

Design Research Epistemologies III

Research in Architectural Design

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Design Research Epistemologies III
Research in Architectural Design



Design Research Epistemologies III
Research in Architectural Design

Department of Architecture, Design and Media Technology
Aalborg University

Edited by: Ole B. Jensen, Elias Melvin Christiansen & Andrea Victoria Hernandez Bueno

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Chapter 1 : Design Research Epistemologies III - Introduction
By *Ole B. Jensen*

This is the third time. The third time the PhD students in the Media, Architecture, and Design Lab (MAD LAB) puts pen to paper in a voluntary attempt to articulate answers to the complex questions of epistemology and philosophy of science. Through yet another long gestation process marked by readings, writings, and discussions the authors of the chapters to follow opens up their struggles in a rather brave gesture. Not all researchers (experienced or not) dare to expose their inner thoughts (and doubts) on epistemology and philosophy of science to public scrutiny. Nevertheless, this is what the five PhD students contributing to the third volume of Design Research Epistemologies are doing. As I turn to the task of writing an introduction for this collection of chapters I cannot help to notice that the theories and frames have changed since the earlier ones (Jensen 2010; Jensen et al 2016). Unsurprisingly this is so since PhD research in the Department of Architecture Design and Media Technology is marked by a relatively high degree of personal autonomy. This means that most PhD students have a great say over the framing and implementation of their research designs. Thereby they may also choose the frames of thoughts to be laid down as the epistemological basis. For example, the main sources of inspiration to the PhD students in DRE I was phenomenology, hermeneutics and some flavours of social constructivist thinking. This changed with DRE II six years later. Here the key influence was still very much phenomenology and hermeneutics, but a much more explicit focus on pragmatism had entered the stage. With DRE III, we see what might be described as a consolidation of pragmatism. Moreover, the current epistemological map has been widened to also include the explorative approaches launched under the term 'non-representational theory'. The imprint and inspiration of Actor-Network-Theory also seems a constant from DRE I-III (fig. 1).

Such epistemological territorialisation is also a wider reflection of the research undertaken at the department. As a matter of fact, the PhD research that you

will see reported in this publication is both a reflection of the research going on in the author's respective research environments as well as the discussion this publication has led to is taking the meta reflections of research and knowledge production 'back to' the research groups with new energy. There is in other words a two-way traffic facilitated and mediated by this now recurrent activity of having department PhD students thinking and writing about the methods and epistemology related to their research projects. Therefore, I do strongly believe that there is a high value in this exercise for the five authors that have spent time and energy on writing these chapters, as well as I think there are lessons to be learned in their research groups from these discussions. The organization of PhD knowledge-production in Universities require a plethora of elements such as HR policies, good work climates, career plans, mentoring, PhD courses, supervisor interaction etc. In the context of the chapters here, we have been working on establishing the MAD LAB as a viable platform for PhD research as well as there is now a fixed and recurrent PhD course offered with the title 'Design Research Epistemologies'. The course is organized and taught by yours truly and has a wider outreach than to the PhD students in MAD LAB. The course also has served as a discussion platform for the design PhD students represented in MAD LAB, and has facilitated interaction with even wider arrays of disciplines.

Writing about University PhD research in a context of public cutbacks and increased demands to external funding and competitiveness cannot help but colour the horizon. As PhD program responsible, research group leader, Head of the Departmental Research Committee and PhD supervisor I am trying to shield off the PhD students from having to think too much about these political frame conditions. However, there is a climate of suspicion surrounding academia these days and it would be strange if the PhD students did not at some level would feel this. That is one reason for why MAD LAB and the publication you are reading now is important. Research is a social activity governed by much else

Name	Thesis Title	Theory Input	Methodology	Epistemology
<i>Elias Melwin Christiansen</i>	Urban Tectonics - In search for an Art of Assembling the City	Architectural theory Urban Design theory Tectonic theory Landscape Urbanism	Theory Development Case study Design Experiment Teaching	Phenomenology Pragmatism Hermeneutics
<i>Line Sand Knudsen</i>	The value of design practice to innovation - Exploring the triggers and drivers of meaning envisioning	Design-driven innovation (management literature) Design practice (design literature)	Case studies Interviews Observations Workshops	Pragmatism
<i>Zakaria Djebbara</i>	Architectural, transition and cognition - An electrophysiological approach to action, perception and architectural transitions	Predictive processing Husserlian phenomenology Pragmatism	Electroencephalograph Event-related potentials Questionnaire	Critical-rationalism Empirical-analytical Pragmatism
<i>Andrea Victoria Hernandez Bueno</i>	Becoming a passenger - Exploring the passenger experience and airport design in CPH Airport.	Urban design Mobilities Aeromobilities Mobilities Design	Ethnographic field studies, observations, interviews, surveys, go along interviews, architectural mapping, Automatic Thermal Tracking: Thermal cameras Attention/ gaze tracking: Eye-tracking technologies	Pragmatism, Actor-Network-Theory, Non-representational theory, Phenomenology, Post-phenomenology
<i>Cecilie Breinholm Christensen</i>	Understanding Mobile Embodied Situations or Metro in Many Ways (working title)	Urban, architectural (and) design theory Mobilities (design) theory	Single-case study, Spatial/material design interventions, Architectural mapping, Observations, ethnographic studies (also reference studies), Interviews (go-along), Thermal camera-'tracking', Eye-tracking (attention and visual tracking)	Pragmatism, 'More-than' representational thinking and process-ontology, Phenomenology, Hermeneutics

Fig. 1: Overview of the Chapters in terms of theory input, method, and epistemology

than academic virtue, and precisely therefore it is important to establish places for contemplation and reflection. The DRE publications are meant to facilitate such 'shielded contemplation' and reflection spaces.

If we zoom in to the actual content of the research reported in this publication, we will again find cross-disciplinary thinking as the research DNA. All projects transgress existing borders and disciplinary configurations in various and often quite creative ways. We are invited on a journey covering design theory and innovation, architectural theory, tectonics, urban theory, landscape urbanism, Mobilities theory, and neuroscience to mention the rough outline of the territory covered. Equally, the span of methods is impressive as the chapters reach from case studies, interviews, observations, over design experiments and workshops to laboratory experiments and design interventions. Amongst the methods there are also a number technology focused projects engaging brain scanning, eye-tracking and thermal camera tracking. Finally, the overview of the different epistemological positions reveals inspiration from pragmatism, phenomenology, hermeneutics, more-than-representational (or non-representational) approaches, actor-network-theory, critical rationalism, and empirical-analytical thinking. Quite an epistemological mouthful one might think. Obviously, you would need to dive deeper into each chapter to understand the finer grains of the research designs and their underpinning epistemologies, however, from this simple list I would say you already get a good impression of width and territorial horizons. An obvious question that comes to mind is then; What sort of design research is nested on these theoretical, methodological and epistemological grounds? The answer to such a complex question is far from simple and straight forward, but I think we can draw some general implications and inferences. The cross-disciplinary tone is one important feature. Furthermore, the design research is carried out across disciplines as well as it relies on multiple methodologies. In relation to the epistemological underpinning it is perhaps not so surprising

that many projects have pragmatism as part of their thinking. The relationship between pragmatism as an epistemological frame of mind and design as both a field of practice and research is evident and important. A research agenda seeking to connect design and pragmatism may highlight the following dimensions (Jensen & Lannig 2017:14):

1. *Practice and 'pragma' as indicator of a focus on the actions taking place in the world*
2. *The situational / In Situ awareness*
3. *The creative and abductive potential of the What if ...?*
4. *The focus on actual consequences*
5. *Interest in 1:1 real-world experiments*
6. *Focus on the multi-sensorial dimensions to a mobile inhabiting of the world*
7. *Embodiment as the key to understanding mobile practices'*
8. *A clear focus on materials and physical properties as something concrete and non-abstract*
9. *A modest ambition in terms of theories and explanations as something that does not 'represent'*

This is of course not an exhaustive list and neither one that fit all the projects 100%. However, it is drawing out the contours of a research landscape that has an exploratory mindset and an openness to perspectives – and this you will find in all five chapters presented here!

In 2016 the Department of Architecture, Design and Media Technology undertook a rather detailed research evaluation (Andersen & Jensen 2017). Positioning the above 'map' in relation to the overview of the research evaluation is a further source to detailed understanding of the kind of design and architecture research we are facing here. It is a contemporary research agenda

taking on some of the latest (and not always simple) twists in the epistemological landscape of architectural research, as well as seeking new and innovative methods and creative combinations hereof. I realize that I hardly can be named an objective outside observer of this process, but I am nevertheless stricken by the innovative and creative energy displayed by these young researchers. I suppose it is a bit of a truism to highlight that the PhD researchers are the 'growth layer' of tomorrow's research, but I am sure that when you have read the five chapters in this publication you will have to agree that this looks definitely to be the case.

So it is (again) with pride that I end the introduction of the third Design Research Epistemologies publication and hope that you will find it rich on factual accounts for the PhD research at this particular moment in the Department of Architecture, Design and Media Technology. In addition, that you will find inspiration to creatively discuss and conduct PhD research your-self if that is the field of your engagement.

Happy Readings!

Ole B. Jensen

Aalborg University, February 2019

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Chapter 2 : Urban Tectonics - In search for an Art of Assembling the City
By *Elias Melvin Christiansen*

Time line: February 2017 - February 2020

Keywords: Architecture, Urban Design, Tectonics, Landscape

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Collaborators: -

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Name	Thesis Title	Theory Input	Methodology	Epistemology
<i>Elias Melvin Christiansen</i>	Urban Tectonics - In search for an Art of Assembling the City	Architectural theory Urban Design theory Tectonic theory Landscape Urbanism	Theory Development Case study Design Experiment Teaching	Phenomenology Pragmatism Hermeneutics

Urban Tectonics - In search for an Art of Assembling the City

Elias Melvin Christiansen

Introduction

The development of the city is constantly challenged by an increasing amount of interlinked social, economic, and environmental challenges, counting everything from climate adaptation, social segregation, cultural and economic dynamics etc. This fluctuating state seems to enable a building culture that creates the city as a collection of isolated buildings with individual appearances and with few if any signs of considerations to how the buildings are positioned within a specific context or how they relate to each other. Within this city, the more sensitive aspects related to notions such as atmosphere (Böhme 2017, Zumthor 2006; Pallasmaa 2005), ambiance (Thibaud 2011), empathy (Mallgrave 1993), the meaning (Schultz 1980) or the experience of architecture and the city (Rasmussen 1962) seems to be omitted in favor of architecture as an autonomous object.

The city as a collection of autonomous buildings is a central point in the theoretical discourse derived from O. M. Ungers and Rem Koolhaas's work with "The city within the city" or "The city as an archipelago" (Ungers, Koolhaas et al. 2013). This discourse has culminated in Koolhaas coining the concept "Bigness" (Koolhaas & Mau 1995), which is stemming from Koolhaas' extensive work and analysis of the Manhattan skyscrapers in the 1970s and is described accordingly: *"Bigness no longer needs the city: it competes with the city; it represents the city; it preempts the city; or better still, it is the city"* (Koolhaas, 1995: 515). A Bigness attitude seems to generate an architecture that is almost against urbanism as the buildings contains the complexity of the city within itself. The idea of the city as an archipelago have further been developed by Pier Vittorio Aureli in his search for an absolute architecture positioning architecture and urbanism as two opposite forces in the city (Aureli 2011). This theoretical school grows from a *"...desire to address the problem of a collective space in the face of a pluralistic society"* (Schrijver 2006: 36), and claims the city is stitched together by the urban

grid, exemplified by the Manhattan grid, and within this structure, all diversity can unfold and cohabitate. Bigness share similarities with other notions such as Landform Buildings (Allen & McQuade 2011), Landscrapers (Betsky 2006) or Megastructures (Banham 1976) that treat architecture as an object, as pure form, and downgrade the buildings spatial effects on the city. The urban space is what is left after the construction of buildings.

Notions such as Groundscapes (Perrault 2016), Grounds and Envelopes (Hensel & Turko 2015), Megaform (Frampton 2009) or Collective Form (Maki 1964) have all pursued a conceptualization of architecture that, in contrast to a Bigness approach understands architecture partly through its relationship with other things. The current study is building from this understanding of architecture and combining it with an understanding of the city as a whole derived from Camillo Sitte (Sitte 1945), Rasmussen (Rasmussen 1985, Rasmussen 1949, Rasmussen 1947), Kevin Lynch (Lynch 1960), Townscape (Cullen 1971), Aldo Rossi (Rossi 1984), James Corner (1999), Charles Waldheim and Landscape Urbanism (Waldheim 2016, Waldheim 2006) and Mohsen Mostfavi and Gareth Doherty (Mostafavi & Doherty 2010) which understands the city as a continuous, interrelated organization of the elements of the city. The question of how can we address and understand the relationship between architecture, or the continuity in the city is what initiated this study

From the above we seem to be able to identify the contours of a challenge in the contemporary city that demands a renewed attention to transitions, thresholds spaces and relationships between buildings, urban spaces and infrastructure. A challenge of how the city is assembled across scales. In architectural theory, the concern of joining is the subject of tectonic theory (Semper 1989, Sekler 1965, Frascari 1982, Frampton 1995, Beim 2004). Tectonic theory seems to be touching upon something more than understanding the mechanics from joining

structural members, or a rich understanding of the experience of space. Tectonics theory can be seen as a way of thinking reserved to an architectural practice that bridges the two understandings. This study addresses the identified challenge by asking whether and how tectonic theory can be re-framed as a way of thinking and point toward an understanding, practice and teaching of architecture and urban design from an integrated perspective.

In this search the project employs a mixed method research strategy, that explore the aforementioned outline of theoretical development in a case study, design experiment and teaching methodologies. Going a step further, this study is growing from an epistemological tradition composed from phenomenology: the philosophy of our perception of phenomena, hermeneutics: the philosophy of interpretation and understanding and pragmatism: the philosophy of the pragmatic and beliefs. These considerations lead to the following research question:

Can tectonic thinking be developed and applied as a critical lens to nuance how we understand the assembling of the city from the landscape to the furniture?

The study opens up this question from three perspectives, related to three levels of thinking. Building from the theoretical development, this concerns analysis to describe, experimentation to apply, and pedagogy in teaching to disseminate, following the three sub questions below:

- 1) How can tectonic thinking be applied as a critical lens to describe the assembling of the city?*
- 2) How can tectonic thinking be applied as an attitude to re-assemble the city through design?*
- 3) How can tectonic thinking be applied as pedagogical means to disseminate a critical understanding of the assembling of the city?*

Theoretical framework

Building on the nineteenth-century re-appearance of tectonic theory in architecture initiated by Gottfried Semper (Semper 1989), the theoretical framework of this study traces the development of a tectonic thinking through the last 150 years. After Semper, Eduard Sekler (Sekler 1965), Marco Frascari (Frascari 1984), Kenneth Frampton (Frampton 1995) and Anne Beim (Beim 2004) is studied in order to understand a tectonic thinking that can be applied to understanding the assembling of the city. The establishing of Urban Design from the Urban Design Conference in 1956 at Harvard (Krieger & Saunders 2009) and its link to tectonic theory through Eduard F. Sekler (Sekler 1964) is relevant to this. Tectonics is here understood as an attitude to architecture coming from a deep understanding of the correlation between the architectural experience and the means that enabled this experience. In other words, tectonic theory focuses on the connection between aesthetic and technique, and claims that the construing and the construction of is critically related to how joints are carried out.

The attention given to tectonic theory seems reclaim a momentum in times of extensive societal changes like the industrialization, the post war periods, digitalization and recently the environmental crisis. According to Marie Frier Hvejsel this say something about the essence of tectonic theory: “...*throughout architectural history, tectonic theory has revolved around the question of 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*” (Hvejsel 2018: 385). Has tectonic theory been the means from which architects and academics have tried to advance the building culture of their times, in search for meaning in the contemporary building industry and society?

Within this theoretical development it is the intention to unfold a tectonic thinking in a landscape understanding of the city coming from Landscape Urbanism (Waldheim 2016, Waldheim 2006, Corner 1999). Landscape urbanists claims that landscape, in contrast to buildings, is the means that ties the city together. Landscape is a medium from which we can understand and interpret the city as a continuity containing the diversity of the city. James Corner describes it as “... *landscape serves as a metaphor for inclusive multiplicity*

and pluralism, as in a kind of synthetic ‘overview’ that enables differences to play themselves out” (Corner 1999: 1). In this perspective, landscape is a notion that capture the continuous relationship among parts and wholes in the city. Bridging this understanding with Frascari’s ideas of the construing and construction of joints (Frascari 1984) serves as the starting point to integrating the theories. Within that framework, tectonic thinking in the city becomes concerned with the meeting, the threshold between differences that enable, or enhance, a landscape reading of the city. When considering the city as landscapes, urban tectonics becomes the concern, or the art, of assembling the parts of the city. It becomes the notion that encapsulates the quality of how a building, or an urban space, an infrastructural element, a green or blue space is related to the site and to the city as a whole. Engaging in tectonic thinking in the city forces you to consider how a design is, or can become, a continuation of the city and how its parts is orchestrated in relation to the urban context as a whole, and how its design and construction in detail, from the city to the furniture scale supports this. And from here, a tectonic thinking opens up for a discussion about the quality of how the city is assembled.

Mixed-method research strategy

The three research questions are unfolded in parallel. As the theme of the study is evolving around how we think and understand architecture and the city, the theme ought to be relevant to several aspects of the profession. This is the basis for the tripartite approach to the subject, a structure that facilitates an engagement with three kinds of thinking. The first question allows for a descriptive thinking: how can what we experience be described? The second question points towards an application thinking: how to apply this thinking when creating? And the third approximates a pedagogical meta-thinking to disseminate: How to think accordingly? Following this principle, the study employs three different research methodologies following the three sub questions. The study thus embarks on a path towards research that do not limit to using only quantitative nor qualitative data, characteristic of a mixed-method research strategy (Creswell & Plano Clark 2011).

The purpose of mixing research methodologies is to establish a more nuanced understanding of the subject and increase the breadth of the inquiry. The aim is not to establish always applicable knowledge, but to explore a subject from different angles that would have appeared one-sided and in lack of nuances if approached from one method alone. A mixed-method strategy is believed to balance weak points as the methods will complement each other (Groat 2013).

The project consists of three studies correlated with the three sub research questions concerning the case study, design experiment and teaching. The structure of the methodologies is following an abductive mixed-method research strategy as shown in the illustration to the right. On a conceptual level the research design follows Charles Sanders Peirce's description of the reasoning in the methodology of science: "*Its reasoning should not form a chain which is no stronger than its weakest link, but a cable whose fibers may be ever so slender, provided they are sufficiently numerous and intimately connected*" (Peirce 1868: 141). In this manner, the study intends to engage a tectonic thinking about the city three levels: to describe, to apply and to disseminate.

The project started from a critical wonder of the isolated autonomous architectural objects within the city and the poor relationship between them. This

established a hypothesis for qualifying these relationships, a lens, or an attitude to the city developed from the theories of tectonics called urban tectonics. This hypothesis includes a theoretical development and is ongoing through the whole study. The subject of urban tectonics is then approached through three studies in parallel, exploring an analytical, to describe, a design experimental to apply and a teaching approach to disseminate the hypothesis. Repeatedly during the process, the attention is returned to the wonder, questioning whether the state of the argument provides new and satisfactory insights. If not, the study returns to the individual studies (fig. 2). As a consequence, the three studies are interlinked and the course in one study will influence and inspire the progression of the two others resulting in the concluding argument becoming a synthesis of the whole study.

All three studies will be concerning scales from the city to the furniture, but the three studies will have different emphasis. Study I will concern the city and the building scale, study II will mainly concern the furniture scale, and study III will deal primarily with the building scale.

Hypothesis

As outlined in the theoretical framework, the theoretical stand point is developed in the hypothesis part and follows a critical reading of texts concerning architecture, tectonics, urban design, landscape urbanism, landscape architecture and integrated building culture that pursue a thesis of an integrated architecture and city. Based on a this a sketch of urban tectonics as the art of assembling the city is developed through writings and re-writings, which eventually will turn into the final theoretical argument. This study is advanced through means of texts, drawings and study of build, imagined and proposed projects from the city to the furniture scale, historically and contemporary, and geographically dispersed.

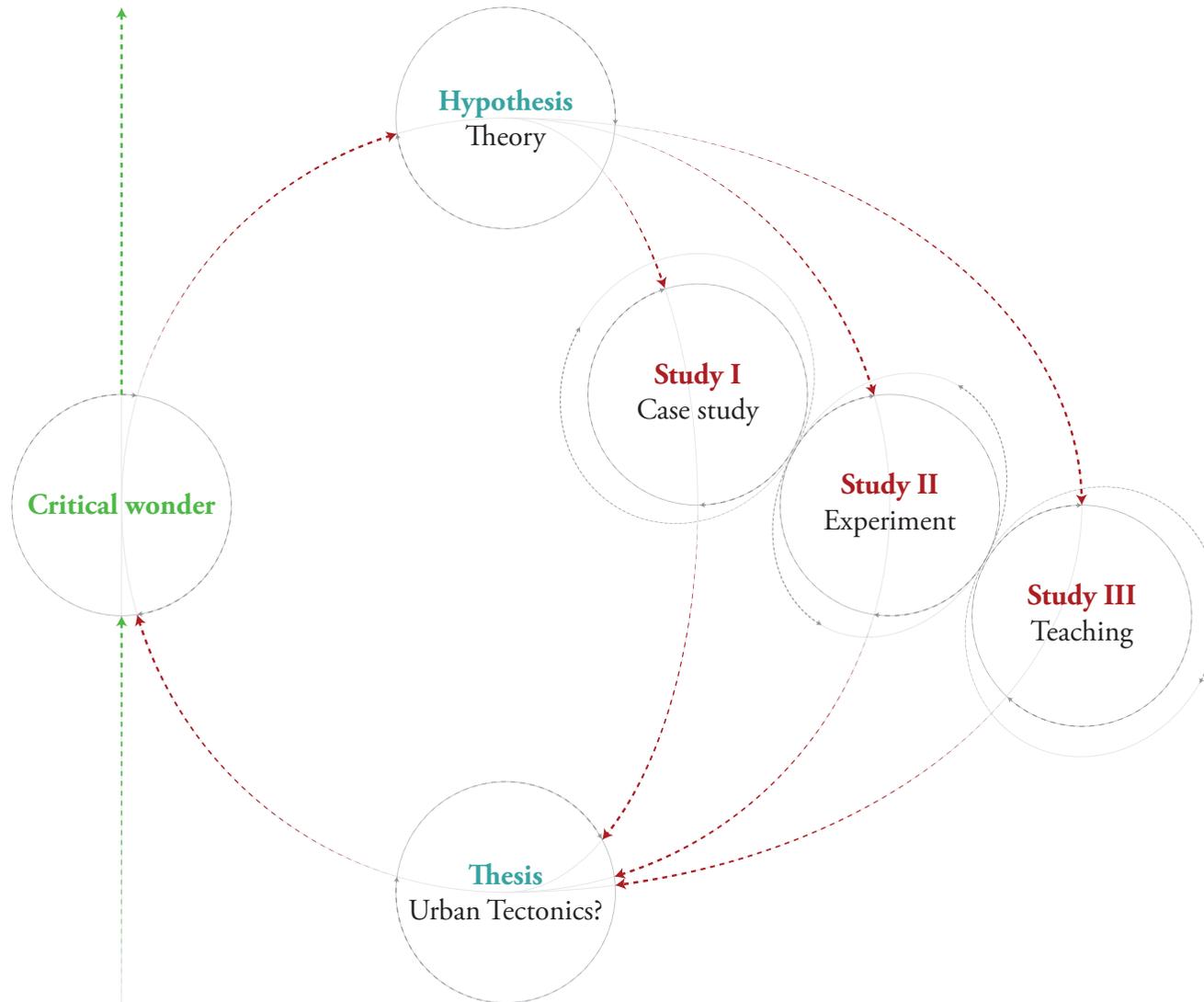


Fig. 2: Model of the abductive mixed-method research strategy applied in the study (Author's own illustration)

Study I

The first study concerns an in-depth description and analysis of SEB and the Kalvebod Brygge development in Copenhagen (Fig. 3-4). SEB is a private bank domicile, a result of a collaboration between Lundgaard & Tranberg arkitekter and SLA Landscape architects, both highly acknowledged for their high standard and expertise. SEB is part of a bigger development along Kalvebod Brygge based on Lundgaard & Tranberg's siteplan (Helhedsplan), and SLA's local plan (Lokalplan). The objective of the study is to identify and describe how the building and the site plan, is assembled into the existing and developing city. This is a "critical case study" that discuss the theme through an extreme example (Flyvbjerg 2001). SEB is considered a critical case as the design of the building convincingly integrates the architectural and urban space. The site plan includes ideas of integration with the existing city, as well as a connecting idea for the

landscape and the buildings, in the shape of a connected elevated green belt across the building plots. Furthermore, the offices involved in the design of the individual plans are distinguished architects and landscape architects that beside Lundgaard & Tranberg and SLA also include Dorte Mandrup. Lastly, the study is chosen for its reasonable size and complicated context in between the criticized harbour front, the train tracks, Fisketorvet, Dybbølsbro and the inner city (Fig 5), which lays the foundation for important consideration of how the city is assembled. The study will engage all scales from the city to the furniture, but emphasizing on the city and the building scale. This study will be based on data from drawings, field studies and spatial interpretations, mappings, planning documents and interviews with the architects and landscape architects involved. The result will be a combination of texts, drawings, illustrations and pictures to describe and visualize the principles of assembling.



