



AALBORG UNIVERSITY  
STUDENT REPORT

# More than a station

- The intermodal transfer experience at  
Aalborg Mobility Hub



MSc. Tech.  
Mobilities & Urban Studies

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Group 12

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**Abstract:**

Within the ‘new mobilities turn’ and the agenda of developing mobility hubs across North Jutland and Denmark as points of departure, this master thesis aims to contribute academic research to the understanding of how wayfinding practices and waiting time are experienced as part of an intermodal transfer journey at Aalborg Mobility Hub and hence being ‘more than a station’. By following the framework of ‘critical points of contacts’, in-depth research has been completed to analyze the ‘life within networks’ based on wayfinding and wayfaring on two selected routes as well as waiting time in an individually performed and experienced manner. By applying eye-tracking as well as structured interviews as mixed-methods, the study revealed that passengers have a more neutral experience towards the hub and its facilities. The thesis concludes with few suggestions for improvements and perspectives towards more sustainable urban mobility which can be relevant for the stakeholders in the area consisting of Aalborg Municipality, Nordjyllands Trafikselskab, Danske Statsbaner, Nordjyske Jernbaner, and Kennedy Arcade as well as the development of other mobility hubs, both inside and outside Denmark.

**Keywords:** *mobility hubs, critical points of contact, wayfinding, wayfaring, waiting time, eye-tracking*

**Dansk:**

Indenfor den 'nye mobilitets paradigme' og den dagsorden der er lagt for udviklingen af mobilitetsknudepunkter i Nordjylland og Danmark, vil dette speciale bidrage med en akademisk undersøgelse til forståelsen af, hvordan wayfinding og ventetid opleves som en del af det intermodale skift ved Aalborg mobilitets knudepunkt og dermed være 'mere end bare en station'. Ved at gøre brug af 'critical points of contact' og dybdegående undersøgelser, har det været muligt at analysere 'livet i netværket' baseret på wayfinding og wayfaring på to udvalgte ruter, samt undersøgelse om ventetid baseret på individuelle oplevelser. Ved at anvende eye-tracking samt strukturerede interviews som mixed methods vil dette speciale afsløre at passagerer har en neutral oplevelse af knudepunktet og dets faciliteter. Specialet afsluttes med at fremsætte forslag til forbedringer for aktører i området ved Aalborg knudepunkt, hvilket indbefatter Aalborg Kommune, Nordjyllands Trafikselskab, Danske Statsbaner, Nordjyske Jernbaner og Kennedy Arkaden.

**Nøgleord:** *Mobilitets knudepunkter, critical points of contact, wayfinding, wayfaring, ventetid, eye-tracking*

**Deutsch:**

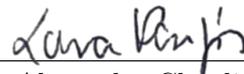
Im Rahmen des 'new mobilities turn' und der Agenda zur Entwicklung von Mobility Hubs in Nordjütland und Dänemark ist es Ziel dieser Masterarbeit, einen Beitrag zur akademischen Forschung zu leisten, der darauf abzielt, wie Wayfinding und Wartezeiten innerhalb eines intermodalen Verkehrsverhaltens am Aalborg Mobility Hub aufgefasst werden. Nach dem Motto 'more than a station' und dem Konzept der 'critical points of contact' folgend, wurde eine umfassende Studie durchgeführt, um das sogenannte 'life within networks' bezüglich Wayfinding und Wayfaring auf zwei ausgewählten Routen zu analysieren sowie Wartezeiten zu untersuchen, welche auf einer individuell durchgeführten und erlebten Weise basieren. Anhand der Anwendung von Eye-Tracking sowie strukturierten Interviews als Mixed-Methods zeigt die Studie, dass Passagiere eine neutrale Einstellung zum Hub und den zugehörigen Einrichtungen haben. Die Masterarbeit schließt mit Verbesserungsvorschlägen und Perspektiven in Richtung einer nachhaltigeren urbanen Mobilität, die für die Interessengruppen am untersuchten Standort, bestehend aus der Stadtgemeinde Aalborg, Nordjyllands Trafikselskab, Danske Statsbaner, Nordjyske Jernbaner und Kennedy Arkaden sowie der Weiterentwicklung anderweitiger Mobility Hubs innerhalb und außerhalb Dänemarks, relevant sein können.

**Schlüsselwörter:** *Mobility Hubs, Critical Points of Contact, Wayfinding, Wayfaring, Wartezeit, Eye-Tracking*

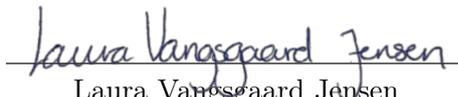
By signing this document, each group member confirms that everyone has participated equally in the project work and that everyone is thus collectively responsible for the content of the report.



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# Preface

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Situated in the field of mobilities and as part of the graduate program *MSc in Technology in Urban Design, spec. Mobilities and Urban Studies* in Aalborg (Denmark), this master thesis takes its point of departure within the new mobilities turn. In neglecting the solely transport-oriented perspective, the new mobilities turn argues instead for adding and embracing the practiced embodied, social and experiential dimensions along the way. Thus, this thesis explores wayfinding and waiting time experienced as part of a shifting journey at Aalborg Mobility Hub within a mixed-methods approach.

Having worked with mobility hubs and wayfinding procedures within our 9th semester internship period as well as already having collected experiences on this topic during our undergraduate program, this gave motivation to pursue and deepen this initial acquired knowledge within this final thesis while broaden our understanding of striving towards sustainable urban mobility.



## Acknowledgements

At this point, we want to sincerely thank Kristoffer Martens, project leader at Nordjyllands Trafikselskab, for contributing his expertise of the work with mobility hubs in Aalborg and North Jutland to this thesis.

We also want to thank our 14 participants for their time dedicated by taking part in our fictional eye-tracking journey. Without your engagement, this study would not have been possible.

Last but not least, special thanks go to Cecilie Breinholm Christensen for her invaluable supervision throughout the project period. Thank you for the constructive feedback on our initial as well as advanced ideas, while guiding us through the varied challenges we have been facing during that time.

*Aalborg University, 25/05/2022*

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**Picture:** Aalborg Mobility Hub. Own representation.

# Table of contents

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<b>List of Figures</b>	<b>vi</b>
<b>List of Tables</b>	<b>ix</b>
<b>List of Abbreviations</b>	<b>xi</b>
<b>Chapter 1 Introduction</b>	<b>1</b>
<b>Chapter 2 Towards more sustainable urban mobility</b>	<b>3</b>
2.1 More than a station - Mobility hubs on the rise . . . . .	3
2.1.1 Definition of mobility hubs . . . . .	3
2.1.2 Development and inspiration of mobility hubs . . . . .	5
2.2 The case of Aalborg Station as a mobility hub . . . . .	6
2.2.1 Defining the area at Aalborg Station . . . . .	7
2.2.2 Stakeholders in the area . . . . .	10
<b>Chapter 3 Research question</b>	<b>13</b>
<b>Chapter 4 Theoretical Framework - Mobility hubs as critical points of contact</b>	<b>17</b>
4.1 What are critical points of contact? . . . . .	17
4.2 CPC - Between wayfinding and wayfaring . . . . .	19
4.2.1 Wayfinding . . . . .	19
4.2.2 Wayfaring . . . . .	22
4.3 Operationalization of theoretical framework . . . . .	25
<b>Chapter 5 Methods</b>	<b>29</b>
5.1 Literature . . . . .	29
5.2 Drifting and mapping . . . . .	30
5.3 Eye-tracking . . . . .	30
5.3.1 Think aloud . . . . .	32
5.3.2 Route tracking . . . . .	32
5.4 Interview . . . . .	33
5.4.1 Expert interview . . . . .	33
5.4.2 Follow-up interviews . . . . .	34
5.4.3 Structured interviews . . . . .	34
5.5 Considerations of philosophy of science . . . . .	35
5.6 Applying methodology . . . . .	36
5.6.1 Operationalization of methodology . . . . .	36
5.6.2 Fieldwork . . . . .	37
<b>Chapter 6 Analysis</b>	<b>41</b>

6.1	Experiencing Aalborg Station . . . . .	41
6.2	Analyzing the ‘life within networks’ . . . . .	45
6.2.1	Wayfinding on two selected routes . . . . .	45
6.2.2	Passengers experience of waiting time . . . . .	75
6.3	Summary - Analytical judgement . . . . .	78
<b>Chapter 7 Discussion</b>		<b>83</b>
7.1	Identifying potentials for the shifting journey . . . . .	84
7.2	Suggestions for re-designing Aalborg Station . . . . .	89
<b>Chapter 8 Conclusion</b>		<b>97</b>
<b>Chapter 9 Reflections</b>		<b>101</b>
9.1	Reflecting upon methodology . . . . .	101
9.2	Reflecting upon Aalborg Station as a mobility hub . . . . .	103
9.3	Further research . . . . .	104
<b>Bibliography</b>		<b>107</b>
<b>Appendix A Interview guide of expert interview with NT</b>		<b>115</b>
<b>Appendix B Follow-up interviews</b>		<b>117</b>
<b>Appendix C Structured interviews</b>		<b>119</b>
<b>Appendix D Consent form</b>		<b>121</b>
<b>Appendix E Mobile situations at Aalborg Station</b>		<b>123</b>
<b>Appendix F Permissions for eye-tracking application</b>		<b>127</b>
<b>Appendix G Critical points on each individual route</b>		<b>131</b>
<b>Appendix H Results of waiting time interviews</b>		<b>139</b>

