations. On the contrary, in model 2, residents only chose their 'Current apartment' 207 times out of the observed 441 choices (46.9%), resulting in a considerably lower positive ASC, which is only slightly significant statistically for its mean as well as highly significant and large for its standard deviation. We tested for consistent status quo bidders (Johnston et al. 2017), but none of these could be identified as protest bidders (i.e., they considered the trade-offs, but preferred the status quo). Likewise, we tested respondents who systematically chose the cheapest or the most expensive options, which could indicate attribute non-attendance. But we could not identify such patterns, and thus, we included their responses in the analyses below.

Table 5 RPL model estimation results for residential building preferences

RPL model – 15.000 Sobol draws					
#0	ASC	**Constant**		**Mean**	**St.dev.**
		α	**fixed**	1,1497 ***	-
#1	a	**Community room in the building**			
		β1(0)	Yes	0,9494 ***	0,9157 ***
		β1(1)	No (ref)	-0,9494	
#2	b	**External welcome area at the entrance**			
		β2(0)	Yes	0,2369	0,2425
		β2(1)	No (ref)	-0,2369	
#3	c	**Personal storage units in the basement**			
		β3(0)	Yes	2,7995 ***	2,2851 ***
		β3(1)	No (ref)	-2,7995	
#4	d	**No. of apartments pr. floor**			
	d1	β4(0)	2-3	0,8484 ***	0,9178 **
		β4(1)	4 (ref)	-0,3306	
	d2	β4(2)	more than 4	-0,5178 **	1,0963 ***
#5	e	**No. of floors in the building**			
		β5(0)	4-6 (ref)	-0,0314	
	e1	β5(1)	7-9	0,5302 ***	0,0038
	e2	β5(2)	10+	-0,4988	1,7167 ***
#6	f	**Price**			
		β6	**fixed**	-0,2341 ***	-
No. observations			495		
LL			-297,23		
Adj. pseudo-Rho^2			0,4107		
AIC			626,45		
BIC			693,73		

Significance at 1% (***), 5% (**), 10% (*).

In the RPL model for building choices (model 1), almost all parameters prove to have a significantly positive effect on respondents' choice of a residential building, except for attributes with more than 2 levels, where one level is positive and the other is negative, given the coding of the baseline (cf. 'Modelling approach'). The mean effect of the price is also negative, as expected. Most of the variables also have a significant standard deviation, suggesting considerable heterogeneity in the preferences of respondents. The goodness-of-fit of the model is 0.38 (McFadden's adjusted R2).

In the RPL model for apartment choices (model 2), there are notably less statistically significant estimates, which is probably due to the restricted sample and the higher number of estimated parameters. Attributes with significant mean effects for apartment choice are 'Designated entry room', 'Balcony size', 'Living room window size', and 'View from living room', which have the expected signs. Some characteristics (e.g. 'Balcony type') also comprise high preference heterogeneity reflected in the standard deviation of its coefficients. Nevertheless, this model is also considered a good fit to describe apartment choices with an adjusted R2 of 0.29.

Attribute levels without statistically significant mean parameter estimates won't be interpreted, as they would most likely require a higher response rate.

Table 6 RPL model estimation results for apartment preferences

RPL model – 25.000 Sobol draws					
#0	ASC	**Constant**		**Mean**	**St.dev.**
		α		0,7693 *	-2,4381 ***
#1	a	**Designated entry room**			
		β1(0)	Yes	0,4272 ***	-0,4404 **
		β1(1)	No (ref)	-0,4272	
#2	b	**Kitchen-Dining-Lounge**			
		β2(0)	Kitchen + Living room	-0,1237	-0,3684 *
		β2(1)	Kitchen | Living room (ref)	0,1237	
#3	c	**Balcony type**			
		β3(0)	Recessed	-0,1755	0,6754 ***
		β3(1)	Hanging (ref)	0,1755	
#4	d	**Balcony size**			
	d1	β4(0)	2-4 (small)	-0,5580 ***	0,4008
	d2	β4(1)	8+ (large)	0,4626 **	-0,6547 **
		β4(2)	5-7 (medium) (ref)	0,0953	
#5	e	**External wood panel**			
		β5(0)	Yes	-0,0412	-0,1934
		β5(1)	No (ref)	0,0412	
#6	f	**Wooden door- and window frames**			
		β6(0)	Unpainted wood	-0,1332	-0,0253
		β6(1)	Painted wood or other material (ref)	0,1332	
#7	g	**Living room window size**			
	g1	β7(0)	Size 1	-0,1603	-0,0018
	g2	β7(1)	Size 3	0,6662 ***	-0,0201
		β7(2)	Size 2 (ref)	-0,5059	
#8	h	**View from living room**			
	h1	β8(0)	Building close-up	-0,2735	0,0092
	h2	β8(1)	Building further away	0,3030 *	0,3150
		β8(2)	Building medium close-up (ref)	-0,0296	
#9	m	**Price**			
		β9	**fixed**	-0,0960 ***	-
No. observations			441		
LL			-306,54		
Adj. pseudo-Rho^2			0,2901		
AIC			663,08		
BIC			765,3		

Significance at 1% (***), 5% (**), 10% (*).

4.2 Willingness-to-pay

Figure 3 shows how the calculated marginal willingness-to-pay estimates influence the aggregated user value of buildings and apartments, based on the above-described model results (Table 5 and 6). The figure is inspired by Ossokina et al. (2021) who use a similar figure as a decision support tool ('Consumer toolbox'). However, we use it merely as a presentation style to ease the interpretation of WTP estimates. In the figure we include only attributes with statistically significant coefficients. Their marginal WTP (mWTP) values are calculated based on Equation 3 compared to the defined baseline levels. Parameters with positive mWTP increase utility/value (coloured green), while those with negative mWTP decrease it (coloured red), relative to the reference (coloured light grey). Attributes with more than 2 levels, including parameters both significant and not significant, are not significant levels are not interpreted (coloured dark grey).

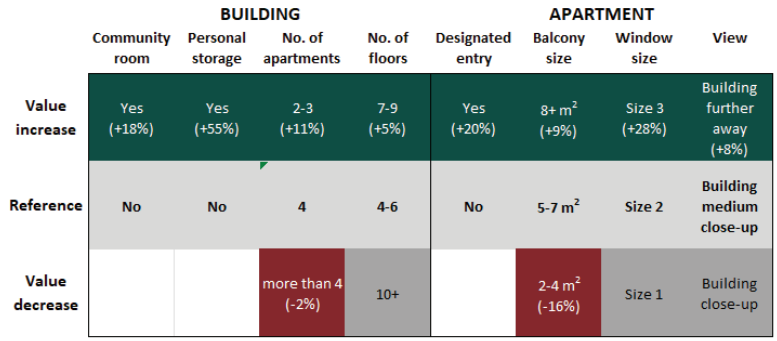


Figure 3 The impact of building and apartment design characteristics on the aggregated user value as measured by residents' WTP

Having personal storage space in the basement of their building seems to have the highest significant effect on the value of apartments for residents in the sampled high-density, mixed-use neighbourhood. Designing residential buildings in this area with personal storage spaces included in the basement increases value by 55%, which corresponds to an mWTP value of 24 000 kr/m^2.

Valuation of the other building characteristics shows that the availability of a community room in the building leads to a rise in the willingness-to-pay with 18%. A building with less than 4 apartments on the same floor is also of value to residents in the sampled high-density neighbourhood. Designing these buildings with only 2-3 apartments per floor yields an 11% higher value compared to the baseline of 4. On the contrary, more than 4 apartment units on the same floor decreased in value by 2%.

Apartment preferences from model 2 suggest, that having a designated entry room is very important for respondents, which correspondingly leads to a rise in their WTP by 20%.

Another significant attribute regarding the architectural design of apartments is the size of the balcony. A large-sized balcony (8+ m2) compared to a medium-sized (5-7 m2) one has a positive impact of 9% on residents' utility as measured by their WTP.

The most important characteristic of apartment design however proved to be the size of the living room window. An apartment with a 'Size 3' (representing a large, floor-to-ceiling window) is more attractive and thus leads to a value increase of 28%. This means that resident is willing-to-pay an additional 12 200 kr/m^2 on average to have that quality.

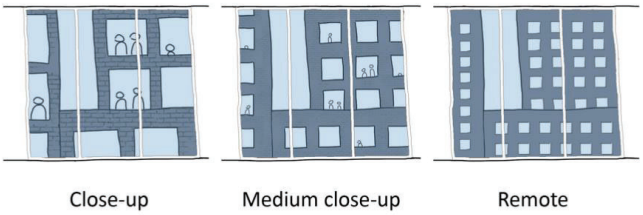


Figure 4 Illustration of the different levels of 'View from living room' on the closest building nearby as they were presented to respondents in the apartment choice experiment

As for the view from that window, there is no doubt that residents, in general, would prefer a view of the sea, or another type of nature. Considering that the sampled area is a high-density neighbourhood where residential buildings are usually high (higher than 6 floors) and close to each other, we wanted to investigate the impact of distance to the nearest building in terms of the view from their living room. Based on our findings, a view of a building that is further away (see Figure 4 for illustration) is preferable to respondents compared to a medium close-up view, resulting in an 8% value increase.

5 Discussion

This paper studied residents' willingness-to-pay for preferred architectural characteristics of apartment buildings.

According to our results, the most valued characteristic of an apartment building is the availability of personal storage spaces in the basement. This is in line with the qualitative findings of Winther (2020) as well as Mechlenborg & Hauxner (2021). Investigating residents' experiences and practices of compact living (with a living space of 14-24,5 sqm pr. person) in small apartments (<65 sqm) in different neighbourhoods of Aarhus and Copenhagen, Winther (2020) found, that shared facilities offered in the basement of the building, including storage spaces, are highly valued and considered essential for compact living by the end-users. According to them: "*A key reason why we're not thinking of moving out is that our living space isn't just this flat, it includes the basement too*" (a resident cited in Winther, 2020, p.121). Although this was found in a case in a lower-density neighbourhood, the need for storage space derives from the restricted size of the apartment itself comparable to the smaller apartment units of the cases investigated in this paper. Additionally, it was found by Mechlenborg and Hauxner (2021), that these facilities as "supporting functions" contribute to residents' quality of everyday life and provide opportunities for ad-hoc chats with the other residents of the same building, thus increasing their sense of community. Other architectural characteristics, that our study found relevant and important for residents' choice of the building leading to a significant increase in their willingness-to-pay was the availability of a community room in the building, as a shared facility, and the number of apartments per floor. These are also linked to neighbour relations and a sense of community. As we uncovered in our

previous qualitative study, where we interviewed residents of 'The Warehouses', the value of a community room in the building lies in "*the possibility to enjoy each other's company without having to book an event venue. […and to] take care of a common space together and be a part of a community in that way*" (a resident cited in Sántha, Hvejsel, & Entwistle 2022, p. 607). Based on the findings of Sántha, Hvejsel, & Entwistle (2022), residents of 'The Warehouses' "build stronger relations (eg. lending equipment to each other or trusting them with a spare key) with immediate neighbours and fellow residents living on the same floor" (p.607) than those living in the same building several floors up or down. This could be one of the reasons for preferring having fewer (2-3) apartments per floor compared to 4, or more than 4, as reflected in the model estimation results (Table 5). This is furthermore in agreement with the findings of Mechlenborg and Hauxner (2021), who – studying multiple cases of high-rise buildings – found, that residents' sense of community is influenced by the total number of apartments and thus the total number of residents living in the same building. They refer to this interrelation as 'social transparency' (p. 17-18). While our study confirms these qualitative findings, we also show that people are willing to pay to have these intangible qualities of an apartment, which does not relate exclusively to the physical design, but also to the community it constitutes.

The subjective nature of preference toward establishing a community with neighbours and fellow residents in the building was also highlighted in the above-cited studies, depending on the socio-demographic characteristics of households. This is also reflected in our building choice model, where all the statistically significant attributes also have a significant, and relatively high standard deviation for their estimates, indicating preference heterogeneity among respondents.

As for the apartment units, we found, that the most valued characteristics by respondents were having a designated entry room and a large window in the living room. In comparison to having your main door open to a hallway leading to the other rooms, as they typically do in 'compact housing' (Winther, 2020) as well as in most of the buildings included in the sample, the value of having a designated entry room could lie in the enhanced spatial capacity and thus the better functionality of the room. As for the window size, the preference for larger windows is probably not that surprising in relation to the daylight conditions they potentially provide for the apartment. A more interesting aspect, however, is the trade-off between daylight and privacy in relation to window size and placement (in terms of view), especially in a high-density neighbourhood, where buildings are typically closer to each other. Aiming to investigate this value relation reflected in choice behaviour, we included 'View' as an attribute in the choice sets focusing on the visual distance from the nearby closest building. However, the parameter estimates were not significant in the model. Whether this is because it is of less importance to residents or it is due to the small sample size, we do not know, so we cannot conclude decisively on that. For qualitative insights regarding the importance of 'visual privacy' in this context see e.g. Mechlenborg & Hauxner (2021). The feeling of privacy in such dense and 'lively' neighbourhoods is furthermore discussed in Sántha (2023) based on data from urban life recordings (activities and traffic) as well as interviews with residents from the same neighbourhood that is investigated here. Qualitative data from interviews with residents of 'The Warehouses' in their homes by Sántha showed, that many of the residents here feel the need to install curtains (which is uncommon in Nordic cultures) – especially in their bedroom/guest room, but for some, also in the living room-kitchen area – to ensure their privacy from the people on the street and/or from the other residents living in the building directly across the road. As a resident living on the first floor described it: "*Well, I actually didn't have curtains in my old apartment* [at a different place]. *Yes, I had dark curtains, but they were just for decoration. But I have had curtains in the other apartment* [in the same

building, just next door to the current one] *in the bedroom because people could directly look in. The curtains were also not completely transparent but white. […] Here* [in the current apartment] *it was really important to have curtains in the bedroom and in the guest room because there is a footpath right there and people can look straight in*".

While the present study allowed us to obtain insight into residential preferences for architectural design solutions, and to translate these preferences into value measured by their willingness-to-pay, it has some shortcomings. First, the findings of our study are limited to the number of attributes that could be included in the study. While the included attributes were selected as 'most relevant' based on extensive qualitative insights primarily from a building user perspective (Sántha, Hvejsel, & Entwistle 2022) and secondary from an architect perspective (Sántha, Hvejsel, & Rasmussen 2022), it does not mean that other attributes are not of importance. Furthermore, it is limited to the sampled area, and possibly only relevant for residents living in high-density neighbourhoods, potentially including compact dwellings and high-rise buildings, as a core concept applied in the development of these areas. Thus, our study operates with a quite restricted sample size. The restricted sample size also meant that we could not investigate building and apartment choices separately by splitting them between respondents. Consequently, we made the assumption, that trade-offs made in the first experiment regarding building characteristics are independent of the second experiment, comprising apartment choices. Considering the small sample size, this assumption was necessary to valuate design characteristics on both scales.