Fig. 3: SEB from the street (Author's own photograph)



Fig. 4: SEB courtyard. (Author's own photograph)



Fig. 5: Kalvebod Brygge development in Copenhagen. (Google earth)

Study II

The second study consists of a practical application of the tectonic lens in a design experiment. This study is concerned with a study of myself entering into a design process, developing a specific design solution, for a specific site, for a specific occasion, through a tectonic lens. This study takes its point of departure from a more practical research-by-design perspective (Archer 1995, Biggs & Karlsson 2011). The study is a result of a collaboration with Polina Chebotareva, a Ph.d. student from Aarhus School of Architecture, and the experiment evolved around an urban installation for the 2018 Aarhus Festuge on Banegårdspladsen in Aarhus (Fig. 6-8). The installation was a “carpet” that gently intervened in



Fig. 6: Detail of the Urban Carpet. (Author's own photograph)

a crossing, without disturbing the use of the space, but introduced a sensual object, an instrument of placemaking. Through the carpet, Banegårdspladsen was re-assembled, and thus changed the perception of the space. The tectonic lens was applied from the overall assembling with the urban space, to the joining of materials and its structure. The study includes an analysis of the site based on the tectonic lens, documentation of the design process, interpretations of the transformed space through the same lens and finally observations on site. This study will mainly focus on the building to the furniture scale. The result will also be a combination of texts, drawings, illustrations and pictures to describe and visualize the principles of assembling.

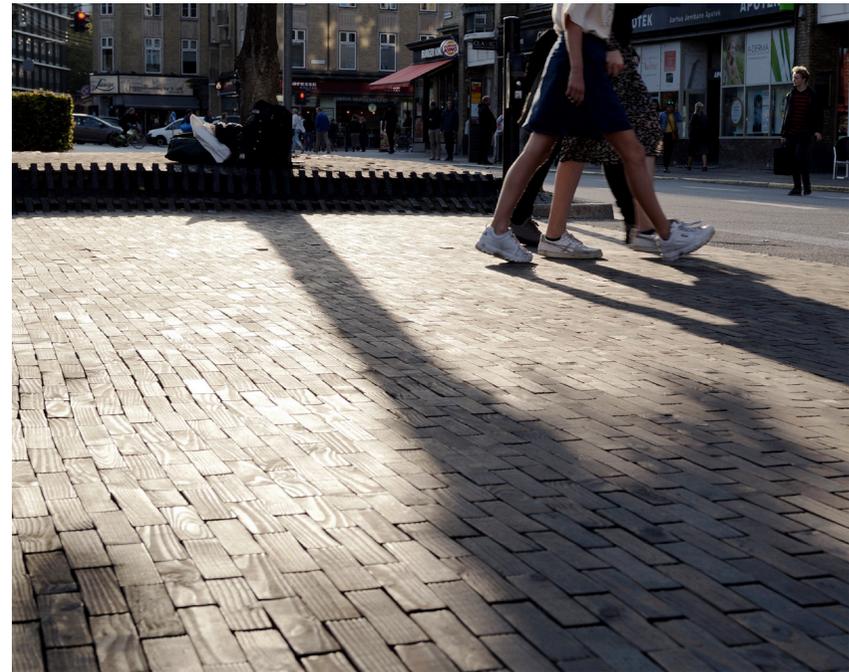


Fig. 7: Use of the Urban Carpet. (Author's own photograph)



Fig. 8: Urban Carpet, Urban installation for the 2018 Aarhus Festuge. (Author's own photograph)

Study III

The third study is following a three-year recurring B.Sc.5 studio. The course contains an introduction to tectonics as a lens to bridge understandings of architecture and urban design and focus on the assembling of the city, informed by the content of this study. The content is communicated through lectures, assignments and workshops asking the students to employ a tectonic lens in analysing and designing a conceptual design intervention on Kellerups Torv in Aalborg combining thoughts on architecture and urban design on a specific site. The outcome of the study is a poster visualizing the student's analysis of the

qualities of the site, and a model describing the students individual work with those specific qualities. The result is exhibited for the entire school (Fig. 9-11). The site recurs in the later semester projects of the student, and thus allows for a study of the effects of the course, and comparison between the different years. This study focus mainly on the building scale and the results will likewise be a combination of texts, drawings, illustrations and pictures to describe and visualizing some of the principles the students approached to assembling the city.

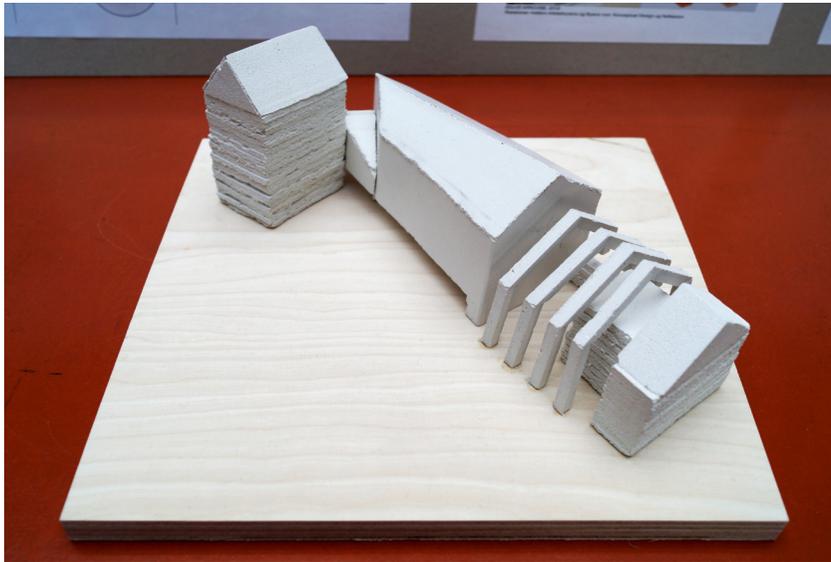


Fig. 9: Signe Hald's model, 2018. (Author's own photograph)

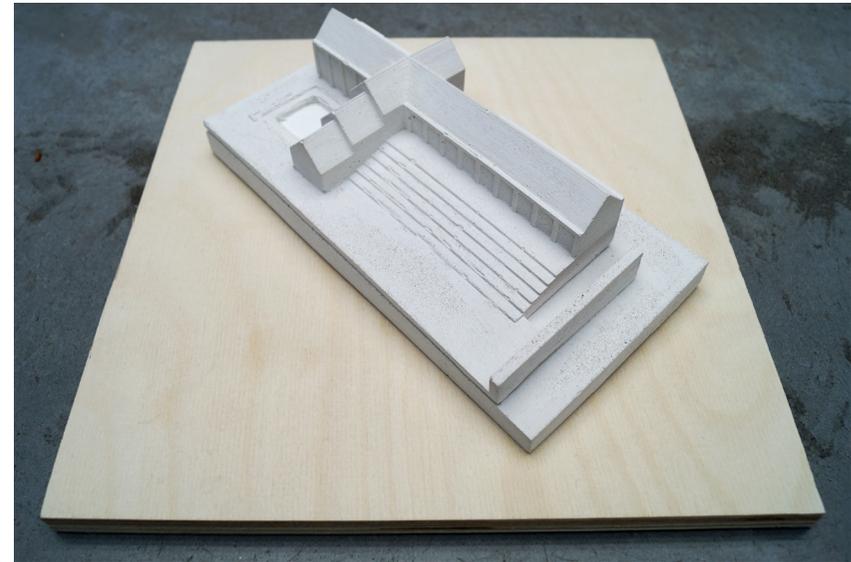


Fig. 10: Asbjørn Christian Carstens' model, 2018. (Author's own photograph)



Fig. 11: Exhibition of the student models and posters for the RUM course. (Author's own photograph)

Epistemologies within an abductive mixed-method research strategy

Given the three kinds of thinking embedded within the research questions and the mixed-method research strategy, not one individual epistemology is able to span the study as a whole. The study thus seems to fall in-between three epistemological traditions, and an essential part of the project thus is to identify how they can be combined together for the credibility of the study at large. Each epistemological tradition is present in all parts of the study, but in different intensities. A rough distinction is that study I, the critical case study, is leaning towards phenomenology, study II, the design experimentation, towards pragmatism, and study III, the teaching, towards philosophical hermeneutics. When that is said, as the three sub studies are thematically linked, developed in parallel and building on each other's knowledge, a strict division between the three epistemologies, as with the studies in general, is inadequate and will not provide a sufficient framework for understanding the study.

A phenomenological experience

Even though the term phenomenology was presented before him, its contemporary interpretation as an epistemology is usually accredited to the German philosopher Edmund Husserl. He criticized what he saw as a crisis in European sciences with an increasing focus on natural sciences, which he thought reduced the experience of the world to more or less unidentifiable phenomenon. He thus called for a philosophy of science that would return to the things themselves and study the phenomenon in all its richness as it is experienced. Husserl saw phenomenology as the transcendental science of pure consciousness. "... Husserl was concerned with the problem of how objective truth could be constituted in and through subjective acts of consciousness, what Husserl called "the enigma of truth" (Moran 2002: 61). After Husserl, his prodigy Martin Heidegger and Maurice Merleau-Ponty, among others, developed the philosophy further (Moran & Mooney 2002). Under the name post-phenomenology following Don Ihde, recent thinkers have introduced phenomenology in a more contemporary contexts increasingly affected by technology, and discussed how human perception and relation to the world is mediated through technology (Ihde 1993).

Phenomenologists challenge the philosophical and scientific dichotomy between

the subject and the object. This entails that the foundation of Phenomenology is a rejection of the mind-body dualism, which states that consciousness and body are separated. Phenomenologists thus try to go beyond a subject/object dichotomy, and they state that we are not able to observe the world from outside, as we ourselves are a part of it (Zahavi 2003). This is in its nature already interesting when we are discussing phenomenology in relation to tectonics. As we have seen, the notion of tectonics implies that architecture is the construing and construction of joints, a bridging the rationality of constructions and the experience of space, which somehow is related to a fusion of the subject/object thinking of the world. Thus, embedded within the theoretical development of this study is an acknowledgment that the experience of the architecture is related to phenomenological perception.

To avoid pure speculations and subjectivism phenomenologists employ what they call the phenomenological epoché or reduction, also sometimes called bracketing. To Husserl this is important because otherwise we would include a prejudicial and ultimately inconsistent theory of the world into an inquiry (Zahavi 2003). The aim is not to exclude the knowledge and delete it, but to suspend it, and to enable an examination of them as a part of the study. This is important in the study of SEB as this is a known and previously discussed project, and thus prejudices of its qualities and challenges can potentially direct a phenomenological interpretation. The study of the three sites: Kalvebod Brygge including SEB in Copenhagen, Banegårdspladsen in Aarhus, and Kjellerups Torv in Aalborg, thus include a survey that identifies pre-existing knowledge, which enables within the study the possibility to compare that with the experiences from the sites.

Post-phenomenology is a critical continuation of the classic philosophy. It is a study of human beings and their relations to technological artefacts, and how it is mediating our experience of the world (Ihde 1993). They define four different relations between humans and technologies and the world: Embodied, Hermeneutic, Alteration and Background enabling a differentiation dealing with how apparent and visible the technology is. For example, we are aware of the technological aspect of an elevator, whilst ventilation functions in the background. In post-phenomenology, technology is understood in a wide

sense, as a study argue, windows could be viewed as a kind of technology that mediates our experience of the outside and inside (Riis 2011). Furthermore, post-phenomenology operates with the concept of trade-offs, which are qualities that we have to accept to gain the quality improvements the technology offers (Rosenberger & Verbeek 2016). We accept the loss of space to car-infrastructure in the city in order to have convenient, precise and cheap transportation and we accept the noise from ventilation and heating solutions in the city to have an enduring indoor climate. In its essence tectonic thinking seems to be related to post-phenomenology, as it is dealing with how technology mediates experience, similar to how tectonic thinking understand technique as a means for aesthetic. Post-phenomenology is relevant to describe the technological means in the underground parking and watering system for the plants for the experience of SEB in study I and the infrastructure and the burned wood surface in study II.

Classic Phenomenology is the study of phenomena and the structure of its appearance. A phenomenon means “*an appearing object as such*” (Husserl 1900: 81). A phenomenon is that which shows itself from itself, that which manifests itself, that which reveals itself (Zahavi 2003). To Heidegger, phenomenology is a methodological conception, a means to get “*To the things themselves!*” (Heidegger 1927: 278). This is understood as the maxim of phenomenology, and from there we can understand phenomenology as the science of phenomena. In that aspect, the phenomena studied here is the ability of a piece of architecture or landscape to invoke a certain understanding, or meaning within us. It is through an interpretation of joints and details and their ability to communicate not only how architecture and landscape are physically assembled together, but also something of ourselves, the place that we are, and our very lives. A phenomenological study is thus inevitably followed by a hermeneutic interpretation, which Heidegger himself also acknowledge by stating “*...the meaning of phenomenological description as a method lies in interpretation*” (Heidegger 1927: 286), because a “*... phenomenological study necessarily involves the interpretation of their implicit meaning*” (Mueller-Vollmer 1989: 22), which eventually leads us to philosophical hermeneutics.

A hermeneutic interpretation

Philosophical hermeneutics, etymologically, is derived from Hermes, the Greek

messenger god, that traveled between cities and gods to deliver messages. Generally, hermeneutics is based on his talents for understanding, interpreting and delivering messages, usually in the form of spoken or written words, and thus through the means of language. Historically hermeneutic has been developed methodologically for interpretation of holy scriptures in the protestant tradition, the study and correct interpretation of laws and the study of the development and changing meaning of words, philology. The focus of hermeneutic is thus how we interpret, and how we let ourselves be interpreted. This applies directly to the study III concerned with teaching, as teaching in its self is a hermeneutic task. Contemporary philosophical hermeneutic has been introduced by Martin Heidegger and his student Hans-George Gadamer (Mueller-Vollmer 1985). Hermeneutics “*...describes the common human endeavour to interpret past traditions in light of pressing contemporary questions in order to make future oriented decisions for completing the project that is our life*” (Zimmermann 2015, 38). Usually hermeneutics is applied to the interpretation of historical texts, and in the light of our historical understanding we can deduct a meaningful perception of it. As “*Architecture, like texts, always functions, to some degree, as a carrier of cultural meaning*” (Kidder 2013: 2), a reading of the meaning in architecture and landscapes is thus governed by a hermeneutic epistemology.

Gadamer uses the concept “Fusion of Horizons” to characterize that of arriving at understanding. A horizon is a plane of perception, a field of knowledge, experience and thus understanding. We have a present horizon, and a historical horizon, and Gadamer claims that when these fuses, we are being blessed with an understanding. “*In fact the horizon of the present is being continually formed in that we have continually to test all our prejudices. An important part of this testing is the encounter with the past and the understanding of the tradition from which we come. Hence the horizon of the present cannot be formed without the past. There is no more an isolated horizon of the present than there are historical horizons. Understanding, rather, is always the fusion of these horizons which we image to exist by themselves*” (Gadamer 1960: 272). Gadamer thus claims that we understand things in light of its history, but also because we ourselves is embedded in a continuous history. This is relevant to the theoretical development in this study in relation to interpretation of the historical texts and how we interpret them and even more critical, how do we combine and re-phrase them in a contemporary context

appropriated for a contemporary practice? In a hermeneutic epistemology this is done by understanding them in a continuum with its history. This applies to the study of the three sites as well, as the buildings and the urban landscapes is interpreted as containers of meaning and it is understood in a continuous history by a positioning according to historical precedents.

A second aspect in hermeneutic epistemology is the concept known as the hermeneutic circle, which essentially means that you interpret the meaning of parts in relation to a whole, and you interpret a whole in relations to its parts. This means when you are searching for meaning in a whole, you “...*revision one’s sense of the whole as one grasps the individual parts, and revising one’s sense of the parts as the meaning of the whole emerges*” (Kidder 2013: 3). This Concept was first introduced by Daniel Friedrich Schleiermacher, but has later been described by several other hermeneutic philosophers. Heidegger described it as: “*In every understanding of the world, existence is understood with it, and vice versa*” (Heidegger 1927: 225). This idea might seem straightforward, and applicable in all aspects of interpretation, if it be a word within a phrase, a chapter within a book, a piece of architecture within a city and so forth. The hermeneutic circle is indirectly referenced in the writings of Marco Frascari and his writings on the architectural detail, or joints, as described earlier. Frascari describes architecture as a whole made out of the individual details. (Frascari 1984). Thus, embedded within a tectonic thinking is an alignment to parts of a philosophical hermeneutic tradition. This aspect is providing the pedagogical base for the study III concerning teaching. By presenting the concepts of parts and wholes in relation to the city, the students can perceive their work embedded within the context of a larger whole, and through Frascari they indirectly are introduced to a hermeneutic interpretation of their own work. The concept of the hermeneutic circle could also be related to the challenge addressed in the study as a whole: The poor relationship between the autonomous buildings of the city and the city as a whole. Is the challenge in general, on a philosophical level, that a reading of the city today, based on the principle of the hermeneutic circle, is too difficult, because current building culture is producing a too fragmented city?

Another concept presented by Gadamer is the notion of play in relation to the acquiring of truth. “*Truth is serious, often gravely so; but the discovery of truth*

requires, like artistry, an openness to unsuspected possibilities, so that philosophical inquiry comes to engage playfully with serious matters, yet to take even that playfulness serious” (Kidder 2013: 21). To Gadamer, play thus seems as a kind of creative take on a scientific inquiry. To creative professions, like architecture, the idea of play reminds us of the creative process of designing. In order to get to a good design a playful attitude is helpful to acquire original ideas. A playful attitude to truth searching is also the idea of allowing for seemingly missteps that eventually will allow for new discoveries. This concept, and attitude, is relevant to several aspects of this study. A playful and speculative approach to interpretation of historical theories is the means to understand them in a contemporary context. The interpretation of SEB and the experimentation in study II is employing the same attitude for interpreting the meaning of a design, and for developing a new meaningful design. But as design experimentation is also a practical act, this taps into pragmatism.

A pragmatic doing

Pragmatism grew out of a concern with connecting philosophical concepts with everyday life and argues that the philosophical questions of our lives should be addressed with resources offered by our social practices. Establishing the Pragmatism epistemology is accredited to Charles Sanders Peirce, with subsequent development by William James and John Dewey. One of the cornerstones of pragmatism is that it “...*challenges the often implicit assumption that our practices are necessarily inadequate and require backup from some standard or principle which lies beyond them*” (Bacon 2012: vii). It thus follows from pragmatism, that the practice of architecture could be a scientific study, which is the basis for acknowledging design experimentations in study II as a proper academic inquiry.

A key aspect of pragmatism is the Pragmatic maxim put forward by Pierce. He states that “*Consider what effects, that might conceivably have practical bearings, we conceive the object of our conception to have. Then, our conception of these effects is the whole of our conception of the object*” (Peirce 1902). Bacon interpret this as the meaning of a concept is a matter of the practical effects of acting in accordance with it and could be clarified by identifying its practical consequences (Bacon 2012). Study III concerning the teaching follows this logic. What the students

have understood of the relationships between buildings and urban space through the studio, is what should be conceived as the effect of the teaching. The same goes for Study II, the effects observed from the urban installation is what is conceived as the qualities of the intervention, and thus an effect of the design, the design process and its execution.

Pragmatism rejects the idea of basic beliefs, a secure foundation of knowledge. Thus, embedded within pragmatism is a conviction that current knowledge is only as good as the current moment allows, and it is always subject to improvements. Pragmatism is thus approaching knowledge as a belief rather than truth. This also means that no one is entitled to the whole truth and allows for multiple understandings, which also impose a humbleness toward the truth and science (Bacon 2012). This is echoed in Merleau-Ponty's phenomenology "*We must say that each moment our ideas express not only the truth but also our capacity to attain it at that given moment*" (Merleau-Ponty 1964: 442). This principle is the whole foundation for doing a study as this, within the available pool of knowledge. If we were to only accept certain truths, then an inquiry of this manner would never be sufficient, as the scope of the research questions do not allow for a dismissal of all uncertainties. Consequentially, it carries an accept of that the knowledge produced in this study eventually will be improved.

This points toward pragmatism having a normative agenda. If knowledge is never final, then there must be a continuous quest for establishing a norm or a 'better' solution to a challenge. By evaluating on the applicability in practice, pragmatism seeks to bettering practice, politics, science etc., informed by specific situations (Gimmler 2012). This is also related to the vision that permeates all aspects of this study: to point toward a different way of understanding, practicing and teaching architecture and urban design from an integrated perspective.