# List of Figures

---

2.1	Visualization of possible facilities at mobility hubs. Own representation. . . . .	4
2.2	Example of mobil.punkt in Bremen. Own representation. . . . .	5
2.3	Visualization of mobipunt in Flanders. Illustration from [Matthys and Meuleman, N.D.]. . . . .	6
2.4	The City of Aalborg and the location of Aalborg Station within the city. Own representation based on [ArcGIS, 2022]. . . . .	7
2.5	The definition of Aalborg Station as the area and its facilities. Own representation based on [Skråfoto, 2021]. . . . .	8
2.6	Overview of the bus terminals and the train station at the area. Adapted from [NT1819Aalborg, 2019]. . . . .	9
2.7	Visualization of the BRT's design. Looking from above with the train station in the lower left corner. Illustration from [Aalborg Kommune, 2020, p. 19]. . .	10
3.1	Chosen Routes A and B for wayfinding at Aalborg Station. Own representation based on [Skråfoto, 2021]. . . . .	15
4.1	From left: example for icons, index, and symbols. Illustration from [Scollon and Scollon, 2003, p. 26 and 28], own adaption of the visualization of symbols.	21
4.2	Operationalization of theoretical framework - mobility hubs as critical points of contact. Own representation. . . . .	27
5.1	Wearable eyetrackers: The elements of Tobii Pro Glasses 2. Illustration from [Tobii Pro, 2021]. . . . .	32
5.2	Operationalization of methodology and its contributitional dimensions. Own representation. . . . .	36
6.1	The area at Aalborg Station with pictures of the area marked on the map. Own representation based on [Skråfoto, 2021] and [Kennedy Arkaden, N.D.a]. The scale bar does not apply to the overview map of Kennedy Arcade. . . . .	42
6.2	'Technical' dimension occuring at Aalborg Station. Own representation based on [Skråfoto, 2021] and [Kennedy Arkaden, N.D.a]. The scale bar does not apply to the overview map of Kennedy Arcade. . . . .	44
6.3	Mapping of the various routes the participants walked from the train platform 1 to the bus area C6. Own representation based on [Skråfoto, 2021] and [Kennedy Arkaden, N.D.a]. The scale bar does not apply to the overview map of Kennedy Arcade. . . . .	46
6.4	PA1 thinks of the ramp as a landmark. Own representation. . . . .	47
6.5	Percentage distribution of participants on Route A divided into categories. Own representation. . . . .	48
6.6	PA2 found bus area C on the map. Own representation. . . . .	49
6.7	PA2 wonders where C6 is. Own representation. . . . .	49
6.8	PA3 found bus area C on the map. Own representation. . . . .	50

6.9	PA4 looked at the digital screens at the train station before continuing outside as there is no information for the buses on it. Own representation. . . . .	51
6.10	PA4 looked at the digital screens at NT's service center. Own representation. . . . .	52
6.11	PA5 saw buses and bus stops when walking around the train station. Own representation. . . . .	53
6.12	PA5 searched for information on the digital screen without recognizing the sign in the lower left corner. Own representation. . . . .	53
6.13	PA5 noticed the directional sign, partly hidden by a bicycle. Own representation. . . . .	54
6.14	PA5 noticed the directional signs to the various bus terminals B, however, area C is not indicated. Own representation. . . . .	54
6.15	PA5 noticed the directional signs to the various bus terminals A. Own representation. . . . .	55
6.16	PA5 noticed the bus area C on the overview map. Own representation. . . . .	55
6.17	Reassuring look to the orientation sign at B3 and B4. Own representation. . . . .	56
6.18	PA5 reaches bus area C. Own representation. . . . .	56
6.19	PA5 wondering and feeling lost in area C. Own representation. . . . .	57
6.20	PA6 sees bus terminal A1. Own representation. . . . .	58
6.21	PA6 saw buses driving around the corner of Kennedy Arcade and assumed that area C is in the very direction. Own representation. . . . .	58
6.22	PA6 looked for information at the digital bus schedule. Own representation. . . . .	59
6.23	PA7 noticed a directional sign to C which lead him inside NT's service center. Own representation. . . . .	59
6.24	PA7 tried to orientate himself at the digital screens. Own representation. . . . .	60
6.25	Mapping of the various routes the participants walked from the bus area C3 to the bus area A1. Own representation based on [Skråfoto, 2021] and [Kennedy Arkaden, N.D.a]. The scale bar does not apply to the overview map of Kennedy Arcade. . . . .	61
6.26	PB1 thinks he found A1. Own representation. . . . .	62
6.27	Percentage distribution of participants on Route B divided into categories. Own representation. . . . .	63
6.28	PB2 recognized bus terminal B3. Own representation. . . . .	64
6.29	PB2 had to tilt her head to make sense of the orientation map because it is turned upside down. Own representation. . . . .	64
6.30	PB2 took a reassuring look to A1 while walking to the pedestrian light. Own representation. . . . .	65
6.31	PB3 found the directional signs at the entrance to Kennedy Arcade. Own representation. . . . .	66
6.32	PB3 looked at a plan of Kennedy Arcade when searching for the spatial location of the bus areas. Own representation. . . . .	66
6.33	PB3 looked at bus schedule in search for cues which bus stop this is. Own representation. . . . .	67
6.34	PB4 looked over to bus area B before deciding to go through Kennedy Arcade. Own representation. . . . .	68
6.35	PB4 looked at the directional sign at the entrance of Kennedy Arcade. Own representation. . . . .	68
6.36	PB4 looked at the directional signs inside Kennedy Arcade. Own representation. . . . .	69

6.37	PB4 looked at this map outside of Kennedy Arcade. Own representation. . . . .	69
6.38	PB4 missed a sign signalling to cross the road to get to A1. Own representation.	70
6.39	PB4 appreciated the art panels on the way to A1. Own representation. . . . .	70
6.40	PB5 found A1 on the map. Own representation. . . . .	71
6.41	PB6 wondered if it is necessary to go inside Kennedy Arcade. Own representation.	72
6.42	PB7 looked at the directional sign pointing into Kennedy Arcade. Own representation. . . . .	73
6.43	PB7 looked at the same sign as PB4, next to the entrance 1K of Kennedy Arcade. Own representation. . . . .	74
6.44	PB7 saw A1 and realized that he needs to cross the street. Own representation.	74
6.45	Diagram of frequency of interviewed passengers using the area. N=35. Own representation. . . . .	75
6.46	Diagram of how passengers arrived to and left Aalborg Station. N=35. Own representation. . . . .	76
6.47	Word cloud of how passengers steal their time back. Own representation. . . . .	76
6.48	Diagram of how much waiting time the interviewed passengers had at Aalborg Station. N=35. Own representation. . . . .	77
7.1	Categorized potentials at Aalborg Station based on critical points identified. Own representation based on [Skråfoto, 2021] and [Kennedy Arkaden, N.D.a]. The scale bar does not apply to the overview map of Kennedy Arcade. . . . .	85
7.2	Added index to bus terminals in area C1-11. Own representation. . . . .	90
7.3	Added directional information to bus terminals in area C. Own representation.	91
7.4	Added crosswalk and identification sign to bus area C. Own representation. . . . .	92
7.5	Added directional sign to bus area C. Own representation. . . . .	92
E.1	Combined bicycle lane and sidewalk due to the construction at area A. Own representation. . . . .	123
E.2	A bicycle biking on the sidewalk at area A. Own representation. . . . .	123
E.3	Passengers waiting at the sidewalk in area B. Own representation. . . . .	123
E.4	The secured bicycle parking and normal parking at area B. Own representation.	123
E.5	People waiting on the stairs between the train and bus area B behind the bike parking. Own representation. . . . .	124
E.6	Signs in front of the entrance to the train station pointing straight for buses. Own representation. . . . .	124
E.7	Signs above the stairs pointing for buses down to the underpass at the train station. Own representation. . . . .	124
E.8	Bikes parked in front of the directional sign at the train station obscuring its visibility. Own representation. . . . .	124
E.9	Directional sign inside Kennedy Arcade pointing to area A, B and C as well as the train and service center. Own representation. . . . .	125
E.10	Directional sign inside Kennedy Arcade pointing to area B and area C going through a store. Own representation. . . . .	125
E.11	Identification signs at the bus terminals in area C had been put down. Own representation. . . . .	125
E.12	Information screen at area B looking north. There is information at both sides of the signs. Own representation. . . . .	125

# List of Tables

---

5.1	Table of participants who performed a shift at Route A from the train platform 1 to bus area C6. Own representation. . . . .	39
5.2	Table of participants who performed a shift at Route B from area C3 to bus area A1. Own representation. . . . .	39



# List of Abbreviations

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ANT	Actor-Network-Theory
BRT	Bus Rapid Transit
CPC	Critical Point of Contact
DSB	Danske Statsbaner
e.g.	Exempli gratia
etc.	Et cetera
ibid.	ibidem
i.e.	id est
min	Minutes
N.D.	No Date for sources
NJ	Nordjyske Jernbaner
NT	Nordjyllands Trafikselskab
s	Seconds
%	Percent



# Introduction

# 1

*“(...) contemporary infrastructure systems and public spaces for everyday life mobility seem increasingly complex. Consider (...) the multimodal interchanges, such as transit terminals, the complex geographies of places like shopping centers, and urban infrastructures in general.”*

- [Lanng and Jensen, 2016, p. 249]

Referring to the quote above as well as in accordance with the recent phenomenon of developing mobility hubs across North Jutland and Denmark, this thesis aims to explore wayfinding and waiting time practices as part of an intermodal transfer to further contribute to the ubiquitous strive towards more sustainable urban mobility. With the goal to reduce trips undertaken alone by cars from 37% in 2017 to a maximum of 20% until 2025 and to even 15% by 2040, the City of Aalborg has a clear strategic vision for the upcoming years, achievable by influencing the citizens' choice of mode of transport through constantly adapting and improving the existing infrastructure as one matter of concern. As part of this vision and to secure sustainable mobility in an ecologic, economic, and social sense, the concept of mobility hubs got introduced with a main node in the Region of North Jutland being termed as Aalborg Station in this thesis. [By og Lanskabsforvaltningen, 2019; Aalborg Kommune, N.D.d]

For grasping the concept of mobility hubs in its entirety, Kristoffer Martens, one of the project leaders at the transport operator Nordjyllands Trafikselskab (NT), has been asked for clarifying this vision's understanding from an expert perspective. Thereby, he stated that a mobility hub is seen not just as a station but rather 'more than' a station fostering combined or multimodal mobility by providing various transport options in close proximity to each other which, in turn, contributes to sustainable urban mobility.