Regarding the representation of the characteristics in the choice tasks, attributes visualized by drawings incorporated a certain abstraction in terms of interpretation. This was done, to make sure that respondents do not focus on the details of construction as presented by more realistic visualization techniques, but to value them as concepts. Also, to reduce any chance of misunderstanding and different interpretations, we accompanied all choice cards with a help text, including legends for interpreting the drawings. Yet, the combination of different representation/visualization techniques within the same choice set might have made their interpretation more difficult for respondents. While we do not foresee specific biases, it may have added noise to the results.

Lastly, the applied payment vehicle relative to the current price of respondents' apartments could be questioned. On one hand, it was chosen according to what similar studies have applied (see Ossokina et al., 2020). On the other hand, using a relative rather than fixed increase/decrease in the levels of the price attribute was more suitable for our choice experiment design, due to the relative increase/decrease in the other attribute levels as well, except for those defined binarily. Another argument for the chosen payment vehicle is, that this way it could potentially be compared to estimates from hedonic price models as an approach to validate the choice behaviour of residents and thus the impact of attributes on apartment prices.

6 Conclusion

In this study, we investigated residents' willingness-to-pay for preferred architectural characteristics of apartment buildings in an urban densification context in Denmark, through a stated choice experiment.

Our results showed that the most valued characteristic in a building is the availability of personal storage spaces in the basement, which apart from its obvious functional value may impact the social cohesion

between residents living in the same buildings. Within the apartment units, we furthermore showed, that having a designated entry room and the size of the window in the living room increase residents' willingness-to-pay significantly in the area, as they have a positive impact on their quality of life.

In doing so, the study contributed to identifying the social value creation potential of different design solutions on both residential building and apartment unit scales in a high-density, mixed-use neighbourhood context. Using a relatively small sample size with strategic sampling, the research was intended as an exploratory study for applying the welfare economic approach, stated choice experiment method within architecture, on specific architectural cases.

The findings of this study can be potentially used by architects on one hand to obtain information on residential preferences for architectural design, and on the other hand to use the quantified value of these preferences as economic arguments in the design process for designing more attractive and inclusive homes for residents in high-density, mixed-use neighbourhoods in future projects. Though, preferably with a larger population sample, especially if multiple user groups (defined by socio-demographic indicators) are considered. Nevertheless, the work done here shows that it is possible to obtain a monetary value on both the tangible and the less tangible qualities of architectural design from the occupants' perspective.

A larger population would potentially also allow us to investigate architectural features on different scales in a combined way, i.e. on the same choice card. This would however probably make the choice task more difficult for respondents. To ease the cognitive burden of the exercise other alternative visualization techniques could be explored, such as 3D images and virtual reality tours (see e.g. Rid et al., 2018), often used by real estate websites and thus potentially more familiar to interpret for residents. However, using such techniques may be challenging if combined with asking respondents to make tradeoffs between attributes, where it is preferable to "see" the actual tradeoffs instantly by comparing the alternatives side-by-side. This is probably easier to do with static than dynamic images. Further investigation of this however remains for future research.

In developing and using DCEs in the future for evaluating architectural design features of residential buildings, our experimental design could provide inspiration and a guide for the identification of relevant attributes. However, as user groups vary and could be very diverse in the case of residential buildings, an exploration of social values through the qualitative narratives of experience from users through their everyday life and practices is recommended prior to setting up a DCE. This points towards the integration of more elaborate qualitative studies (from semi-structured interviews to more exhaustive ethnographical studies) and their empirical findings in setting up DCEs. Future research applying DCE within architecture could focus on extending the sample to larger geographical units, potentially including more or another combination of relevant attributes for residents, such as green areas. Though, the more comprehensive these studies become, possibly the less directly applicable they can be in everyday architectural practice as they inherently become less specific. Another future perspective in relation to this could be to generalize based on a user-group level, to identify different user profiles by investigating the interactions between architectural attributes and socio-demographic characteristics of residents. This would also allow for acquiring insight into designing different buildings targeting different user groups. The quantitative nature of DCE further allows for investigating not only the preference diversity but also the group size. Using DCE to inform the field of architecture on the diversity of user groups can help the architects to accordingly "diversify" their design and thereby address user needs more flexibly, so it could

be of value to residents preferably throughout the building's lifetime, thereby (from a social aspects) contributing to its sustainability.

Acknowledgements This study is a part of the Industrial PhD research project "CATALYST" at the Department of Architecture, Design & Media Technology (CREATE) at Aalborg University and the architectural studio AART Architects A/S (AART), in collaboration with the Department of Food and Resource Economics (IFRO) at the University of Copenhagen, in Denmark. The authors would like to acknowledge the help of all colleagues at IFRO, who participated in the economic valuation seminars and thus contributed to the improvement of the design of the choice experiments. The authors are furthermore grateful to the two main supervisors of the PhD project, Johanne Mose Entwistle (Head of Impact Team at AART), and Marie Frier Hvejsel (Professor at the Aarhus School of Architecture) for their continuous engagement and critical reflection on the work. Lastly, but most importantly, the authors would like to express their gratitude to every resident, who devoted their time to respond to our survey and thus provided the data for our economic analysis.

Funding The study was funded by AART Architects A/S and Innovation's Fund Denmark (Industrial PhD grant no. 9065-00220B).

References

Aarhus Kommune. n.d. *Her arbejder vi - private byggeaktiviteter.* Aarhus Ø. Retrieved 10 July 2020, from https://aarhusoe.dk/her-arbejder-vi/private-byggeaktiviteter/

Aarhus Kommune. (2020). *Aarhus i tal.* Aarhus i tal. Retrieved 10 July 2020, from https://ledelsesinformation.aarhuskommune.dk/aarhus-i-tal/default.aspx?doc=vfs://Global/AARHUS-I-TAL/Hjem.xview

Aarhus Kommune, & Aarhus Havn. (2003). *Helhedsplan for de bynære havnearealer*. Aarhus: Aarhus Kommune. https://www.aarhus.dk/media/5498/helhedsplan-for-de-bynaere-havnearealer.pdf

Bibri, S. E., Krogstie, J., & Kärrholm, M. (2020). Compact city planning and development: Emerging practices and strategies for achieving the goals of sustainability. *Developments in the Built Environment, 4* (100021). https://doi.org/10.1016/j.dibe.2020.100021

Boliga. n.d. *Boligpriser.* Boliga statistik. Retrieved 15 September 2022, from https://www.boliga.dk/boligpriser/resultater?area=28000&type=1&data=0

Broch, N. R., Sattrup, P. A., & Sejr, K. (2017). In Sejr, K. (Ed.), *Architecture creates value*. Danish Association of Architectural Firms.

Christiansen, E. M. (2020). *Tectonics and the city: In search of a critical perspective on assembling the city*. Aalborg University Press.

Czajkowski, M., & Budziński, W. (2019). Simulation error in maximum likelihood estimation of discrete choice models. *Journal of Choice Modelling, 31*, 73-85.

Determann, D., Gyrd-Hansen, D., de Wit, G. A., de Bekker-Grob, E. W., Steyerberg, E. W., Lambooij, M. S., & Bjørnskov Pedersen, L. (2019). Designing unforced choice experiments to inform health care decision making: Implications of using opt-out, neither, or status quo alternatives in discrete choice experiments. *Medical Decision Making, 39*(6), 681-692.

Freeman, A. M., Herriges, J. A., & Kling, C. L. (2014). *The measurement of environmental and resource values: Theory and methods*. RFF Press.

Hay, R., Samuel, F., Watson, K. J., & Bradbury, S. (2018). Post-occupancy evaluation in architecture: Experiences and perspectives from UK practice. *Building Research and Information: The International Journal of Research, Development and Demonstration, 46*(6), 698-710. https://doi.org/10.1080/09613218.2017.1314692

Hess, S., & Palma, D. (2019). Apollo: A flexible, powerful and customisable freeware package for choice model estimation and application. *Journal of Choice Modelling, 32*, 100170.

Heyman, A., Chen, X., Nowell, M. S., Manum, B., & Barton, D. N. (2017). Attributes of location and housing prices in Oslo: A monetary valuation with spatial configuration in mind.

Jensen, M. B. V., & Troelsen, M. (2017). *Adding value to the social dimension of sustainable building*

Jensen, S. R. (2018). Architectural strategies for promoting well-being in energy renovation of postwar social housing–progress report. *Technical Report Civil and Architectural Engineering, 6*(5), 30.

Johnston, R. J., Boyle, K. J., Adamowicz, W., Bennett, J., Brouwer, R., Cameron, T. A., Hanemann, W. M., Hanley, N., Ryan, M., Scarpa, R., Tourangeau, R., & Vossler, C. A. (2017). Contemporary guidance for stated preference studies. *Journal of the Association of Environmental and Resource Economists, 4*(2), 319-405. https://doi.org/10.1086/691697

Louviere, J. J., Hensher, D. A., & Swait, J. D. (2000). *Stated choice methods: Analysis and applications*. Cambridge University Press.

Lundhede, T. H., Panduro, T. E., Kummel, L., Ståhle, A., Heyman, A., & Thorsen, B. J. (2013). *Værdisætning af bykvaliteter-fra hovedstad til provins.* København: Institut for Fødevare-og Ressourceøkonomi, København Universitet.

Mariel, P., Hoyos, D., Meyerhoff, J., Czajkowski, M., Dekker, T., Glenk, K., Jacobsen, J. B., Liebe, U., Olsen, S. B., & Sagebiel, J. (2021). *Environmental valuation with discrete choice experiments: Guidance on design, implementation and data analysis*. Springer Nature.

McFadden, D. (1973). Conditional logit analysis of qualitative choice behavior. In Zarembka, P. (Ed.), *Frontiers in Econometrics*. Academic Press.

Mechlenborg, M., & Hauxner, K. (2021). Boligliv i højden: Ny viden om boligmiljø og socialt liv i de danske højhuse. Aalborg University Press.

Metrics, C. (2019). Ngene 1.2--user manual & reference guide, 2018. Choice Metrics.

Mulgan, G., Potts, G., Audsley, J., Carmona, M., De Magalhaes, C., Sieh, L., & Sharpe, C. (2006). *Mapping value in the built urban environment*. The Young Foundation.

Ossokina, I. V., Arentze, T. A., van Gameren, D., & van den Heuvel, D. (2020). Best living concepts for elderly homeowners: Combining a stated choice experiment with architectural design. *Journal of Housing and the Built Environment, 35*(3), 847-865.

Rid, W., Haider, W., Ryffel, A., and Beardmore, B. (2018). Visualisations in Choice Experiments: Comparing 3D Film-sequences and Still-images to Analyse Housing Development Alternatives". *Ecological Economics* 146, 203–217.

Sántha, E. (2023). Transforming the Harbour – The Role of Architecture in Creating Urban Life. In: F. Neuhaus (ed.) *AMPS Proceedings Series 30 – Cultures, Communities, and Design*. Calgary, Canada. 296-307.

Sántha, E., Hvejsel, M. F., & Entwistle, J. M. K. (2022). Tectonics of human well-being: Describing architecture in terms of constructed spatial gestures and their impact. *Architecture, Structures and Construction,* 1, 1-14.

Sántha, E., Hvejsel, M. F., & Rasmussen, M. K. (2022). Lost potentials?–Unpacking the tectonics of architectural cost and value. *Nordic Journal of Architectural Research,* 34*,* 1.

Sattrup, P. A. (2020). Documenting value creation: A business opportunity for architects, their clients and society. *Architectural Design, 90*(4), 22-29. https://doi.org/10.1002/ad.2586

SIMNA. (2018, February 20). Social value international: Accounting for value. https://simna.com.au/social-value-international-accounting-for-value/

Stender, M., & Jepsen, M. B. (2021). An outdoor living room: Balconies and blurring boundaries. In Stender, M. (Ed.) *Architectural anthropology*. Routledge.

Toppinen, A., Röhr, A., Pätäri, S., Lähtinen, K., & Toivonen, R. (2018). The future of wooden multistory construction in the forest bioeconomy – A Delphi study from Finland and Sweden. *Journal of Forest Economics, 31*(1), 3-10. https://doi.org/https://doi.org/10.1016/j.jfe.2017.05.001

Train, K. E. (2009). *Discrete choice methods with simulation*. Cambridge University Press.

Watson, K. J., Evans, J., Karvonen, A., & Whitley, T. (2016). Capturing the social value of buildings: The promise of social return on investment (SROI). *Building and Environment, 103*, 289-301.

Winther, A. H. (2021). Urban compact living: Making home in the city - An ethnographic case study of compact living in an urban Danish context. Aalborg University Press.

Chapter 4 | DISCUSSION AND CONCLUSIONS

Valuing Gestures? – An interdisciplinary view at the social and socio-economic value of architecture

This is the closing chapter of the dissertation. Presenting a short-term (3-year) industrial PhD research work, the dissertation started with situating the research within the wider academic discussion on improving existing frameworks and assessment approaches for evaluating architectural design based on the outcomes of design decisions; outlining the theoretical approach; and formulating the corresponding hypothesis, research questions, and objectives (Chapter 1). In Chapter 2, the applied research strategy was described in detail, comprising the research mode (industrial and interdisciplinary); the methodology; the applied research philosophy; and the research design. The dissertation reports the development and testing of the proposed interdisciplinary methodological framework by a collection of six scientific papers. Concrete findings of these studies, and how they link together, as well as the specific research methods applied, were already discussed within each of those papers.

Therefore, this chapter contains a critical reflection on the overall outcome of the research project. The first section summarizes the main and overall outcomes (section 4.1) according to the research questions outlined in Chapter 1. Then, adding to the outcomes of the research, the proposed methodological framework is evaluated here, in a sustainable urban development context by discussing the main concepts and the architectural theoretical approach employed in its development (section 4.2). This is followed by methodological reflections (section 4.3) based on the experiences and learnings from testing the proposed framework through the interrelated studies, combining architectural, anthropological, and economic perspectives. The section outlines the experienced challenges and the identified limitations of the research mode (subsection 4.3.1) and of the integrative approach applied in the interdisciplinary "translation" through a pragmatic research philosophy, and an embedded mixed method research design (subsection 4.3.2). The following section then presents some of the implications for practice (section 4.4) on the utilization of the proposed framework in the architectural design process, as well as how such frameworks as tools for design may shape the current and future architectural practice, and eventually the building culture. Furthermore, the section provides guidelines for the eventual utilization of the findings (from the testing of the framework) in the architectural design practice (subsection 4.4.1). The section also

gives an overview of future industrial research perspectives on the operalization of the proposed methodological framework in the architectural design practice, as well as an account of some of the alternative value mapping and valuation approaches (subsection 4.4.2), inspired by some of the parallel ongoing works closely related to the research presented in this dissertation. Lastly, the dissertation is concluded with some closing remarks (section 4.5).