Conclusion: Synthesis of epistemologies

The three parts in the study are roughly positioned within their individual school of thought. When that is said, and as have been showed through the preceding chapter, they are all intertwined and each study is in themselves a particular combination of the three epistemologies and schools of thought. The three studies will occur simultaneously, and insights from one study affect the

progression of the others and vice versa. As all three studies are feeding in to a combined result, a strict separation is not intended. As the preceding chapter have sought out to explain, in this study, a clear distinction between the three schools of thought is difficult, as overlaps and even sharing of concepts occur among them. But is it even possible to combine schools of thoughts, philosophies and epistemologies? Philosophical hermeneutics and phenomenology are as mentioned linked, especially through the writings of Martin Heidegger (Moran & Mooney 2002). Phenomenology and pragmatism have been associated through Charles Sanders Peirce, who developed his own phenomenology (Spiegelberg 1956), and studies of the comparisons between pragmatism and hermeneutics have been presented by the pragmatist Richard J. Bernstein (Bernstein 2010). This suggests that there might be ways to combine elements from the different schools of thoughts. And, as the previous chapter hopefully have hinted at, this triad of epistemologies seems to approximate something of a core of architectural and urban design research. But it might also come close to something essential in a tectonic thinking as it is combining philosophies related to phenomenological experience, hermeneutic interpretation and pragmatic doing. Aesthetic and technique.

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Chapter 3 : The value of design practice to innovation - Exploring the triggers and drivers of meaning envisioning
By *Line Sand Knudsen*

Time line: January 2017 - January 2020

Keywords: *Industrial design, meaning creation, design practice*

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Name	Thesis Title	Theory Input	Methodology	Epistemology
<i>Line Sand Knudsen</i>	The value of design practice to innovation - Exploring the triggers and drivers of meaning envisioning	Design-driven innovation (management literature) Design practice (design literature)	Case studies Interviews Observations Workshops	Pragmatism

The value of design practice to innovation - Exploring the triggers and drivers of meaning envisioning

Line Sand Knudsen

Introduction and motivation for the study

The ultimate goal of design is to bring products and services to the world that create real value and meaningful experiences to the users. In this perspective, design is regarded as an act of meaning creation which is the topic for this PhD project entitled: *'The value of design practice to innovation: exploring the triggers and drivers of meaning envisioning'* (Working title).

As a designer myself, I have always been dedicated to the early phases of the design process; to the phases where everything is complex, confusing and where exploration is key. In this process, we (designers) need to develop a deep understanding of how users' needs, behaviors and values change over time, as well as an understanding of how and why present products or services succeed or fail in accommodating these. This understanding is fundamental to make sure that new products and services will provide meaningful experiences and real value to the users. However, identifying relevant information and making sense out of disconnected parts is also what seem to be the ultimate challenge of designing and we do not know much about this process. Until now most research addresses how people perceive existing products, i.e. what products communicate and mean to individuals. But we do not know much about how designers embed this meaning in the design process. I was curious about this issue. Most of all, I was curious about what designers do in the real world; I had read a lot about the ideal methods to apply in the design process but as a novice designer I have also experienced that creating a meaningful experience in practice is not as simple as that. Moreover, a number of studies show how implementation of design is more complex than often portrayed. I was sure that the best designers were hiding something; something that I could not find an answer of in the books. The greatest designers are those who can deal with complexity, uncertainty ambiguity but how do they do it? This PhD project was my opportunity to search for their secret in the real world - to get insight into the best designers' practice. The

driving questions for me were centered on the triggers and drivers for designers' visions for creating and communicating new meanings through products. Moreover, I found it interesting to explore how designers translate an abstract vision of this meaning into the concrete solution. And what is it that makes a product meaningful after all? If we are not to be drowned by the increasing abundance of new products we see in the world today, products should have a distinct purpose and reason for existence. Designers have a huge responsibility for how our society changes and develops and this responsibility needs to be carefully considered when bringing new products to the world. There is a need to uncover the key characteristics of the rather complex phenomenon of meaning creation. This study aims to increase understanding of the meaning creation process based on cases from Danish and Dutch companies that represents the best designers with most experience in the field. Insights gained from the study may provide guidance for non-designers and novice designers in how to approach and construct meaningful experiences that succeed in accommodating future user needs, values and behaviors. As such, the objective of the operational perspective is to illuminate the real value of design practice to innovation.

This contribution of Design Research Epistemologies III is developed halfway in the PhD study. In this perspective, it should only be seen as a mid-way reflection rather than the final conclusion of the epistemological position and the methodological approach. The study's focus has been developed over time due to emergent insights from four separate studies; therefore, design strategies and theoretical frameworks have been adjusted continuously according to new insights discovered in the empirical world. Furthermore, the study is limited by reality in terms of what is possible to study in practice, e.g. it takes time and effort to get through to companies and establish a confident relationship that allows us to step into their busy workdays. After all, however, learning is the essence of all research; the contribution of this PhD study might seem as a small

step in design research but it is a big step on a personal level as well as in my professional career.

This chapter reflects the methodological considerations for the study including both the philosophical position and concrete methods for how to increase understanding of meaning creation in design. The chapter proceeds as following: first, a brief introduction of the theoretical framework will be presented which follows by the ontological view on the research subject. Next, the methodological approach is discussed including an overview of key methods used, and finally, the epistemological position of the study will be discussed.

Theoretical Framework

Design-driven innovation

Innovating remarkable product design is usually a difficult challenge in a world that has an increasing abundance of products and services. Companies are often challenged to find new ways to differentiate from competitors and they are forced to find new approaches to go beyond the functional features to win the customers' attention. In recent years, the concept of design has gained increasing interest. In particular, design is acknowledged as a driver for innovation (Utterback et al. 2006, Verganti 2009, Von Stamm 2008). Design is regarded as a competitive advantage for business and a strategic resource to create meaningful experiences for the users that are not driven by market demands or technology development but by experience and the emotional parameters of the future solution. In 2003, Verganti introduced the concept of 'design-driven innovation' as a type of innovation where creation of new meanings is used as a strategy to make radical change in a socio-cultural context (Verganti 2003). The idea of design-driven innovation is rooted in the discourse of design theory on semantics where products are what they *communicate* they are (Krippendorff 2006, Hekkert & Dijk 2011). Hence, product meaning is defined in a communicative perspective where the information derived from the product is the central part; not the product in itself. In this sense, product meaning is commonly understood as a rather complex phenomenon since it is context dependent and socially constructed; thus, what individuals perceive as being meaningful is based on their context, previous experiences and cultural factors. According to Verganti (2003), every product has a certain language and meaning and thus the key of design is

to create emotional and symbolic value to the users. As such, the main aspect of designing is to both envision a new meaning and make it tangible through the product in a way where the user clearly understands its intention (Kazmierczak 2003). This requires that the designer is aware of both their own understanding of the product being proposed as well as different users' understanding of the product (Krippendorff 2006). These intertwined understandings are essential parts of meaning creation.

The concept of design-driven innovation has had a huge influence on the business world's understanding of design as a valuable resource to innovation today. Moreover, it has had a great impact in the design field where designing is increasingly regarded as a situated activity of meaning making (Harrison et al. 2007, Ylirisku et al. 2009). However, studies on design to innovation has mainly been investigated in the field of innovation management concerning people involved, management of activities and business approaches (e.g. Öberg 2015, Dell'Era & Verganti 2007, Dell'Era & Verganti 2009, Dell'era & Verganti 2011, Verganti 2016, Verganti & Shani 2016). In design literature, studies related to product meaning focus on what existing products communicate and how people understand and experience existing products (e.g. Kazmierczak 2003, Krippendorff 2006, Rampino 2011, Desmet & Hekkert 2007, Crilly 2011, Waltersdorfer 2017, Goto & Ishida 2014). This gap opens up a potential for this study to investigate the concept of design-driven innovation from a design perspective that concentrates on the operational activities related to meaning creation. The driving research question for the entire study is:

What are the triggers and drivers of meaning creation in the context of expert designers?

As there is no existing research that explicitly address the operational activities of meaning creation, it might be a useful starting point for this study to build on relevant theories of designers' practice. A key resource is theory on product framing.

Product framing

In recent design literature, framing is represented as the designer's key skill (Hey

2008). Kolko (2010) describes framing as a way of moving from insights and analysis into design synthesis. He argues that framing is an activity which makes immaterial values more tangible, clear and accessible for development. In this way, frames form the underlying reasoning behind a concept, thus arguing for strategic decisions and establishing key points of the design in the early phases of development. An important milestone in research on framing is Dorst's work (2011) when he defined framing as the designer's approach to a 'wicked problem'. He showed that when designers work with a design problem which is complex and ambiguous by nature (Buchanan 1992) and thus not possible to design upfront 'what' the future solution is or 'how' the solution should work, the designer creates a frame. This frame serves as a working hypothesis for how the solution should work in order to achieve an aspired value ('why'), see fig. 12. Dorst calls this approach 'frame creation' (Dorst 2015) which allows for radical innovation of new meanings. Framing in design research provides an important contribution to understand meaning creation on a processual level; however, research is still lacking the content and related activities in the process.

Despite an increasing interest in design to innovation in industry and accordingly growing literature in the design field, there are still no explicit descriptions on how meaning is created on an operational level. For the same reason, meaning creation becomes a difficult process to implement and manage in practice as there is very little guidance for how to address and construct meaning in design teams. This gap in research provides the point of departure for this PhD project which builds on current literature on design-driven innovation and on key frameworks on designers' practice.

Ontological View (How we understand the research object)

Before elaborating on the methodological approach for this study, we must fully understand the lens through which we investigate the research object. The choice of how reality can be investigated (methodology) relates to how we understand reality (ontology). In other words, we need to understand the paradigm for studying design activity as there are many possible ways of describing design processes. A starting point might be to define the 'reality' of designers' practice

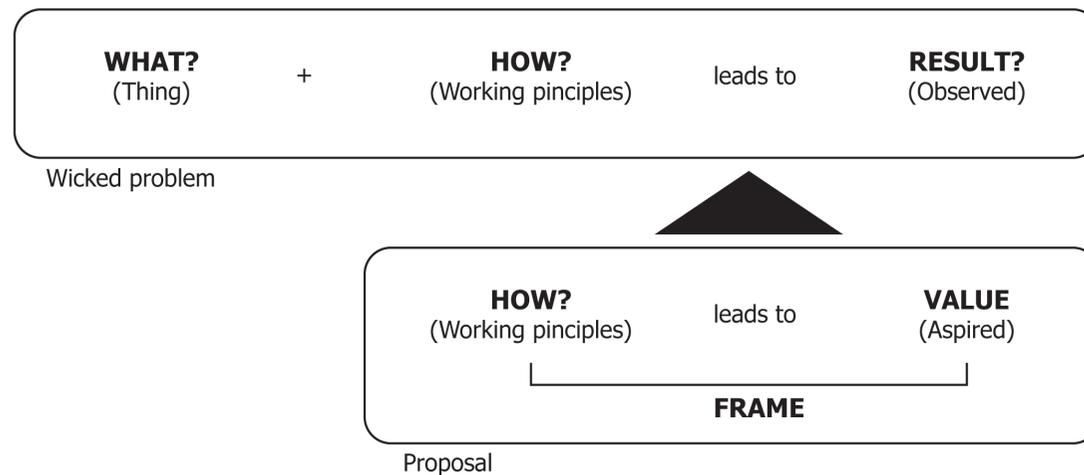


Fig. 12. Dorst's definition of a frame - as a proposal to a wicked problem (based on Dorst 2011, p. 523-524)

for this study, also called the 'ontological view' in the following. As such, the ontological view offers a frame for how to approach and investigate the research object.

Design research has shown that there are many possible ways of describing design processes. In this context, Dorst and Dijkhuis (1996) compare two fundamentally different paradigms for approaching design activity: rational problem solving and reflection-in-action. Regarding design as a process of rational problem solving takes a logic-positivistic stance which was introduced by Simon (1969) in the 1960's. In this paradigm, logical analysis is used to produce knowledge about the design process in a rational manner. It refers to the ontological view which concerns an objective view of reality and seeks explanations. The radically opposite paradigm is seeing the design activity as a process of reflection-in-action. This theory was introduced by Donald Schön (1983) in his work on the reflective practice. In contrast to the rational approach, Schön argues that design cannot be generalised into a rational search process. Rather, design is a '*reflective conversation with the situation*' where decisions are based on perceptions, and every design situation is tackled as being unique. This view refers to ontological constructionism which concerns the subjective view of reality, i.e. reality is a product of what is interpreted by the individual (Egholm 2014).

This study is highly related to Schön's view on the design process as a reflective practice. The aim of this study is to increase understanding of how designers make sense of complex environments; accordingly, the central point is interpretation and meaning of products which is unquestionably constructed on the basis of human perception and thought processes. Along these lines, the concept of framing plays an important role. Schön defined framing as '*the underlying structure of belief, perception and appreciation*' (Schön & Rein 1994: p. 23) which allows to '*see things as*' (Schön 1983) or to create specific '*object worlds*' (Bucciarelli 1988). Several studies on design activity build upon Schön's perspective on framing to describe how designers work and think (Valkenburg & Dorst 1998, Stumpf & McDonnell 2002, Dorst & Cross 2001, Roozenburg & Eekels 1995). In this perspective, design actions are based on cognitive frames which are established from the designer's understanding of the situation (Dorst

& Dijkhuis 1996). Positioning this study in an ontological paradigm where reality is regarded as subjective and multiple, takes its point of departure in a qualitative stance; accordingly, the methodological approach for this study reflects a qualitative investigation of the designers' practice. The process of qualitative research involves emerging questions and procedures and data is typically collected in the participants' setting (Creswell 2014). The qualitative strategy seeks to describe complex contexts in a holistic manner, i.e. multiple perspectives and a variety of factors of the situation are investigated in the research process (Groat & Wang 2013). Besides a holistic approach, the study reflects an open-ended style of inquiry which adheres to an abductive strategy. This strategy is central for this study where the focus has gradually developed concurrently with new insights from the empirical world.

Methodological Approach: Systematic combining (Abduction)

The methodological approach for this study relates to 'systematic combining' which is an abductive approach to case research (Dubois & Gadde 2002). In this approach, multiple data sources and methods are used to discover different dimensions of the research area. This study includes in-depth interviews, workshops, follow-up interviews and observations which are related to 4 different studies in the project. An overview of the study is found in Fig. 13.

The main characteristic of 'systematic combining' is a continuous movement between the empirical fieldwork and the theoretical framework. In practice, it means that the focus for this study has been reconsidered several times as it is greatly guided by insights from the empirical world and accordingly, the redirection of the research focus called for additional theory and new concepts. As such, the research process is highly reflective and experimental (Rylander 2012); inquiry is guided by purpose and exploration which means that the next step is dependent on the previous; experience opens up new ways of inquiry and pays close attention to the empirical context, and as a consequence, the result has not been possible to plan in advance.

For instance, in Study 2 the resulting data from the workshops showed that the quality of insights used in the process has a significant impact on the final outcome. In the study, we investigated the underlying processes of successful

Study/publication	Focus	Data sources/context	Type of data
Study 1: <i>The construction of meaning in design-driven projects: a paradox-initiated process</i>	Explore the triggers of meaning envisioning	Case studies: In-depth interviews with expert designers supported with project material	Retrospective data (based on existing products)
Study 2: <i>The characteristics of successful meaning construction in design teams</i>	Explore the factors that influence successful vs. unsuccessful meaning creation in novice design teams	Workshops: Observations and follow-up interviews with master design students	Real-time data (based on emergent projects)
Study 3: <i>Seeking insight into an unknown future: an exploration of designers' strategies to discover key insights</i>	Explore the triggers of meaning envisioning	Case studies: In-depth interviews with expert designers supported with project material	Retrospective data (based on existing products)
Study 4: <i>The translation process of insights to a meaningful experience: closing the gap</i>	Explore how insights lead to establishment of key frames (how designers tie together research and conceptualization)	Case studies: Observations of design meetings / stakeholder presentations and follow-up interviews with expert designers	Real-time data (Based on emergent projects)

Fig. 13. Project overview: 4 studies (Author's own illustration)

and unsuccessful teams in the context of design student projects. The successful design teams searched for insights concerning user behaviour, i.e. insights unique to the design situation. They further questioned the motives behind the behaviour they observed which was the starting point for envisioning a new product meaning. This strategy contrasted with the one from the unsuccessful teams which were driven by product features, often resulting in formulations like 'easy to use'. These types of formulations did not help the team forward in developing new meaning but rather created small improvements of existing solutions' features. As such, the study emphasised that the concept of 'insights' was critical for meaning creation which appeared to be an interesting concept to follow and further explore in subsequent studies. Accordingly, the new research focus triggered the search for additional theory and new conceptual models on 'insights' in design. Data collection followed in a similar way but with the new research focus, namely how expert designers discover insights (Study 3).

Abduction is further characterised as an open-ended process. This means that this study comes to an end but the design processes in the real world continue; conclusions will stay open-ended as they are based on data from a specific situation, context and time for which it was conducted as well as the empirical data available for this study. Therefore, the study would not claim to present the whole truth about how designers approach product meaning in the process; rather, it will stay open-ended in the sense that more empirical evidence, other theoretical lenses and frameworks or different perspectives from for instance an organizational macro-level might represent a different truth about meaning creation as a strategy to innovation. On the other hand, it will strive towards the most useful proposal to the subject of inquiry, based on available knowledge and empirical material produced in the given time and context.

A central perspective in the systematic combining approach is that interaction between an empirical phenomenon and its context can best be understood through in-depth case studies (Dubois & Gadde 2002). Data for this study is mainly collected by multiple-case studies in an abductive way to explore and discover the triggers and drivers of meaning creation. This process is characterised as a nonlinear, iterative and path-dependent process where the researcher constantly moves between asking questions, generates hypotheses and makes

comparisons (Dubois & Gadde 2002; Strauss & Corbin 1990).

Methods

Multiple-case study

Yin (2014) defines a case study as “*an empirical inquiry that investigates a contemporary phenomenon (the ‘case’) in depth and within its real-world context, especially when the boundaries between phenomenon and context may not be clearly evident*” (Yin 2014: 16). For this PhD study, the phenomenon of inquiry is the process of meaning creation which is mainly investigated in-depth through multiple cases in a real-world context. While laboratory experiments isolate the phenomenon from its context, case studies emphasise the real-world context in which the phenomenon occur (Eisenhardt & Graebner 2007). This means that case study research produces concrete, context-specific knowledge (Flyvbjerg 2006). The aim is to understand influencing factors on the process and for that we need more empirical cases to get insight into contextual conditions; the phenomenon must be understood in respect to its circumstances as there might be variations across the cases included. Only if we include multiple cases (compared to a single case), we are able to identify characteristics of meaning creation in a more general perspective as well as the contextual factors that influence the process. This means that the study concentrates on the relationships that are replicated across cases (rather than all details of one case). Pluralistic viewpoints are embraced, both in terms of the different actors involved in the same project but also across cases which represent different types and sizes of companies and industries.

Multiple data sources

Case studies are typically based on a variety of data sources which is also the case for this research. Multiple sources for data collection are used to discover new dimensions of the research object. The entire study combines retrospective and real-time cases. The retrospective cases (Study 1 and 3) rely on in-depth interviews supported with project material (design briefs, prototypes, stakeholder presentations, early drawings etc.). The qualitative interview is commonly used to collect opinions, beliefs and reflections about past, present or future facts seen from the interviewee's viewpoint (Blessing & Chakrabarti 2009). This perspective is a critical issue for this study; the designers' reflections on the

design situations are central to understand the actions and the reasoning behind the final outcome. As such, the main objective of interviews for this study is to explore and identify the factors that trigger and drive the process until the final solution. The designers' motives and drivers of their actions and decisions is more precisely described through interviews (compared to e.g. observations). On the other hand, data collected from interviews represent selected information based on the designer's memory; accordingly, interviews do not reflect all actions and decisions made in the process and there might be issues that will not emerge through interview data. Also, the process might seem clear, straight-forward and linear in a retrospective view which is often not the case in practice. Therefore, the retrospective cases are supported with real-time observations to arrive at a more detailed knowledge of meaning creation activities – out of control of the researcher. E.g. in Study 4, real-time data is collected in emergent design projects in different companies and includes observations of design meetings and stakeholder/client presentations to follow how meaning emerges over time and to identify related influencing factors. Observations are supported with follow-up interviews with designers and managers to track reflections continuously.

Case selection

The selected cases aim to represent the best designers in Danish and Dutch design companies and agencies. Cases are selected based due to their information-rich nature where key informants are especially important sources on a specialised issue (Patton 2015). Companies and designers are selected based on their representativeness (Eisenhardt & Graebner 2007) due to their experience in the field, their design-driven approach and their successful product portfolio representing a variety of different product categories. Key informants (designers) for interviews are selected based on their experience in the field (minimum 8 years); thus, the type of product is less important as the study focuses on the design situation and not the product itself.

Epistemological Reflection

The outlined ontological and methodological aspects described in this chapter points towards a clear direction for epistemological positioning for this study. This PhD study seeks to understand the process of meaning creation in design teams through multiple cases and takes an open-ended and iterative approach for

inquiry. The methodological characteristics for this study reflect some of the core concepts that stem from the philosophy of pragmatism, mainly related to the thoughts of the classical pragmatist John Dewey (1859-1952). Reflections of such positioning will be elaborated in the following.

Schön's theory on the reflective practice (described in the section on "Ontological View") was greatly inspired from Dewey's work. A central aspect in Dewey's work was to reconcile the dualistic theory of logic (Dewey 1938). Along these lines, pragmatism represents neither only the realistic worldview (positivism) nor only the constructed worldview (social constructivism). This means that knowledge is not only based on objective understandings of reality or social constructed facts isolated from reality. Hence, factors cannot be studied in isolation as they are a part of a whole; this idea represents a situated perspective where no subject or phenomenon in the world can be understood outside of its context (Dalsgaard 2009). In this way, knowledge in pragmatism is produced through embodied (subjective) experience in a concrete (objective) situation (Egholm 2014). Since this study aims to explore the underlying process of how designers embed meaning in products, it can be regarded as an examination of how social reality is created but it is limited by the context in which it takes place. Particularly, it looks at how design teams socially understand or interpret the design situation which underlies how they deal and act with it in practice. Hence, practice becomes a consequence of the constructed reality.

In the pragmatist perspective, the world and phenomena in it are emergent; accordingly, the concept of meaning is not regarded as a fixed or stable concept. In pragmatism, theories stem from practice and as the world is constantly changing, so are theories tentative and relative (Dalsgaard 2014). This dynamic perspective represents a highly situated view on human activity in which human thought and action form the basis for how we make sense of things (ibid.). The situated view plays a key role for this research where knowledge is produced from specific cases (situations) in which product meaning is embedded successfully and unsuccessfully. One could say that the unstable and context-dependent nature of meaning and design activity investigated in this study relate to what Dewey terms an 'indeterminate situation' (Mackay 1942, Dewey 1998). Expert designers successfully deliver meaningful and understandable products again and

again, while other products fail on the market to deliver meaningful experiences in spite of that they have been through the same phases and processes. The idea of this study is to identify the elements that are critical for creating product meaning, by investigating different situations and compare best practices with less successful cases (novice practice). In this process, inquiry rarely unfolds in a straight-forward manner; our initial understanding of the situation forms ideas and hypotheses which are tested in practice. Experience from practice will often require the researcher to revise hypotheses and assumptions on essential points. As such, knowledge from this study is produced in an iterative manner by going back and forth between the empirical world and theoretical frameworks until hypotheses are transformed into facts of existence (Dalsgaard 2014) – or in Deweyan terminology: to move the indeterminate situation towards determinacy (Dewey 1998). This process of inquiry reflects the abductive approach described in the section on “Methodological Approach”. Dewey (1958) argues that the attitude of openness and exploration is key to this process. The aim of the study is not to prove anything (like in a positivist perspective) but rather to learn something and thus develop a nuanced view of reality (Flyvbjerg 2006).