This implies that mobility hubs can seem confusing for the first time a passenger is traveling through or does not visit the area that often. Based on an experience of the research group themselves, the international group members got confronted with challenges while finding their way around upon arrival at Aalborg Station. This gave additional inspiration and motivation to approach this issue with a researcher's mindset. As part of the current mobility hub development and by investigating the complex site-specific case of Aalborg Station as multimodal mobility hub, the focus lies therefore within how user-friendly and well-functioning it is to ensure seamless integration for improved user experience and facilitation of the use of alternative transport options. Even though being part of the overall development of hubs, there is no one-size-fits-all solution but instead every hub is unique and comes with different characteristics, as stated by Martens.

In pointing out that wayfinding is a focal feature for NT when talking about mobility hubs, though Aalborg Station is not to be considered the most critical case, there will always be people asking where to find a specific locale in the area. In further admitting that one could surely be much better in that regard of leading people in their desired direction as well as considering waiting time, which according to Martens no study has been conducted on at Aalborg Station so far, as part of the shifting journey, this argues for filling the gap and the research purpose of how wayfinding practices and waiting time are experienced at the multimodal mobility hub Aalborg Station. In-depth research has been completed to analyze the ‘life within networks’ based on wayfinding and wayfaring on two selected routes as well as waiting time in an individually performed and experienced manner. By completing eye-tracking as well as structured interviews as mixed-methods, the study applied an empirical-operational approach by following the framework of critical points of contacts [Jensen and Morelli, 2011].

Within the recent mobilities thinking of NT and the innovative approach of the ‘new mobilities turn’ [Jensen, 2013; Cresswell, 2006; Sheller and Urry, 2006], an approach to movements being ‘more than A to B’ by foregrounding social qualities performed along the way, passengers using the hub stand in focus of this investigation in terms of their experiences and feelings at Aalborg Station. Thus, as opposed to conventional transport research focusing on quantitatively measurable characteristics, this study moves beyond this solely infrastructural assemblage of a station and follows the typical ‘more than’ thinking.

Seen from a mobilities perspective of being more than a station, this thesis aims to provide insights into challenges and potentials occurring at Aalborg Station as a mobility hub and propose suggestions for further improvement of wayfinding and waiting time performances which are addressed to the stakeholders in the area consisting of Aalborg Municipality, Nordjyllands Trafikselskab, Danske Statsbaner, Nordjyske Jernbaner, and Kennedy Arcade.

After introducing the matter of concern within this **chapter 1**, the problem analysis in **chapter 2** follows in building up the background information and definition of mobility hubs including Aalborg Station as a case and how it strives towards more sustainable urban mobility. Based on this background information, **chapter 3** argues for the determined research question in this project. The following **chapters 4** and **5** focus on the theoretical framework of mobility hubs as critical points of contact [Jensen and Morelli, 2011] as well as the methodology applied in regard to the theory and research question. The results of the investigation of wayfinding and waiting time practices are going to be analyzed within **chapter 6** and discussed together in **chapter 7** whereas suggestions for further improvements of the current situation of Aalborg Station in regard to the user experience are outlined. The thesis concludes with **chapter 8** which answers the research question as well as the final **chapter 9** which reflects upon the methodology, Aalborg Station as a mobility hub as well as further research that can be conducted based on the study.

# Towards more sustainable urban mobility 2

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## 2.1 More than a station - Mobility hubs on the rise

Mobility hubs have gained more attention in the past years, among others due to environmental challenges such as climate change and the therefore changing perspective from transport being car-centered to more sustainable public transport [Frank et al., 2021]. Nodes need to be rethought to develop attractive and efficient mobility hubs which contribute positively to a sustainable shift in transportation [Lanng and Olesen, 2020].

### 2.1.1 Definition of mobility hubs

Even though the term ‘mobility hub’ is being widely used, there is no explicit definition of it but rather a contested concept used across disciplines. While researchers within the transportation sector concentrate more on a seamless connection of various sustainable and also shared modes of transportation [Aono, 2019; Engel-Yan and Leonard, 2012], scholars of Urban Design pay more attention to the potential of creating a hub that acts as a lively urban space and meeting point for citizens [Lanng and Olesen, 2020]. Besides, seen from a mobilities perspective, *“mobility hubs are critical points of contact (Jensen and Morelli 2011) that shape the (im)mobilities that constitute a dynamic backbone in the twenty-first century global society”* [Larsen, 2020, p. 84].

However, according to Engel-Yan and Leonard (2012), *“mobility hubs are more than just transit stations”* [Engel-Yan and Leonard, 2012, p. 42]. While transport nodes fulfill only the transportation role of moving people and goods as efficient and quickly around as possible, one essential feature of a mobility hub is the role of placemaking. This means that the hub gets to be a destination in itself by offering various activities and connecting people [Engel-Yan and Leonard, 2012]. In other words, an ‘experience layer’ gets added to simply transporting people from A to B which coincides with the notion that *“mobilities is much more than simple movements of people, goods and information from A to B”* [Jensen, 2015, p. 1].



*Figure 2.1.* Visualization of possible facilities at mobility hubs. Own representation.

As shown in figure 2.1, the different modes of transportation that vary from all kinds of sustainable transport accommodate a seamless transition which supports connectivity throughout public transport, individual modes and shared modes. The latter element of mobility hubs can be shared mobility services, e.g. bike or car sharing [Aono, 2019]. Since a necessary part of mobility hubs is the selection of different modes of transport, they can also be referred to as multimodal hubs [Frank et al., 2021]. Multimodal mobility can be described as the possibility of using and combining different modes of transport within one’s reach which are, for instance, located at specific locations such as mobility hubs and thus facilitating to choose the most suitable transport option for the journey to the desired destination [Jonuschat et al., 2015]. Besides, mobility hubs are located at places with a high accumulation of urban life [Aono, 2019]. As, when implemented successfully, mobility hubs are a part of the urban activity and in doing so, they gather flows of people and their interactions with one another and the environment [Lanng and Olesen, 2020]. Additionally, the concept of wayfinding should get addressed at a mobility hub to make navigation at the hub as convenient and user-friendly as possible [Metrolinx, 2011].

To sum the components of a mobility hub shortly up, it is a place that provides not only the shifting between different sustainable modes of transport, in the sense of an intermodal transfer including shared mobility, but is also a destination in itself as it is a part of the urban life, as the illustration in figure 2.1 visualizes. Hence, the objectives of a mobility hub differ from the ones of only being a transit node. While both should assure a safe and secure travel, mobility hubs also focus on a seamless integration of the modes of transport. Moreover, mobility hubs aim towards improving the user experience while waiting for the next transportation option and incorporate the creation of a sense of place. Additionally, several public and private stakeholders are part of implementing a successful mobility hub such as the municipality, transport operators etc. [Aono, 2019]

### 2.1.2 Development and inspiration of mobility hubs

As already mentioned before, in the past years, the idea of mobility hubs has gained more awareness and has since then expanded to more countries. One of the pioneers in Europe was the City of Bremen in Germany. In 2003, Bremen established several smaller mobility hubs, called ‘mobil.punkte’, around the city on public street space. The focal point of each mobil.punkt is, besides being structured around public transport options, a car sharing station and that the hubs are made visible with a three meter tall marker [Glotz-Richter, 2016], as seen in figure 2.2.



*Figure 2.2.* Example of mobil.punkt in Bremen. Own representation.

In the city center, the mobility hubs include four to twelve station-based car sharing vehicles which are placed next to other public transport options, such as buses, and moreover convenient to reach for, amongst others, pedestrians and cyclists. Another variation of their mobility hub concept is called ‘mobil.pünktchen’ and describes the smaller version of it. These encompass two to three cars and are located in the close neighborhood apart from public transport options [Mobil.punkt, N.D.]. Hence, this idea of mobility hubs is highly accessible for people living in or close to the city as well as car sharing opportunities reclaim the street space occupied by regular cars to restructure the environment to more sustainable and green living spaces [Glotz-Richter, 2016]. In the following years, Bremen has expanded this project and an analysis carried out by SHARE-North (2018) showed, amongst others, that the traffic and the parking demand got significantly reduced [Schreiner et al., 2018]. More specifically, due to mobil.punkt, more than 3,700 vehicles were replaced from the street in the city [Glotz-Richter, 2016].

Another example for the implementation of mobility hubs is the region Flanders in Belgium with their concept ‘mobipunt’, which is inspired by the City of Bremen. Like the concept mobil.punkt in Bremen, it expresses the opportunity to switch to shared and sustainable mobility options and is located close to public transport stations as well as being accessible for everyone. However, it is also made clear that their vision of mobility hubs, such as seen in the illustration in figure 2.3, encompasses not only transportation options, but it should be understood as an enrichment for the neighborhood as other functions, such as a small

shop, a café as a meeting place or a post office, are preferably placed there as well. [Matthijs and Meulemann, 2017] In order to operate as a mobipunt at least five functions, which are divided into the four categories; essential features, extra mobility, extra comfort and additional features, need to be fulfilled, whereas car sharing, closeness to public transport and the possibility to store bicycles always needs to be supplied [Matthys and Meuleman, N.D.].