4.1 Summary of outcomes

As outlined in Chapter 1, the goal of the research work presented in this dissertation was to investigate "*How, and to what extent we can describe and valuate architectural design based on its potential for value creation on the social dimension in a sustainable urban development context*". This entailed the development, testing, and evaluation of an interdisciplinary methodological framework to study and describe the link between architectural design and the social and socio-economic value of its qualities, thereby evaluating architectural design from a combined architectural, anthropological, and economic perspective.

The research was based on the identified industrial need for interdisciplinary strategies to inform the architectural design process. The need emerged from an experienced discrepancy between means and ends in architecture by AART, due to the characteristics of the contemporary building industry and a lack of appropriate approaches to qualify and justify architectural design choices.

The main outcome of the work is the proposed methodological framework, utilizing tectonic theory in practice, for understanding, quantifying, and reporting the social and socioeconomic value of architectural quality in a systematic way from multiple disciplinary perspectives. The framework was tested through three main interrelated studies (corresponding to each of the integrated perspectives) in a post-occupancy case study, involving two mixed-use building complexes designed by AART. By investigating specific design characteristics on a detailed level within a building scale, through the central notion of *spatial gesture*, tectonics was directly linked to the "human scale", enhancing its potential to emphasize the socio-spatial context and value of design and form. Thereby promoting an evaluative shift within the current post-occupancy evaluation practice to move away from assessing building performance, focusing predominantly on the technical aspects of building use. As well as, to move towards investigating the interrelations between the built reality and people, in combination with quantifying the contribution of the individual design solutions to their well-being, as key gestures to the various groups of end-users. Hereby evaluating the architectural design decisions made, eventually in relation to the resources applied in the construction.

The main body of the research (studies comprising the development, and the testing of the proposed framework via interrelated analyses) was presented as a collection of scientific papers within the present dissertation. The outcomes of these are summarized in the list below.

- Paper 1: Mapped the potentials and established a suitable methodological framework to assess the social and socio-economic value of architecture, thereby proposing a new, cross-disciplinary application of tectonic theory in architecture towards a "tectonics of cost and value".
- Paper 2: Described and analyzed spatial gestures from an architectural perspective, i.e. gestures intended by architects, in two building projects. The paper shed light on some of the lost value potentials within the design of those buildings. Consequently, the study drew attention to the importance of the explicit articulation of spatial gestures for architects, who try to negotiate these within the design process, with the objective to incorporate meaning in design, comprising its value and thus its quality.
- Paper 3 and 4: Described and analyzed spatial gestures "lived" by the end-users of the buildings and the surrounding urban public space, as a result of meaningful spatial dialogues. Paper 3 proposes to address gestures to specific user groups and encourage architects to learn from the practices and experiences of the users, from a phenomenological perspective, focusing on the complex interrelations between people and their built environment. Unfolding the key gesture of urban life, as a specific aspect of social and socio-economic value creation by architecture, Paper 4 highlights the importance of the nuances that contribute to increased well-being thereby discussing the role of architecture in it. The paper also drew attention to the possible challenges and weaknesses in terms of addressing user needs and designing exclusively for what is desired as a critique of participatory design and post-occupancy evaluation approaches.
- Paper 5 and 6: Expressed the welfare economic value of some of the architectural design characteristics of commercial office buildings (Paper 5), and apartment buildings (Paper 6) in a mixed-use, high-density neighbourhood, through the quantification of employee and residential preferences, respectively. Operating with a relatively small sample, the studies tested and collected the learning points about the application of the discrete choice experiment method within architecture on a case-specific level.

Outcomes from these studies seeked and answered the sub-research questions, thereby addressing the "how" of the main research question, i.e. "how […] we can describe and valuate architectural design based on its potential for value creation on

the social dimension in a sustainable urban development context". The following sections seek to elaborate on the "what extent" part of the same question by evaluating the tectonic framework through a methodological reflection, and by providing an account of the implications for its future use in architectural practice as well as its further development within future interdisciplinary research.

4.2 Evaluation of the methodological framework

Addressing the "what extent" part of the main research question, i.e. "[…] to what extent we can describe and valuate architectural design based on its potential for value creation on the social dimension […]", the proposed methodological framework is evaluated in this section in a sustainable urban development context by discussing the main concepts and the architectural theoretical approach employed in its development.

Within the research project, architectural quality was defined by the potential to create social and socio-economic value for different stakeholders, through their everyday life, i.e., through the interactions with, and the experiences of the architectural end-product comprising the built reality. In studying the relationship between design choices made by architects and the value of design for stakeholders within the proposed framework, *value* was investigated by an overall welfare economic understanding from an end-user perspective in the cases involved. Consequently, *social value* in the project was referred to as "understanding the relative importance that people place on changes to their wellbeing, and using the insights we gain from this to make better decisions" (www.socialvalueint.org, 2023.04.20). The marginal change in the well-being of end-users was thereby put in relation to the architectural design details on a building scale with the objective to support the future architectural decision-making in practice regarding the design choices made on the specific architectural instruments in the design process. Accordingly, the term 'socio-economic' referred to the overall economic perspective on value, which "builds on the foundation of economic value creation by attempting to quantify and incorporate certain elements of social value" (Emerson et al., 2001).

As such, a utilitarian approach to value was applied to the project, which assumes people themselves know what makes them "better of" and they make choices accordingly on the market as rational consumers aiming to maximize their own individual well-being (utility). In this constellation, it was assumed that the well-being of end-users, as a basis for social value, is observable and measurable through their preference for architectural design characteristics of their home, and workplace. While the utilitarian perspective does provide a way to move beyond the 'usefulness' (Dean et al., 2016) of architectural elements toward the embodiment of well-being,

it does it via measuring preference, and thus quantifying the value of the architectural characteristics, design elements involved in the study. The framework, as tested, proved to be successful in doing just that, so the resulting knowledge on the value of the specific architectural instruments can inform the future architectural design practice, comprising the research need of the project. In doing so, however, greater emphasis was eventually put on the physical design elements, which is a general criticism of tectonic theories (Hurol, 2022).

The socio-spatial context is also a perspective, tectonic theories ought to address in principle, as a critic of the functional determinism of modernism. In the framework, this was meant to be addressed by using the notion of gesture defined as a spatial dialogue to focus on the relationship between the physical design instruments as "carriers" of the gesture and their social value to end-users through their experience, thus better understanding the field of action of the architects in terms of how and what extent their gestures are communicated through the architectural form. The proposed framework provides the potential to study this dialogue by identifying and discussing gestures (as argued in Chapter 2), as those could be addressed more directly from an architectural and anthropological perspective via the narratives and practices of architects and end-users. In testing the framework, however, this potential was not fully utilized, due to the applied embedded mixed method design fitting to the specific interdisciplinary approach applied (elaborated under section 4.3 'Methodological reflections').

Furthermore, the economic valuation of those gestures was done indirectly, through the valuation of design characteristics, where the interpretation of gestures by end-users is bounded in the process of perception as a form of evaluation. As such, due to the overall economic perspective applied in the testing of the framework, the value of gestures was eventually integrated into the notion of utility. Consequently, the resulting value estimates from the economic analysis in the present research are not directly the actual gesture valued, or at least uncertain to what extent it is. Economically speaking, since the increase in one's well-being from a certain architectural instrument (comprising its social value) was measured indirectly, it is also uncertain to what extent value is actually based on utility. Maximizing one's utility as the *only* motivation for choosing a building to live in (as a resident), or work in (as an employee), might not hold in practice (Broom, 2001). The understanding of social value creation by architecture thus cannot be "reduced" to the quantification of the marginal utility gained from its properties, unless the utility itself and its relation to architectural design is explored. This is also in line with the current developments within economic theory, namely moving away from considering social value as "objective, fixed, and stable" towards understanding preferences and thus value not only subjectively, but also dynamically (Mulgan, 2010, p. 38). People learn through

their experiences and being exposed to matters and situations, which shape their needs and preferences, thus priorities and values change.

The advantage of using the framework is to simultaneously express the value of architectural design instruments in monetary terms and address it in a more phenomenological and descriptive way, overall through multiple – architectural, anthropological, and economic – disciplinary perspectives. By accounting for the needs and preferences of building users (comprising the social value of architectural design), the framework contributes to addressing the social domain of sustainability in design. Though, in order to encourage actors in the building industry to create a long-lasting design that is desirable and attractive for future generations as well, one would need to identify trends across the different user groups to map those "general" needs and preferences, which are not expected to change *significantly* over time. However, the ultimate objective of using the framework is not to be confused with "doing what people want", which equals "good design" or "quality design". This is, among others, because their preferences *are* subject to change (e.g. by time or by newly obtained experiences), and those preferences might be in conflict with other (e.g environmental) values (e.g. the use of recycled building material) in relation to architectural design, which architects need to address holistically in a sustainable development context. In their study, Mulgan et al. (2006) stresses, that the point of value mapping/valuation exercises in the built environment is to establish a dialogue between professionals (architects) and the public (end-users) in the design process. Such a dialogue, they describe, can potentially be established by better capturing the "less tangible things [for which markets do not exist] that people value from places" and thus "ensure these values receive greater prominence in future decisions on proposed developments" (Mulgan et al. 2006, p. 3), since they are currently often overlooked or underprioritized. Similarly, the purpose of the proposed methodological framework here is to establish a dialogue on social and socioeconomic value in the architectural design decision-making process, where the economically quantified values expressed in monetary terms fit the economic logic dominating the decision-making in the contemporary building industry. Thus it can serve as a point of departure for developing and discussing design concepts.

The evaluation of the proposed methodological framework is based on the learnings and considerations arising from its testing through the interrelated studies combining architectural, anthropological, and economic perspectives. The following section elaborates on those learnings and considerations, based on the experienced challenges, and identified limitations.

4.3 Methodological reflections

4.3.1 Overall reflections on the research mode

The present research was carried out in the form of collaborative research (between an industrial and two academic institutes) within the applied industrial research mode as "mode 2" research (Chapter 2). While this research mode allowed addressing the complex problem of the research, and that with immediate relevance to practice, it did require significant resources in the form of regularly scheduled meetings with the various stakeholder groups of the project (Table 1 in Chapter 2) to mediate between different objectives and interests as well as to qualify the work across the different phases of the project. However, due to these meetings, it is my evaluation that the collaboration worked efficiently and the multidisciplinary competencies from all parties proved to be well-matched for the project.

However, a limitation of the research project deriving from its short-term definition due to the industrial research mode is, that it leaves the concrete practical use and the possible integration of the researched framework into the everyday architectural design practice unexplored. Despite that all research projects must come to an end, greater commitment from the industry in research in the form of a long-term research strategy aiming to create a stronger link between the individual research projects would probably increase the value creation potential of the research itself for the company. Expanding the time horizon of research projects, especially when it intends to facilitate a paradigm shift in practice via introducing new or alternative approaches to design (in terms of decision support by information gained from research), is not to push the balance toward more theoretically heavy research in practice, but to maximize the potentials of industrial research in ensuring both its validity and applicability.

Involving multiple disciplinary perspectives in the research already increased the complexity and posed a considerable challenge to the project, especially within its short-term timeframe of 3 years. This also determined the need to apply an interdisciplinary approach, combining perspectives in an integrative way. Implications of this approach include the inherent transgression of the disciplinary boundaries of architecture, anthropology, and economics, thus transforming and adjusting their existing practices and methods to fit the interdisciplinary objectives of the project. Though, as described earlier (in Chapter 2.1.2), this was done to a different degree (due to the professional and educational background of the researcher), introducing a bias towards the economic perspectives and its applied method in valuating benefits from a given architectural design for building users. In doing so, the architectural and anthropological analyses were more significantly tailored and transformed (in terms

of the applied methods and logic) from how they are usually defined and performed within their own disciplinary boundaries (as presented in Chapter 2, section 2.4 'Research design'). Analyses from architecture to economics, through anthropology in this research followed the "red thread" of 'key intended gestures' (identified by the architects in the first, architectural analysis) as hypotheses of what creates value for users, thereby applying a semi-deductive logic for studying the user's perspective (hence, an anthropological view) on these gestures. This approach inherently limits the possibilities for hypothesis generation inductively, i.e. following the lead of the informants and letting them guide the research to eventually problematize dilemmas on a greater (society) level in relation to design, such as green areas, public space, gentrification, and safety (touched upon in Paper 4), which is otherwise the main logic and objective of qualitative research within anthropology.

Further implications of the methodological choices made in relation to the integrative approach applied in the interdisciplinary "translation" through a pragmatic research philosophy, and the embedded mixed-method research design are elaborated below.

4.3.2 Interdisciplinary research guided by pragmatism using an embedded mixed method design

A certain level of limitation incorporated in the value definition applied in this research by assuming a linear and causal relation to architectural quality was already addressed in the discussion of Paper 1 within Chapter 2. Therefore, the emphasis in this sub-section is on the experienced challenges and identified limitations in relation to the interdisciplinary "translation" of gestures between the interrelated studies, continuously integrating architectural, anthropological, and economic perspectives within the testing of the proposed methodological framework.

Integrating architectural, and anthropological perspectives

Building on the phenomenological and practical perspectives of architecture, introduced in Chapter 1, architecture can be described as "the use of creative thinking and design to create new products, environments, and activities, that generate the highest possible value experienced by as many stakeholders as possible with wise and responsible use of resources – ideally in a global perspective" (Sattrup, 2020 p. 107). This entails that architecture as a discipline is, or should be, "self-critical" and transformative, i.e. open to ideas that come from other fields and/or actors involved in the design process or affected by its outcome, that is the built reality.

From an anthropological perspective, the value potential of architecture, based on the same phenomenological approach, can be described by the interrelations

between architecture and people, who consciously and unconsciously experience and interact with architecture within that built reality. Within anthropology, knowledge of this relation is constructed from multiple realities, which are subjectively defined through one's perception, interpretation, or experience of it (Johannson, 2018).