The situated approach through case studies also means that results from this study is not a representation of the universal truth. The pragmatist perspective recognises that multiple perspectives can offer multiple truths about the same phenomenon (Bacon 2012). This means that meaning creation studied in other situations, under different circumstances and by other methods and approaches may provide a different truth than the one presented for this PhD study. The value of theory in pragmatism rely on the ways they help us grasp and act in the world; as such, ideas and theories are ‘true’ if they are regarded as useful in practice (Brinkmann 2006). In this sense, this study will – in its pragmatic nature – strive towards the most useful design support for meaning creation, based on available knowledge and empirical material produced in the given and present context. As such, the goal of this project is to contribute with a proposal that is useful to both academia (contributing to design research) and to industry (supporting design teams in practice) on the subject of meaning envisioning in design teams.

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Chapter 4 : Architectural, transition and cognition - An electrophysiological approach to action, perception and architectural transitions
By *Zakaria Djebbara*

Time line: February 2017 - February 2020

Keywords: Architecture, predictive mind, transitions, architectural cognition

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Name	Thesis Title	Theory Input	Methodology	Epistemology
<i>Zakaria Djebbara</i>	Architectural, transition and cognition - An electrophysiological approach to action, perception and architectural transitions	Predictive processing Husserlian phenomenology Pragmatism	Electroencephalograph Event-related potentials Questionnaire	Critical-rationalism Empirical-analytical Pragmatism

Architectural, transition and cognition - An electrophysiological approach to action, perception and architectural transitions

Zakaria Djebbara

Introduction

A general outline

Following chapter discuss qualified modus of reasoning for an interdisciplinary study, as dealt with in the PhD-project concerning architectural transitions “Architectural, transition and cognition – an electrophysiological approach to action, perception and architectural transitions.” The project seeks to answer:

Does the active passage in architectural transitions have an impact on the body, brain and thus, experience?

The aim of this chapter is to present an interdisciplinary approach, which positions the project in epistemological stances by justifying the produced knowledge to be practical knowledge. As the project is highly interdisciplinary, crossing cognitive neuroscientific methods, philosophical frameworks of embodiment and architectural theory, it is mainly linking how the mind makes sense of the world with how scientists unravel knowledge in nature. Thus, these aims are guided by similarities between theoretical developments in epistemology and epistemic cognitive processes seen through empiricism and pragmatism, to argue the justification of a probable truth. Friction between empiricism and pragmatism will lead the chapter to an abductive hypothetico-deductive model, a Peircean-Popperian hybrid, which is argued to best fit an interdisciplinary study concerning cognition and environment. This is to be thought of as a strategy considering Groat & Wang’s structure of architectural research (2013). How the mind acquires knowledge about the world is a Bayes-optimal approach, which surprisingly has foundational similarities with justifying knowledge (epistemology) in scientific research.

Body, brain and environment is, according to embodied theories, informing cognition dynamically (Clark 1999). With an equal interest in the human being

and the environment (architecture), this project is situated in the broad field of cognitive science, with a particular interest in the interaction of body-brain and environment. The belief of departure is that architecture is better understood through the experience of human beings, instead of an abstract geometrical art form, injected with symbols and metaphors (absurd formalism). What is meant by architecture, as the definition is rather inclusive than exclusive (see Quintal, 2016 for 121 definitions), is *a composed spatial structure inducing designed experience*.

By referring to “*composed*” structure, and “*inducing designed experience*”, the definition implies an underlying intention of the architect. If we accept the suggested definition of architecture, this study considers a major component that involves both the composed space and the experience, namely the perplexing nature of transitions. In inquiring transitions, which is a component architects perceive differently from cognitive scientists, it is necessary to account for the meaning from both aspects.

On an architectural scale, transitions represent the idea of physically passing a spatial threshold, an action-dependent change of environment, where both the environment and threshold are individually defined. Such transitions dependent solely on the experience of the inquired agent, as each individual defines independently when undergone such transitions, i.e. turning a corner, passing a door, stepping up to a podium etc. (Moretti et al. 2002, Tschumi 1996). These transitions are highly influenced by the geometrical shape or obstruction of the architecture, creating a static conception of transitions. This, I will refer to as architectural transition, as it depends on the environment and geometric threshold. On the scale of experience and cognitive science, transitions can be understood as the flux of moving in space and time, which itself is the nature of human conception (Husserl and Moran 2001, Pöppel 1988, Wittmann,

2014, Wittmann and Butler 2017). This type of transition is often referred to in the discourse of temporality, and is inherently rooted in both philosophy and cognitive science. This, I will refer to as transition flux, or merely flux, as this is an inescapable prerequisite of the stream of experience. The transition flux is central to our understanding of how experience comes about, and in what order. The order of space is essential to understand architectural transitions, i.e. is the experience of space B, passing from space A, similar to the experience of space B, passing from space C? See figure 14. Thus, the general purpose of the project is to investigate the relation between architectural transitions and the transition flux. Whether composed architectural constraints of space correlate with the flux of experience.

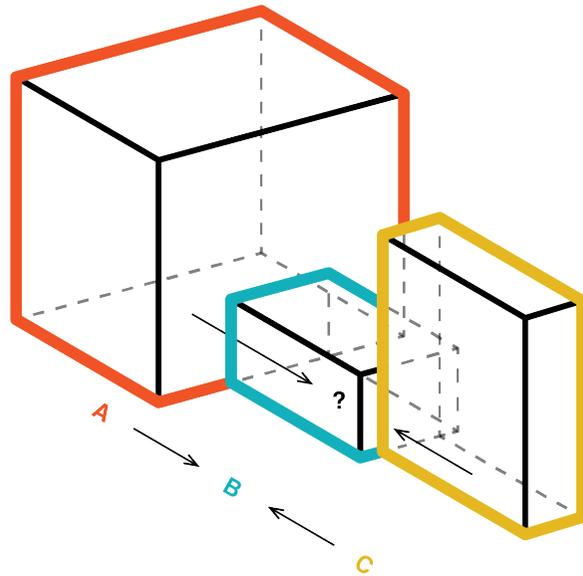


Fig. 14: The ultimate experience of space B, transitioning from space A, is incomparable to the experience of space B from space C.

Having an embodied approach to transitioning, the project goes beyond traditional understanding of perception and seeks to intertwine action and perception. In this sense, the current project produces knowledge both in architectural and cognitive scientific fields, by virtue of dealing with the very essence of how human beings experience the environment.

Human beings are dealing with ontology, *'what is reality'*, and epistemology, *'are there good foundations for belief'*, constantly in their transitional flux with the environment. To avoid confusion, the term epistemology is used in the sense of the philosophical discourse in justifying scientific knowledge, while the term episteme designates the bodily justification of experienced content, through sensory-datum. Crucially, sensory-datum is different from awareness of sensation, as this would refer to experience – instead, sensory-datum is understood as the sensory content. This distinction will illuminate the pragmatic importance of human cognition in epistemology. The structure of epistemic content, part of human cognition, shares similarities with scientific epistemology (Quine 1969). One can think of this vindication as the evidence of senses being similar to the evidence of sciences (Gładziejewski 2017).

Philosophy of perception can be categorized as internal and external perceptions, where the former informs the agent of internal states, such as being hungry, anxious and locating limbs, whereas the latter handle exteroceptive stimuli, i.e. various sensory content. What one perceives is highly dependent on sensory-datum, and thus functions as a primary instrument. However, sensory is subject to err, evidently in i.e. optical illusions and i.e. vivid hallucinations in schizophrenia, putting sensory-datum into question; if epistemic structure of basic observation through senses is subject to err, what legitimacy does the foundation of sensory and its empirical status at all hold, then?

How one makes sense of sensory-datum is a crucial issue to consider if a parallel is to be drawn between cognitive episteme and research epistemology. Note that errors on sensory level does not preclude the efficiency of how one makes up the world, but is rather, epistemologically, an error on an instrumental level. Possibly the most important critique, in light of episteme and epistemology, is Sellars' critique of the Given, as it addresses the instability and structure of sensory

content. Sellars questioned the epistemic status sensations inherit according to empiricists (to know by virtue of sensation). The Sellarsian dilemma (1963) states that if sensory data encompass self-assured content, then it firstly falls short of singularly convincing and judging epistemic content as correct, as it would require an additional reason to believe the content. Consider an optical illusion where other sensory (i.e. touch) differs. Secondly, if sensory-datum presents the world in a particular way (consider any color), the assertion of the content cannot be arbitrarily asserted, therefore, the content require reason for itself (why this experience), and consequently, the epistemic structure cannot end at sensory state. In this case, the sensory content, and thus belief, would depend on a given. Alternatively, if sensory does not bear any content, being brute stimulations, *“they do not represent anything as being a certain way”* (Gładziejewski 2017), meaning experience cannot provide a reason for justifying any proposition as true. In such case, the sensory signal is purely receptive and silent in content. Unraveling and giving an account of the phenomenon of experience is central to the project, therefore the research questions are followed by an embodied account of how sensory datum culminates in experiences.

Research questions

The use of movement through architectural structures, resulting in a series of ordered sequences/transitions, has been an invariable architectonic device throughout most of the history of architecture. It is found in religious, as well as civil and domestic, buildings, and across various cultures. It can be found e.g. in ancient Egypt (Fazio et al. 2008: 33), ancient India (2008: 79), ancient Rome in which *“the basic notions of center, path and domain are unified to form a hierarchical system”* (Norberg-Schulz 1980: 53–55). In Christian religious architecture, the path is inseparably linked to symbolic meaning (Norberg-Schulz 1980: 73–74), but is nevertheless found in civil and domestic buildings as well. Thus, a key idea of one of the most influential books throughout the history of western architecture, *“The Four Books of Architecture”* (Palladio 1965) by the Italian Renaissance Architect Andrea Palladio (1508-1580) is exactly architectural transition, demonstrated in a series of villas he designed. In modern times Le Corbusier’s idea (Samuel 2010) promotes the idea, virtuously used for example by diverse architects as James Stirling (1926-1992), Tadao Ando (1941-) Rem Koolhaas (1945-) and many others. Transitions are by definition dynamic events,

concerning the duration of altering one condition to another (OED, 2018). By virtue of theories on embodied cognition, the project seeks to establish a discourse on the bodily and cortical impact of actively passing transitions.

In questioning architectural transitions, one is obligated to consider temporal and spatial perspectives, as they constitute the core elements of a transition. Having an embodied approach to transitions, the questions range from how the body moves in space and the offered potential actions to transit to another space. Architecture is in the position of creating affordances, the possibilities to act with reference to the body-skills (Chemero and Anthony 2009, Clark 1999, Gibson 1979, Kiverstein et al. 2017), which in turn influences how the body and brain program the necessary bodily trajectory to propel itself through space and time. During movement, space is heterogeneous (Bergson 2001), and due to the constant enacted body, architecture is never grasped homogeneously – one constantly process possibilities to move, and by virtue of movement, perception of architecture is considered dynamic (Friston et al. 2011, Friston 2013). The predictive processes of movement reflect the main function of the brain, which is to predict from lower sensorimotor, including sensory to perception, to higher cognitive levels (Clark 2015, Friston 2010). Experience of space heavily depends on the perception of space, which in turn depend on sensory-datum. The central question is whether movement in space can influence the experience of space. The temporal aspect of any given experience is bound to shed light on causality and explanation, especially if bodily (interoceptive) reactions coincide with (exteroceptive) perceptions continuously. The inquiry put forward here, is whether an architectural transition correlates with physiological states. In other words, whether cortical states reflects architectural transition. Such inquiry puts to question causality of physiological changes. To put these fundamental questions in perspective of current project, consider the main research question:

Does the active passage in architectural transitions have an impact on the body, brain and thus, experience?

The question is multifaceted, addressing questions as; which element in the transition have an impact, how does action relate to perception and does action itself influence the experience of space?

One can proceed to deconstruct the question to even more simple and general inquiries. Albeit, the central question in this epistemological context, is how the approach on embodied cognition and predictive processes corresponds to the justification of knowledge in scientific research.

Predictive processing; an embodied theory of cognition

Predictive processing (PP) is a theoretical framework of cognition, which postulates an active, predictive and interpretive perceptual contact with our environment by resisting tendency to disorder, or put simply, self-correcting by minimizing free energy (Clark 2015, 2013, Friston 2013, Friston et al. 2006, Hohwy 2013). PP is an embodied theory of cognition backed up from early studies in artificial intelligence and Bayesian rational to probability. The core

thesis of PP is the predictive nature of our being consists of a multi-layered hierarchical generative model examining generated prediction onto bottom-up signals, where any detected prediction-error will result in adjusting and adapting for future predictions. The predictions generated follow a truth-conductive self-correcting Bayesian rationality.

“Errors in predicting lower level inputs cause the higher-level models to adapt so as to reduce the discrepancy. Such a process, operating over multiple linked higher-level models, yields a brain that encodes a rich body of information about the source of the signals that regularly perturb it.” (Clark 2013)

Put forward by Friston and Stephan (2007), prediction-errors are ensued through motor-action and active inference, which means perception depends on action, which in turn informs an internal generative model, triggering a minimization of top-down predictions by bottom-up sensory signals. Such predictive apparatus is linked to Helmholtzian unconscious inference (von Helmholtz and Southall

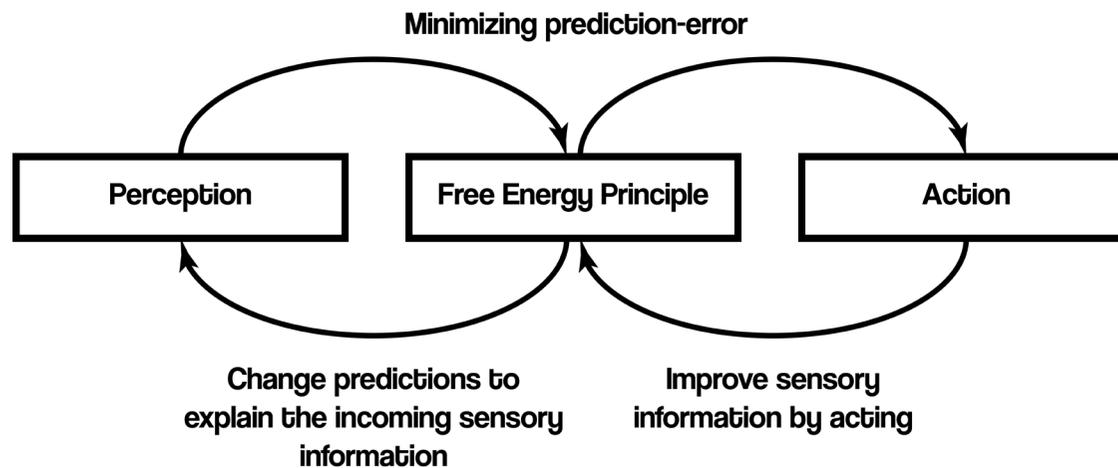


Fig. 15: A conceptual diagram of the inner workings of PP, displayed through action-perception cycle. A constantly acting sensory process updates itself, where any detected prediction-error is used to inform the transitional state of the agent situated in a world. This ensues in an outcome, used to inform the iterative process of action-perception. The detection of a prediction-error elicits an abductive reasoning, forcing the brain to generate new hypotheses about the world based on sufficient statistics in Markovian manner.

1962) and conceptually to Kantian “a priori” (Kant and Meiklejohn 2003) and thus is by no means historically novel. Being less radical on the concept of “a priori”, PP is intrinsically related to that notion, since cognition is stated to be predicted (action) rather than an output (reaction). Perception becomes a knowledge-driven probabilistic inference process, situated in a test/update process, usually interpreted as a form of abductive reasoning (Gregory 1980). According to PP, action cause perception, in the sense that confronting the sensory signal itself with a top-down prediction, enables the model to adjust predictions/estimations. Thus, the dynamic relation between sensory and prediction, here the equivalent to action-perception cycle, is crucial for getting a hold of the environment.

Within the hierarchical structure, higher-level predictions are chained with lower-level prediction through hyper-priors, which is where the competition of top-down and bottom-up signals takes place, and it is the hyper-priors that require adjustments pending on the competition. There exists variations on the properties of different processes in PP (Clark 2015, Hohwy 2013, Seth 2014) however, the described outline is the core of any PP-related alternative. In agreement with Luenberger’s definition of dynamic systems (1979: 1), PP is considered to be a self-organizing continuing evolutionary process that produce time-changing patterns interrelated with those at other times. Coherently linked stream, or flux, of unfolding events, only becoming more and more certain of itself over time by virtue of its coherent-ness. In other words, the strength of PP is precisely because it is constructing coherent and continuous knowledge about the world, without unexpected obstructions. Unexpected obstructions are considered prediction-errors, which lay the basis of how the brain functions. As the brain continuously constructs knowledge about the environment, it demands a certain energy consumption. By predicting the environment instead of distributing attention to the continuous bottom-up sensory information, the brain preserves energy more effectively by predicting the world through hypotheses/priors, which are generated by action/perception loop.

Having established how the brain actively predicts the environment through action/perception and prediction-errors, the project will now be positioned in epistemological terms, to argue the strength and similarity to PP.

Positioning the project

Why foundationalism and empiricism are insufficient

In line with classical pragmatists, it is believed that epistemology must connect to human cognitive capacities; therefore, questioning these is believed to provide a coherent theory of epistemic and epistemological judgement. PP is a pragmatic system that mediates between – and therefore situated according to – coherentists and foundationalists. As a point of departure, stating that epistemology is similar to epistemic judgment, is subject to the coherentists regress fallacy, as stated by critics of coherentism.

$$(p \vdash a) \perp (a \vdash p)$$

The line states that if p is used to support a, then a cannot be utilized to support p. In other words, if the argument is that action is derived from perception, then perception cannot be derived from action. According to coherentists, we can safely enter such systems of belief, if the system is coherent to a sufficiently high degree. If the belief contributes to the holistic system, by i.e. creating subsets, and introduces no internal inconsistencies, then it is not a false belief – au contraire, the belief system is justified precisely because of its holistic sense of coherency (BonJour, 1985). Needless to state that;

$$A_1 \rightarrow A_2 \rightarrow \dots A_n$$

$$\frac{\neg(A_1 \wedge A_2 \dots A_n)}{\therefore \neg A_1 \vee \neg A_2 \dots \neg A_n}$$

If belief A1, then belief A2, and if A2, then An. Given the system A (A1 and A2... An) is false as a holistic system, we can infer that one, or all beliefs, are false. Thus implying the ability to avoid validating whole systems that contains a false belief. According to coherentists, justification is not a linear process, which would ultimately base any justification on sensory belief; in fact, it is a matter of justifying a belief system. In contrast, foundationalists states that any justification is founded upon independent basic beliefs, which in turn serve to justify non-basic beliefs (Bacon 2012: 149). Such strong foundationalism

implies basic beliefs, such as sensory-datum, to be indubitable and as illustrated, however, such belief is misguided. Although foundationalism rests on misguided status to sensory, it is, in contrast to coherentism, consistent with empiricism, as experiential inputs are possible as sources, rather than a relation to other beliefs. In return, coherentists do not accept that, we can distinguish between cognitive and sensory elements in experience and by stating that experience is cognitive, coherentists believe to have escaped the empiricism-problem of sensory status.

Consider PP, which takes point of departure in an informed prediction met by a sensory signal that might construe prediction-errors. In this case, the top-down/bottom-up competition is not a closed coherent system that needs internal justification through other beliefs, contrarily; it takes point of departure in experience, similar to foundationalism. Albeit, clearly linked to an empirical stance, PP states that predictions on sensory signals are inferences to the best explanation, equivalent to a coherentist's set of beliefs, which ultimately situates PP between both isms. A set of coherent beliefs, a set of coherent sensory-datum, is necessary to make informed predictions. In agreement with abductive reasoning, PP states the hierarchical model to generate hypotheses of the world informed by various sensory signals and prior experiences, to better prepare the agent for various scenarios, even before sensory-datum inputs. Recall that PP is an embodied dynamic theory, which seeks to reduce tendency to disorder (homeostatic balance), by minimizing prediction-errors, over time-changing patterns. Recognizing a coherency of patterns is thus necessary to the generative model. Each sensory signal offers a dimension of the environment, however, the signal does not construe its own model of the world, rather, it enjoys participating as a subset in a bigger coherency, either fulfilling or falsifying the predicted hypotheses for the generative model. For each sensory signal, a precision weight is encoded and updated when confronted with error (Clark 2013). Haack offers a notable metaphor of such abductive inference to the best explanation:

“How reasonable one's confidence is that a certain entry in a crossword puzzle is correct depend on: how much support is given to this entry by the clue and any intersecting entries that have already been filled in; how reasonable, independently of the entry in question, one's confidence is that those other already filled-in entries are

correct; and how many of the intersecting entries have been filled in.”
(Bacon,2012: 150, Haack 1993: 82)

Haack herself holds a foundherentists stance; a hybrid of both, very similar to PP (Bacon 2012: 150). The core idea is to locate where episteme seems to take place according to PP, whether in higher-level cognition or in lower-level sensory, and derive an epistemology to scientific research. One could question, if sensory-content entails any knowledge? We are encountering the Sellarsian dilemma.

Is sensory content epistemic or not?

Sensory content is a cousin of qualia. In this context, however, it is not the content itself, the qualia, that is of interest, but rather locating the apprehension of the content. In phenomenological terms, this may be referred to as intentionality.

In contrast to Peirce's limitation of pragmatism to experimental purposes, Dewey broadens pragmatism to all areas of human life, including metaphysics, epistemology and political theory (Bacon 2012: 7). Dewey states *“Indeed, it lies in the nature of pragmatism that it should be applied as widely as possible; and to things as diverse as controversies, beliefs, truths, ideas, and object”* (Dewey 1908: 87). Precisely due to Dewey's naturalistic broadening of pragmatism, it permits pragmatic statements on cognitive processes from pragmatism itself. Haack believes “experience and reasons are both elements in justification, and an adequate theory of justification must show how they work together” (Bacon 2012: 149). This is not to say that Peirce included no aspect of naturalism, Dewey merely explicitly puts forward the potentials. This is also noted by Quine (1969: 26):

“With Dewey I hold that knowledge, mind, and meaning are part of the same world that they have to do with, and that they are to be studied in the same empirical spirit that animates natural science.”