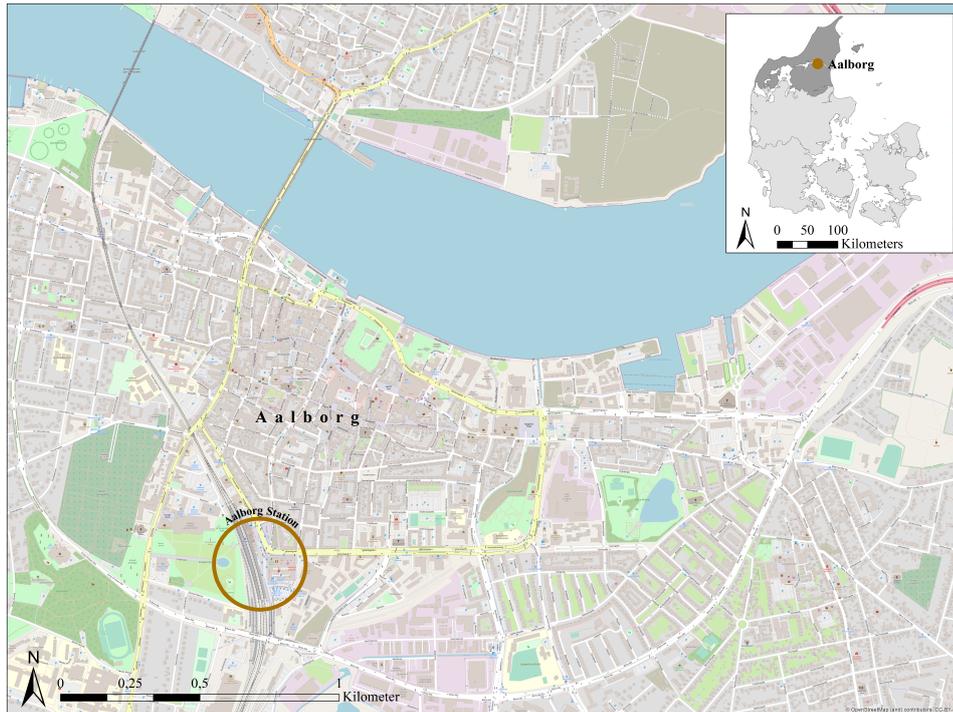


*Figure 2.3.* Visualization of mobipunt in Flanders. Illustration from [Matthys and Meuleman, N.D.].

## 2.2 The case of Aalborg Station as a mobility hub

Being a recent phenomenon in Denmark, the public transportation company in North Jutland, NT, has been working with mobility hubs since 2018 and their aim is to connect the various public and private mobility options at one place, also desired from Plustur and GoMore to provide a meeting point for carpooling, as mentioned by Martens. NT's mobility hubs are symbolized with a mobility hub sign instead of a written term as in the examples before. In 2020, 35 nodes have been highlighted with their mobility hub sign in the individual municipalities of North Jutland. In the future, more transportation options should get connected to the already established hubs and people should be made aware of the meaning of the mobility hub sign. In addition, the idea is to gather different services at the hubs. [Kidmose and Kamp, 2020]

This thesis focuses on the City of Aalborg located in North Jutland, Denmark. More specifically, the case investigated is situated within Aalborg city center as indicated in figure 2.4.

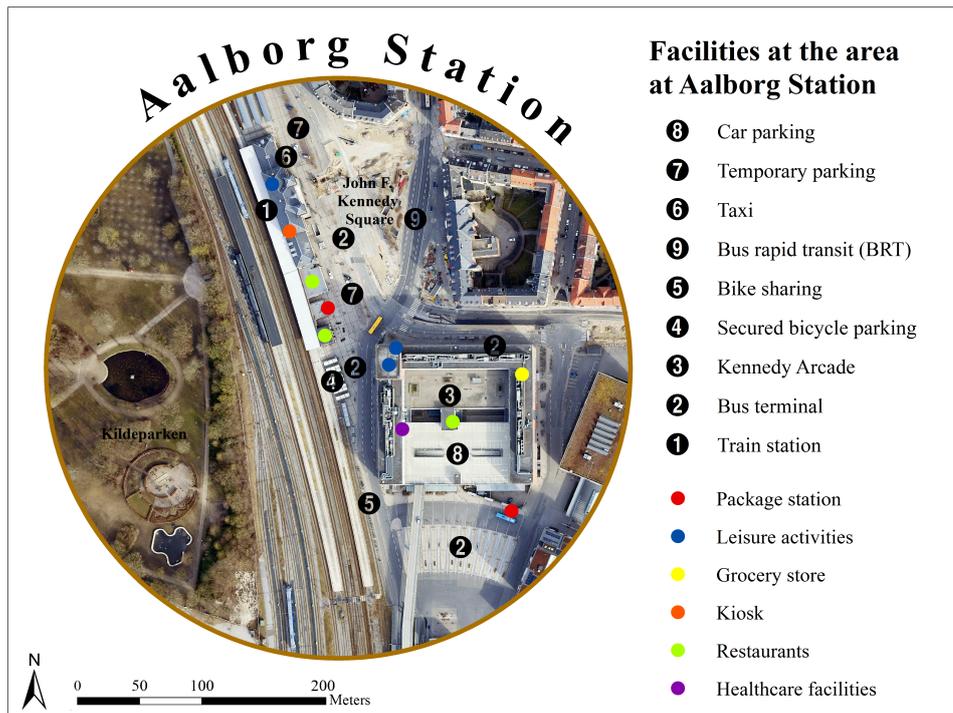


**Figure 2.4.** The City of Aalborg and the location of Aalborg Station within the city. Own representation based on [ArcGIS, 2022].

Thus, the following subsections focus on this thesis' framing of Aalborg Station as a mobility hub, consisting of the facilities as well as contributing stakeholders.

### 2.2.1 Defining the area at Aalborg Station

As described earlier, a mobility hub is an area where it is not only possible to seamlessly change the mode of transport, but also an area that contributes to 'more than' a modal shift. Therefore, the train station in Aalborg as a major transport infrastructural component embedded within the city center, officially referred to as Aalborg Station, will be used as a point of departure in this investigation. In accordance with the concept of mobility hubs, the area does not only encompass the train station itself but also the bus stations as well as the shopping center Kennedy Arcade located in approximate distance to it. Within Kennedy Arcade, a service center from NT is integrated, whereas on its roof, car parking got established, which both additionally argues for relating the shopping center to this mobility hub area. This results into the new framing of the following area within this project defined as *Aalborg Station*, as shown in figure 2.5.



**Figure 2.5.** The definition of Aalborg Station as the area and its facilities. Own representation based on [Skråfoto, 2021].

Figure 2.5 indicates the ensemble of facilities at Aalborg Station defined as a mobility hub which includes different infrastructural components of combining different modes of transport or making use of shopping, dining, health care and leisure opportunities. Aalborg Station therefore consists of a train station and bus terminals as public transport options. In addition to public transport, there are individual mobility modes such as temporary car parking, taxi services, bicycle racks scattered around the area including a main bicycle parking facility which secures the bikes from getting stolen, and bike sharing. The latter refers to the facility of station-based bike sharing from the company Donkey Republic, while further, depending on availability, free-floating electric scooters of the company VOI can be borrowed as a micro-mobility option [Aalborg Kommune, N.D.e; Donkey Republic, N.D.]. Facilities apart from transport modes that can be found at the area at Aalborg Station are the shopping center Kennedy Arcade, as mentioned before, as well as the variety of facilities that come with it ranging from grocery shops, clothing stores and fitness center to cinema and health care facilities such as pharmacy and private hospital [Kennedy Arkaden, N.D.c], whereas car parking is established on its roof. [Nordjyllands Trafikselskab, N.D.; Kennedy Arkaden, N.D.b] Furthermore, package pick-up points are to be found at the two anchor points of Kennedy Arcade and the train station. Even a Virtual Reality Game facility is integrated within the train station [VRGame, N.D.].

The modes of public transport provided at Aalborg Station are characterized by being spatially divided and scattered across the area. The following map in figure 2.6 displays the bus areas reaching from area A to C as well as the train station.



Figure 2.6. Overview of the bus terminals and the train station at the area. Adapted from [NT1819Aalborg, 2019].

At this point, it needs to be mentioned that until December 2022 there is construction work in connection with a Bus Rapid Transit (BRT) in the area opposite to the bus and train station which will open in 2023. This also comes with bus terminal A2 being demounted whereas A4 is temporary moved a few meters down the street. A visualization of the finished area can be seen in figure 2.7. The BRT will go from the race track in Aalborg West to the new Aalborg University Hospital in Aalborg East [Aalborg Kommune, N.D.b] [Aalborg Kommune, N.D.c]. This will function as a major expansion to the existing area, whereas the setting at John F. Kennedy's Square will contain a larger stop including better opportunities for restoration, trade and cultural life, and will be in connection with the already established bus and train stations [Aalborg Kommune, N.D.c].



*Figure 2.7.* Visualization of the BRT's design. Looking from above with the train station in the lower left corner. Illustration from [Aalborg Kommune, 2020, p. 19].

### 2.2.2 Stakeholders in the area

The area at Aalborg Station has several stakeholders, both within the transport sector and other enterprises. The following provides an overview of the major actors involved: Nordjyllands Trafikselskab (NT) is an administrative company responsible for bus transport in North Jutland and owned by the 11 municipalities in the North Jutland Region. It thereby operates the bus area which is located behind Kennedy Arcade and the service center inside. [Kennedy Arkaden, N.D.a; Nordjyllands Trafikselskab, N.D.] Besides, Kennedy Arcade as a shopping center acts as another stakeholder in the area, including its variety of facilities. Next to Kennedy Arcade, there is the train station for which Danske Statsbaner (DSB) is responsible. DSB is a state-owned company that is in charge of train operations in large parts of Denmark, however, in North Jutland they only route up to and including Aalborg Airport, whereas Nordjyske Jernbaner (NJ) is responsible for train operations from Skørping located south of Aalborg to Hirtshals and Skagen in the north of Denmark. Last but not least, as Aalborg Station is located in Aalborg Municipality, this makes them an additional stakeholder to the area. [DSB, N.D.a; Nordjyske Jernbaner, N.D.; DSB, N.D.b]

#### NT and Aalborg Municipality as stakeholders

NT and Aalborg Municipality can be identified as significant contributors to evolve Aalborg Station from simply being a transport node to a mobility hub. Their recent work within the prevailing concept of mobility hubs in Aalborg and North Jutland will therefore be briefly outlined in the following.