Due to the similar perspective (phenomenology) present in both architecture and anthropology, which probably also contributed to the emerging interdisciplinary field of architectural anthropology (Stender, 2017), it was easier to integrate architectural and anthropological perspectives in the framework, i.e. to translate from *intended* to *lived* gestures in the research project. Though it was discovered in Paper 2, that in practice, architects are not necessarily used to the explicit articulation of gestures, i.e. relating the chosen architectural instruments to practice by describing *how* a specific architectural design element contributes to the development of a desired experience, activity, behaviour, or environment. It was also pointed out by Fabian (2016), that modern architecture is struggling to integrate 'the social factor' into architectural design. Similarly to architects, it was also discovered in Paper 3 of this research, that the end-users of the building are generally not used to describing their practices and experiences specifically relating them to one or a constellation of architectural design elements. This could probably be explained by the study of Ballantyne (2011), who argues, that the architectural design of buildings comprising the built environment is rarely in the focus of our attention as 'habitants', rather they are the 'habituated background' for our everyday life, influencing us and our practices unconsciously.

These findings might point towards the importance of deriving qualitative data not only from interviews but also through observations to better analyse the link between the *what* (architectural instruments) and the *how* (practice and behaviour), which otherwise seems to be challenging to describe both for architects as well as occupants of the building. In the qualitative studies (comprising the anthropological dimensions for testing the proposed framework) of the present research, only interview techniques were applied as a method for qualitative data collection. In doing so, the exploration of the interrelations between space and place, the architectural design and people, was limited to the identified key spatial gestures intended by architects in the selected cases, forming the basis of the semi-structured format for the interviews. This resulted in a number of assumptions/hypotheses on how the individual instruments were believed to create value according to the architects' intention (intended gesture) and those perceived through the narratives of the occupants' everyday life (lived gesture) situated in, and around the studied buildings. Nevertheless, these hypotheses, based on the findings from the studies on intended gestures (Paper 2) and lived gestures (Paper 3 and Paper 4), provided the basis for identifying relevant architectural instruments to include (those that potentially are or

could be of value to the occupants) in the choice experiment in translating from architecture to economics.

Integrating architectural, and economic perspectives

In a sense, it was relatively easy to integrate architecture and economics, at least in terms of finding an argument for the quantitative inquiry of the economic dimension within the testing of the framework. This is probably due to the inherently interdisciplinary nature of the architectural discipline (Groat & Wang, 2013), being used to draw both from subjective interpretivism (architecture or art) and objective positivism (architectural engineering).

A challenging aspect in the translation of spatial gestures from *intended* to *valued* was however regarding the specification of the level of detail to be captured in the valuation, on and within the building scale. Using the notion of gesture from tectonic theory, it was argued throughout the research that it allows for investigating and critically discussing the details of design comprising its quality as a result of strategic choices made in their construction across scales (Sántha, Hvejsel, & Rasmussen, 2022). The contextualization of construction through these choices is thus central to architecture.

Consequently, arguments for a more detailed description (and thus a potentially more realistic visualization) of the architectural instrument were, that it is the fine details and nuances that comprise and carry the specific meaning (the intended spatial gesture of the architect) of an architectural work and thus its value, in a given context. Choosing a more detailed approach however would have been more challenging in terms of finding an appropriate (relatable) payment vehicle to include in the choice experiments, thus potentially losing the possibility to express value in monetary terms, an explicit objective of the research in aiming to improve the existing approaches for evaluating architectural design quality.

Arguments for a more general (conceptualized) description, and thus a more abstract visualization of the architectural instruments (see in Paper 5 and 6) were, that it is considered a better fit to inform the architectural practice. This is because in this way they can feed into the process of defining visions in future projects as inspiration/reference (best practice approach), without parametrizing them too much, thereby constraining the creative work of architects in refining and contextualizing their concepts. For example, in pursuing a more conceptual approach, the size of the window (in relation to the wall) was included in the economic analysis, but its shape, or how it "sits" in relation to the surface was not. Even though, that these characteristics, in the case of 'The Warehouses', were indeed identified by the architect as a gesture to soften the "*heavy look*" of the building by "breaking the

volume of the buildings' mass" (Sántha, Hvejsel, & Rasmussen, 2022, p. 100) apart from its functional quality to provide natural light for the room.

As also argued in Papers 5 and 6, the resulting dominant reason for choosing the more general approach was, in case of the future use of the results, to allow the architects to specify the details for each project "freely", as a field of creative experimentation to construct different design scenarios, using the valued architectural features as a point of departure. Furthermore, it gives room for the architects to potentially address other aspects of sustainability (e.g. environmental), and thus incorporate other values in design apart from the social. A more conceptual approach in the design of Discrete Choice Experiments of architecture on, and within the building scale can facilitate such a dialogue regarding the "soft" (less tangible) values of architecture (section 4.2) and was suggested for future DCE studies aiming to express the monetary value of architectural features in Paper 5 and 6.

Integrating anthropological and economic perspectives

The translation of gestures from *lived* to *valued* and thus the integration of an anthropological perspective to economics in the proposed interdisciplinary framework seemed to be the most challenging, given the mutually exclusive world views of the two scientific domains. Nonetheless, the objective of the research was not to feed the antagonistic relation between the two but to pragmatically connect the two by utilizing their advantages and using them strategically to supplement each other's weaknesses to best address the research problem in its complexity. Guided by the pragmatic approach, the potential link used between anthropological and economic perspectives was that value is defined by people, based on their experiences and practices. While within the anthropological domain, emphasis was put on exploring this relation through semi-deductive knowledge acquisition, within welfare economics, the quantification of value was done through modelling the choices and trade-offs people make, based on their experiences and behaviour (Freeman et al., 2014; Johnston et al., 2017) as a deductive way of combining theory and data.

For this combination, it was ultimately assumed, that people themselves know what they like best (possibly with some uncertainty which is accounted for but not explored), and that they make rational decisions according to what gives them maximum utility (McFadden, 1973). Due to this assumption, a general limitation of preference studies within welfare economic valuation methods is, that the underlying motivations for choice often remain un-, or underexplored as the focus is on the physical good itself (the building) and its properties (architectural characteristics). This limitation was also acknowledged under the section for evaluating the framework proposed within this research (section 4.2). There, it was also mentioned, that to

address this, and thus to provide a more detailed contextual understanding of people's possible choice behaviour, investigating the anthropological dimension of gestures through the narratives of end-users and architects. However, it is furthermore acknowledged, that the potential to explore the socio-spatial context was not fully utilized in the present research, because the anthropological approach within the testing of the framework did not comprise observations. Consequently, it was inherently limited by the semi-deductive approach applied to its exploration. Nevertheless, it is still considered an important empirical link in the interdisciplinary "translation" of gestures between architecture and economics.

Accumulated considerations

To sum up, the test setup of the framework in terms of the chosen methods according to an interdisciplinary approach aiming to integrate architectural, anthropological, and economic perspectives pragmatically, generated some challenges. These were inherent to the tensions in the underlying philosophies of the disciplines as well as in the different subject-object focus within them. Consequently, the interdisciplinary approach applied in the testing of the proposed framework resulted in limitations compared to a multidisciplinary approach, where each dimension can be explored to a greater depth according to the disciplinary rules delimiting the research philosophy and specific research methods to be used. This would however require greater resources as well, both in terms of time (length of the research) and human resources (specialized researchers). Considering that this was industrial research, these factors had to be considered as well. An integrative approach in the context of the present research allowed effective and efficient testing of the framework in a holistic system perspective, where results from the individual studies directly "fed" into each other. Thereby it was possible to continuously evaluate, validate, and interpret the findings across different disciplinary perspectives. Furthermore, the strengths of such an integrative approach to the present interdisciplinary research from an academic perspective lie in its ontological logic to potentially drive change in the current practices. In the context of the present research, for architecture, this means moving towards the more nuanced quantification of value potentials and a more explicit expression of those potentials (linking the *what* and the *how*) in the architectural rhetoric, and design practice. For anthropology, it reinforces the importance of participant observation as the way to work *with* end-users in uncovering the rich contextual experiences of the built reality as "lived" in comparison to the possibilities of living (dwelling). Lastly, for economics, it means emphasizing the subjective nature of social value (Mulgan, 2010), possibly moving to a direction where value estimates in relation to architectural design to describe the impact of design decisions need to be accompanied by detailed descriptions of what lies behind the value, i.e. to address utility more directly, in relation to the specific architectural instruments.

4.4 Implications for practice

Findings from the interrelated studies provided support for the conceptual premise that there is a demonstratable link between architectural design and the economic value of its qualities, which can simultaneously be quantified and unfolded through qualitative approaches within the proposed interdisciplinary methodological framework. This section presents some of the implications for practice on the eventual utilization of the findings from testing the framework, as well as integration of the use of the framework in the future architectural design process. Thereby, the discussion here taps into the architects' dilemma of the use of such tools and how these may shape architectural practice, and eventually the building culture in the future. The section also gives an overview of alternative value mapping and valuation approaches, acknowledging some of the parallel ongoing research works closely related to the research presented in this dissertation.

In practice, architecture comes with constraints, requirements for sustainability, and other interests from multiple stakeholders entering the design process. Consequently, architects need to prioritize and optimize design solutions through consolidated decisions, based on the best available information, which might exceed the architects' field-specific knowledge, as the industry becomes more and more complex. For this, it was outlined in Chapter 1, that there is a need for cross-disciplinary approaches to inform the architectural design process, based on knowledge from research.

From a combined architectural and building engineering perspective, Jensen (2022) described several different *architectural* strategies to inform the design process, under a Research Informed Design framework, on social value (in terms of well-being) in relation to the environmental values (in terms of energy renovations) comprised by sustainable architectural design. Jensen identified these strategies along a spectrum, ranging from intuitive qualitative approaches to quantifiable metrics intended for computer simulations (Figure 8).

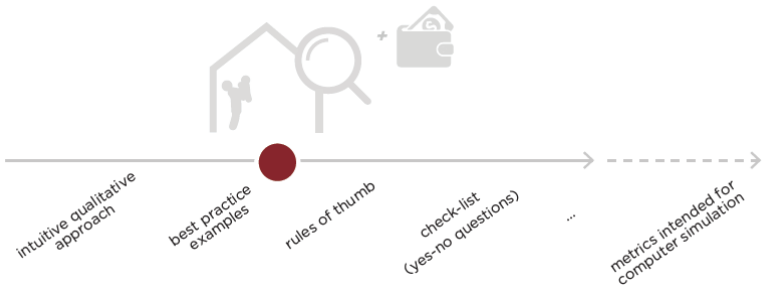


Figure 8. Combining qualitative "impact cases" with economic valuation as a "best practice example" approach to inform the architectural practice as proposed by Jensen (2022). (Source: Jensen, 2022, p.181)

According to Jensen, the concept of informing the process through qualitative studies as 'impact cases', which are supplemented with economic valuation as a quantitative approach, can be characterized as "best practice example" strategy on this spectrum. Jensen already identified this type of strategy within a RID framework, even though such strategy is also the main logic applied in traditional POE studies, i.e. acquiring feedback on user satisfaction and well-being and feeding this information back to the internal learning loops of design in a Building Performance Evaluation framework.

By investigating specific design characteristics on a detailed level within a building scale, through the central notion of spatial gesture applied in the proposed methodological framework, this research also promoted an evaluative shift away from a classical BPE framework. Comprising knowledge from research, gained through multiple disciplinary perspectives, which thereby comprises both quantitative and qualitative methods to map and report the social and socio-economic value potentials of architecture, the tested interdisciplinary framework can be considered flexible to apply in different project contexts in practice. Depending on the stakeholders involved (with the various requirements and interests they may present) in the design process of a given project, different forms (qualitative or quantitative) of arguments, and types of information strategies can prove to be successful. The various requirements and interests present in the design process can therefore define how to address the gap between means and ends, that is to effectively release the value potentials.

In case the context allows an "authority" of architectural creativity, that is to emphasize the phenomenological perspective, architects may rely on the more intuitive qualitative approaches from the above-presented architectural strategies. Utilizing the proposed methodological framework in such a project context, the same

phenomenological approach can be applied by adjusting the methodology to emphasize the anthropological perspectives (Figure 2, concept no. 1), focusing on the specific articulation of value potentials (in the form of intended gestures) based on knowledge gained from previous post-occupancy cases as "best practices" on the complex interrelation between people and the design. Thereby improving the activation of the architects' own field-specific knowledge of value creation, through design, in the project.

However, due to the increased complexity present in the contemporary building industry, which also led to the rapid development of computer technology (thus computer-aided design and various software-based tools), decisions in the design process are often based on quantitative information. The same process is also largely dominated by economic considerations. Consequently, it is a general tendency among architects to move towards "numbers" and computer simulations on the spectrum of information strategies. It is also an experience of AART, that intuitive qualitative approaches, relying exclusively upon the architects' own field-specific knowledge and experience, is often "weak argument" for specific design solutions in most projects within the contemporary building industry. Hence their strategic focus on measurable and accountable value creation through the establishment and development of a multidisciplinary 'Impact Team', and their motivation to financially support the industrial research presented in this dissertation. This tendency and experience not only comprised the research need for the development of a methodological framework for understanding and quantifying value potentials in design from multiple disciplinary perspectives, but also to adjust the testing of the framework accordingly, by putting more emphasis on the economic dimension. That is because it has the potential to provide not only quantified value estimates but those expressed in monetary terms. Thus, effectively providing support for decision-making in the contemporary design process for justifying design solutions (those with a high potential for social value creation), which traditional POE methodologies have failed to provide.