As e.g. John Locke (1632-1704), Francis Bacon (1561-1626), David Hume (1711-1776), and other traditional empiricists argue, it seems that the only existing reality we can agree upon is the one empirically measurable. A

prerequisite of being part of reality is the fact that others agree upon its existence as well. An assumption made by traditional empiricists is the sensory states of an agent are epistemically basic, that is, sensory states offer justifiable mental representations without being dependent on prior representational states. What we perceive, is epistemically basic, and not derived from any Given, creating a strong link to foundationalism and the belief that any perception is individual. For instance, Hume denied the ability of experiencing causal relationships between objects, i.e. observing “one billiard ball striking another, [...] we cannot see one cause the other to move, but only one movement followed by another” (Bacon 2012: 36). Such radical empiricist skepticism gave rise to Kantian metaphysical transcendental ego, and to James argument against empiricists representationalism, by approving experiencing relations between events. Similar to Kantian “a priori”, the general critique of empiricism is that representationalism being unable to link an active experiencing agent to the context of life. Kant sought to solve such skepticism by giving rise to a less separated division between mind and world using the notion of “a priori” (Kant and Meiklejohn 2003, Kitcher 1990), which ultimately poses a self that stands apart from the world. In such radical Kantian stance, sensory content entails no epistemic content, as episteme is transcendental, beyond the empirical world. James’ stance, that is a direct confrontation of the world, imposes a perception that is independent of any re-presentation (Bacon 2012: 36–37). According to James, then, sensory transports already existing properties of environment to the agent’s perception. The sensory content seems not to be silent in this regard.

In other words, empiricists state that all knowledge must conform to experience, whereas Kant state that all experience must conform to knowledge. We may draw a link to top-down hypotheses as knowledge and bottom-up sensory signals as experience¹.

So where does episteme take place in PP? Applying the Sellarsian dilemma onto PP, sensory signals can either bear, or not, any epistemic content. Drawing on Gupta’s (2006) concept, following reasoning is suggested to the Sellarsian dilemma of epistemic content (Gładziejewski 2017):

1. This crude link is merely conceptual to emphasize the disagreement between empiricists and Kantian transcendentalism in PP-context. By no means can sensory-signal be equivalent to experience.
2. Coherentist, in the sense that it follows coherentism, reasoning through the circular conception of using sensory-datum to continuously update the model and vice versa. The sensory signal is only valid because it fits somewhat with the model, while the model is only considered valid because it fits somewhat with the continuous incoming sensory signals. If there is no consensus, a prediction error ensues.

$$m = s \rightarrow \Gamma s(m)$$

The generative hierarchical model depends on both the sensory signal and the perceptual hypothesis, which is a function of the generative model derived from the sensory signal. The bottom-up signal s , enters the competition contra top-down expectation, m , through a function of sensory signal. PP is not considered to be a representationalistic theory, as empiricism otherwise tends towards, because the interpretation of sensory signal takes place in the generative model, rather than the sensory signal itself. Sensory signal, as the logical proposition implies, is not part of the Bayesian rationale implemented in the generative model, because sensory signals is not evaluated, but rather ignites the process of perceptual hypotheses. Ultimately, PP holds that the world is delivered to the noetic apprehension, to use Husserlian terms, already interpreted and judged unconsciously. Similar to Husserlian phenomenology: “The body’s interactive interpretation of its environment is not noetic; it is not performed by a knowing subject, but by the body itself, living through its hyletic [intention-less sensory-datum] processes, dealing with its physical environment” (Gallagher 1998: 135). Status of sensory signal is still essential for the link between priors and perceptual hypotheses, but bears no interpretation itself. Evidently, an abductive sense of epistemic judgement is present in PP’s reasoning of environment through generating well-informed hypotheses (in Bayesian rationale to increase posterior probability). The essence of epistemic convergence, revising successive sensory signal with perceptual hypothesis (and vice versa), seems coherentist²;

$$\langle s_1, s_2 \dots s_n \rangle \leftrightarrow \langle m_1, m_2 \dots m_n \rangle$$

Sensory signal affirms the empirical validity. The sensory signal is, although intention-less, essential to ignite the generative model. Peirce captures the essence when stated that “different mind may set out with the most antagonistic views, but the progress of investigation carries them by a force outside of themselves to one and the same direction conclusion” (Peirce 1878). Ultimately, PP states perception is

(Bayes) probable; therefore, episteme is sufficiently certain, merely probably true, according to the generative model. As put forth by Rorty, that even the most justified of beliefs, might not even be true (Bacon 2012: 157).

Returning to Kant and a priori, which can be understood as a process before reasoning, such radical understanding culminates in a metaphysical understanding, whereas compared to PP, which seems to naturalize a priori to hypothesis/top-down generated expectations, a priori is only beyond experience in the sense it takes place before the reasoning through experience. Predictions about every sensory signal take place before experience, hence PP hold an a priori stance to reasoning.

To illuminate the equivalent epistemological approach for scientific studies, it seems the abductive reasoning is strikingly convenient, considering the similarities to PP. Perhaps, the following approach gains strength precisely because the nature of cognition and epistemology are coherent.

A Peircean-Popperian model for scientific discoveries

Potentially the biggest pitfall of doing interdisciplinary investigation is the misinterpretation of data, due to inconsiderate reasoning. The project involves architecture and cognitive neuroscience, and by addressing reasoning-issue in these terms the link to PP is further established. Poldrack (2006) emphasizes the underlying issues of a common reasoning in cognitive neuroscience, reverse inference, which can be framed as;

$$\frac{P \rightarrow Q, Q}{\therefore P}$$

If P is true, then Q is true. Case is that Q is true, therefore P is true. Poldrack (2006) demonstrates the fallacy in neuroscientific context;

“(1) In the present study, when task comparison A was presented, brain area Z was active. (2) In other studies, when cognitive process X was putatively engaged, then brain area Z was active. (3) Thus, the activity of area Z in the present study demonstrates engagement of cognitive process X by task comparison A.”

$$\frac{X \rightarrow Z, A \rightarrow Z}{\therefore A \rightarrow Z \wedge X}$$

It is known from other studies that during cognitive process X, brain area Z is active. It is currently observed that during task A, activity in brain area Z arise. Therefore, the task A implies presence of cognitive process X and activity in brain area Z. Affirming the consequent is an invalid inference, which can exclusively be considered deductively valid if, and only if, X exclusively cause brain area Z activation. It might not be possible to capture the purpose of a neural system in one word. Systems in the brain may not follow our cultural idea of a certain concept (Barrett, 2017), e.g. being afraid. Therefore, by assigning a concept to describe neural systems, i.e. activity in amygdala implies being afraid, we may limit our understanding of the neural causality. It has established that activity in amygdala is found during not-afraid states (Gallagher and Chiba 1996, Murray and Baxter, 2002; Schultz, 1998). Therefore, neural systems are mapped and identified with which mechanistic systems exists and are active during such and such situations. In other words, data is gathered on a large scale before formulating a theory. Affirming the consequent is therefore not necessarily wrong, but should be concluded carefully (Poldrack 2006), and as shall be presented, Popperian approach is potentially a supportive approach. The hypothetical syllogism is closely related to inverse inference:

$$\frac{A \rightarrow B, B \rightarrow C}{\therefore A \rightarrow C}$$

We know that A implies B. We observe B implying C, therefore, A may imply C. Such logical progress is based on hypothesis generation, where the observation is replaced by hypothesis; if we hypothetically observe B implying C, then A implies C. Therefore, similar to the nature of hypotheses, such reasoning is speculative, and as both Peirce (1878) and Popper (2007) puts forward, only hypotheses can bring scientific discoveries. Gamez (2012) states the general issue of poor theory-development:

“But the ‘lighting up’ of the ‘language faculty’ in a functional magnetic resonance imaging (fMRI) scan does not explain how the brain produces language; it just tells us that this part of the brain is more linked (on average) to language production than other parts, which might also be essential.”

Gamez (2012) is emphasizing the importance of theoretical explanation of brain activity and function, to progress further research instead of data-acquisition as an end in itself. An explanation is considered valid, if belonging prediction is valid. Consider how PP utilize hypotheses to gain knowledge about the world, namely by tests (action) and updates (perception). It is only prediction-error, which the generative model seeks to minimize, that cause update, and thus new information about the world. Why is falsification stronger in discoveries than verification?

Popper’s hypothetico-deductive suggestion for scientific discoveries (Popper 2007) can be framed as an approach of series of critical reasoning, which initiates discoveries with what can be as abstract as imagination (although inspired/qualified guess might be more promising) as long as they deductively culminate in testable and falsifiable hypotheses. A prerequisite is that the hypotheses, from the guesswork/qualified theory, withstand internal consistency; there cannot

exist any internal contradictions, as illustrated in logics of coherentism. Should the hypotheses hold true, subsequent to experimentation, they are further substantiated. However, if erroneous, the hypotheses are discarded and the theory is deemed to be revised. Such approach puts forward that scientific reasoning is a dynamic relation among theory, logical prediction and observational evidence. Considering current limited knowledge on mind/brain and experience, nothing counters the Popperian initial step (imagination), at least not in any interdisciplinary research involving cognitive neuroscience. In other words, it simply does not matter where the initial theory comes from, as long as it admits to experimentation by way of falsifiable hypotheses. The upshot of a falsifiable, rather than verifiable, hypothesis, is the strength of decision. Falsifying is decisive, it is certain, which points towards why PP states prediction-errors are registered, rather than prediction-success.

Hypothesis-development is evident in cognition and experience, as experience itself is not decisive. To take the example from Gładziejewski (2017) and Gupta (2006), an agent staring at a bright green wall, large enough to occupy the whole visual field, can also be achieved by looking a white wall through bright green glasses, or a blue wall through yellow glasses. The experience cannot distinguish between the given options, which *“gives rise to the claim that the given in*

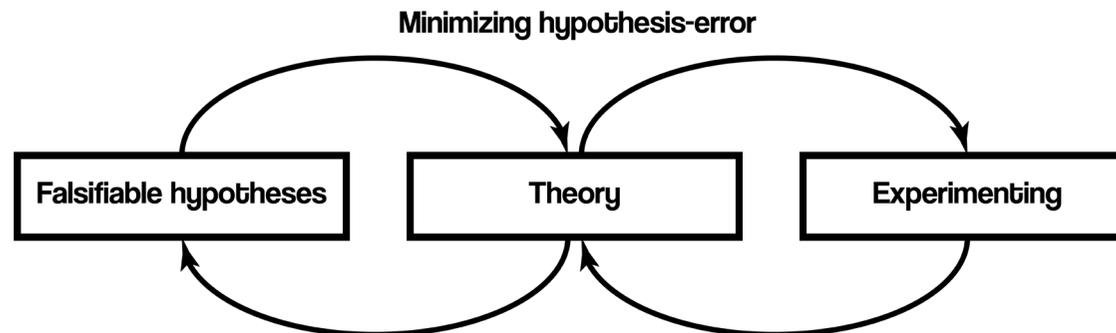


Fig. 16: A conceptual diagram of the epistemological approach. A constantly acting experimentation process updates itself, where any falsified hypothesis is used to inform the state of the theory situated in a world. This ensues in an outcome, used to inform the iterative process of examining a case. The detection of a falsified hypothesis elicits an abductive reasoning, forcing the scientist to generate new hypotheses about the world based on sufficient statistics in Markovian manner.

experience is 'hypothetical' in nature." Such claim has Kantian roots, in the form of a priori possession of particular experiences.

Consider the suggested approach to epistemology; take O to be an observation, T to be theory and H_f to be falsifiable hypothesis. In case of inconsistency between theory and observation (potential scientific discovery):

$$\frac{T \rightarrow H_f \rightarrow O, O \rightarrow \neg H_f}{\therefore O \rightarrow \neg T \wedge \neg H_f}$$

From our theory of the world (T), one can develop a falsifiable hypothesis (H_f), which undergo experimentation and observation (O). The case is, observation does not yield the hypothesis, and therefore theory and hypothesis are false and prone to revision. Thus, the framework consists of a qualified theory with an explanatory power, utilized to deduce an internally consistent conclusion from which one generates a falsifiable hypothesis. If experimentation results in a case of non-fallible state, the hypothesis substantiates the theory. If case of fallible state, the theory is prone to revision and adjustments according to results. This will result in new qualified and informed guesswork used to generate new experiments.

Towards a Popperian neuroscience; electroencephalogram and event-related potentials

To be clear, insofar it has been argued that the general approach to research is somewhat similar to the approach of how brain makes sense of the world. It was attempted to encapsulate the general approach as a hybrid of Peirce and Popper, from which falsifiable hypotheses are generated and lead on further by abductive reasoning. The research question, does the active passage in architectural transitions have an impact on the body, brain and thus, experience, must account for various bodily process and their relations to offer an answer that suffice. Through thorough reading of predictive processing, free energy principle and enactivism, and by using firstly logical argumentation as a research strategy, it can be hypothesized that the perceptual processes in the brain are processed as early as 60-200 milliseconds. These fast processes are hypothesized to be influenced by the potential action of the given environment. Thus, the strategy to test

the hypothesis leads to an experimental setup; however, to control the chaotic environment as much as possible, the experiment must take place in a laboratory to ensure specifically the mentioned processes are targeted. The experiment has to manipulate the action potentials of the experiencing agent, while recording cortical activity at the scale of abovementioned milliseconds. Recordings are hereafter strategically subject to correlation with the architectural variability within the scope of the hypothesis. A total of three research strategies have been incorporated into the Peircean-Popperian model, namely a generative strategy of logical argumentation, formulation of a falsifiable hypothesis subject to experimentation and experimental explanation explaining correlation above causality.

The tactic (Groat & Wang 2013) and method considered to be used is the electroencephalogram (EEG), from which various cortical analyses can be conducted, i.e. event-related potentials (ERPs), event-related spectral perturbations (ERSPs) etc. The EEG measures the micro voltage during the firing of millions of neurons. The voltages that are generated consist mainly of two types; the action potential and the postsynaptic potential. The differences are both temporal and functional. As Luck (2005: 27–31) clarify, action-potentials are very hard to measure directly from the scalp, however postsynaptic potentials are easier. This is due to the resultant voltage when ion channels opening or closing, which arise when a neurotransmitter binds to the receptor. Measuring single neurons with a non-invasive EEG is impossible, as the voltages of a single potential are extremely small, however, it is possible to measure thousands and millions. When recording neurons, their measurable summed action or postsynaptic potentials are named, respectively, multi-unit recording and local field potential recording. Regarding action potentials, due to the position of axons, polarity and timing of fire in neurons, some spikes might cancel each other out. However, postsynaptic potentials do not fire at fixed rate but rather instantaneously, and are largely confined to the dendrites (arms of the neural-cell) resulting in summation rather than cancellation. Thus, ERP signals reflect postsynaptic potentials (Luck 2005: 29). Note that the nature of neurons is an active debate in the scientific communities, reaching from theories ascribing neurons single-purpose behavior, to many-purpose behavior.

Utilizing the suggested approach is believed to yield concrete progressive

steps in science. Further, the accumulation of data, and testing through meta-analyses is not dismissed, in fact such analyses might be more efficient than single experiments. However, the thesis put forward here, is that the nature of neurons is vast and complicated, firing instantaneous proving more activity than inactivity, thus in order to construct an explanation, hypotheses must confine a two-way answer. Either the hypothesis holds, or it does not. More importantly, the hypothesis should “kick” the theory the hardest way possible, deriving very accurate predictions, which are prone to experimentation.

Conclusion

We construct our knowledge, as we construct our world. Through an enclosed loop of action/perception, the human brain constructs its own reality, constantly informed, and informing, a hierarchical generative process. During the loop of action/perception, prediction-errors might ensue. These are used to inform the generative model and update the impression of the world. Knowledge is considered “rolling”, and only probable. Novel discoveries are considered knowledge if following the described line of reasoning. In addition, in coarse steps, current research advocate similar cortical processes. Following PP, perception is construed following an abductive probabilistic rational (Clark 2015, Gładziejewski 2017, Hohwy 2013), only spending cortical currency on what seems to falsify the generated top-down/hypothesis. In the very nature of the cognitive system, error-minimization mimics the evolution of scientific discoveries if approached in Popperian manner. With every falsification of a given hypothesis derived from a theory, that theory is prone to less err in the future, thus minimizing error to establish a stable theory; inference to the best explanation, one might state. Here is shown the similarities of approximating knowledge about the world in both cognition and development of scientific theories, and also stated why these must share the same root (Dewey 1908, Gładziejewski 2017, Haack 2009, Quine 1969) , through a discussion of Sellarsian dilemma and sensory content. Such approach of creating knowledge is, as Russell holds, mixing truth and epistemology with truth and an indicator of truth (Russell 1967).

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Chapter 5 : Becoming a Passenger and Airport Design Epistemology
By *Andrea Victoria Hernandez Bueno*

Time line: March 2017 - March 2020

Keywords: Mobilities, Aeromobilities, Mobilities Design, airport design, urban design, architecture, passengering practices and experiences

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Collaborators: The PhD study is the Work Package 1 (WP1) of the project AirCiF - Airport City Futures that has as partners CPH airport, SAS, Danish Business Travel Association (DBTA), Aalborg University (C-MUS), Maersk, Danfoss, MOVIA, DSB, IKEA, Vestas.

Biography: M.Sc. in Urban Design (2016) Aalborg University, Denmark; Architect (2009) Universidad Simon Bolivar, Venezuela

Name	Thesis Title	Theory Input	Methodology	Epistemology
<i>Andrea Victoria Hernandez Bueno</i>	Becoming a passenger - Exploring the passenger experience and airport design in CPH Airport.	Urban design Mobilities Aeromobilities Mobilities Design	Ethnographic field studies, observations, interviews, surveys, go along interviews, architectural mapping, Automatic Thermal Tracking: Thermal cameras, Attention/ gaze tracking: Eye-tracking technologies	Pragmatism, Actor-Network-Theory, Non-representational theory, Phenomenology, Post-phenomenology

Becoming a Passenger and Airport Design Epistemology

Andrea Victoria Hernández Bueno

1. Introduction – Motivation

This chapter unfolds the PhD *Becoming a passenger: exploring the passenger experience and airport design epistemological position*. The research seeks to explore the passenger processes, practices, experiences and airport design, using CPH Airport as a case. Putting focus on studying the way passengers make sense of/engage with the material designed space, which processes and practices are performed, and how design influences those process, practices, and experiences that frame different ‘ways of becoming’ a passenger. Those insights might inform future practices in urban design for transit spaces, particularly in airport design. Departing from the fact that air travel has become more familiar and embedded practice in the societies’ everyday life; aeromobilities have influenced and changed people’s lifestyles in the recent years, which is accelerating social, political, economic growth and the production of places of transit, such as the airport (Cwerner et al. 2009). Airports at the same time have worked as platforms to blur geographical, social and political barriers, and have equally created new borders and jurisdictions that are influencing socially, politically, economically and in urban terms the places that hosts them. Airports have become cities of the new ‘global order’ (Urry 2009) promoting and facilitating mobile lifestyles, global city positioning, new societal configurations and ways of engaging with the world we inhabit. Besides, airports have been criticized and categorized as part of the ‘generic city’ (Koolhaas 1994) or ‘non-places’ (Augé 1995), as standardized spaces of constant and efficient flow, with similar design, commercial models, activities and regulated areas of processes for an optimal functioning and lacking of identity. That means that airports are conceived as just transitory spaces of flow, where ‘nothing’ happens, and where just going from A to B as fast as possible matters. However, some scholars within the mobilities research argue that spaces of transit and especially airports are places (Cresswell 2006, Kitchin and Dodge 2009). These spaces of transit contain and are produced by different encounters of flows and meanings – they become places – and where the ‘more than A to B’

mobilities approach unfolds all those meanings behind the motivation of moving and becoming mobile (Urry 2007, Cresswell 2006, Jensen 2013, Jensen and Lannig 2017). This research conceives airports as places made of the entanglement of mobilities in situ (Jensen 2013) and ways of becoming. Airports are constantly changing and expanding. In this respect, airports are vast landscapes for material, human, non-human, technological and normative flows and encounters. They establish public and private, local and global realms that still need to be studied from their material design and passenger perspective dimensions. The focus of this research is then to explore the qualities of the designed airport spaces and mobilities that allow the process of becoming a passenger – hence becoming a place – and how those can endure different conditions and fast changes of flow, occupation and development. This can shed light on informing design alternatives and ‘ideals’ that can deal with this airport nature of ‘being in constant state of becoming’, expansion and spatial transformations in relation with the operational processes and passengers practices. What are the practices behind the process of becoming a passenger? How can we unfold all the material relations (technological and physical) and encounters that are performed when people become passengers? What are the meanings behind the process of becoming (that create places) and how can we use those meanings for understanding and feeding design decisions in the future? How can we explore the influence of design through material interventions?

Motivation

This PhD is part of a bigger project called AirCiF – Airport City Futures (Lassen et al. 2017), giving the chance to collaborate with different disciplines and project scales, followed by a multidisciplinary methodological set up based on the combination of traditional and new technological methods for urban design and social science studies. In addition, a parallel collaboration with another PhD project (PhD student Cecilie B. Christensen, see chapter 6) and

project supervisors (MiST group) is based on sharing and developing theoretical perspectives, the methodology mentioned before (see subsection 2.3 Project Methods in this chapter) and seminars for discussing the overlaps and differences between both research. Seeking to incorporate different ways of understandings and backgrounds in both research iterative processes and under the umbrella of 'design thinking' (Cross 2007, Jensen and Lannig 2017).

The nature of this research is pointing towards pragmatism that addresses non-representational theory, Actor-Network-Theory, phenomenology and post-phenomenology philosophies. This chapter will be unfolded starting with the state of the art, PhD introduction of research questions, theoretical framework and methods, ending with the philosophical assumptions – Design Research Epistemology.

This chapter is outlined as follow. Section two (2) summarizes the PhD project problem statement and methodology, setting the ground for the understanding of the epistemological positioning presented in section three (3). Section four (4) draws the concluding remarks re-capturing the main aspects that position this research project under the pragmatism, (post) phenomenological, non-representational and ANT approaches.

2. PhD project introduction and description

This section explains briefly the state of the art of the areas addressed in the project, the theory framework, research questions and methodological considerations.

2.1. State of the art – Urban Design, Mobilities, aeromobilities and Mobilities Design.

The state of the art is based on urban design and urban mobilities design studies as follow:

Urban design is a cross-disciplinary field that includes a combination of different philosophical theories and methods for the understanding and production of urban spaces, and provides a vary array of concepts for the exploration, analyses and development of urban environments (Bahrainy and Bakhtiar 2016).