In relation to mobility hubs helping to offer seamless travels, NT's objective is to create coherence and create a safe travel experience for their customers. This is done through the vision called *NT båndet*, which is a design concept for all terminals and stops. Furthermore, NT also wants their stations in the future to contain functions that help to facilitate customers' everyday lives in addition to being a hub in public transport. These could e.g. be parcel pick-up points and the opportunity to buy food on the go, like an extra layer of

the node. [CF Møller Architects, 2020] In addition to focusing on a similarly suitable design to create coherence and recognizability for the travelers, NT has also declared themselves not just being a transport company, but as a mobility company as well. This means that they do not only focus on better connections between their modes of transport but also work on creating better coherence in a broader sense, which includes micro-mobility and private transport options as well. In this connection, NT also collaborates with the e-scooter business VOI and Nabogo, the latter being a carpooling company, to promote mobility and the green transition with less congestion on the roads. [Kollektivtrafik, 2020; Nordjyllands Trafikselskab, 2020]

In addition to NT focusing on hubs in terms of easily changing transport modes, Aalborg Municipality works with the same term. However, they also partly work with it in relation to creating areas where it is possible for commuters to safely park their car or bicycle and travel on with either public transport or a rental car. The municipality has classified four categories of hubs; network nodes, hinterland nodes, destination nodes as well as park and travel nodes. The network node is a hub with many public transport connections, safe bicycle parking and the opportunity to move on to other infrastructure. Hinterland nodes are closely related to NT's node concept and signs, as they are located at NT's main network or at villages. These hubs focus on good conditions for micro-mobility in the form of walking and cycling, as well as the possibility of parking cars and thereby traveling further by public transport. Like hinterland nodes, park and travel nodes are nodes where it is possible to park the car and travel on by public transport. However, the park and travel hubs are mainly located near the main road network, so it is easier to drive out of the city. Destination hubs are, unlike the other hubs, a place where there is mainly only one type of public transport and frequently located at a destination such as an urban community, where the focus will be on creating security for both pedestrians, cyclists, and users of the urban space created in connection to the hub. In relation to this categorization, Aalborg Municipality defines Aalborg Station as a network node. [Aalborg Kommune, N.D.a]

This focus on hubs does not only help to ensure better and more seamless public transport but also helps to promote a sustainable transition. With the mobility development plan *Mobilitet 2040*, Aalborg Municipality focuses on promoting sustainable transport, as there is an increased focus on mobility. This also means that action is required to create the best possible mobility for users and thus increase the attractiveness and in this way get more people transferred to e.g. public transport, private carpooling, and micro-mobility, which is linked to hubs. This is done to live up to the UN's 17 Sustainable Development Goals. [Aalborg Kommune, N.D.d]



# Research question 3

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As mentioned in the previous chapter, mobility hubs first started to develop a few years ago in Denmark. For the region of North Jutland, the responsible public transport company NT is one of the stakeholders of the establishment of such a node. In collaboration with the particular municipality, in this case Aalborg Municipality and other stakeholders, they are working together to strengthen already existing mobility hubs and develop new ones. One of the already existing hubs, even though there is no mobility hub sign put up yet, is Aalborg Station with the linked bus terminal as well as the shopping center Kennedy Arcade, as introduced in section 2.2. Even though the objective of NT and the partners is to develop and strengthen mobility nodes, their understanding of mobility hubs encompasses mostly the transportation factor, as hubs should primarily connect various forms of public and private modes of transport [Kidmose and Kamp, 2020]. Nonetheless, one of the significant differences between a transportation node and a mobility hub is the experience factor that is added at a mobility hub, as discussed in subsection 2.1.1. Moreover, due to the various modes of transport and additional factors such as the user experience or service, mobility hubs collect together several layers of networks that are considered to complement each other. While this functions well in theory, the physical interfaces of the various networks and hence their interplay can cause some difficulties in practice. More specifically, as the journey of individuals changes from being passively transported with public transportation such as train or bus to becoming a pedestrian, one needs to actively engage with the environment around oneself for finding the way to the next departure point.

Therefore, the project takes its point of departure not as Aalborg Station being a destination in itself but rather a shifting location which should meet the new approach of mobility hubs based on Aono framework's contributing to sustainable as well as seamless mobility [Aono, 2019]. With the background agenda of Aalborg Municipality's development plan *Mobility 2040*, mobility hubs should be designed as a suitable and user-friendly area in order to promote close proximity and easy accessibility to sustainable options of modes of transport, enhancing the overall goal of evolving an increased attractiveness. Consequently, mobility hubs can be interpreted as "*critical points of contact*" [Larsen, 2020]. Thus, the aim of the thesis is to investigate and analyze those interplays to understand the performed and experienced mobility in-situ. Therefore, the aim of the thesis is to investigate and analyze those interplays to identify possible challenges and hence also potentials for improvement. That being said, this project as within the scope of a mobilities approach concludes with initial recommendations based on the empirical findings, which however should not be considered as thought-through design solutions but should rather initiate further discussions amongst the relevant stakeholders

in the area. In referring to the defined area at Aalborg Station, as outlined in section 2.2, the factor of finding the way around the mobility hub to get to a specific bus stop will be examined as well as the experience of waiting for the next mode of transport as part of the intermodal transfer.

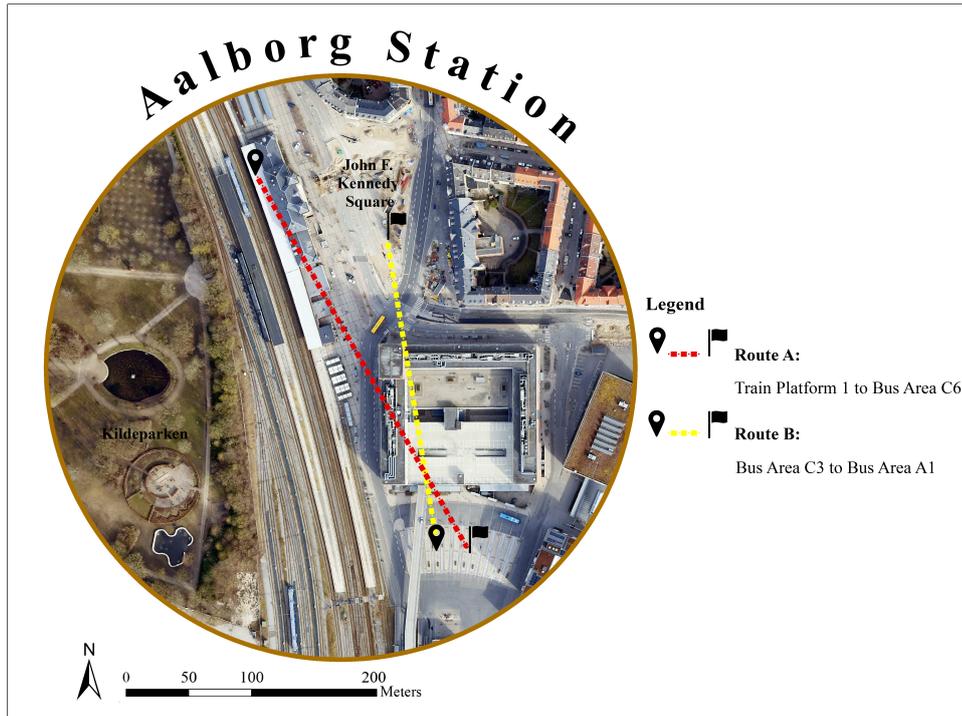
This results in the following research question:

*By applying the critical points of contact approach, also referred to as ‘life within networks’, how is the transfer between two public transports performed and experienced at the multimodal mobility hub at Aalborg Station area, and what improvements could be suggested?*

In order to analyze this research question in-depth, it is subdivided into two subquestions investigating integral parts during such as transfer. While having a primary research focus on wayfinding and a secondary on waiting time practices, this results in the following subquestions:

1. *How user-friendly is it for the individual passengers to find their way on two selected routes?*
  - Route A leads from platform 1 of the train station to area C6 at the bus station.
  - Route B leads from the bus area C3 to the bus area A1.
2. *How do passengers experience the in-between time at Aalborg Station while waiting for their choice of transport?*

As stated in the research question, one part of the mobility hub Aalborg Station that will be investigated is wayfinding. Carried out as the primary focus, therefore, the first subquestion explores wayfinding on two specific routes from one mode of transport to another to analyze the first part of the research question. The chosen Routes A and B in the area at Aalborg Station are visualized by a straight line in the following map in figure 3.1. This depiction is due to the routes not being predetermined but rather open while individually performed and understood as a journey.



*Figure 3.1.* Chosen Routes A and B for wayfinding at Aalborg Station. Own representation based on [Skråfoto, 2021].

In this first subquestion, the expression ‘user-friendly wayfinding’ is based on individual needs and desires but is in this thesis interpreted as the level of convenience for passengers to find the way as well as how attractive the route is. Thereby, Route A will lead people from the train to the bus station whereas Route B will represent a shift from one bus station to another one. The two selected routes were chosen due to the timetable dependency passengers encounter when traveling with public transport as passengers cannot determine their amount of waiting time to a certain extent. This however does not apply to bike sharing options or other means of individual transport as one can highly determine the arriving or departing time from the station by oneself and is less dependent on the timetable, hence the power dynamics that occur when using and waiting for public transport do not apply. Moreover, as bicycle racks are established around the entire mobility hub, it would be challenging to study wayfinding as every cyclist naturally walks different routes, depending on where they parked their bicycle. Other considerations for selecting the stated Routes A and B are a geographical maximum coverage of the area to grasp the entirety of ‘life within networks’ whereas Route A got chosen from train to bus, and not vice versa, due to buses leaving on the street level while being combined with everyday urban life which might create challenging situations of finding the way. In relation to this, the train tracks are rather easily identifiable which argues for conducting research in the opposed direction as mentioned ut supra. Destination C6 got selected due to being located in the middle of all the bus terminals at area C whereas C3 for Route B is located between the bus terminal B4 and the entrance to Kennedy Arcade, hence, leaves the option open for the participants to choose their individual embodied route. Generally, Kennedy Arcade as the shopping center is spatially located between the arriving and destination point which is why area C got chosen for both routes since it is visually hidden from the

remaining parts identified as Aalborg Station, compare figure 2.6 on page 9.