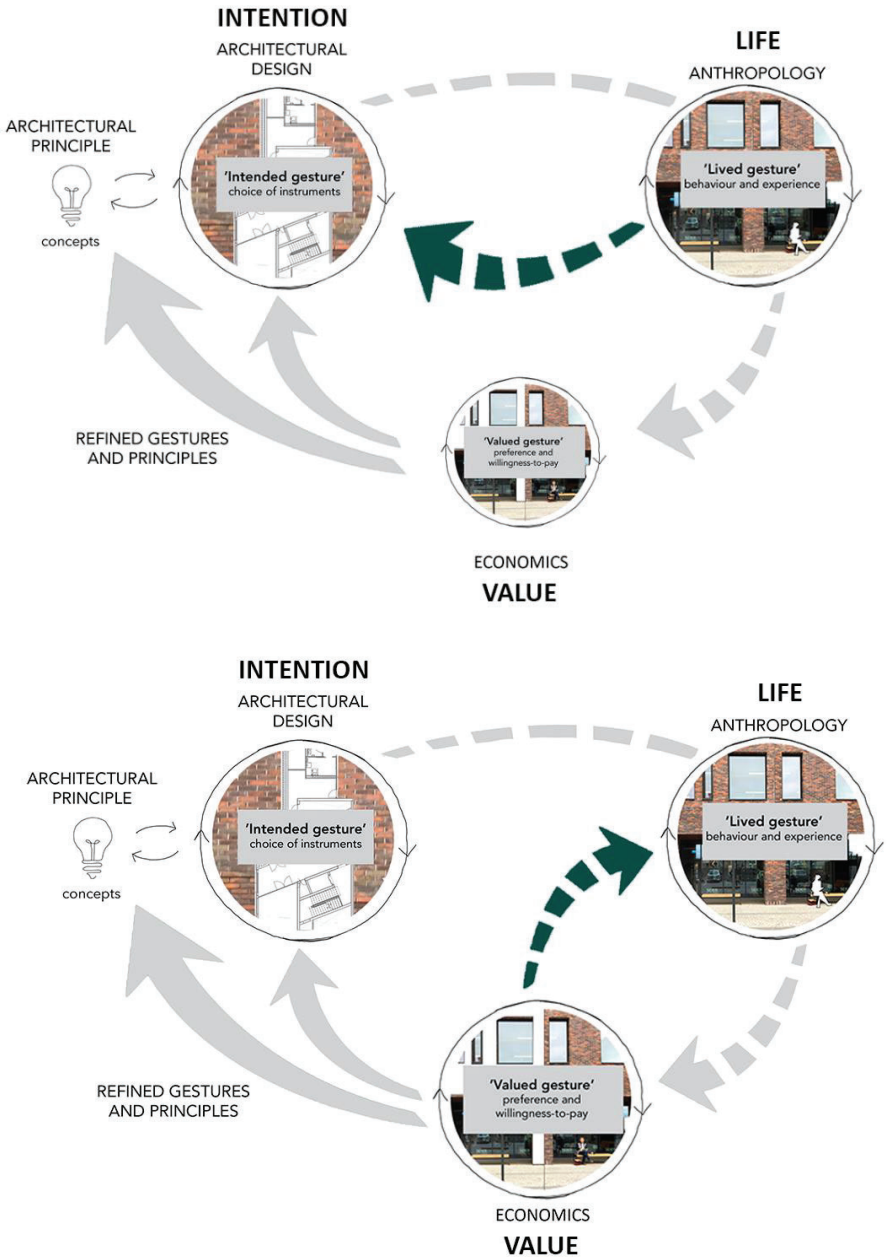


Figure 9. Alternative setups of the proposed methodological framework. Concept no. 1 (top) places a larger emphasis on the anthropological dimension and the interrelations to architecture. Concept no. 2 (bottom) places equal emphasis on all dimensions but with an extra "feedback loop" between the anthropological and economic dimensions.

In these cases, where architecture is "forced" to comply with the rules of "business" and apply a more positivist approach (accepting/rejecting hypotheses) with quantified methodologies towards expressing the value potentials of architecture might prove to be more successful. This however entails focusing on architectural design as a multidimensional problem-solving exercise, aided by quantitative data and potentially software-based tools. This approach towards architecture, however, "struggles" with the classical, phenomenological approach, and architects might feel distanced from what is at the core of the architectural discipline, the careful detailing and creative experimentation with forms and materials.

This consideration feeds into a dilemma of whether and how far architects are willing to move towards such design approaches, that potentially limit, or modify what architecture and thus the task of the architect is, according to the architects themselves. Maybe, the question should rather be how to find the balance between the application of the different information strategies along the spectrum of the more qualitative and the more quantitative methods (and thus the emphasis on the anthropological and/or economic perspectives) and find the appropriate approach to apply in each context pragmatically. This however raises the question of where the balance is, as well as whether there is a "threshold" where the architects can process interdisciplinary information from complex frameworks without compromising what traditionally lies in the core of architecture.

A pragmatic interdisciplinary approach toward architecture would also require the architect or the researcher/analyst, as a consultant in the design process, to be aware of the different definitions of 'value' when "transcending" between the different disciplinary perspectives (due to the different underlying philosophies), as well as of the particular strengths and limitations of the specific methods applied in those. Consequently, accumulated findings from the interrelated analyses of this research, as part of testing the interdisciplinary methodological framework, to inform design decisions in future projects should therefore be utilized with caution. The experienced challenges and identified limitations of the methods applied in testing of the framework through an integrative approach (in section 4.3) might be a "slippery slope" towards a potential misuse of the value estimates.

4.4.1 Towards tectonics of cost and value – A slippery slope?

As a prolongation of the above dilemma, the question could be raised whether it is "right" to comply with the rules of business within architecture. That is to promote the utilization of methodological frameworks, where quantification is the end goal, and the economic dimensions receive the emphasis. Even if they are thought as and developed to aim for the provisioning of quantified measures that can possibly shape

the contemporary building culture significantly, without suppressing the qualitative dimensions of architecture. The understanding of social and socio-economic value creation that falls within a linear economic logic, is risking architecture to become "victims" of this inherent premise. And thus, even unintentionally, but contributing to shaping the industry to be a "number game", where knowledge from quantitative research methods is the commonly accepted objective "truth" which provides *the* strong argument for specific design solutions in the decision-making process.

This standpoint is not to invalidate the importance of economic quantification of social value in relation to architecture by using the proposed framework, but to clarify, that it does not provide a "magic number" as the ultimate argument for design decision-making. This should be emphasized in order to avoid potential misinterpretation and misuse of the results on 'value' from the present research. The value of architectural design instruments estimated here are utility-based theoretical values expressed in monetary terms which reflect the preferences and priorities of the end-users. These value estimates are expressed by people's 'willingness-to-pay' in a hypothetical market setting based on welfare economic principles and econometric modelling. Consequently, they cannot be used directly as an "add-on" to the actual market price, e.g. by increasing the selling price of apartments in the studied mixed-used neighbourhood, as that would probably lead to other, socio-demographic challenges on an urban level, such as gentrification (also pointed at in Paper 4). Also, preference for a certain level of characteristics (e.g. for the biggest window size) was quantified relatively to a pre-defined baseline and to the other design characteristics, and thus to the whole. Consequently, the calculated value of the individual design instruments is to be interpreted in relation to the other instruments/characteristics included in the valuation exercise. This also implies, that deriving the value potential of different architectural instruments dynamically in the design process, in terms of including and excluding design elements to and from the valuation exercise, has limited flexibility. This, however, does not mean that it cannot provide effective support for concept development. In fact, it can serve as a point of departure for discussing different design concepts, based on various constellations of the same set of design elements, by helping the architects to prioritize and optimize the details of those elements (level of design characteristics). By looking at the trade-offs between those, it can also be shown where to compensate for potential value losses due to some predefined design elements, given the context of the specific project. For this purpose, Ossokina et al. (2020) developed the 'consumer toolbox' for visualizing value estimates for a dynamics assessment of the different architectural design concepts.

Regarding the use of the proposed methodological framework as a RID practice, it is not advised to apply it for the evaluation of architectural quality on a case-specific

level, but based on a collection of cases (e.g. by building typology). It can already be seen as a problem in the current POE approaches, that their case-specific application lead to a fear of obtaining bad results/reviews on the specific project (Hay et al., 2018). This is part of the cause for the low take-up of POE-type activities in actual architectural design practice (Hay et al., 2018), as it is often only applied in cases where a rather positive "story" is expected as an outcome. But efforts for understanding and reporting on the value potentials of architecture from an end-user perspective should not only be applied to cases where we think results will be good, i.e. the design is "satisfactory", as some kind of "certification" from the end-users on the social sustainability of buildings. Similarly to the phenomenon of "green washing" (which refers to "a practice of making products, here in the context of architecture, look and feel greener and more sustainable than they necessarily are in order to harvest the financial gain that comes with a sustainable and green appearance" (Christiansen, 2020, p. 34)) this probably gives a place for a potential "value washing" or "impact washing", which is to "enlarge", and focus on the positive side of impacts and value potentials of architecture. Apart from possibly leading to unified design solutions, such an approach does not fully utilize the learning potential from previous designs, thereby further limiting the capabilities for improving its quality.

Aspects in relation to sustainability and livability fall typically easily under a practice of indicator-based score-sheet evaluation approaches with benchmarking, contributing to the 'international ranking obsession' based on economic and political considerations reflecting a 'prosperous city' perception (Nielsen, 2019; Simpson & Weiss, 2019). The reason why it is relatively easy to fall into that practice is possibly due to the complexity of such concepts (sustainability and livability) and their various aspects, which makes them hard to define in a specific context. It has therefore been argued by Weiss (2019) and Nielsen (2019), that part of the problem is that their WHAT (what is good) and WHO (for whom) have never been specified, whereas they should be defined for each context (Nielsen, 2019). The same should apply to value mapping and valuation approaches of architecture as a POE-type activity within the social dimension of sustainability.

This is also why the proposed methodological framework here was developed with the integration of anthropological perspectives with both the architectural and economic ones. Thereby aiming for the provisioning of quantified measures that can possibly shape the contemporary building culture significantly, without suppressing the qualitative dimensions of architecture. Though, for this to achieve, a more iterative process between the understanding (from an anthropological perspective) and quantification (from an economic perspective) of social value within the framework would probably be needed in terms of addressing value creation more holistically within a social sustainability context, that is not necessarily by architecture

alone but via the multidimensional interaction between people themselves and with their built environment. A corresponding possible adjustment of the methodology applied within the framework is presented in Figure 2 (concept no. 2). Further future perspectives for researching the barriers and solutions for operationalizing the proposed methodological framework in the architectural design practice, as well as an account of some of the possible alternative value mapping and valuation methods which can possible, be applied within the framework are outlined in the next section.

4.4.2 Future industrial research perspectives

As outlined at the beginning of the section, the type of knowledge needed to inform the practice on social and socio-economic value may vary depending on the project and its context. Due to the unexplored potential of the application of the framework in practice, future research is advised in testing it on different building typologies, involving different end-user groups, and using alternative qualitative and quantitative methods for mapping and reporting on the social and socio-economic value potentials in architecture.

There are a number of alternative approaches for integrating architectural and anthropological, as well as architectural and economic perspectives and methods for describing and quantifying those value potentials. Some of the parallel ongoing research projects are focusing on these guided by the same visions, that is to improve the existing POE methodologies, and the evaluation of architecture based on its potential for a positive impact on society and value creation for its end-users. Integrating architectural and anthropological perspectives, the Industrial PhD project of Mia Kruse Rasmussen at AART and Aarhus University is focusing on 'Social Commissioning' as an alternative approach for exploring and describing the entanglements between practices and building performance in relation to social value creation (Rasmussen, n.d.).

Integrating architectural and economic perspectives, the Industrial PhD project of Vibeke Grupe Larsen at the Danish Association of Architectural Firms and the University of South Denmark is aiming to contribute to the development of a circular approach within the social housing sector, investigating the comprehensive environmental, economic and social co-benefits of architectural efforts supporting the design decision-making with evidence-based knowledge (Larsen, n.d.). Larsen's project is a good example of socio-economic value mapping and valuation approaches on a macro level, which allows for addressing overall sustainability concerns in relation to architecture, by investigating what is good for society, instead of individuals. Promoting the development of a 'Social Life-Cycle Assessments' (S-LCA),

the valuation approach applied in her project is based on the calculation of 'Social Return on Investment' (SROI). SROI has been identified as the most developed method to apply with a robust framework for implementation, based on a review in Watson and Whitley (2016), of measures to account for the impact of products, here architecture. The calculation of SROI is based on a traditional 'Cost-Benefit Analysis' (CBA) frequently applied in economic evaluations, which assigns a monetary value to social returns (value) via a range of financial proxies, and socio-economic indicators compared to the investment costs to determine the SROI ratio (value:cost) (Watson and Whitley, 2016). This method for quantifying the socio-economic value and impact of architectural design is probably more relevant for projects developed by public agencies, where it can provide important information on whether to forgo a specific project (in case the SROI ratio is larger than 1), as well as on how to prioritize between building projects, based on their overall value creation potential/positive impact, compared to costs (projects with the biggest SROI ratio).

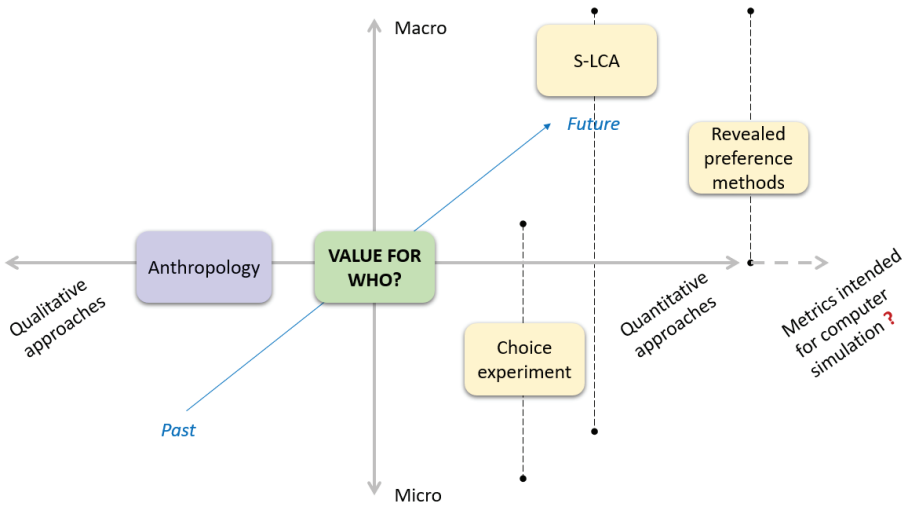


Figure 10. Result of the exercise from a workshop with Vibeke Grupe Larsen, and Peter Andreas Sattrup from the Danish Association of Architectural Firms, as well as Johanne Mose Entwistle from within AART. During the exercise, we discussed the placement of the different value mapping and valuation approaches on the axes of scale (micro/macro) and approach (qualitative/quantitative), departing from the central question of what is value, and for whom.

On a more micro-level, focusing on the quantification of benefits gained by increased architectural design quality, preference-based methods are generally a better fit (Figure 10). A number of reasons for choosing the stated preference method, choice experiment, for the economic analysis within the testing of the proposed framework in this research were provided in Papers 5 and 6. Due to the massive amount of data

needed for carrying out a revealed preference study, these, especially on/within a building level are very rare (for example see Turan et al. (2020), who quantified the value of daylight in office buildings). Though, as these estimations are based on actual market behaviour, results eventually provide "harder" economic evidence when and if needed to be used in future design decision-making processes via socio-economic analyses. However, further research on this would be needed.

The above-outlined methods can all be tested within the proposed methodological framework (on the anthropological and economic dimensions respectively), and compared, thereby possibly concluding which methods are best to apply within those dimensions, depending on the different characteristics of a given project (scale, segment (building typology), design phase, target group (end-users), etc.), and the available resources (both in time and competencies).