Airports are contemporary typologies of urban spaces; they offer infrastructure,

services, connectivity, economic opportunities, ways of governance and identity. Airports are hybrid infrastructures, they are urban centers in a local scale and ports of connectivity in a national and global scale, and therefore, they are cities that create urban relations in a human, local and global scale. Urban design theories provide a background knowledge to address the wide scale of the airport dynamics, and how they are perceived as urban entities. Different theories are used as point of departure for the understanding of the airport as an urban space. The image of the city (Lynch 1960) draws an array of concepts that allow evaluating the airport space from the passengers' perspective. Those concepts can be used to understand how passengers make sense of the urban space to navigate and orientate themselves and hence create the map of the airport city. Those findings can guide to understanding and elaboration of the airport 'pattern language' (Alexander et al. 1977) that will feed the main outcome of this thesis that is an airport design 'manual'. Recognizing that even though people 'read' urban environments differently and individually, there are common understandings that connect us socially, create networks and the identity of the place. Jane Jacobs's conceptions behind the construction of the city are also relevant in this research. She argues in *The death and life of great American cities* that in order to understand and plan the city it is necessary to do it from the citizens experiences and taking into account the current values and specific necessities of the place (1960). In the same way, scholars like William Whyte (1980) and Jan Gehl (1971, 2010, 2013) are important references and sources of inspiration in this project. They introduce a combination of methods to study urban to understanding everyday life practices in order to 'measure' the impact of design and the build environment in the production of those.

The airport produces different urban and social relations, networks and mobilities. This project is grounded in research areas like the 'new mobilities paradigm' (Urry 2007, Cresswell 2006), *Staging Mobilities* (Jensen 2010; 2013; 2014), and aeromobilities (Adey et. al. 2007; Cwerner et. al. 2009; Fuller and Harley 2004; Bloch and Lassen 2015; Pascoe 2001; Salter 2009; Urry 2007).

Concepts draw from the mobilities paradigm model support the theoretical framework for the notion of becoming a passenger from the situational perspective (Jensen, 2013). Aeromobilities focus on the impact that air travel

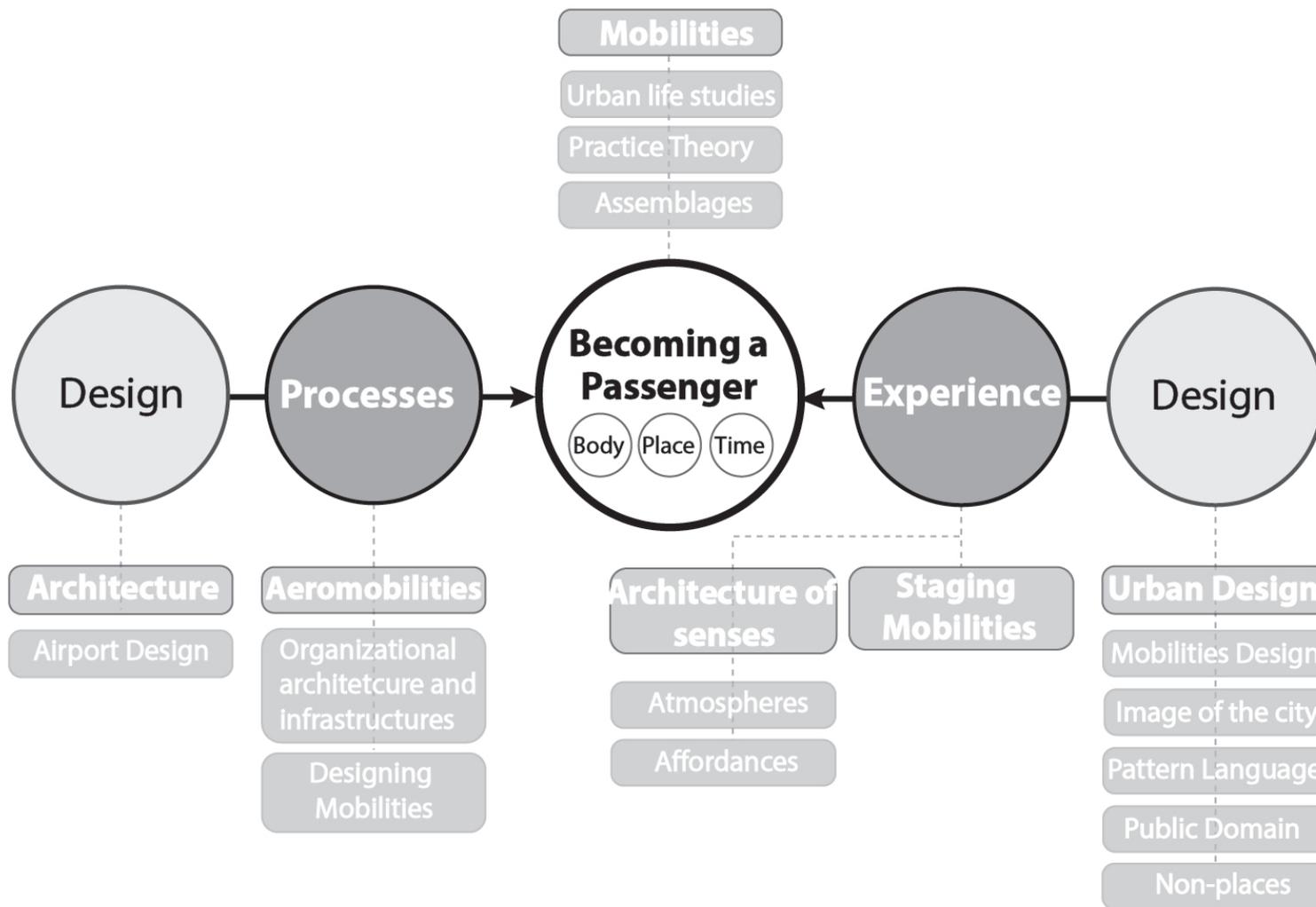


Fig. 16: *Becoming a passenger theory framework mapping* (Hernández, forthcoming)

is having in societies, especially because of the fast development and growth of aviation that has become an ordinary event in people's everyday life, generating new local and global relations, and ways of life and city development (Cwerner et al., 2009). Aeromobilities research draw as well studies around frequent travelers, which are relevant focus for this thesis and for developing passenger typologies that will guide the analyses of design, proposals and design interventions.

Mobilities Design (Jensen and Lanng 2017) is establishing a symbiosis between the mobilities and urban design research, taking as a point of departure the 'mobilities in situ' approach (Jensen 2013) and the strong influence of the material, the tangible and ephemeral dimensions of the urban spaces within the creation of practices and urban mobile life (Jensen and Lanng 2017). It focuses on the study of mobilities from the ANT and non-representational perspectives including an interventionist approach as a way to engage with the design process. This area of research is relevant to this study because elaborates concepts and methods to understand the 'material sensitivities' of the everyday life on the move in relation with urban design conditions through design interventions in real scale.

2.2. Introduction to research questions and theoretical framework

This subsection is inspired and uses as a reference the theoretical framework of this thesis that is developed in the forthcoming paper called 'Becoming a passenger: exploring the passenger experience and airport design in CPH airport' (Hernandez, forthcoming). Those concepts are shaped around the problem statement as follow.

The overall research question is:

How does One 'become' a passenger, and how is that experienced?

In order to delimit this, the project will take the situational experiences of business travellers in Copenhagen Airport as the point of departure for answering the following sub-questions:

- a. *What are the different airport 'mobile situations' in CPH?*
- b. *How the airport design is affecting/enhancing the 'situational' airport 'mobile practices' in CPH?*
- c. *Which are the different airport citizens/ passenger typologies in CPH airport?*
- d. *How can new methods like thermal cameras and eye tracking contribute to a fuller understanding of the situational passenger experience?*
- e. *How can an airport design 'manual' be made so to inform design practices for enhancing the passenger experience and for feeding into a more comprehensive decision support model for the airport?*

The definition of becoming a passenger will be used as a theoretical tool, which can help to understanding different situations along the passenger journey, and how the material design affects and facilitates the process of becoming a passenger. The idea behind this understanding of the passenger and its engagement with the architecture and urban environment will be used to elaborate a design 'manual' that can lead the exploration of future design decisions based on the contemporary understanding of the air travelers' practices, behaviors and experiences. In this sense, the concept of becoming a passenger concerns on studying the practices of passengering and spatial and material perception relations (Hernandez, forthcoming). The figure 16 shows a work-in-progress concept-mapping diagram of the theory framework where the concept of becoming a passenger is built from different fields, keeping an interdisciplinary approach. The concept of becoming a passenger and the diagram showed in this chapter (figure 16) are elaborated further and taken from the theoretical chapter of this thesis (Hernandez, forthcoming).

2.3. Project methods

The project combines seven key methods focused on the understanding of the passenger experience from two perspectives 'outside-in' and 'inside-out', such as the so-called 'classic' ethnographic field studies, by the application of observations and architectural mapping, qualitative and quantitative research, by using interviews and surveys. 'New' technologies such as automatic tracking, by the implementation of thermal cameras, and attention tracking, by the use of eye tracking glasses, and finally 'design', through the 'design thinking'

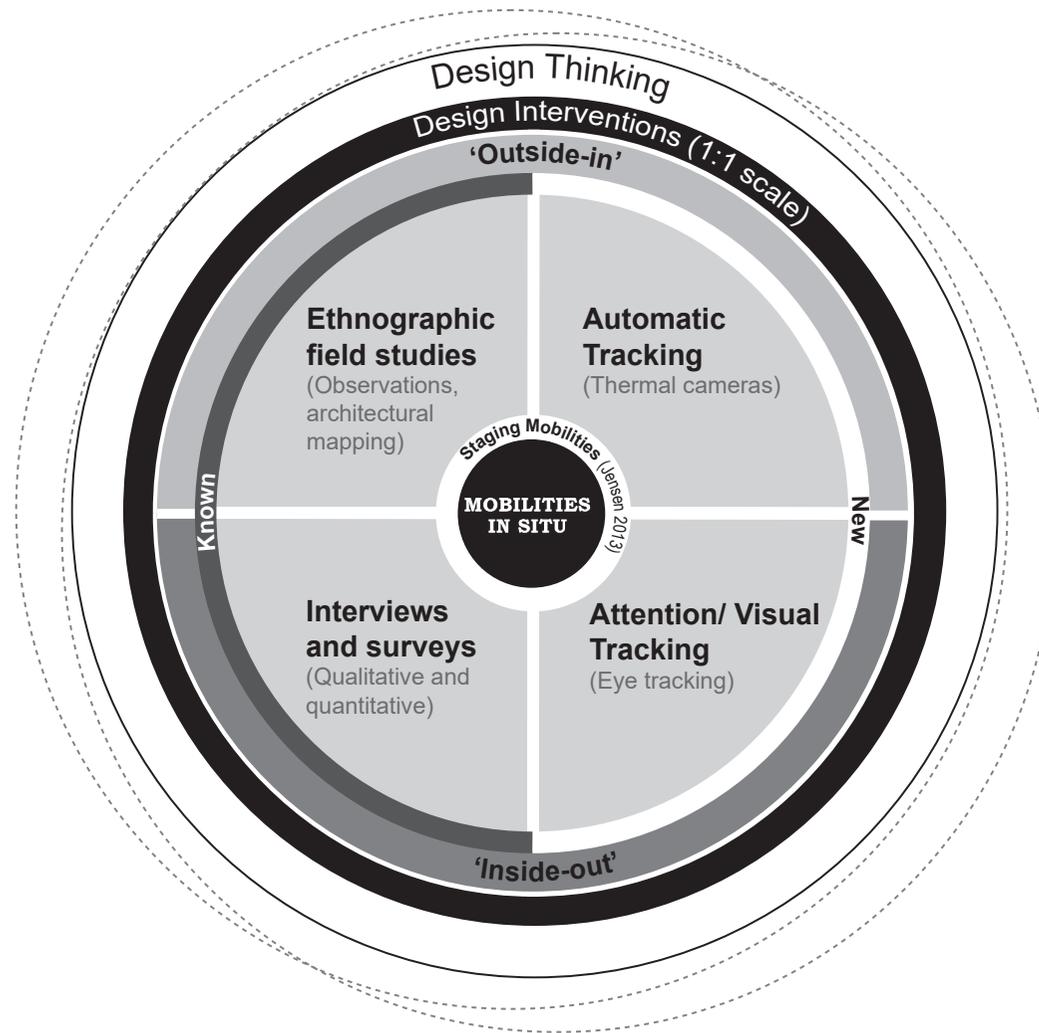


Fig. 17: Project methods (Jensen et al. forthcoming)

approach (Cross 2006, Jensen and Lannig 2017), referring to the iterative process of designing and the application of 1:1 scale design interventions (Jensen et al. forthcoming - see Fig. 17 which is developed and shared with PhD student Cecilie B. Christensen, p. 93)

The methods orchestration takes its point of departure in the ‘staging mobilities’ model (Jensen 2013) putting focus on the mobile situations that are influenced by social interactions, material settings, and embodied performances staged from above as from below (Jensen 2013). The application of the methods will be orchestrated in different phases. However, there is not a fixed systematic order of its application. On the contrary, they can overlap during the process of data collection and analyses:

First phase - Collecting existing data: during this stage a research of existing data (data analysis, data processed, previous projects and analysis made for/in the airport) is collected in order to use it as a base for further data collection. In addition, meetings with CPH are held in order to obtain information about challenges in the airport and future design modifications. Ethnographic field studies, architectural and design-oriented mapping, photo registration, and analyses of technical drawings and wayfinding system take place in the early stages and frequently along with the different phases of the project development. Qualitative research interviews with people working and travelling within the system take place during the data collection periods and the development of the thesis to understanding the nature of the airport and its passengers.

Second phase - Pilot 1 CPH: During this stage, the test of the technological methods and its orchestration is carried on in preparation for the data collection. In addition, the knowledge gained is used for the development of the conceptual design interventions that are implemented in the airport during the next phase – data collection. The methods applied in this phase are thermal cameras (Gade et al. 2016, Jensen et al. 2016, Jiron 2011), eye tracking (Kiefer et al 2014, Gade et al. 2016, Jensen et al. 2016, Cave et al 2013, Krik et al 2012), in combination with surveys and in-depth studies: ‘go-along’ interviews (Kusenbach 2003, Büscher et. al. 2011).

Third phase – Data collection: Seven key methods application. Design interventions are evaluated and negotiated with the airport organization, in terms of areas for design implementation, time of development, security and legal requirements.

3. Design Research Epistemology

The PhD project seeks to understand the problem from different perspectives and using a multidisciplinary approach, therefore, the outcome should be able to provide multidisciplinary answers, presented in different formats such as analytical, practical and technical. The main areas the project puts focus on are urban design and architecture, mobilities design, technologies and social sciences, all of them based on different theoretical and philosophical assumptions and methods. The idea behind the combination of different disciplines comes from the project motivation of bridging theory and practice by the understanding of how passengers become by engaging with the airport space – from ‘outside’ and ‘inside’ the passenger perspective – full of dynamics, organizational structures, material and technological landscapes and regulations. Besides, the airport is a very particular place in contrast from other public realms, due to airports combine in local and global scale services, private and public domains, cultures, tempos and rhythms. Therefore, there is a need of having an interdisciplinary understanding of this complex transit space. This holistic approach of the project relates with a pragmatic position, understood not as a paradigm or worldview but as an array of philosophies that can be used for conduct a study (Creswell 2014). The pragmatist dimension of this research includes and addresses phenomenology, post-phenomenology, non-representational theory and Actor-Network-Theory philosophies.

“Pragmatism is not a total approach, a philosophy with an answer to every question... pragmatism avers that philosophical judgments must always be made against the case at hand, dependent on the specific use, purpose and result... pragmatism rather than being a conventional “big idea” is instead “an idea about ideas”.
(Barnes 2008: 551).

In this respect, pragmatism is seen as ‘tools’ “for achieving particular purposes” (Barnes 2008: 551) or as a way to find the best tools to understand a particular

problem.

Pragmatism takes into account the place, time and community, and hence it is focused on human practices as a way to engage with the world and create knowledge. One way is obtaining knowledge by making, and the other one is obtaining knowledge by doing with others, so from the interaction with others (Bohman 2002: 500). The project seeks to understand the passenger experience from the human, non-human and urban material encounters, taking a specific mobile situation and a specific case of study, which is CPH airport. Therefore, the research is focused on studying the everyday life practices of CPH 'airport citizens', as a way to obtain knowledge, map challenges and potentialities that can be used for informing practices in urban and airport design:

“Pragmatism challenges the often implicit assumption that our practices are necessarily inadequate and require backup from some standard or principle which lies beyond them... For pragmatists, suggestions for improvements are themselves worked up from elements contained within those practices... In other words, pragmatism takes our lives, in all their richness as well as their deficiencies, seriously, and theorizes from that basis”
(Bacon 2012: vii)

Reinforcing the last though, pragmatism focus on practices and specific situations in everyday life encounters where is possible to find social inquiries related with those specific communities and places, which are important for a better understanding and development of society. As Healey argues, “the great value of the pragmatist tradition lies in its focus on acting in the world and in the methods it suggests for thinking through complex claims as these arises in specific situations.” (2009: 288). In addition, pragmatism bases its knowledge production on the study and interpretation (hermeneutics) of social interactions and practices (Barnes 2008: 1545), far away from the creation of generalizations, normative, foundationalism or establishing fixed ideas for the resolutions of problems and the way researchers look at the world. Instead, it is interested into establishing ‘conversations’ through practice in the real world between the different actors, materials, rules, and so forth. Always keeping in mind the idea of evolution and transformation (Rorty in Barnes 2008:1549). As Barnes argues:

“[T]here is no enduring entity or timeless set of rules, or universal form of logic that guarantee a reflective correspondence between the world itself and our ideas of the world... Knowledge claims are not justify by an outside philosophical foundation, but through only the customs and beliefs found inside a community”
(2008: 1549).

That means that philosophy should be transformational rather than foundational (Shusterman in Barnes, 2008). In this research, the design ‘manual’ for airport design, as the main outcome, is not conceived as foundational or fixed ‘guides’ that can be applied everywhere, on the contrary they are general conceptually and theoretically to understanding which elements, variables and conditions need to be taken into account to study the place holistically and develop design decisions, but not practically. When I say practically I mean on developing tangible and measured design solutions as prefabricated and standard elements that can be placed everywhere. On the contrary, the outcome will draw specific design practices for the case of CPH derived from the understanding of its specific mobile situations and urban mobilities. It is here where the situational approach is crucial and important to understanding airports as ‘places’ and design as part of that locality. This also put in evidence the ANT, non-rep and phenomenological dimension of this research where the assemblage (Latour 2005, Farias and Bender 2010) of the material and tangible world elements and human bodies are equally important and related in the process of becoming a passenger and designing airports. The material design agencies and meanings are explored in strong co-relation with human practices, therefore, including the notion of reciprocal interactions of co-creation as ways of becoming (Hoel and Carusi 2018).

Putting focus on the study of practices foregrounds the body and embodied perceptions as keys for understanding mobilities, mobile situations and different ways of becoming. This addresses both phenomenological and post-phenomenological approaches where the body perception is used to ‘measuring’ and expanding new dimensions of being and becoming (Merleau Ponty 1962, Hoel and Carusi 2018). This means to neglecting the division between subject/object and human and non-human bodies as only isolated entities to be studied, and it turn to recognize their co-dependence to exist and hence creating ‘new’

realities, a 'lifeworld' (Merleau Ponty 1962, Hoel and Carusi 2018). Then the human body's actions on the move – in this case actions means mobile practices – are seen as 'integrators' (Hoel and Carusi 2018:54) and creators of meaning and places (becomings).

Pragmatism deals with the unexpected, unpredictability and change, so it takes them as opportunities to solve problems (Barnes 2008). The research has an open-minded agenda when it comes to data analyzes and results, it means that it seeks to explore the current airport space through design without expecting 'fixed' situations and hence results. The project takes into account the nature of the airport space as a place in constant change, a place that is in constant becoming (Fuller 2009). Therefore, the outcome of the research takes into account the idea of 'looking towards the future' and conceives the idea of design as adaptable, plural and flexible enough to deal with the nature of 'becoming' and allow different practices, changes or unexpected situations to perform and co-exist. This means looking at the designed material space and social interactions together as an 'organism', meaning that evolves and transforms by this reciprocal relations and agencies.

Pragmatism uses experimentation as a way to find answers and create improvements. This supports the idea of bridging theory and practice (Healey 2009) through design interventions (Jensen and Lannig 2017). The use of conceptual design interventions in the airport space, as a way to provoke practices, actions, and different encounters, are generated from theoretical understanding and conceptualization of people's mobilities, behaviors, and ways of making sense of the space. Therefore, the idea is to build in situ material interventions that come from rational understanding of the way we engage with the space in a particular place or situation, and using that as strategies to intervene.

Through experimentation (design interventions), it is possible to establish ways of democracy, evaluating its effect from different perspectives (passengers, organizations, designer), allowing the possibility of making design changes. The experiments allow creating 'conversations' between different parties, taking into consideration different points of view within the airport organization, and from

the users. The analyzes of this interventions put focus on practices, interactions and disruptions, when things go wrong or when there is a dialogue or clash between passengers. It also put focus on identifying patterns in terms of practices, passenger typologies and ways of engaging with the airport space, with the aim to implement solutions that involve both passengers and airport organizations: the airport citizens. This fact goes aligned with the pragmatist view regarding society and the importance of the collective and individual desires toward a democratic construction of society, because pragmatism takes into account human needs based on the particular situations placed in time and place, and includes everybody in the 'conversation' (Barnes 2008, Healey 2009). This notion of design interventions as tangible 'democratic conversations' between airport citizens addresses as well phenomenological and post-phenomenological ideas captured in the concept of body and embodiment perception as a language, as a way of expression and communication (Merleau-Ponty 2011) in relation with the agencies and affordances (Gibson 1986) of the technologies and material world. Then practices embodied perceived, facilitated and prevented by the design interventions are 'symbolic' (ibid), they have meanings once they both (material and practices) interact and come together. This interactions and meanings can be repeated and adapted by others resulting as collective patterns of behavior' (ibid., Hoel and Carusi 2018) that can be closely explored in this research to recognize different ways of becoming as a collective process when interaction of materials and bodies on the move takes place.

Pragmatism has also repercussions in design and mobilities research, which are the main areas of focus of this research, specifically around the 'materials', the tangible, and the influence that design and designed elements have in mobilities. This research takes Mobilities Design research as an inspiration and point of departure to positioning this project in the 'pragmatist array'. Mobilities Design approach is focused on the 'materials' and 'tangible mobilities sites' (Jensen and Lannig 2017: 42), 'zooming in' on the material dimension of the mobile situations that take place when people move:

"The emergence of 'mobilities design' brings more sensitivity to materialities, non-human entities, spaces, and sites. Furthermore, it grounds our analysis in concrete situations of everyday life mobilities. This then takes place on a theoretical and

philosophical backcloth of what elsewhere has been termed 'material pragmatism' (Jensen 2016; Jensen and Lanng 2017)... This is done with a frame of reference that increases its sensitivity to materials, surfaces, volumes, colours, voids spaces and other material markers of mobilities design"
(Jensen 2017: 6).