In order to answer this subquestion, the theory of critical points of contact in combination with the concept of wayfinding and wayfaring will be applied. The second part of the research question is adding another perspective to the first one as most shifts between public transport bring along waiting time which makes this aspect inevitable to investigate as well. Carried out as the secondary focus, hence, this subquestion will examine how passengers experience their waiting time and discuss the usage of in-between time as well as the general experience of waiting and spending time at Aalborg Station. A beneficial theory for that will be waiting time investigated through a wayfaring approach.

As mentioned before, both subquestions are supplementing each other to be able to analyze a transfer at Aalborg Station whereas waiting time is an added component to complement the wayfinding perspective. Investigated in an independent manner, the interplay of both parts assists in considering suggestions to minimize conflict points and therefore critical points of contacts and instead increase the seamless integration of the various layers of a mobility hub in terms of the individual experience of the place.

# Theoretical Framework - Mobility hubs as critical points of contact 4

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Situated within the ‘new mobilities turn’, a movement termed as being ‘more than A to B’, and by highlighting the performed mobility in situ of wayfinding and wayfaring considerations, the theory adapts an experiential dimension serving the field of mobilities as opposed to a conventional transport approach. The theoretical framework of this project thus takes its point of departure within the assumption of mobility hubs being understood as *critical points of contact*, which is first introduced in the following and later complemented by the argued focus on wayfinding and wayfaring.

## 4.1 What are critical points of contact?

Coined by Jensen and Morelli (2011), key thinkers of urban theory and service design, the notion of *critical points of contact* (CPC) explores the linkage of urban mobility and service design, and how they “*interact, overlap, exist in parallel, converge, conflict etc. thus creating an unforeseen complexity and a situation of less transparency*” [Jensen and Morelli, 2011, p. 37]. Thereby, they touch upon the various scales of networks shaping modern urban communities and challenging their interconnection by its multiplexity within so-called socio-technical systems, “*that is to say sites or nodes where different systems meet and either traffic, friction, communication, or exchanges between systems occur*” [Jensen and Morelli, 2011, p. 37]. Referring to them as ‘hot spots’, they further argue that these sites are characterized by the paradox of ‘physical friction’ and ‘interaction’ and are one of (facilitating) modal shifting [Jensen and Morelli, 2011], while adding the supplementary layer of ‘meaning’ in accordance with Cresswell’s (2006) understanding of mobilities which consists of the elements meaning and power besides simply being a movement [Cresswell, 2006].

By arguing towards an agenda of how everyday life mobilities occur within these systems, Jensen and Morelli aim to set this framework of CPC as an analytical tool for gaining comprehensive in-depth knowledge into networked experiences and connectivity (and a lack thereof), implying the existent ‘life within networks’ [Jensen and Morelli, 2011]. Dealing with these systems, Jensen and Morelli refer to Castells’ (1996) *network society* as well as Latour’s (2005) contribution of the *actor-network theory* (ANT) while pointing out that human-human relations might occur but human-nonhuman relations might stand more in focus within the CPC framework, including semiotic understandings [Castells, 1996;

Latour, 2005].

Further, Jensen and Morelli claim that multilayered networks and contact points often remain unnoticed by the users or rather not initially seen as a problem until the system collapses. However, the purpose of the CPC approach is to engage even before such an event takes place, which should make discrepancies apparent without being caused by a major incident. Depending on the taken ‘point of view’, networks can therefore evoke different stages of appraisal which leads to some turning out to be rather ‘critical’ while others are not. Thus, CPC strives for improving the overall performance, functionality and design between the different systems in a multidimensional manner whether it is a more critical or less critical network and might contribute to the creation of a new public space. [Jensen and Morelli, 2011]

Derived from the Oxford Advanced Learners Dictionary, they identify three buzzwords for defining their framework of CPC constituting of the following:

- *Interface: ‘The point where two subjects, systems, etc. Meet and affect each other’*
- *Node: ‘A point at which two lines or systems meet or cross: a network node’*
- *Network: ‘A complicated system of roads, lines, tubes, nerves, etc. That cross each other and are connected to each other’*

[Jensen and Morelli, 2011, p. 37]

Thereby, it is distinguished between the three components consisting of the technical, the social and the aesthetic dimension. By approaching the ‘life within networks’ of the socio-technical systems in an analytical manner, the ‘technical’ refers to infrastructural elements such as trains, ticket systems, or platforms and their operation respectively. The ‘social’ includes a mobility component of experiencing the systems by different users being on the move, also including a power related approach. Lastly, the ‘aesthetic’ represents the architectural design, art, and other visual elements.

As to further operationalize contemporary mobilities within socio-technical systems, Jensen and Morelli introduce the following framework for CPC, based on previously conducted research on the metroscares of e.g. Copenhagen, Paris, and London. The framework consists of:

1. *Identify a site of two or more intersecting systems performing as CPC*
2. *Map technical, social and aesthetic dimensions of the identified CPC*
3. *Make an analytical judgement of the CPC in terms of a chosen point of view/research question (e.g. technical functionality, social exclusion, economic revenue etc.)*
4. *Identify a potential for social and economic value that has not been fulfilled by the CPC (e.g. a service not catered for, a user group not included etc.)*
5. *Make a first tentative proposal for a re-design catering for the identified potential*

[Jensen and Morelli, 2011, p. 40]

According to Jensen and Morelli, this framework is to be seen as an open agenda, however, a decisive factor lies within its operational nature of pointing ahead and identifying the needs of what should be done for further developing and improving the status-quo of the CPC. For investigating the CPC, the application in itself may still vary since it is determined by the specific ‘point of view’ chosen as the research focus. This implies that

aspects appear more relevant than others, hence, some vanish and remain on a superficial assessment. One perspective to approach the socio-technical interaction at CPCs, which is mentioned by Jensen and Morelli, is the wayfinding process. Here, it can be seen from a user's viewpoint of how to find the way throughout the networks of everyday mobility and is therefore arguably crucial in order to take this framework as a point of departure for investigating wayfinding and user experience within the multiplex system of a mobility hub. [Jensen and Morelli, 2011]

## 4.2 CPC - Between wayfinding and wayfaring

Based on the introduced CPC framework, the following subsections will delve more deeply into the matter of the system's complexity while identifying two significant theoretical concepts relevant for the thesis' focus. In this regard, CPCs are seen in the light between a more instrumental wayfinding and a rather experiential wayfaring approach.

### 4.2.1 Wayfinding

Finding the way from A to B is an activity on a daily basis for people with all different kinds of transport modes, whether they drive a car, use public transport, cycle a bicycle, or walk and therefore participate as pedestrians in traffic. While the process in itself seems self-explanatory and straightforward, it is instead a complex action which requires multitasking [Vandenberg, 2016]. Whereas the ingenious wayfinding system is rarely noticed at places with an effective and user-friendly structure, a place, no matter if indoor or outdoor which is confusing in itself and with a poor wayfinding system, will lead to confusion and cause problems [Dogu and Erkip, 2000]. Hence, especially places such as shopping centers, airports, and mobility hubs benefit from well-established wayfinding.

Since the establishment of mobility hubs, researchers engaged themselves with wayfinding studies and its various foci. One of it concentrates on the importance of a sign system that guides passengers easily and efficiently to their destination and also emphasizes the significance of *“the accuracy and continuity of signage and the rationality of sign position”* [An et al., 2019, p. 366]. Another study was conducted by van der Hoeven and van Nes (2014) in which they investigate the usage of *“the space syntax methodology”* [van der Hoeven and van Nes, 2014, p. 64] to assess the orientation, the visibility and the wayfinding of passengers in the metro stations of Bockstael and Anneessens in Belgium [van der Hoeven and van Nes, 2014]. Furthermore, Fian and Hauger (2020) discussed the application of both analogue and digital components for a wayfinding system to suggest *“a holistic, barrier-free and user-friendly wayfinding system at transport hubs”* [Fian and Hauger, 2020, p. 1].

Wayfinding has been firstly described by Lynch (1960) in the book *The Image of the City*, where he mentioned the *“five types of elements: paths, edges, districts, nodes, and landmarks”* [Lynch, 1960, p. 46] that people use to orientate themselves in an unfamiliar environment. Lynch also claims that these five elements contribute to forming a series of mental images of the place [Lynch, 1960]. Later on, Passini (1984) argued that wayfinding can *“be defined as cognitive processes comprising three distinct abilities: a cognitive-mapping or information-generating ability [...]; a decision-making ability [...]; and a decision-executing ability [...].”* [Passini, 1984, p. 46]. Additionally, he illustrates

that the ability to accomplish a wayfinding task specifically depends on three hints, which are “*extracted from signs, directions, maps*” [Passini, 1984, p. 54].

While Lynch in his first study mostly focuses on architectural cues, Weisman (1981) focuses more on the mental image one can build of the entire area and considers it essential for proper wayfinding. Moreover, Weisman points out that people who have been to a place before and are hence familiar with it, have an advantage over others when considering the wayfinding behavior [Weisman, 1981]. In general, he characterizes four elements that influence the process of wayfinding: “*visual access, the degree of architectural differentiation, the use of signage or room numbers, and plan configuration*” [An et al., 2019, p. 358]. All these different variables which researchers defined as important for wayfinding behavior can be seen as ‘decision-making points’. Contrary to the initial thought that people only encounter decision-making points at intersections or similar when finding their way, these points encompass all places where a person needs to stop and orientate oneself again while consciously deciding which way to go as well as reconsidering if one is still on the right path [An et al., 2019]. Hence, the wayfinding process faces an increased complexity the more decision-making points one comes across. Moreover, personal characteristics such as age, gender or education affect the decision-making and therefore the wayfinding behavior as well [Montello and Sas, 2006].