Based on the research work of Jensen (2022) and Larsen (n.d.), the social housing sector and renovation projects seem to have a unique potential to facilitate future valuation studies and value mapping approaches. This is due to the established practice of stakeholder involvement in the design process, where end-users of the buildings are relatively well-known (socio-demographically). Furthermore, residents in social houses are also investors in the renovation of those, and thus their satisfaction (in terms of accommodating their preferences and needs) with the resulting new/improved design of the building is a success criterion for the project. These future studies could also look into value creation for the different types of stakeholder groups, and possibly collect the findings in a knowledge database to compare, and identify general tendencies.

Questions regarding the possible barriers and solutions for operationalizing (effectively integrating) the proposed methodological framework in the architectural design practice remain unanswered from the findings of this research, as the framework was only tested in a retrospective assessment of selected cases, post-occupancy. In this regard, future research questions include how the different alternative setups of the framework (in terms of the different emphasis on its dimension, as suggested in Figure 9, as well as the specific method applied within those) perform in an actual decision-support setting, i.e. informing the design of ongoing projects in different segments, scales, and design phases. Potential challenges and barriers to operalization may relate to the different educational backgrounds, mindsets, and individual practices within an architectural company, which need to be considered, otherwise, the uptake and wide-range utilization of new approaches could fail. Further research, possibly in the form of in-depth qualitative research (see e.g. van der Linden, 2019) or 'research through design' studies (Jensen, 2022), should be undertaken to investigate how all the new knowledge created by

research from multiple disciplinary perspectives can "translate" back to architecture and get integrated into design thinking and practice.

4.5 Closing remarks

Using a systematic and interdisciplinary methodological framework with qualitative insights and quantified measures to assess the value creation potential of architecture allows the architects to experiment with different design concepts and see what constellation of architectural instruments (comprising spatial gestures) works and what does not in reality. This conscious focus on the nuances of design, studying the potential effect of small incremental adjustments, can possibly clarify and strengthen the arguments for specific design solutions which may expand the architects' scope of action in the design process. While on a broader perspective, this may contribute to shaping the contemporary building culture, mapping, describing, and reporting on the social and socio-economic value potentials of architectural qualities it does not automatically mean that they can or will be considered in construction budgets.

Value creation on the social dimension of sustainability was addressed in this research from an end-user well-being perspective, which only comprises one of the three aspects of sustainability. This means that what is valuable to individuals or specific user groups, is not necessarily valuable for society, e.g. in terms of environmental or economic sustainability, on a macro scale.

Without the aim to address the comprehensive issue of sustainability in its complexity in relation to the long-term impacts of architecture, the project contributes to the development of the current architectural practice by describing architecture at the intersection of 'what it is' and 'what it does'. The research provides a new interdisciplinary research strategy (that is the developed methodological framework itself) along with guidelines (based on the findings from testing the proposed framework) to inform the practice on the social and socio-economic value of architectural design in an urban development context. Thus, it potentially contributes to narrowing the gap between means and ends, and to optimizing the use of resources in construction. This, by enhancing the architects' ability to translate from cost to value in architecture potentially needed for justifying and qualifying their design choices in the design process of the contemporary building industry. Thereby potentially securing architecture's capacity for value creation on the social dimension of sustainability, encouraging other actors in the building industry to create a long-lasting design that is desirable and attractive for future generations as well.

References

Ballantyne, A. (2011). Architecture, life, and habit. *The Journal of Aesthetics and Art Criticism,* 69(1), 43-49. DOI:10.1111/j.1540-6245.2010.01445.x

Broome, J. (2001) Economics and Ethics. In N. J. Smelser & P. B. Baltes (Eds.) I*nternational Encyclopedia of the Social & Behavioral Sciences*. Pergamon. DOI:10.1016/B0-08-043076-7/01025-1.

Christiansen, E. M. (2020). *Tectonics and the city: In search of a critical perspective on assembling the city*. Aalborg University Press.

Dean, E., Elardo, J., Green, M., Wilson, B., & Berger, S. (2016). *Principles of Microeconomics: Scarcity and Social Provisioning*. Open Oregon Educational Resources.

Emerson, J., Wachowicz, J., & Chun, S. (2001). Social Return on Investment (SROI): Exploring Aspects of Value Creation. Working Knowledge: Business Research for Business Leaders (Archive). Harvard Business School. Available at: https://hbswk.hbs.edu/archive/social-return-on-investment-sroi-exploring-aspects-of-value-creation#3

Fabian, L. (2016). The spatial, the social and the architectural. In B. B. Jensen, & K. L. Weiss (Eds.), *Art of many, the right to space: The danish pavilion - bienniale architettura 2016* (pp. 189). DAC, The Danish Architectural Press.

Freeman, A. M., Herriges, J. A., & Kling, C. L. (2014). *The measurement of environmental and resource values: Theory and methods*. RFF Press.

Groat, L. N., & Wang, D. (2013). *Architectural research methods* (2nd ed.). Wiley.

Hay, R., Samuel, F., Watson, K. J., & Bradbury, S. (2018). Post-occupancy evaluation in architecture: Experiences and perspectives from UK practice. *Building Research and Information: The International Journal of Research, Development and Demonstration*, 46(6), 698-710. DOI:10.1080/09613218.2017.1314692.

Hurol, Y. (2022). *Tectonic Affects in Contemporary Architecture*. Cambridge Scholars Publishing.

Jensen, S. R. (2022). *Architectural strategies for promoting well-being in sustainable renovation of social housing*. Aarhus University Press.

Johansson, J. (2018). *Evaluering og arkitektur: Brugere, interview, analyse og fænomenologi* (1st ed.). RUM.

Johnston, R. J., Boyle, K. J., Adamowicz, W., Bennett, J., Brouwer, R., Cameron, T. A., Hanemann, W. M., Hanley, N., Ryan, M., Scarpa, R., Tourangeau, R., & Vossler, C. A. (2017). Contemporary guidance for stated preference studies. *Journal of the Association of Environmental and Resource Economists,* 4(2), 319-405. DOI:10.1086/691697.

Larsen, V. G. *Circular transition of social housing.* ResearchGate*.* Retrieved January 2023, from https://www.researchgate.net/project/Circular-transition-of-social-housing-Generating-environmental-economic-and-social-co-benefits-by-design

McFadden, D. (1973). Conditional logit analysis of qualitative choice behavior. In Zarembka, P. (Ed.), *Frontiers in Econometrics*. Academic Press.

Mulgan, G. (2010). Measuring Social Value. Stanford Social Innovation Review, 8(3), 38-43.

Mulgan, G., Potts, G., Audsley, J., Carmona, M., De Magalhaes, C., Sieh, L., & Sharpe, C. (2006). Mapping value in the built urban environment. The Young Foundation.

Nielsen, T. (2019). The livable city and its long shadow. In K. L. Weiss (Ed.), *Kritisk by/critical city* (pp. 169). The Danish Architectural Press.

Ossokina, I. V., Arentze, T. A., van Gameren, D., & van den Heuvel, D. (2020). Best living concepts for elderly homeowners: Combining a stated choice experiment with architectural design. *Journal of Housing and the Built Environment*, 35(3), 847-865.

Rasmussen, M. K. *Social commissioning*. BloxHub. Retrieved January 2023, from https://bloxhub.org/circular-built-environment-network/social-commissioning/

Sántha, E., Hvejsel, M. F., & Rasmussen, M. K. (2022). Lost potentials? – Unpacking the tectonics of architectural cost and value. *Nordic Journal of Architectural Research*, 34 (1), 89-118.

Sattrup, P. A. (2020). Documenting value creation: A business opportunity for architects, their clients and society. *Architectural Design,* 90(4), 22-29. DOI:10.1002/ad.2586.

Simpson, D., & Weiss, K. L. (2019). Livability as metric regime. In K. L. Weiss (ed.), *Kritisk by/critical city* (pp. 27). The Danish Architectural Press.

Social Value International. Retrieved April 2022, from https://www.socialvalueint.org/.

Stender, M. (2017). Towards an architectural anthropology - What architects can learn from anthropology and vice versa. *Architectural Theory Review,* 21(1), 27-43. DOI:10.1080/13264826.2016.1256333.

Turan, I., Chegut, A., Fink, D., & Reinhart, C. (2020). The Value of Daylight in Office Spaces. *Building and Environment*, 168.

van der Linden, V., Dong, H., & Heylighen, A. (2019). Tracing architects' fragile knowing about users in the socio-material environment of design practice. *Design Studies*, 63, 65-91. DOI:10.1016/j.destud.2019.02.004

Watson, K. J., Evans, J., Karvonen, A., & Whitley, T. (2016). Capturing the social value of buildings: The promise of social return on investment (SROI). *Building and Environment,* 103, 289-301.

Weiss, K. L. (2019). *Kritisk by / critical city*. Arkitektens Forlag.

Bibliography

Aarhus Kommune, & Aarhus Havn. (2003). *Helhedsplan for de bynære havnearealer*. Aarhus Kommune. Retrieved July 2020, from https://www.aarhus.dk/media/5498/helhedsplan-for-de-bynaere-havnearealer.pdf.

Aarhus Kommune. (2020). *Aarhus i tal*. Aarhus i tal. Retrieved July 2020, from https://ledelsesinformation.aarhuskommune.dk/aarhus-i-tal/default.aspx?doc=vfs://Global/AARHUS-I-TAL/Hjem.xview.

Aarhus Kommune. *Her arbejder vi - private byggeaktiviteter*. Aarhus Ø. Retrieved July 2020, from https://aarhusoe.dk/her-arbejder-vi/private-byggeaktiviteter/.

AART architects. *Projects*. AART. Retrieved March 2020, from https://aart.dk/en/projects.

Albertsen, N. (2012). Gesturing atmospheres. Paper presented at the *Congress on Ambiances, Montreal,* 2012. Montreal, Canada.

Anguelovski, I., Connolly, J. J., Garcia-Lamarca, M., Cole, H., & Pearsall, H. (2019). New scholarly pathways on green gentrification: What does the urban 'green turn'mean and where is it going? *Progress in Human Geography,* 43(6), 1064-1086.

Appel-Meulenbroek, R., Kemperman, A., van de Water, A., Weijs-Perrée, M., & Verhaegh, J. (2022). How to attract employees back to the office? A stated choice study on hybrid working preferences. *Journal of Environmental Psychology,* 81.

Bachelard, G. (1994). *The poetics of space*. Beacon Press.

Ballantyne, A. (2011). Architecture, life, and habit. *The Journal of Aesthetics and Art Criticism,* 69(1), 43-49. DOI:10.1111/j.1540-6245.2010.01445.x.

Barry, A., Born, G., & Weszkalnys, G. (2008). Logics of interdisciplinarity. *Economy and Society*, 37(1), 20-49. DOI:10.1080/03085140701760841.

Bech-Danielsen, C., Beim, A., & Madsen, U. S. (2014). *Towards an ecology of tectonics: The need for rethinking construction in architecture*. Edition Axel Menges.

Beim, A., & Hvejsel, M. F. (2016). Everyday Tectonics? Clarification of concepts. *Structures and Architecture: Beyond their Limits*, 179.

Beim, A., Bundgaard, C., Christiansen, K., & Madsen, U. S. (2014). Towards an Ecology of Tectonics: The Need for Rethinking Construction in Architecture. Axel Menges.

Bhatt, R. (2000) The Significance of the Aesthetic in Postmodern Architectural Theory. *Journal of Architectural Education*, 53(4), 229-238.

Bianco, L. (2018). Architecture, values and perception: Between rhetoric and reality. *Frontiers of Architectural Research,* 7(1), 92-99. DOI: 10.1016/j.foar.2017.11.003.

Bibri, S. E., Krogstie, J., & Kärrholm, M. (2020). Compact city planning and development: Emerging practices and strategies for achieving the goals of sustainability. *Developments in the Built Environment,* 4. DOI:10.1016/j.dibe.2020.100021.

Bjørn, N. (2014). *Evidens for sociale effekter af fysiske indsatser i udsatte boligområder. Review af 27 effektstudier fra ni lande*. Københavns Kommune. Available at: http://www.nielsbjorn.dk/evidens-sociale-effekter-af-fysiskeindsatser-i-udsatte-omr%C3%A5der.

Boliga. *Boligpriser*. Boliga statistik. Retrieved September 2022, from https://www.boliga.dk/boligpriser/resultater?area=28000&type=1&data=0.

Bötticher, C. G. W. (1844). The principles of the hellenic and germanic ways of building with the regard to their application to our present way of building. In H. F. Mallgrave (Ed.), *In what style should we build? The German debate on architectural style* (pp. 147-167). Getty Publications.

Bowles, S., & Gintis, H. (2002). Homo reciprocans. *Nature*, 415(6868), 125-127.

Broch, N. R., Sattrup, P. A., & Sejr, K. (2017). In Sejr K. (Ed.), *Architecture creates value*. Danish Association of Architectural Firms.

Broome, J. (2001) Economics and Ethics. In N. J. Smelser & P. B. Baltes (Eds.) I*nternational Encyclopedia of the Social & Behavioral Sciences*. Pergamon. DOI:10.1016/B0-08-043076-7/01025-1.

Brundtland, G.H. (1987) *Our Common Future: Report of the World Commission on Environment and Development*. Geneva, UN-Document A/42/427.

Buchli, V. (2013). *An anthropology of architecture*. Bloomsbury.

Bunce, S. (2009). Developing sustainability: Sustainability policy and gentrification on toronto's waterfront. *Local Environment,* 14(7), 651-667.

Castaldo, V. L., Pigliautile, I., Rosso, F., Pisello, A. L., & Cotana, F. (2017). Investigation of the impact of subjective and physical parameters on the indoor comfort of occupants: A case study in central italy. *Energy Procedia,* 126, 131-138.

Center for Transport Analytics. "Transportøkonomiske Enhedspriser." Technical University Denmark. Last modified: May 2022. Accessed: 11 Sep, 2022, at https://www.cta.man.dtu.dk/modelbibliotek/teresa/transportoekonomiske-enhedspriser.

Cha, S. H., Steemers, K., & Kim, T. W. (2017). Modelling building users' space preferences for group work: A discrete-choice experiment. *Architectural Science Review,* 60(6), 460-471.

Chafi, M. B., Harder, M., & Danielsson, C. B. (2020). Workspace preferences and non-preferences in activity-based flexible offices: Two case studies. *Applied Ergonomics,* 83.

Chen, James. *Homo Economicus*. Retrieved July 2021, from https://www.investopedia.com/terms/h/homoeconomicus.asp.

Christensen, N. L. S., & Krogstrup, H. K. (2017). At arbejde med forandringsteori: Praktikeres guide til brug af forandringsteori i projektudvikling og evaluering (2nd ed.). Aalborg University.