The previous thought is relevant due to in order to set the theoretical framework of this research, the experiential, corporeal and embedded perception of the space and the material world are taken into account to establish the parameters and variables to understanding the airport mobile situations within the process of becoming a passenger. As explained before, this project has design as one of its methods and as an outcome, therefore, it uses the 'design thinking' (Cross 2007, Jensen and Lanng 2017) to analyze the areas of focus, orchestrate the methodology (traditional and technological methods), and proposes design interventions as a way to explore and engage materially with the space and the mobile situations. Creativity is part of the research processes and it is explored through the interventionist approach established in the mobilities in situ (Jensen 2013) and mobilities design (Jensen and Lanng 2017) frameworks which opens up a possibility of create a variety formulation of design interventions. The outcomes and knowledge produced in this thesis are pragmatic in the sense that they are not looking for trues or specific results, as mentioned before, but they are exploring and unpacking everyday life situations on the move for designing places of, and for, mobilities:

"Posing, pondering and practicing the What if...? question is one the most important inquires in mobilities design. This line of reflection evokes issues related to abduction, creativity and thought experiments – hallmarks of designerly ways of thinking that informs the emergent field of mobilities design, and a set of ideas deeply rooted within pragmatism... we would pointed out to an (open-ended) set of foci for studies: situated practices, doings, acts and interactions, objects artefacts, systems, technologies, spaces, the intersections between human and non-human, sensed and embodied mobile practices (kinesis)"
(Jensen and Lanng 2017: 41)

This 'material pragmatism' advocates for the 'non-representation' of the material

environment as just 'objects' in the space but as 'things' that help to build meanings in the everyday life of mobilities (Jensen and Lanng 2017), in that respect, it explores the assemblage of the materials and people interacting on the move. This Actor-Network-Theory approach is aligned with pragmatism.

In planning and policymaking, pragmatism was a fundamental tool (Healey 2009), followed by the idea of creating a democratic ground to include everybody, from the particular "attention to the situated particularities of practices [and the interaction with others]... We are forced to reassess our beliefs and doubts in the flow of actions when faced with practical demands that require us to act." (Healey 2009: 287). The project outcome is framed as design guidelines that should provide input for a decision support model for aviation in Denmark, in this respect, it has a pragmatist connotation and the outcome needs to be able to create a 'democratic ground' for its use in the different dimension of the model (management, planning, policies, design).

Pragmatism allows going back and forth in the research process, without following a red line or establishing fixed solutions, it allows, in turn, adding or summing ideas and answers for particular situations (Barnes 2008, Healey 2009).

"[P]ragmatists emphasize the importance of systematic methods rather than reliance only on analytical methods to arrive at problem solutions. Systematic methods move continually between parts and wholes, challenging accepted frames with new ideas and evidence"
(Healey 2009: 287).

This approach helps the project methods application, triangulation of data for analyzes, and results, and the idea of using the methods not only to collect data but also to test ideas (see next section).

A Pragmatic Research design

Pragmatism offers an open space for combining different methods and philosophies, therefore, one of the best research design approach is based on mixed methods research, described as a combination of quantitative and qualitative research approaches and methods (Creswell 2014, Creswell and

Clark 2012). It has a methodological orientation because of its nature of mixing different methods, approaches and philosophies in different stages of the research study (Creswell 2014, Creswell and Clark 2012).

Taking into account the pragmatist approach it is possible to place the project's research design approach within the 'mixed methods' framework. It combines and integrates qualitative and quantitative research and data (Creswell 2014) by the use and combination of different methods. Within this design approach a 'convergent' and 'transformative' mixed methods model is used (Creswell 2014). A convergent model means that the different methods are merged in their application to have different kinds of information that, in turn, will be combined during the analyses phase, providing a holistic approach for the understanding of the problem(s) statement(s). The 'transformative model' refers to the use of theory as an analytical tool to draw analyses of the problem, and it also helps to create guidelines for the orchestration of the methods in terms of application and data analyses. The project establishes theoretical lens to orchestrate the application of the methods and as a way to do analysis. Besides those two mentioned, a new model is incorporated, the design 'experiments' conducted as design interventions in situ. Design interventions are used as a 'mean of inquiry' and as 'vehicle for inquiring' (Matthews et al. 2015). As a mean of inquiry, design is used to create interventions in situ that will be observed and documented through selected methods in order to 'see' how the mobile situations are staged after the intervention, to unfold practices around the interventions and if those interventions are actually affecting those practices – it is an open-ended exploration of design. As a vehicle for inquiry, design is used as a method for analyzing the spatial conditions, document empirical data and as a way to understand the process of design and design decisions for transit spaces. This is done through 'designerly ways of thinking' approach (Cross 2007, Jensen and Lanng 2017), which means looking at the potentials and challenges critically in relation with the human and material interactions, analyzing and looking at what are the external agents, actors, normative, spatial conditions, functions, organizations and how they influence the design decisions and materialization. This is important due to design is looked at as static and sedentary, as a way of controlling behaviours towards a 'non-place' notion (Augé 1995), however, the design process reflects a variety of negotiations and engagements with the

space, users and 'owners' of the space. It involves a holistic understanding of the place and it reflects a more dynamic dimension of the design and material environments. Airports are in constant transformation because of those different elements that configures it as a place, all those actors and material conditions are in constant negotiation driven by economic development. Understanding the nature of the airport space using design and vehicle of inquiry is crucial for its future design and passenger experience, because it affects materially, culturally, socially and politically the airport spaces.

In this project there is an interest to bridge and overlap research and practice, arguing that "...outcomes of research need not to be concepts communicated by writing or nomenclature; they can be artifacts such as performances, exhibitions, certainly buildings." (Groat & Wang 2012: 52). The idea of using design as a method is to provoke situations and explore new interactions and practices in the space (Jensen and Lanng 2017). Outcomes of this research are then conceived as a mixed of different formats to grasp the complexities behind the airport situations but also the process of design. The understanding of the mobile situations and design cannot be linear, it is more a 'back and forth' processes, because design is always 'open' and subjected to different interpretations and 'imageability' (Lynch 1960). There is no one single 'right' answer to spatial solutions, on the contrary, decisions are made based on the context conditions and different actors, and hence material and social interactions and practices can perform differently and in equalitarian terms.

4. Conclusions

This chapter outlines the research project 'Becoming a passenger' epistemological position from the relational understanding of its theoretical and methodological frameworks, problem statements and outcomes. This allowed me to recognize the pragmatic dimension of the research by unpacking aspects of the project that resemble the presence and entanglement of other philosophies, such as, phenomenology, post-phenomenology, non-representational theory and Actor-Network-Theory.

This research concerns to the different social and material mobile encounters in the airport that can lead for a better understanding of the passenger experience analyzed and constructed from the mobilities, urban design and architectural

perspectives in order to inform airport design practices. Then, the pragmatic dimension is supported by the particular project interest of exploring and studying the everyday life mobile practices, meanings, passengers' motivations and perception of the designed built environment in the airport from 'outside-in' and 'inside-out' the passenger perspective. Moreover, the interest in focalized and situated human practices, interactions and human life richness as a base to theorize, analyze and draw improvements. Therefore, pragmatism sets a democratic ground, establishing 'conversations' between different actors involved in the mobile situation to create solutions, instead of claiming for fixed and foundational solutions (Barnes 2008: Rorty in Barnes 2008:1549). Then, the project endorses the co-relational and co-creational dimension of the mobile situations produced by the interaction between different human, non-human, spatial and material actors in specific time and place.

The body perception is central for this research, because the notion of 'becoming' entails the analyses from the 'inside-out' passenger perspective. This material exploration from the passenger perspective helps me to understand the expandable and transformative qualities of the airport place, designed environment and passengers' practices, experience and affections during the process of becoming a passenger. This leads to a pragmatic, phenomenological and post-phenomenological approaches, in terms of dealing with and embracing the unpredictable, unexpected and changeable features of urban spaces and design configurations and mobile situations, based on socio-material, political and economic interactions. Specially, in the airport space, that is constantly constructed by looking towards the future (Roseau 2012), and hence, it is in constant state of becoming (Fuller 2009). This approach is also presented in the methodological framework of the project, by the implementation of design interventions in the airport as part of the methods' toolbox. Allowing to test ideas, provoke situations and exercise practice-based research by including the experimental, creative dimensions and iterative process of 'design thinking' (Cross 2007, Jensen and Lanng 2017). Additionally, it foregrounds the importance of studying the 'material sensitivities' of urban places and mobile practices interaction by unpacking their social meanings and motivations (Jensen and Lanng 2017).

In his sense, methods are used not only to analyze the urban spaces and mobile situation, but also as ways to test ideas in the city as a lab. Therefore, it is a present a mixed methods research design by implementing convergent, transformative and experimental models (Creswell 2014, Matthews et al. 2015, Cross 2007, Jensen and Lanng 2017). The convergent model refers to the combination, triangulation of data and orchestration of different methods for analyzing, the transformative refers to the use of theoretical frameworks as analytical tools, and the experimental refers to the designed material interventions as both, a way to analyze and as an outcome (Matthews et al. 2015).

Exploring the epistemological position of this research unfolds and supports the idea of looking at design of the built environment as a 'plastic' tool (Palasmaa 2005), which means, as an elastic transformative and plural medium that integrates, recognizes and frames different ways of spatial readability and understandings, material sensitivities (Jensen and Lanng 2017), practices, and social 'moments of encounters' (Amin & Thrift 2002) and hence ways of becoming (Hernandez, forthcoming). Then, the project epistemology foregrounds the idea of (airport) design as mobile (Adey 2008), transformed by those social, material, political, cultural and experiential moments of encounter. Recognizing the human conditions, practices, ways of interpretation and imaginaries of the airport place according to the different mobile cultures and social backgrounds (Hernandez, forthcoming).

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Chapter 6 : Kaleidoscopic Understandings of Mobile Embodied Situations - or what makes the metro possible
By *Cecilie Breinholm Christensen*

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Keywords: Architecture, Urban Design, Mobilities, Mobilities Design, Metro/Subway, Multi-methods study, Passengering practices and experiences

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Name	Thesis Title	Theory Input	Methodology	Epistemology
<i>Cecilie Breinholm Christensen</i>	Understanding Mobile Embodied Situations or Metro in Many Ways (working title)	Urban, architectural (and) design theory Mobilities (design) theory	Single-case study, Spatial/material design interventions, Architectural mapping, Observations, ethnographic studies (also reference studies), Interviews (go-along), Thermal camera-'tracking', Eye-tracking (attention and visual tracking)	Pragmatism, 'More-than' representational thinking and process-ontology, Phenomenology, Hermeneutics

Kaleidoscopic Understandings of Mobile Embodied Situations - or what makes the metro possible

Cecilie Breinholm Christensen

Introduction

The matter of concern

Present social conditions can be characterised by increased mobility, increased separation of time and space, social acceleration and individualisation and following changed patterns of living on a global scale (Giddens 1996, Rosa, 2014, Urry 2000). People are settling and moving in new and different ways, and spend ever more time being on the move on an everyday basis (Creswell 2006). However, the spaces we move through in the city are often designed with mere functionality in mind, to enable easy and efficient movement from A to B as primary concern, and further, these spaces have been criticized for being 'non-spaces', empty spaces of non-existence (Augé 2008). Yet, research in the wake of the 'mobilities turn' has shown how movements of people in the city are indeed much more than A to B transportation (Jensen 2013, Urry 2000). The way we move and the layout of the spaces we move through impact our general wellbeing, our interactions and relations with others and even our understandings of ourselves (Bissell 2018, Jensen 2013, Vannini 2012). These spaces are also often public domains, i.e. spaces that we all use when we move around in the city and where we meet our fellow citizens (Hajer & Reijndorp 2001, Jensen 2013). Consequently, it should be of utmost concern for architects, urban designers and planners to study how to make these spaces not only efficient in enabling transportation, but also interesting and meaningful, make them good and safe places to be. This chapter will present and discuss the knowledge produced in a doctoral research project. Following the above, the matter of concern for this project, is to look at the in-between mundane spaces of the city that we move through on an everyday basis and study which difference their architecture, the way they are designed, make – both for our very movements, but also for the experience of moving through the city. This doctoral research aligns with the emerging field of Mobilities Design (Jensen 2014, Jensen & Lanng 2017) and will contribute to this emerging field by combining methods and theory from the

mobilities, architecture and urban design fields, as well as by further exploring an epistemology of Mobilities Design.

How this will be studied and answered

Since the matter of concern outlined above does not target a specific well-defined problem or a specific approach, part of the aim of this contribution is to discuss how research-based knowledge can be created on the matter of concern within a mobilities design-perspective. This will be done by arguing the overall research objectives as well as the object of study. First, the very object of study will be defined based on state-of-the-art-theory related to the fields of mobilities and urban design. Second, the contribution will discuss the kind of knowledge needed to answer the matter of concern, or the purpose of the research in an epistemological sense. From there, a methodological approach to explore the object of study will be mapped out. These three points will be summed up respectively as forming the research objectives of this doctoral research, which again form the basis of the specific research questions. Finally, a tentative positioning of the doctoral research project in terms of ontological and epistemological orientation will sum up this contribution.

Object of Study

In defining the object of study as well as the first research objective, this doctoral research will take point of departure in the Staging Mobilities-framework as defined by Prof. Ole B. Jensen (2013), which also forms the foundation of the emerging mobilities design field (Jensen & Lanng 2017). This will be elaborated with perspectives from urban design theory that are also inherent in the Mobilities Design-framework (Jensen & Lanng 2017), as well as supplemented with theory on the interplay between humans and environment.

Staging Mobilities

The main claims of the Staging Mobilities-framework is to understand movements of people as meaningful social practices as well as focus on the impact of architecture and design as sites for such practices (Jensen 2013). Meaningful movements of people, termed 'mobilities', do not just happen, rather they are meticulously staged 'from above' by among others design decisions, planning etc. as well as acted out 'from below' by social agents via embodied practices (ibid.). Further, such mobilities come together in situ, in the mobile situation that is expressed in the three aspects of physical settings, material spaces and design; social interactions as well as embodied performances (Jensen 2013: 6). Three points from the Staging Mobilities-framework will be highlighted in defining the object of study; namely how movements of people can be understood as embodied mobile practices, how such practices are situated in space and time as well as how material surroundings are part of and have agency in such situations.

"The mobile body is the entry point to understanding the individual's engagement with the world as well as it is key to seeing the way meaning and norms are created in embodied cultures of mobilities. This is particularly relevant to notice when the epicentre of analysis is the mobile situation"

(Jensen 2013: 119)

Focus of analysis, therefore, is the situation and the way embodied practices are actually performed in situ. The situation is not to be considered a 'fixed' and absolute entity in its own, but rather as an event that constantly comes into being through embodied performances, a hybrid assemblage of relationality (Jensen 2013). The assembled dimension of the mobile situation underscores the point of giving agency to the material world. It acts, does something, and takes active part of the hybrid assemblage of the mobile situation, rather than being a mere backdrop for playing out human practices.

"The mobile situation takes place within a setting that we may see as an assemblage of material spaces, artefacts and objects, infrastructures and social subjects."

(Jensen 2013: 16)

Jensen builds upon several streams of thought in making this point including

pragmatism and especially Goffman's dramaturgical metaphors in analysing social interactions, as well as theories on perception and sense-making in motion. Another important influence is Actor-Network Theory (ANT) as put forward by among others Bruno Latour (2005). This radical and mind-blowing philosophy advocates for absolute symmetry between human and non-human actors, and to include everything that makes a difference in the actor-network as a (social) actor (Jensen 2013). In sum, the point of the Staging Mobilities-framework is to demonstrate how the material world is not an empty backdrop for actions played out, but rather an integral part of the mobile embodied situations, and how the physical settings affect and impact the situation. This point aligns with Mobilities Design that links the Staging Mobilities-framework to research in architecture and design and focus on how mobile situations are staged by design decisions (Jensen & Lanng 2017).

Urban design and theory

When looking to existing literature on urban design and theory, it is not new to take an interest in how architecture and design affect the life of people in the city, and how to design good cities for people. Notably, architect Jan Gehl, sociologist William H. Whyte and journalist Jane Jacobs all did pioneering and inspiring work studying the social life of cities in relation to their layout, planning and design (Gehl 1971, Jacobs 196, Whyte 1980). This was, at least for Gehl and Jacobs, primarily as a response to modernistic planning principles around the 1950's and 1960's. Through numerous empirical studies, they all advocate for the importance of the public spaces of the city and point to the possible influence of design in terms of making these spaces attractive and bringing people together. Essentially, they take on a human perspective and propose specific design guidelines based on observations of what people actually do as a bottom-up approach to urban design and planning (Jensen & Lanng 2017). However, around the turn of the millennium late-modern approaches both to urban design, but also to the understanding of what a city 'is' and which spaces constitute a city, emerged. Recent urban theory puts emphasis on the city as an urban condition rather than an object or a place (Amin & Thrift 2002, Farias & Bender 2010). Amin and Thrift propose a more fluid understanding of cities as orderings of uncertainty rather than fixed structures, assembled on an everyday basis by a multitude of actors and constantly in a process of 'becoming'

(Amin & Thrift 2002). This has consequences for how 'the urban' should be studied, where the Mobilities Design-approach advocate for a shift, or at least a broadening, in focus of the spaces studied towards the mundane and the in-between spaces rather than focusing on the formal squares and plazas of the city that Gehl and Whyte studied (Gehl 1971, Jensen & Lanng 2017, Whyte 1980). These mundane in-between spaces should be seen as the city's actual public touchpoints, as its public domains (Hajer & Reijndorp 2001). These spaces have, however, been depicted with a negative image of being generic 'non-spaces' (Augé 1992/2008, Koolhaas 1995). With reference to Gehl, Whyte and Jacobs this should, then, be an invitation to show a greater concern for these mundane in-between spaces of the city, and to study the life of citizens in these spaces, taking a bottom-up approach to point to design guidelines on how to make these spaces attractive public domains.

The interplay between humans and environment

As pointed out above, one of the bases of the Staging Mobilities-framework is theories on the interplay between humans and environment. The approach taken can be termed as 'ecological', stressing the mutuality of this relation and how both humans and the physical environment are actively engaged with and affect each other, but without defining the nature of this relation or interplay in more precise terms. However, when studying the role of architecture and design decisions in mobile embodied situations, with a view to designing good mundane urban spaces for people, more aspects seem relevant to take into regard. One such aspect, is the notion of 'dwelling', which points to the affective and personal relation between humans and environment from a phenomenological viewpoint. In this sense, dwelling is the basis of very human existence; it is fundamentally our way of being in the world existentially speaking (Heidegger 2000, Pallasmaa 1995, Vacher 2011). We relate to our environment in an embodied manner and gradually habituate our understanding of ourselves as well as our body to this environment over time, in this way feeling at home and belonging to this specific environment (ibid., Winther 2006). From this point, there is a link between environment and understanding of self, and it thus points to the importance of everyday urban spaces for basic human needs such as security, stimulation and identity (Lawson, 2001). This further links to theories on 'personal space' that rest on studies of social interaction in public spaces and the

idea of territorialisation (Hall 1966, Lawson 2001, Sommer 1969/2007). Based on the human sensorial system as well as socio-cultural aspects, humans uphold certain distances to each other in public (ibid.). Knowledge on these 'proxemics' of human behaviour points to design decisions and the actual spatial layout and dimensioning of urban public spaces. As such, these above-mentioned theories seem relevant as supplement to the Staging Mobilities-framework, in order to point towards the role of architecture and design decisions in mobile embodied situations.

Research objective 1: Increase understandings of mobile embodied situations as they are staged by architecture and design decisions

In sum, the analytical unit of this doctoral research project as well as the object of study can be defined as mobile embodied situations as they are enacted and embodied by social actors as well as staged by architecture and design. Research questions related to this objective are:

- How are mobile situations embodied by social actors?
- How are these mobile embodied situations staged by architecture and design decisions?

Knowledge for Design

Having defined the object of study and the first research objective, the following will move on to account for the nature of the knowledge needed, which again relates to the overall purpose of the doctoral research project. The goal is to create knowledge for architecture and design fields, thereby contributing to improve the mundane in-between spaces of the city.

Exemplary knowledge

Having said that, the issue is that design knowledge is hard to define. Design problems can be characterised as 'wicked problems' (Buchanan 1992) or 'non-insight problems' in cognitive psychology (Matlin 2009). Such problems do not have linear solutions in the sense that they cannot be solved through already defined tasks, the solution often occur suddenly, and the formulation of the problem often evolves hand-in-hand with the solution (Buchanan 1992, Dorst & Cross 2001, Lawson 2004). Design solutions are not absolute, but should

rather be understood as the best possible answer under the circumstances given, as well as a result of a process where many parameters have influenced the specific answer, such as e.g. economy, client and project brief, politics, site, form and taste preferences. They are created through iterative processes, where knowledge acts as input to evaluate different design proposals against each other and in this way keep the process going towards a presented design proposal. The knowledge needed cannot necessarily be known in advance, as it depends on which direction the process takes, but it can be recognized during the process (Lawson 2004). Often, valuable knowledge for driving an architectural design process is exemplary knowledge, why architects often use reference projects to get inspiration for and to evaluate own design proposals. In so doing, the inspiration taken is on a conceptual level that has to be adjusted and translated into the specific design problem and context in question.

Research by design

Creating knowledge for design is thus by no means a simple task. On the other hand, design thinking as well as design methods and process can be used to drive research, in that sense bridging design and scientific inquiry. Implementing design thinking and methods first of all enables a strong focus on how mobile situations are staged by architecture and design, pointing to a deep empirical basis of research (Jensen & Lanng 2017). Further, design thinking invites utopian imagining of that which is not, taking on a more exploratory approach to doing research, a creative trying out of things rather than following fixed processes and procedures (ibid.). In this sense, design thinking also relates to the idea of research knowledge as being essentially produced by researchers that again links to ideas in 'non-representational theory', which will be elaborated on later (ibid., Thrift, 2007).

Research objective 2: Contribute to improve architecture and design of urban mundane in-between spaces.

The knowledge created through this doctoral research project should enable better design of the mundane in-between spaces that frame the movements of people on an everyday basis, so that these become better and more interesting places to be for people on the move. The research question related to this

objective is:

- Which design principles can guide the design of public urban spaces to better stage mobile embodied situations?

Methodology

Following the above, the aim of this doctoral research project is to study mobile embodied situations with a goal to produce knowledge valuable for architecture and design fields. In the following will be accounted for the tools suitable for creating such knowledge, both in terms of the methodological set-up as well as the single methods.

Complexity of the laboratory of the 'real world' and the object of study

The first challenge is the level of complexity in both the object of study as well as the knowledge needed. Both are rather hard to define in specific terms, and it is not a simple task to 'capture' mobile embodied situations (Jensen 2013). Furthermore, the situational perspective implies that one has to stay with the complexity of the real world, since situations are essentially contextual. If they are taken out of context and e.g. moved to a laboratory setting, it would not be the same situation. Consequently, there is no way to apply an analytic-experimental approach where variables are singled out and kept constant as in a classic laboratory experimental comparative study. One must accept the 'messiness' of the situation. The purpose of the methodology is, therefore, to work with the complex object of study as a basic precondition and try to understand mobile embodied situations in all their complexity, rather than trying to control or simplify them.