At this point it is essential to explain the difference between the wording wayfinding and navigation. While wayfinding does not rely on additional tools such as maps, navigation does. It is therefore a possibility that an area has an efficient wayfinding system without guiding people the way with signs or similar. During wayfinding, people not only find their way to their destination but while doing so develop a spatial understanding, a so-called cognitive map, of the area. On the other hand, during turn-by-turn navigation the person gets guided at every possible decision point with e.g. GPS-based navigation. The result is that people find their way effectively but are missing an overview of the entire route and area. [Schwering et al., 2017]

### **Geosemiotics - The (dis)position of signs**

Everyday life is filled with signs we pass as we move around in the environment. This can be a wide range from road signs and overview maps that indicate the right direction to advertisements that adorn facades and banners. Geosemiotics are the interface between the physical world and semiotics and is used as a study for the meaning of the material world and how it is designed. Geosemiotics is essential to understand the systems of how the language is located in the environment such as signs on streets [Scollon and Scollon, 2003]. In providing an extensive amount of data the brain has to take in at once, this makes it important to identify the most necessary information according to the situation. This, Scollon and Scollon (2003) have tried to break down into three categories of signs; icons, indexes, and symbols that are used in different contexts in their book *Discourses in Place - Language in the material world*. The different variants of signs are going to be briefly explained in the following as well as a visualization is shown in figure 4.1. An ‘icon’ is described as being a sign that symbolizes an object and indicates how one is expected to act. Scollon and Scollon give the example that at an escalator there may be signs that show that you should hold children by the hand while you are on the escalator, or that

an icon is the symbol of a train. ‘Indexes’ can be signs with arrows that show in which specific direction one can e.g. find certain modes of transport. It is helpful to guide a person to a certain destination and it is often combined with icons. An example of this is an icon of a train and an arrow in the directions where it is possible to find the train. ‘Symbols’ are opposed to icons signs on which there may be written words or pictograms where it requires knowledge to understand the meaning of it. Also, symbols can contain a letter X over an icon, which creates the understanding of an action that is not allowed. [Scollon and Scollon, 2003]



**Figure 4.1.** From left: example for icons, index, and symbols. Illustration from [Scollon and Scollon, 2003, p. 26 and 28], own adaption of the visualization of symbols.

In addition, Gibson (2009) categorized four different kinds of signs in his work *The Wayfinding Handbook*; identification signs, directional signs, orientation signs, and regulatory signs. ‘Identification signs’ are basic to give the first impression of a destination such as places and spaces. An identification sign can be a logo or the name of e.g. a supermarket or gate numbers at an airport. Next, ‘directional signs’ are helpful signs that are simple to understand to make it easier to navigate around in traffic or in buildings such as airports. ‘Orientation signs’, like directional signs, help to navigate around. However, this is not by pointing in a specific direction, but by having an overview map of areas, and preferably with a marker for where one is located. Lastly, ‘regulation signs’ are signs that help to tell visitors about what is and is not allowed in a place. This may be a sign that smoking is prohibited or that it is not allowed to enter certain areas in a place. [Gibson, 2009]

Geosemiotics play a significant role within wayfinding practices, however, is surely not limited to it. Wayfinding encompasses more than simply relying on signages and reaches beyond those instrumental techniques of leading people through space. Furthermore, too many signs can be confusing, which is why infrastructural designers have to be careful when putting up signs and focus on making it as captivating as possible. [Jensen, 2013]

### **Wayfinding: Beyond geosemiotics**

Having discussed the various understandings of wayfinding, one can sum up that wayfinding is the process of navigating the way to a destination with the aid of natural visual hints and spatial elements but also by making use of different tools such as signs or maps [Farr et al., 2012]. Even though researchers have over time concentrated on different aspects of wayfinding, the general process is the same and can be separated into four factors: decision making, orientation, path integration and closure [Vandenberg, 2016].

However, as the concept of wayfinding is widely spread and various people adapt it differently, terms can alter depending on the individual author. As illustrated by Farr, et. al (2012), the researchers Downs and Stea (1973), for instance, apply additionally the word ‘route selection’ and adopt the term ‘route control’ instead of ‘path integration’ as well as ‘recognition of destination’ instead of ‘closure’ [Farr et al., 2012]. Nonetheless, the statements are much alike, hence, only the one defined by Vandenberg will be explained in detail in the following.

The first factor ‘decision making’ is about the conscious decision to go to a specific place. However, while the initial idea of walking somewhere is only one part of this factor, it is also a significant part to reconsider where to continue walking when one encounters these decision-making points, as mentioned earlier. The next component of wayfinding is ‘orientation’ which is about the person’s understanding of their location within the spatial environment [Vandenberg, 2016]. To know where one is located is fundamental to find the way to the destination. If a person is familiar with the area, the orientation comes naturally and without paying intensive attention to the environment. However, if a person is unfamiliar with the place, various factors influence their orientation, starting with the environmental and spatial configuration of a space, in other words, the layout of the area. This includes architectural elements such as landmarks and the horizontal as well as vertical build-up of the place but also how well different buildings or places differentiate from each other. In addition, other visual elements like semiotics, the lighting or coloring of a place play an important part as well [Dogu and Erkip, 2000]. All these factors contribute to developing a mental map that aids people in knowing where they are and where they need to go. Next, the third component of wayfinding is ‘path integration’ which can be understood as *“the constant updating of the navigator’s position and orientation during movement”* [Chrastil et al., 2017, p. 1]. In other words, it is the constant orientation while walking due to tracking one’s speed and direction of travel. This measurement can be based on both idiothetic and allothetic signals, meaning both internal and external cues [Loomis et al., 1999]. The last component is ‘closure’ which expresses that the person recognizes and realizes that one reached the destination. Successful wayfinding is therefore not accomplished until this last component is achieved [Vandenberg, 2016], implying that wayfinding designers need to ensure that people not only find their way around but also realizing when they actually reached their destination.

#### **4.2.2 Wayfaring**

In their attempt of linking wayfinding with wayfaring, Lanng and Jensen (2016) argue for wayfaring covering a multisensorial perspective while finding the way in an urban surrounding, which should be considered within designing practices. They define it as follows: *“Wayfaring is the holistic experience of the world, mediated by sensations and perceptions of much more richness and detail than simply finding the way from point A to point B”* [Lanng and Jensen, 2016, p. 249]. Situated within the mobilities turn, this reflects the ‘more than’ approach and reduces the wayfinding not only to the movement from one location to another based on cue elements in the environment [Lynch, 1960] but adds an additional layer operational-wise of the embodied performance of the mobile person and so contributes to an enhanced understanding of what a person experiences on the move. Speaking of experiences and ambiances along the way, the feeling of the traveler as well

as senses, other than solely the visual perception that primarily dominates the concept of wayfinding, play a significant role within wayfaring. Building upon Ingold's (2000) argument in his book *The Perception of the Environment*, wayfaring is a conduct being opposed to an instrumentalized transport movement of connecting the point of departure and arrival respectively [Ingold, 2000]. Rather, wayfaring refers to the mobile life performed during the journey where multidimensional experiences such as embodiment, negotiations, and other interactions matter, hence, exploring the dynamic interplay of space design and mobilities practiced 'in-situ' of what Jensen termed staging 'from below' and being staged 'from above' (embracing power relations, semiotics) [Jensen, 2013]. Specifically staging 'from below' communicates also what Vannini's (2012) in-depth ethnography shows on the performances of passengers traveling by ferry on Canada's West Coast [Vannini, 2012], which will further be introduced in the upcoming subsection. Based on Vannini's research, Lanng and Jensen sum up that "*on the ferry journeys, people are not just being transported. Instead the travelers have the kind of experiences and interactions that are inherent in wayfaring while undertaking a journey*" [Lanng and Jensen, 2016, p. 255].

Thereby, Lanng and Jensen claim that both orchestrations are utterly intertwined implying that, when finding the way around, people are turning not only into wayfinders but also inhabit the environment as wayfarers [Lanng and Jensen, 2016]. This interrelation is additionally induced by what Gibson (1986) termed the concept of *affordances*. Derived from a rather ecological context, affordances connect the perception of the physical surrounding, such as hints when wayfinding, to the materialities and design within this environment which might be understood by the individual or the mainstream users as 'affording' in the sense of encouraging certain actions but also inhibiting other. [Gibson, 2015]

With the linkage of wayfinding and wayfaring, Lanng and Jensen raise awareness towards a change in perspective by outperforming the solely functional interpretation of wayfinding being more than a movement from A to B. To rephrase it, there are underdeveloped and unexplored capabilities of integrating wayfaring experiences into the design of everyday life mobilities within public spaces, specifically those of transit driven by efficiency. In evoking new considerations of designing a public space by not only having the affordance of facilitating instrumental wayfinding practices on the one hand but also the encouragement of sensorial and experiential performances on a traveler's journey on the other, Lanng and Jensen call for intensifying and upgrading the 'ephemeral qualities' of 'lives lived' when finding the way around in the urban environment. [Lanng and Jensen, 2016]

### **Waiting as wayfaring**

In accordance with Lanng and Jensen's approach to wayfaring, they refer to Vannini's (2012) work situated within the new mobilities turn called *Ferry Tales – Mobility, Place, and Time on Canada's West Coast* [Vannini, 2012]. In this study, Vannini explores the performances of travelers during a journey, more specifically, how the individuals bridge their travel time spent from their departure point to their destination. This involves the entire process from arriving at a ferry terminal to the actual travel on the ferry where he touches, amongst others, upon waiting procedures, time considerations, and power relations. Thereby, Vannini conducts in-depth ethnographic research on small

island ferry journeys in British Columbia to understand the traveler's practices and social interactions while delving into their own community and habitat. He argues that mobility arrangements of ferries, its terminals, and operational routes, etc. are not solely physical infrastructures or what he terms 'mobility assemblages' that are put together of what seems suitable for each other to transport people across the water, but rather represent a distinctive mobility option of daily life of the island dwellers with peculiar practices and experiences. Vannini goes on in outlining the nexus of these assemblages being on the one hand tied to conveniently facilitating the desired travel movements and on the other inducing inconvenience through dependency on the operators and unexpected incidents that might occur [Vannini, 2012]. This arguably represents the coherence of CPCs being more than just an assemblage, also indicating power relations towards the travelers when mentioning the case of the ferry schedule which determines not only the sailing time but also the time one needs to plan ahead to actually reach the ferry on the first hand.