Christiansen, E. M. (2020). *Tectonics and the city: In search of a critical perspective on assembling the city.* Aalborg University Press.

Clark, A., & Emmel, N. (2010). *Using walking interviews*. Morgan Centre, University of Manchester.

Clausen, Rune T. (2011). *Værdifuld arkitektur: Et eksplorativt studie af bygningers rolle i virksomheders værdiskabelse*. Copenhagen Business School.

Creswell, J. W. (2009). Mapping the field of mixed methods research [editorial]. *Journal of Mixed Methods Research,* 3(2), 95-108.

Creswell, J. W., & Creswell, J. D. (2017). *Research design: Qualitative, quantitative, and mixed methods approaches*. SAGE publications.

Czajkowski, M., & Budziński, W. (2019). Simulation error in maximum likelihood estimation of discrete choice models. *Journal of Choice Modelling,* 31, 73-85.

Dam, T. (2007). Does tectonics make meaning in landscape architecture? Paper presented at the *Tectonics Making Meaning Conference,* 2007. Eindhoven, Netherlands.

Darbellay, F. (2012). The circulation of knowledge as an interdisciplinary process: Travelling Concepts, Analogies and Metaphors. *Issues in Integrative Studies*, 30, 1-18.

de Chazal, J. (2010). A systems approach to livability and sustainability: defining terms and mapping relationships to link desires with ecological opportunities and constraints. *Systems Research and Behavioral Science*, 27(5), 585–597.

Dean, E., Elardo, J., Green, M., Wilson, B., & Berger, S. (2016). *Principles of Microeconomics: Scarcity and Social Provisioning*. Open Oregon Educational Resources.

Denmark Green Building Council. Retrieved April 2023, from https://www.rfbb.dk.

Determann, D., Gyrd-Hansen, D., de Wit, G. A., de Bekker-Grob, E. W., Steyerberg, E. W., Lambooij, M. S., & Bjørnskov Pedersen, L. (2019). Designing unforced choice experiments to inform health care decision making: Implications of using opt-out, neither, or status quo alternatives in discrete choice experiments. *Medical Decision Making,* 39(6), 681-692.

Djebbara, Z., Jensen, O. B., Parada, F. J., & Gramann, K. (2022). Neuroscience and architecture: Modulating behavior through sensorimotor responses to the built environment. *Neuroscience & Biobehavioral Reviews,* 138.

Dooley, L., & Kirk, D. (2007). University-industry collaboration – Grafting the entrepreneurial paradigm onto academic structures. *European Journal of Innovation Management*, 10(3), 316-332. DOI:10.1108/14601060710776734.

Dunne, A., & Raby, F. (2013). *Speculative everything: Design, fiction, and social dreaming*. The MIT Press.

Ehmke, M. D., Lusk, J. L., & List, J. A. (2008). Is hypothetical bias a universal phenomenon? A multinational investigation. *Land Economics,* 84(3), 489-500.

Elmahadi, M. A., Tahir, M. M., Surat, M., Tawil, N. M., & Usman, I. (2011). Effective office environment architecture: Finding ingenious ideas in a home to stimulate the office environment. *Procedia Engineering,* 20, 380-388.

Emerson, J., Wachowicz, J., & Chun, S. (2001). Social Return on Investment (SROI): Exploring Aspects of Value Creation. *Working Knowledge: Business Research for Business Leaders* (Archive). Harvard Business School. Available at: https://hbswk.hbs.edu/archive/social-return-on-investment-sroi-exploring-aspects-of-value-creation#3.

Entwistle, J. M. K., & Rasmussen, M. K. (2021). Fra indsigt til forandring. *Jordens Folk*, ,121–131.

Fabian, L. (2016). The spatial, the social and the architectural. In B. B. Jensen, & K. L. Weiss (Eds.) *Art of many, the right to space: The Danish pavilion - Bienniale Architettura 2016* (pp. 189). DAC, The Danish Architectural Press.

Federal Facilities Council (FFC) & National Research Council (NRC). (2002). *Learning from our buildings: A state-of-the-practice summary of post-occupancy evaluation*. Technical Report No. 145. National Academies Press.

Fich, L. B., Jönsson, P., Kirkegaard, P. H., Wallergård, M., Garde, A. H., & Hansen, Å. (2014). Can architectural design alter the physiological reaction to psychosocial stress? A virtual TSST experiment. *Physiology & Behavior,* 135, 91-97. DOI:10.1016/j.physbeh.2014.05.034.

Fifer, S., Rose, J., & Greaves, S. (2014). Hypothetical bias in stated choice experiments: Is it a problem? and if so, how do we deal with it? *Transportation Research Part A: Policy and Practice,* 61, 164-177.

Filyushkina, A., Agimass, F., Lundhede, T., Strange, N., & Jacobsen, J. B. (2017). Preferences for variation in forest characteristics: Does diversity between stands matter? *Ecological Economics,* 140, 22-29.

Flyvbjerg, B. (2006). Five Misunderstandings About Case-Study Research. *Qualitative Inquiry*, 12(2), 219-245. DOI:10.1177/1077800405284363.

Frampton, K. (1983). Towards a critical regionalism: Six points for an architecture of resistance. In H. Foster (Ed.), *The anti-aesthetic. essays on postmodern culture* (). Bay Press.

Frampton, K. (1995). *Studies in tectonic culture: The poetics of construction in nineteenth and twentieth century architecture*. MIT Press.

Frascari, M. (1981). The tell-the-tale detail. In G. R. Owens, & E. K. Katić (Eds.), *Semiotics: The proceedings of the semiotic society of America* (pp. 325-336). Philosophy Documentation Center.

Freeman, A. M., Herriges, J. A., & Kling, C. L. (2014). *The measurement of environmental and resource values: Theory and methods*. RFF Press.

Galison, P. (1996). Introduction: The context of disunity. In P. Galison, and D. Stump (Eds.), *The disunity of science: Boundaries, contexts, and power*. Stanford University Press.

Gehl, J., & Svarre, B. (2013). *How to study public life*. Birkhäuser Boston. DOI:10.5822/978-1-61091-525-0

Groat, L. (1982). Meaning in post-modern architecture: An examination using the multiple sorting task. *Journal of Environmental Psychology*, 2(1), 3-22. DOI:10.1016/S0272-4944(82)80002-9.

Groat, L. N., & Wang, D. (2013). *Architectural research methods* (2nd ed.). Wiley.

Hanemann, W. M. (1984). Welfare evaluations in contingent valuation experiments with discrete responses. *American Journal of Agricultural Economics,* 66(3), 332-341.

Haworth, J. T. (2004). Work, leisure and well-being. In Haworth, J.T., & Veal, A.J. (Eds.), *Work and Leisure* (pp. 182-197). Routledge. DOI:10.4324/9780203489321

Hay, R., Samuel, F., Watson, K. J., & Bradbury, S. (2018). Post-occupancy evaluation in architecture: Experiences and perspectives from UK practice. *Building Research and Information: The International Journal of Research, Development and Demonstration,* 46(6), 698-710. DOI:10.1080/09613218.2017.1314692.

Hess, S., & Palma, D. (2019). Apollo: A flexible, powerful and customisable freeware package for choice model estimation and application. *Journal of Choice Modelling,* 32.

Heyman, A., Chen, X., Nowell, M. S., Manum, B., & Barton, D. N. (2017). Attributes of location and housing prices in Oslo: A monetary valuation with spatial configuration in mind. Available online at: https://aho.brage.unit.no/aho-xmlui/bitstream/handle/11250/2492712/Attributes%2Bof%2Blocation%2Band%2Bhousing%2Bprices%2Bin%2BOslo%2B-%2BCopy.docx?sequence=1&isAllowed=y.

Holst, J. (2017). The fall of the tektōn and the rise of the architect: On the greek origins of architectural craftsmanship. *Architectural Histories,* 5(1), 1-12. DOI:10.5334/ah.239.

Hurol, Y. (2022). *Tectonic Affects in Contemporary Architecture*. Cambridge Scholars Publishing.

Hvejsel, M. F. & Beim, A. (2019). Circular tectonics? – A critical discussion of how the architectural discipline can drive ecological continuity. Paper presented at the *Fourth International Conference on Structures and Architecture,* ICSA2019*,* Lisbon, Portugal.

Hvejsel, M. F. (2011). *INTERIORITY: A critical theory of domestic architecture.* Aalborg University Press.

Hvejsel, M. F. (2018). Gesture & principle: Tectonics as critical method in architecture. In I. W. Foged, & M. F. Hvejsel (Eds.), *Reader: Tectonics in architecture* (pp. 395-409). Aalborg University Press.

Ingold, T. (2000). *The perception of the environment: Essays on livelihood, dwelling and skill*. Routledge.

Ingold, T. (2013). Designing Environments for Life. In *Anthropology and Nature* (p. 14). Routledge

Jencks, C. (1978). Post-Modern history. *Architectural Design*, 1 (78), 13-58.

Jensen, M. B. V., & Troelsen, M. (2017). *Adding value to the social dimension of sustainable building.* Aalborg University Press.

Jensen, S. R. (2022). *Architectural strategies for promoting well-being in sustainable renovation of social housing*. Aarhus University Press.

Johansson, J. (2018). *Evaluering og arkitektur: Brugere, interview, analyse og fænomenologi* (1st ed.). RUM.

Johnston, R. J., Boyle, K. J., Adamowicz, W., Bennett, J., Brouwer, R., Cameron, T. A., Hanemann, W. M., Hanley, N., Ryan, M., Scarpa, R., Tourangeau, R., & Vossler, C. A. (2017). Contemporary guidance for stated preference studies. *Journal of the Association of Environmental and Resource Economists,* 4(2), 319-405. DOI:10.1086/691697.

Kahneman, D., & Tversky, A. (2013). Prospect theory: An analysis of decision under risk." In Handbook of the fundamentals of financial decision making: Part I. In L. C. MacLean & W. T. Ziemba (Eds.), pp. 99-127.

Kamols, N., Foth, M., & Guaralda, M. (2021). Beyond engagement theatre: Challenging institutional constraints of participatory planning practice. *Australian Planner,* 57(1), 23-35.

Karvouni, M. (1996). Tectonics of the Human Body and Architectural Embodiements. Paper presented at ACSA European Conference, 1996. Copenhagen, Denmark.

King, A. C., & Woodroffe, J. (2017). Walking interviews. In P. Liamputtong (Ed.), *Handbook of research methods in health social sciences* (pp. 1-22). Springer Singapore. DOI:10.1007/978-981-10-2779-6_28-1.

Kinney, P. (2017). Walking interviews. *Social Research Update,* 1-4.

Kleis, B. (Ed.). (2020). *Co-creating architecture - EFFEKT*. Graphic Design & Press.

Kvale, S., & Brinkmann, S. (2009). *Interviews: Learning the craft of qualitative research interviewing* (2nd ed.). SAGE Publications.

Lancaster, K. J. (1966). A new approach to consumer theory. *Journal of Political Economy,* 74(2), 132-157.

Landon, R. (2016). *Aravena's "reporting from the front" is nothing like koolhaas' 2014 Biennale – But it's equally as good.* ArchDaily. Retrieved 7 Apr 2020, from https://www.archdaily.com/789409/aravenas-reporting-from-the-front-is-nothing-like-koolhaas-2014-biennale-but-its-equally-as-good.

Larsen, V. G. *Circular transition of social housing.* ResearchGate*.* Retrieved January 2023, from https://www.researchgate.net/project/Circular-transition-of-social-housing-Generating-environmental-economic-and-social-co-benefits-by-design.

Larsen, V. G., Tollin, N., Sattrup, P. A., Birkved, M., & Holmboe, T. (2022). What are the challenges in assessing circular economy for the built environment? A literature review on integrating LCA, LCC and S-LCA in life cycle sustainability assessment, LCSA. *Journal of Building Engineering,* 50.

Latour, B., & Yaneva, A. (2008). Give me a gun and I will make all buildings move': An ANT's view of architecture. In R. Geiser (Ed.), *Explorations in architecture: Teaching, design, research* (). Birkhauser.

Lautrup, M. (2022). *Valuing the world outside your doorstep.* University of Copenhagen.

Lawson, B. E. (2008). The value of environmental justice. *Environmental Justice,* 1(3), 155-158.

Lefebvre, H., & Nicholson-Smith, D. (1991). *The production of space*. Oxford Blackwell.

Lennon, M. (2021). Green space and the compact city: Planning issues for a 'new normal'. *Cities & Health,* 5(sup1), S212-S215.

Li, P., Froese, T. M., & Brager, G. (2018). Post-occupancy evaluation: State-of-the-art analysis and state-of-the-practice review. *Building and Environment* (Preprint). DOI:10.1016/j.buildenv.2018.02.024.

Litman, T. (2010). *Sustainability and livability: Summary of definitions, goals, objectives and performance indicators*.

Louviere, J. J., Hensher, D. A., & Swait, J. D. (2000). *Stated choice methods: Analysis and applications*. Cambridge University Press.

Lowe, M., Whitzman, C., Badland, H. M., Davern, M., Hes, D., Aye, L., Butterworth, I., & Giles-Corti, B. (2013). *Liveable, healthy, sustainable: What are the key indicators for melbourne neighbourhoods?* McCaughey Vic Health Centre for Community Wellbeing.

Lundhede, T. H., Panduro, T. E., Kummel, L., Ståhle, A., Heyman, A., & Thorsen, B. J. (2013). *Værdisætning af bykvaliteter – fra hovedstad til provins.* University of Copenhagen.

Lusa, S., Käpykangas, S. M., Ansio, H., Houni, P., & Uitti, J. (2019). Employee satisfaction with working space and its association with well-Being – A cross-sectional study in a multi-space office. *Frontiers in Public Health,* 7, 358.

Macmillan, S. (2006). Added value of good design. *Building Research & Information*, 34(3), 257-271. DOI:10.1080/09613210600590074.

Mariel, P., Hoyos, D., Meyerhoff, J., Czajkowski, M., Dekker, T., Glenk, K., Jacobsen, J. B., Liebe, U., Olsen, S. B., & Sagebiel, J. (2021). *Environmental valuation with discrete choice experiments: Guidance on design, implementation and data analysis*. Springer Nature.

McFadden, D. (1973). Conditional logit analysis of qualitative choice behavior. In Zarembka, P. (Ed.), *Frontiers in Econometrics*. Academic Press.

McMeekin, N., Wu, O., Germeni, E., & Briggs, A. (2020). How methodological frameworks are being developed: Evidence from a scoping review. *BMC Medical Research Methodology,* 20(1), 1-9.

Mechlenborg, M., & Hauxner, K. (2021). Boligliv i højden: Ny viden om boligmiljø og socialt liv i de danske højhuse. Aalborg University Press.