The metro as case

As mentioned previously, an obvious implication of the defined object of study as well as the goal to create knowledge for design is to base research findings on empirical studies. Therefore, a case is introduced as context for gathering concrete empirical data. Using a case can be argued on the basis that the specific always holds some generality (Flyvbjerg 2009) as well as from the point of creating exemplary knowledge as being very valuable for design. The case of this doctoral research project is the metro of Copenhagen. The metro has had a big increase in number of passengers since its inauguration in 2002 (from 3,2mil. to 60,9

mil. In 2016), and with a limited capacity the growing number of passengers challenges the operation of the metro (www.m.dk). Consequently, an agreement has been made with Metroselskabet, the company that plans and builds the metro, to specifically look at capacity related issues in the. The empirical question is to study what makes the metro possible, thereby pointing towards an understanding of the metro as more than just A to B transportation, but rather as a mobile situation that is assembled by both physical settings, social interactions and embodied performances, with reference to the Staging Mobilites-framework. Answering this empirical question then invites understandings of mobile embodied situations, how they are enacted and come together in situ in the metro, as well as how they are staged by architecture and design. In that sense, asking such an empirical question in relation to a specific case can be seen as a 'method' in its own right.

Kaleidoscopic understandings

In order to obtain comprehensive understandings of mobile embodied situations in the metro without reducing the complexity of the object of study, the intention is to use several approaches for studying these. This is obtained by applying distinctly different methods in terms of their ontological and epistemological basis, which can be seen as in fact experiencing or seeing the situation from different point of views in a phenomenological and hermeneutic sense. Don Ihde, professor in philosophy and one of the founders of what he himself terms postphenomenology, argues for such a multivariational approach to study real-world phenomena, thereby operationalising phenomenological philosophy for doing empirical studies (Ihde 2008, 2012). This corresponds well with the Staging Mobilites-framework that also builds on phenomenological and interpretive philosophy and how, in order to 'see' and understand, researchers as interpreters need to bring themselves at a distance to the observed in a hermeneutic sense (ibid., Jensen, 2013: 17). Combining essentially different kinds of methods is termed 'eclectic pragmatism' in the words of professor in psychology Svend Brinkmann (2012). Brinkmann argues in favour of taking a pragmatic approach, where specific methods are used for the kinds of questions they can answer (ibid.). For this doctoral research project, this multi-perspective approach is expressed in applying respectively an observational 'outside-in' perspective as well as a subjective 'inside-out' perspective on the mobile embodied

situations studied (see fig. 18 below, which is shared with PhD student Andrea Victoria Hernandez Bueno, p. 75). For the outside-in perspective ethnographic observations and field-work, architectural mapping and thermal cameras are used, and for the inside-out perspective interviews, a background survey and attention and visual tracking is used. Furthermore, 'known' and primarily ethnographic methods are supplemented with 'new' so-called tracking technologies, which can also be seen as two different kinds of perspectives on the mobile embodied situations studied.

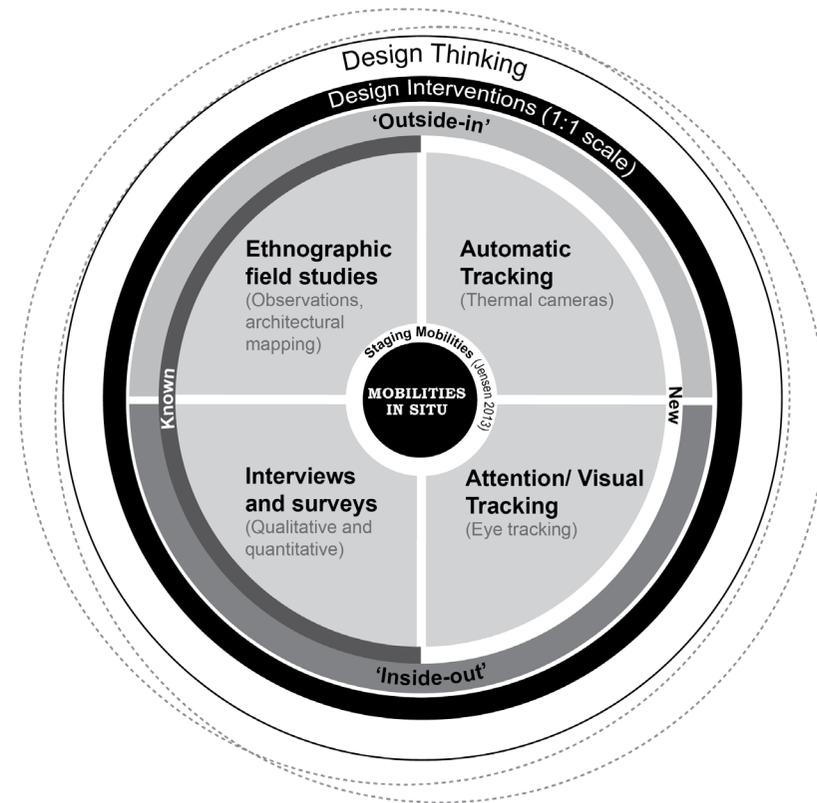


Fig. 18: Situated Mobilites Cross-Methodology, developed with Jensen, Smith and Hernandez

New vs. known methods: introducing tracking technologies

Tracking technologies offer potentials in relation to studying mobile embodied situations, as they open up for answering questions in different ways, gathering different kinds of data (Gade et al., 2016; Kiefer et al., 2014). Previous studies on movements of people in public urban spaces have been carried out by select researchers primarily based on studies done in the 1960's and 70's (Gehl, 1971; Jacobs, 1961; Lynch, 1960; Whyte, 1980). These studies have primarily rested on traditional ethnographic methods based on manual observational analysis done in situ (Gehl, 1971; Jacobs, 1961; Lynch, 1960) or through video recordings (Whyte, 1980). Further, interviews have been used to obtain knowledge on citizens' mental image of the city (Lynch, 1960). These methods rest on a phenomenological and hermeneutic approach, traditionally labelled as qualitative methods (Brinkmann, 2012), and have been developed and tested over years, especially the methods of Jan Gehl that are still used today as basis for design and decision processes (www.gehlpeople.com). The strength of ethnographic methods such as observations and interviews are that they give a deep insight into the embodied phenomenological experience of a subject in mobile embodied situations, i.e. these methods provide the perspective of the social actor that performs actual embodied mobilities in situ. However, there are several potentials in using tracking technologies, as they might contribute with new insights supplementary to these known methods, thereby enabling more comprehensive and contemporary understandings of mobile embodied situation. First, such technologies can gather a bigger amount of data, as the data collection is automatic, as well as more exact data locating mobile embodied situations in time and space accurately. Second, the data can be analysed by use of algorithms thereby processing bigger amounts of data, broadening evaluation possibilities by quantifying findings (Gade et al., 2016). Also, as the tracking technologies record the mobile embodied situations on video, the situations can be played over and over and the recording speed can be regulated for analysis purposes, which allows for very thorough analysis of the situations in study. Finally, the situations observed are distanced from the researcher through a medium, a technology, which adds another level of translation and an opportunity to look at the mobile embodied situation from a different perspective. On the one hand, using tracking technologies then brings the researcher closer to the actual situation by recording it as it was actually performed, and on the other hand, the situation is translated

through the lens of the tracking technology, literally speaking, thereby allowing a distanced view of the situation. The tracking technologies that will be used for studying mobile embodied situations are respectively thermal cameras and eye-tracking glasses. Thermal cameras are characterised by recording temperatures instead of colours, which has advantages in terms of respecting the privacy of citizens when putting these up in public places (Gade et al., 2016). Furthermore, it is easy to distinguish people as hot objects on a cold background, meaning that the movements of people can be translated into positions in time and space for specific persons. This data can then be visualised in several ways, e.g. identifying velocity of people, single tracks etc. (ibid.). Eye-tracking comes in several forms, but the basis of the technology is to record the movements of the pupils, thereby analysing where people are looking (Bojko, 2013). Further, it is based on the eye-mind-hypothesis that there is a correspondence between where people are looking and what they actually see, i.e. what they process cognitively (ibid.). In studying mobile embodied situations eye-tracking glasses are used as mobile sensors to identify what social actors then see in the situations. This gives deep insight into how people relate to their physical surroundings by enabling the researcher to see what they are looking at.

Design interventions and thinking

One way of implementing design as a method is to use design interventions as a way of changing the actual material and spatial setting of the mobile embodied situation, thereby provoking a change of the very situation (Jensen & Lannig, 2017). Design interventions are, then, to be understood as changes to the spatial and/or material layout of the mobile situations studied. In this way, design interventions become midwives for creating understandings of mobile embodied situations, and specifically how these are staged by the design of the physical setting and design decisions (ibid.). Further, the very process of forming design interventions requires engaging with the specific physical setting in a very practical and material sense. Through the design process understandings of the specific design conditions and parameters are obtained, e.g. security issues, required durability of materials, design intentions etc. In this sense, design practice is brought into the research as a way of engaging with the world and forming an empirical foundation of the research, thus bridging practice and theory. This further relates to design as being a way to project possible futures

in order to better understand the present, but also to point out directions for eventual better futures, as previously mentioned (ibid.; Levitas, 2013; Urry, 2016). Thereby, design interventions should be seen as potential answers rather than ‘fixed’ solutions, as experiments in situ, where the understandings obtained can act as input for (in)forming new design interventions in an iterative process of ever more refined potential design answers that point towards future design of physical settings in mobile embodied situations. Supplementary to implementing design interventions as drivers for the research, design thinking and process is used in the way the various methods are applied. This is reflected in the focusing of the methods towards understanding how mobile embodied situations are staged by their physical setting and design decisions. Further, the empirical foundation of the research is built in an iterative and explorative process of analysis and intervention (Jensen et al., forthcoming) in order to form understandings of the dimension of the physical settings in the observed mobile embodied situations. This will be further elaborated below.

Orchestration and analysis: translations and unfolding situations

A crucial part of the methodology is how the different methods and perspectives will be combined both in the orchestration of data collections as well as in the data analysis. First, the approach sketched here is not a ‘fixed’ methodology, rather it can – and should – be scaled according to the specific context and site in question. E.g. the methodology is currently being implemented in two different doctoral studies, one with an airport and one with a metro as case, which is already resulting in different ways of application (see Andrea V. Hernandez Bueno’s contribution in this publication). There is a certain logic order of the orchestration, which structures how the individual methods are applied: 1) defining the situation, 2) recording mobile embodied performances in-situ, 3) altering the scene by design interventions, 4) recording altered mobile embodied performances in-situ and 5) analysis and evaluation. This is, however, not a linear process, due to the overall explorative ‘designerly’ approach taken, which means that the orchestration and collection of empirical data is in fact much more iterative and hard to depict. Also, the orchestration is not to be understood as a classic comparative before and after-study, since the situations recorded cannot strictly be the ‘same’ with only one variable changing. The situations will be comparable as they are situated in the same physical setting and the embodied

performances and social interactions will be similar, but the design intervention is not the only variable that changes, e.g. the social actors will change. Instead, analysis and intervention inform each other in the orchestration and collection of empirical data, and understandings will slowly crystallise through jumping back and forth between different methodological perspectives (see fig. 19 below). Pragmatist thinker John Dewey describes this process as organising the ‘indeterminate situation’ into a coherent whole by simultaneously working to define the problem and the ‘resolution’ or understanding of the situation in iterative ways (1938). As mentioned earlier, the very forming of design interventions will e.g. also contribute with knowledge and understandings of the material preconditions of the mobile embodied situations studied. Also, the planning of placement of the thermal cameras, the route taken by participants wearing eye-tracking glasses, the interview guide etc. necessitates pre-analysis and understanding of the spatial conditions and mobile embodied situations, before doing any recordings.

Analysis of the empirical data requires some words of clarification in relation to combining essentially different methods epistemologically speaking. Referring to a non-representational approach (Jensen & Lanng, 2017; Thrift, 2007), the empirical data is considered as a reference to the mobile embodied situations studied, but not representative of these in a 1:1 manner. The data is not the situation in itself, but a re-presentation or translation of it produced by the researcher and the tools and methods used. Thereby the knowledge and understandings formed are seen as translations of the mobile embodied situations studied, and are therefore at the same ‘level’ epistemologically speaking (ibid.). In this way, combining different kinds of data from different kinds of methods becomes possible. Consequently, the methodology outlined here is also an effort to overcome traditional dualities in science between body and mind, materialism and idealism, quantitative and qualitative studies (ibid.). Taking a situational approach means that the mobile situation as it is embodied by social actors make out the unit of analysis. This implies that the analysis aims at unfolding mobile embodied situations in terms of the different actors and components involved. Referring to the Staging Mobilities-framework, where the physical setting is also seen as an active part of the mobile situation, both human and non-human actors have agency in the situation (Jensen, 2013; Jensen & Lanng,

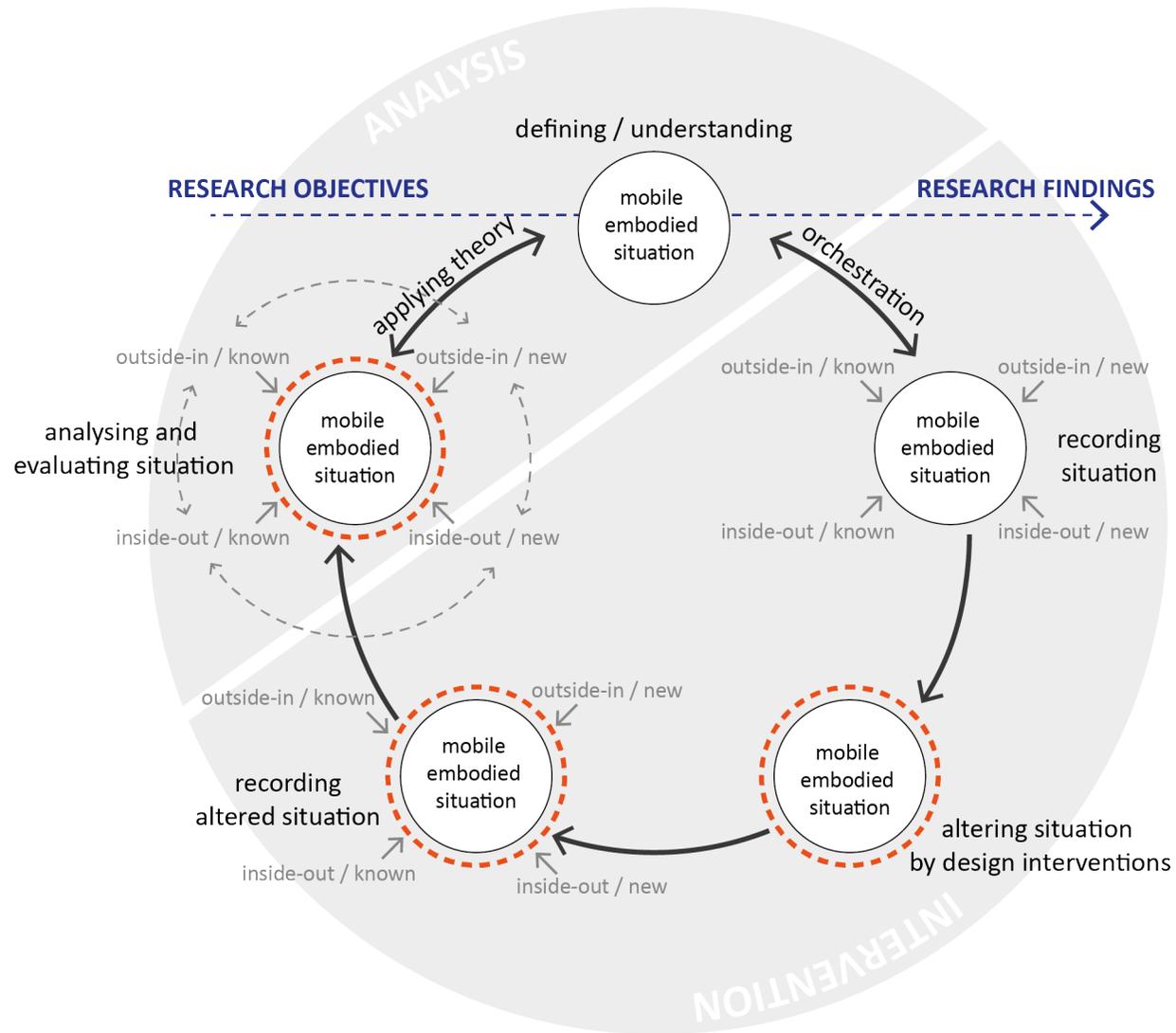


Fig. 19: Knowledge building as an iterative and hermeneutic process of analysis and intervention

2017). Thereby, focus of analysis is to identify what makes a difference in the situation, which actors have agency to influence the situation, and specifically which difference the non-human material actors of the physical setting make in the situation (Jensen & Lanng 2017). The process of unfolding mobile embodied situations in analysis can be described by 'mapping' (Clarke et al. 2018, Corner 1999) or by the organising of the 'indeterminate situation' into a coherent whole as described before (Dewey 1983). First, all components and actors of the situation are defined, and from this, relations and positions are slowly uncovered in an iterative process of producing observations and mappings, defining the problem of the situation, coming up with ideas and conceptions and crystallising understandings (Clarke et al. 2018, Dewey, 1938). However, this requires that the empirical data have already been processed into understandings and preliminary findings, in short: that it has already been translated to the same level epistemologically speaking.

Research objective 3: Kaleidoscopic understandings in a novel methodology

The methodology described is not a well-tested one, the methods used have not been put together before in this way. Consequently, it is an objective to explore how and whether this methodology and especially the use of tracking technologies can enable better, in the sense more comprehensive and contemporary, understandings of mobile embodied situations. The research question related to this objective is:

- How can tracking technologies (thermal cameras and eye-tracking glasses) be used to gain increased understandings of mobile embodied situations?

Epistemology and Positioning of research

In conclusion, this contribution will sum-up and try to position this doctoral research in terms of its epistemological orientation. This will be done by first reflecting upon the ontological outlook of this research, i.e. what it considers to be the 'being', which in turn points a direction for what we can get to know about this, the theory of knowledge. Further, the methodology and research objective to create knowledge for design also points a direction for the epistemological positioning of this research, which this section picks up and reflects on.

A process-ontology and more-than representational epistemology

First, this research can be characterised by a process-ontology, where 'the real' is seen as something that constantly comes into being (Jensen & Lanng 2017, Thrift 2007). This relates to the object of study, mobile embodied situations, and how these come together in assembled manner through the performed practices of social actors (Jensen, 2013). In line with pragmatist thinking the world is seen as made up of doings, of practices, which parallels the mobilities perspective of studying our social world as made up of various movements (ibid., Urry 2000). The unstable character of our world is emphasised as a world of becoming rather than a static entity (Jensen & Lanng 2017). In the metro case, asking the empirical question of what makes the metro possible, invites a pragmatic focus on the actual embodied practices that make the metro come together as a mobile and spatial situation. This question, then, points to the metro as something which is 'practiced' rather than something which 'is' as such. Another important aspect of the ontological outlook of this research is the ontological decentring of humans in studying mobile situations. Instead, the role of architecture and design, the physical, material and designed setting for mobile metro situations to happen, is drawn to the front. In this way, agency is given to the material world, and situations are seen as not only entanglements of human actors, but also of material and technological actors. This follows postmodern streams of thought more than pragmatist thinkers, who were not elaborating much upon the role of the material world. Especially Actor-Network Theory (ANT) has taken up the perspective of a 'flat ontology' between human and non-human agents (Latour 2005), and especially Albena Yaneva has used this perspective to advocate for seeing the built environment not as static objects, but as a myriad of materialities, technologies and 'things' that have agency in their own right because of what they do (Latour & Yaneva 2008, Yaneva 2009). As follows, the built environment is not neutral, but highly political. Though maybe not applying a fully flat ontology, this doctoral research does concern itself with the agency of the architectural design of the metro in relation to the mobile embodied situations taking place there. The epistemological positioning of this research, then, follows from the ontological outlook described above. If 'the real' is something that is in constant flux, then it escapes a fixation of it as universal 'truths'. Consequently, scientific knowledge cannot 'capture' the world as it is, since it will already be something else, it can never be a 1:1 representation of

'the real' in a linear manner. This follows both from pragmatist philosophy, but is elaborated further in non-representational theory as an essential point (Jensen & Lanng 2017). Here, scientific knowledge is emphasised as being essentially produced by a researcher through a process of applying scientific tools such as methods, theory, instruments etc. In this way, scientific knowledge is seen as an extra layer of understanding upon the object of study, something that adds more to the understanding of our world, why it is also labelled 'more-than-representational theory' (Jensen & Lanng 2017). However, this also opens up for experimentation, for a strong empirical basis of research, and for trying out new ways of doing research e.g. by applying design methods and theory (ibid., Thrift 2007). Seeing the process of scientific inquiry more as a creative process of knowledge-building was already coined by Dewey (1938), as mentioned earlier. This, again, parallels design processes and how possible design solutions are created in an iterative process of design, intervention and analysis of the workings in relation to the design problem. This, then, opens up for incorporating design experiments or interventions, trying out of new tracking technologies etc. as part of the process of building scientific knowledge, as is the case in this doctoral research project. Yet, this also places great responsibility on the researcher concerning scientific rigour and validation. This relates to the purpose of the knowledge created, what it should say something about and what it should do. Following a non-representational and pragmatic line of thinking, scientific knowledge is something in itself that can act and make a difference. Further, this is what scientific knowledge should be validated against; its functionality or practical applicability, its relevance and ability to enable better practices (Dewey 1938, Jensen 2013). In sum, good scientific knowledge is useful knowledge. For this doctoral research, this is defined in research objective 2: contribute to improve architecture and design of mundane in-between spaces, and more specifically, with the metro as case. Thereby, the scientific knowledge of this doctoral research should be evaluated for its relevance in contributing to improve the architecture and design of the metro, with a view to capacity issues.

Knowledge ideal

In closing, just a few comments on the ethical responsibility as a researcher-designer-producer of scientific knowledge with intended implications for improving the design of our built environment. In agreement with Bent

Flyvbjerg, who argues that social science should have a different knowledge ideal than natural science since it deals with different kinds of problems, I will advocate for a phronetic knowledge ideal (Flyvbjerg 2009). This builds on Aristotle's distinction between three different kinds of knowledge, where phronetic knowledge is essentially pragmatic and contextual, related to ethical concerns regarding practice and is oriented towards guiding action (ibid.). It builds on experience from specific examples and the purpose is to point towards more reflected and ethical practice. A phronetic knowledge ideal corresponds well with the pragmatic ambition of the Mobilities Design-field to look at what difference architecture and design (decisions) make (Jensen & Lanng 2017). In using design interventions – and for design in itself: such projections of possible futures cannot be neutral, rather they work as implicit critiques of the present and suggest normative ideas of what such better designed futures might be (Levitas 2013). Flyvbjerg's definition of phronetic knowledge contains such a clear ethical concern and encourages the researcher to take on moral obligations and responsibility in pointing out directions for the future. Referring to the above-mentioned process-ontology, researchers then have an ethical responsibility to produce 'moral knowledge', since such knowledge will 'act' on its own and influence future research, design processes and eventually political decisions. Moreover, the knowledge produced in this doctoral research project should act on its own, and hopefully influence, enable, inspire and encourage other architects, designers, researchers, planners, decision-makers and politicians and guide these towards better design of the mundane in-between spaces that frame everyday movements of people in cities!

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