Metrics, Choice. 2019. "Ngene 1.2--User Manual & Reference Guide, 2018." Sydney: Choice Metrics.

Mill, J. S. (1836). On the definition and method of political economy. *The philosophy of economics*, 41-58.

Moslehian, A. S., Kocaturk, T. & Tucker, R. (2021). An integral view of innovation in hospital building design: understanding the context of the research/practice gap. *Building Research & Information*, 49(3), 265-280. DOI:10.1080/09613218.2020.1740577.

Mossin, N., Stilling, S., Bøjstrup, T., Larsen, V. G., Blegvad, A., Lotz, M., & Rose, L. (2018). *An architecture guide to the UN 17 sustainable development goals*. KADK. Available at: https://kadk.dk/sites/default/files/downloads/article/un17_guidebook_single_page_low.pdf.

Mulgan, G. (2010). Measuring Social Value. Stanford Social Innovation Review, 8(3), 38-43.

Mulgan, G., Potts, G., Audsley, J., Carmona, M., De Magalhaes, C., Sieh, L., & Sharpe, C. (2006). *Mapping value in the built urban environment*. The Young Foundation.

Nature Economy. *Homo Oeconomicus and Homo Politicus*. Retrieved July 2021, from http://natureeconomy.de/elements/homo-politicus/.

Nielsen, T. (2019). The livable city and its long shadow. In K. L. Weiss (Ed.), *Kritisk by/critical city* (pp. 169). The Danish Architectural Press.

Norberg-Schulz, C. (2019). Genius loci: Towards a phenomenology of architecture (1979). *Historic Cities: Issues in Urban Conservation,* 8, 31.

Nowotny, H., Scott, P., & Gibbons, M. (2001). *Re-thinking science: Knowledge and the public in an age of uncertainty*. Polity.

Ossokina, I. V., Arentze, T. A., van Gameren, D., & van den Heuvel, D. (2020). Best living concepts for elderly homeowners: Combining a stated choice experiment with architectural design. *Journal of Housing and the Built Environment, 35*(3), 847-865.

Pallasmaa, J. (2012). *The eyes of the skin* (3rd ed.). Wiley.

Peavey, E., & Vander K. B. W. (2017). Evidence-Based Design and Research-Informed Design: What's the Difference? Conceptual Definitions and Comparative Analysis. *Health Environments Research & Design Journal*, 10(5), 143-156.

Picon, A. (2013). Architecture, Innovation, and Tradition. *Architectural Design*, 83, 128-133. DOI:10.1002/ad.1535.

Pink, S. (2012). *Situating everyday life*. SAGE Publications.

Postiglione, G., & Lupo, E. (2007). The architecture of interiors as re-writing of space: Centrality of gesture. In J. Gigli (Ed.), *Thinking inside the box: A reader in interiors for the 21st century* (pp. 145-154). Middlesex University Press.

Preiser, W. F. E. (2005). Building Performance Assessment: From POE to BPE – A Personal Perspective. *Architectural Science Review*, 48, 201-204. DOI:10.3763/asre.2005.4826.

Preiser, W. F. E., White, E., & Rabinowitz, H. (1988:2015) *Post-Occupancy Evaluation* (Routledge Revivals, 1st ed.). Routledge.

Purup, P. B., Jensen, S. R., & Petersen, Steffen. (2017). Towards a Holistic Approach to Low-Energy Building Design: Consequences of Metrics for Evaluation of Spatial Quality on Design. Paper presented at PLEA2017 - Design to Thrive, 2017. Edinburgh, United Kingdom. Available at: https://www.researchgate.net/publication/318317796.

Rasmussen, M. K. *Social commissioning*. BloxHub. Retrieved January 2023, from https://bloxhub.org/circular-built-environment-network/social-commissioning/.

Rasmussen, M. K., Entwistle, J. M. K., Stender, M., & Petersen, S. (2022) Wellbeing at the office: An anthropological approach to POE. Paper presented at *5th International Conference on Structures and Architecture*, ICSA2022 July. Aalborg, Denmark. Available at: https://www.icsa2022.create.aau.dk/digitalAssets/1162/1162340_icsa2022_full-program_27-june-2022-final.pdf.

Rid, W., Haider, W., Ryffel, A., & Beardmore, B. (2018). Visualisations in Choice Experiments: Comparing 3D Film-sequences and Still-images to Analyse Housing Development Alternatives. *Ecological Economics*, 146, 203–217.

Ridoutt, B. G., Ball, R. D., & Killerby, S. K. (2002). Wood in the interior office environment: Effects on interpersonal perception. *Forest Products Journal,* 52(9), 23.

Rittel, H. W., & Webber, M. M. (1974). Wicked problems. *Man-made Futures,* 26(1), 272-280.

Rönn, M. (2011) Quality in Architecture – A Disputed Concept. Paper presented at *Considering Research: Reflecting upon current themes in Architecture Research*, ARCC2011, April. Detroit, United States. Available at: https://www.researchgate.net/publication/277744433.

Rouse, R. (2004) Measuring value or only cost: the need for new valuation methods. In S. Macmillan (Ed.): *Designing Better Buildings* (pp. 55-71). E&FN Spon.

Ryan, M., Kolstad, J., Rockers, P., & Dolea, C. (2012). *How to Conduct a Discrete Choice Experiment for Health Workforce Recruitment and Retention in Remote and Rural Areas: A user guide with case studies*. The World Bank.

Salvatore, A. (2006). Evidence-based design development update. Paper presented at *Healthcare Design*. Available at: https://www.healthdesign.org/education/conf/.

Sántha, E. (2023). Transforming the Harbour – The Role of Architecture in Creating Urban Life. In F. Neuhaus (Ed.) *AMPS Proceedings Series 30 – Cultures, Communities, and Design* (pp. 296-307*)*. AMPS, 2022. Calgary, Canada.

Sántha, E., Hvejsel, M. F., & Entwistle, J. M. K. (2022). Tectonics of human well-being: Describing architecture in terms of constructed spatial gestures and their impact. *Architecture, Structures and Construction,* 1(14), 599-612.

Sántha, E., Hvejsel, M. F., & Rasmussen, M. K. (2022). Lost potentials? – Unpacking the tectonics of architectural cost and value. *Nordic Journal of Architectural Research,* 34 (1), 89-118.

Sántha, E., Hvejsel, M. F., & Rasmussen, M. K. (2022a). Intention, life, value: A multidisciplinary approach to understanding architectural quality in the city. In J. Montgomery (Ed.), *AMPS Proceedings Series 24.1. – Cities in a Changing World* (pp. 67-78). AMPS, 2021. Virtual.

Santoro, M. (2000). Success breeds success: the linkage between relationship intensity and tangible outcomes in university-industry collaborative ventures. *The Journal of High Technology Management Research*, 11(2), 255-73.

Sattrup, P. A. (2020). Documenting value creation: A business opportunity for architects, their clients and society. *Architectural Design,* 90(4), 22-29. DOI:10.1002/ad.2586.

Schmeer, K. (1999). Guidelines for conducting a stakeholder analysis. PHR, Abt Associates.

Sekler, E. F. (1964). Structure, construction, tectonics. In G. Kepes (Ed.), *Structure in art and in science* (pp. 89-95). Studio Vista.

Semper, G. (1989). *The four elements of architecture* (2nd ed.). Cambridge University Press.

SIMNA. (2018). *Social value international: Accounting for value*. Retrieved April 2022, from https://simna.com.au/social-value-international-accounting-for-value/.

Simonsen, K. (2007). Practice, spatiality and embodied emotions: An outline of a geography of practice. *Human affairs*, 2, 168-181.

Simpson, D., & Weiss, K. L. (2019). Livability as metric regime. In K. L. Weiss (Ed.), *Kritisk by/critical city* (pp. 27). The Danish Architectural Press.

Siren, A., Grønfeldt, S. T., Andreasen, A. G., & Bukhave, S. F. (2019). *Sociale mursten: En forskningskortlægning af fysiske rammers betydning i velfærdsindsatser.* Realdania. Available at: https://realdania.dk/publikationer/faglige-publikationer/sociale-mursten-en-forskningskortlaegning-af-fysiske-rammers-betydning-i-velfaerdsindsatser.

Social Psychology. *Homo economicus vs. Homo sociologicus: Do values influence actual behavior?* Retrieved July 2021, from https://www.psypost.org/2014/01/homo-economicus-vs-homo-sociologicus-do-values-influenceactual-behavior-22390.

Social Value International. *What is social value?* Retrieved April 2022, from https://www.socialvalueint.org/.

Ståhle, A., Lundin, H. K., Wezelius, I., Minoura, E., Rydell, M., & Gjertsen, S. (2018). *City measures - A guide for research driven urban design*. SPACESCAPE.

State of Green. Retrieved April 2023, from https://www.stateofgreen.com.

Stender, M. (2017). Towards an architectural anthropology-what architects can learn from anthropology and vice versa. *Architectural Theory Review,* 21(1), 27-43. DOI:10.1080/13264826.2016.1256333.

Stender, M., & Bech-Danielsen, C. (2021). Home, walls, and boundaries. *Architectural Anthropology: Exploring Lived Space,* 31. Routledge.

Stender, M., & Jepsen, M. B. (2021). An outdoor living room: Balconies and blurring boundaries. *Architectural anthropology*, 48-61. Routledge.

Stender, M., & Walter, A. (2019). The role of social sustainability in building assessment. *Building Research and Information : The International Journal of Research, Development and Demonstration,* 47(5), 598-610. DOI:10.1080/09613218.2018.1468057.

Strimel, G. J., Kim, E., Bosman, L. (2019). Informed Design through the Integration of Entrepreneurial Thinking in Secondary Engineering Programs. *Journal of STEM Education*, 19(5), 32-39.

Suckley, L., & Dobson, S. (2014). Measuring social and spatial relations in an office move. Paper presented at the 6th *International Conference on Social Informatics,* ICSI2014. Barcelona, Spain.

Toppinen, A., Röhr, A., Pätäri, S., Lähtinen, K., & Toivonen, R. (2018). The future of wooden multistory construction in the forest bioeconomy – A Delphi study from Finland and Sweden. *Journal of Forest Economics,* 31(1), 3-10. DOI:10.1016/j.jfe.2017.05.001.

Train, K. E. (2009). *Discrete choice methods with simulation*. Cambridge University Press.

Turan, I., Chegut, A., Fink, D., & Reinhart, C. (2020). The value of daylight in office spaces. *Building and Environment,* 168.

Tuzcuoğlu, D., Yang, D., de Vries, B., Sungur, A., & Appel-Meulenbroek, R. (2021). The phases of user experience during relocation to a smart office building: A qualitative case study. *Journal of Environmental Psychology,* 74.

Ulrich, R. S. (1984). View through a window may influence recovery from surgery. *Science,* 224(4647), 420-421. DOI:10.1126/science.6143402.

Understanding pragmatic research. Health E-learning and Media Team. Retrieved January 2023, from https://www.nottingham.ac.uk/helmopen/rlos/research-evidence-based-practice/designing-research/types-of-study/understanding-pragmatic-research/section10.html.

United Nations. (2018). *The 2030 Agenda and the Sustainable Development Goals: An opportunity for Latin America and the Caribbean.* UN document LC/G.2681-P/Rev.3. ECLAC.

Urbina, D. A., & Villaverde, A. R. (2019). A critical review of homo economicus from five approaches. *American Journal of Economics and Sociology*, 78(1), 63-93.

Valentin, E. M. M. (2000). University-industry cooperation: a framework of benefits and obstacles. *Industry & Higher Education,* June (2000), 165-172.

van den Berg, P., Weijs-Perrée, M., Dane, G., van Vliet, E., Liu, H., Sun, S., & Borgers, A. (2022). A comparative study of urban park preferences in China and the Netherlands. *International Journal of Environmental Research and Public Health*, 19(8), 4632.

van der Linden, V., Dong, H., & Heylighen, A. (2019). Tracing architects' fragile knowing about users in the socio-material environment of design practice. *Design Studies*, 63, 65-91. DOI:10.1016/j.destud.2019.02.004.

Vidal, D. G., Maia, R. L., Vilaça, H., Barros, N., & Oliveira, G. (2018). Green spaces and human rights: To an environmental justice in urban space: Espaços verdes e direitos humanos: Para uma justiça ambiental em espaço urbano. Paper presented at the *2nd International Conference in Ethics, Politics and Culture: Human Rights,* 2018.

Vischer, J. C. (2009). Applying knowledge on building performance: From evidence to intelligence. *Intelligent Buildings International*, 1(4), 239-248. DOI:10.3763/inbi.2009.SI02.

Wadel, C. (1991). *Feltarbeid i egen kultur: En innføring i kvalitativt orientert samfunnsforskning*. Seek.

Wang, C. E. (2012). Preliminary analysis on design principles and development trends of modern office buildings. *Applied Mechanics and materials*, 209, 141-144.

Watson, K. (2016). Learning Loops in Sustainable Design: Applying Social Return on Investment (SROI) to Buildings. University of Manchester.

Watson, K. J., Evans, J., Karvonen, A., & Whitley, T. (2016). Capturing the social value of buildings: The promise of social return on investment (SROI). *Building and Environment,* 103, 289-301.

Webster, K. (2017). *The circular economy* (2nd ed.). Ellen MacArthur Foundation Publishing.

Weiss, K. L. (2019). *Kritisk by / critical city*. Arkitektens Forlag.

Whyte, J., & Gann, D. M. (2001). Closing the loop between design and use: post-occupancy evaluation. *Building Research and Information*, 29(6), 460-462. DOI:10.1080/09613210110072683.

Willacy, S. (2020). Aarhus Ø. Retrieved from https://aarhusoe.dk/media/44511/20200716_folder_aarhusoe_engelsk-m-foto.pdf.

Winther, A. H. (2021). Urban compact living: Making home in the city: An ethnographic case study of compact living in an urban danish context. Aalborg University Press.

Wölfflin, H. (2009). Prolegomena zu einer psychologie der architektur (1886). *Kunstgeschichte – Open Peer Reviewed Journal.*

World Green Building Council. Retrieved April 2023, from https://www.worldgbc.org.

World Health Organisation (2008). Closing the gap in a generation: health equity through action on the social determinants of health. *Final Report of the Commission on Social Determinants of Health*. WHO.

Wright, F. L., Kaufmann, E., & Raeburn, B. (1974). *Writings and buildings*. New American Library.

Yaneva, A. (2020). The Happy City: An actor-network-theory manifesto. In *Ecologies design* (pp. 181-187). Routledge.

ISSN (online): 2446-1628
ISBN (online): 978-87-7573-758-1

AALBORG UNIVERSITY PRESS