Specific focus within this thesis is therefore put on the waiting time practices of the individual travelers which is also expressed by Vannini's question of "*what happens 'before' one gets onboard a means of transport?*" [Vannini, 2012, p. 162, own reinterpretation of original emphasis]. Based on his assumption that "*passengers are artful social actors*" [Vannini, 2012, p. 162.], Vannini claims for people actively considering spatial and temporal components when it comes to planning for their travel with public transport. In this regard, he introduces the concept of taskscapes which refers to traveling not necessarily being empty nor lost time spaces but time plots to perform self-chosen undertakings. Thereby, Vannini mentions that these practices vary from a wider range of relevant activities carried out by the travelers both 'reflexively' and 'unreflexively' as well as 'creatively' and 'uncreatively', while constantly adapting to the environment and context across time and space. Thus, the travelers make use of the time before departure suiting their individual purposes by meaningful practices and reclaiming the otherwise rather considered wasted time due to the forced schedule of the public transit. Bissell (2018) therefore argues for the phrasing of 'produced' or 'productive' time instead of an initially presumed 'wasted' or 'dead' time within an exclusively economic perspective. Between activity and inactivity, waiting time scenes, hence as part of travel time, can be performed freely by the passengers 'from below' [Jensen, 2013], whether in establishing individual habits and patterns or adapting variations of earlier implemented practices which in turn leads to a multitude of different experiential appraisals. Thereby, he points out that especially modern technology features such as mobile phones have reshaped the awaiting performances and experiences as well as perception of time throughout the last years [Bissell, 2007, 2018].

Vannini goes even further in adding a power component and identifies the power discrepancy which in his case is related to the ferry operator BC Ferries versus the individual traveler. Speaking of practiced 'strategies' of the transport company and even 'time thieves' in the sense of stealing the time of the individual traveler, he refers to waiting time as 'stolen timespaces' derived from the Italian term 'tempo rubato' [Vannini, 2012]. Originally stemming from the music scene, this approach implies an instruction of unconfined interpretation by the player of the upcoming rhythm, while manoeuvring and 'tactically' reassigning time from a certain spot to somewhere else. Used as metaphor, this represents the staged transit schedules which the travelers must stick to in order to conveniently use the provided public transport services. In short, Vannini identified various

engagements of waiting performances which he refers to as carried out ‘tactics’ to steal time back which got initially stolen by the ferry operator.

With the privatization of BC Ferries and its prevailing system based on the principle of first-come first-served within an unofficially regulated lining-up culture, the approach of ferry systems in British Columbia might distinguish from other public transport practices. The frame however remains the same, the situation is staged ‘from above’ determining waiting as integrated and determined part of traveling whether due to necessary premature occupation as in *Ferry Tales* to catch the next leaving ship or in this thesis’ focus due to the CPC networks in terms of intermodal journeys of an earlier arriving transport mode at the mobility hub such as train or bus where the time needs to be bridged accordingly. In this context of mobility hubs, waiting time should therefore not necessarily be seen as immobility but as the interface between mobility and immobility channeling travelers at definite times throughout various service facilities offered at such a location implying diverse adaptive tactics to undertake meaningful practices within the demanded time slot for stealing back their ‘stolen’ time.

### 4.3 Operationalization of theoretical framework

The theoretical framework applied throughout this project generates an overarching but integrated approach of investigating wayfinding practices at Aalborg Station as a multimodal mobility hub. With its definition of facilitating an intermodal shift, its contribution to more connectivity between sustainable mobility options as well as adding an experiential layer, the earlier introduced CPC framework in section 4.1 is explored from the point of view of the individual user providing insights into the perceived ‘life within networks’ [Jensen and Morelli, 2011]. On-site empirical research has therefore been conducted, as the CPC framework suggests this approach to both assess the present intersecting systems and later to reinvent or modify them [Jensen and Morelli, 2011]. Hence, the status-quo of the area is explored with the background agenda of developing mobility hubs in Denmark as introduced in chapter 2 on page 3 as well as based on its rather operational character of the CPC framework, recommendations for improving the current situation will be given.

Working with the CPC framework thus means to slightly adapt the identified categories and guidelines to suit the project’s focus and perspective taken accordingly. Thereby, Aalborg Station is added as the site-specific case, the point of view has been shifted to be more focused on a from below perspective, and the addressed tentative proposal has been replaced by a rather recommendation-driven approach. The adjusted theoretical framework applied is outlined in the following:

1. *Identifying Aalborg Station as a CPC of multiple intersecting systems*

This first attempt to approach the framework’s application refers to pointing out how Aalborg Station constitutes a CPC and which intersecting systems and features are present at this multimodal mobility hub. It therefore touches upon the status-quo of the available components, while delivering the background information to build up the further analysis accordingly. This initial part of the CPC framework is thus explored within the section 2.2

on page 6 of this project and provides the argument for conducting research across these identified multilayered systems.

2. *Mapping technical, social and aesthetic dimensions of Aalborg Station as identified CPC*

The second instruction aims to map the different dimensions occurring at the CPC from technical to social to aesthetic components and is mostly explored through on-site research. Through outlining the multidimensional landscape which the CPC deals with, this indicates the current situation of the complex networks and gives a first impression of how the socio-technical systems at Aalborg Station might interact. In analyzing these dimensions within the beginning section 6.1 on page 41 of the analysis, this functions as the backbone to the further analysis whereas referring rather to the staged perspective ‘from above’ [Jensen, 2013].

3. *Making an analytical judgement of Aalborg Station in terms of the point of view of the user experience*

This instruction represents the core of the framework where the empirical research mostly comes into play while investigating a ‘from below’ perspective [Jensen, 2013]. A part of the empirical research involves the concept wayfinding which has been outlined before. More precisely, the understanding of wayfinding practices that will be applied is a combination of approaches from researchers such as Lynch, Weisman and Scollon and Scollon. For the operationalization of wayfinding, it is defined in this thesis as the physical movement of a person while finding the direction from A to B. This process is subdivided into several stages, starting with the decision to walk to a specific destination, orientating where one is located, and based on that, selecting a route. This route can be adapted throughout the process. During the walk, one is constantly confirming their position until the person recognizes having reached the desired destination. In this thesis, the first stage is already completed as the study’s participants will be provided with the destination which is either the bus station C6 or the bus station A1, depending on which way the participant should find. As explained in subsection 4.2.1, while walking, people take advantage of spatial as well as visual cues to find the way. These can be e.g. architectural hints as well as geosemiotics to orientate oneself.

Complemented is the concept of wayfinding by the notion of wayfaring [Lanng and Jensen, 2016] in adding an experiential layer including the multisensorial reactions to the environment, the embodiment, interactions during the journey as well as the secondary focus on waiting time as part of the intermodal shifting. Touching on the wayfaring notion, waiting practices will be operationalized through Vannini’s approach to taskscapes and tactics as well as Bissell’s considerations on the subjective usage of time. Outlined within the section 6.2 on page 45 of this project, this functions as the analytical judgement of the CPC’s ‘life within networks’ [Jensen and Morelli, 2011] while investigating the viewpoint of the individual user at Aalborg Station which then leads to the possibility of further identifying potentials in this regard.

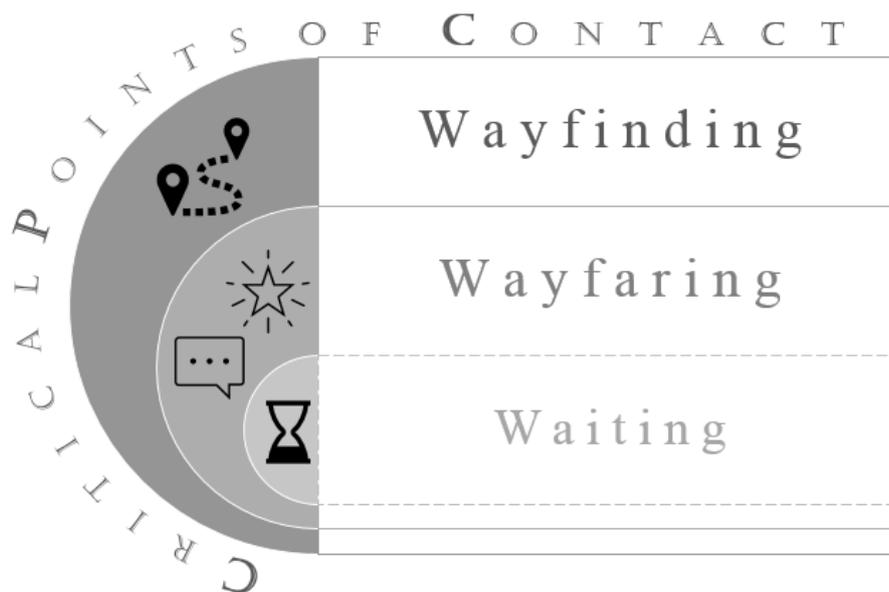
4. *Identifying potentials (for social and experiential value) that have not been fulfilled at Aalborg Station (yet)*

Based on the analysis conducted in point 3., these fourth instruction delivers the scope to identify potentials of the interplay between wayfinding and the user experience at the mobility hub at Aalborg Station, hence what is lacking in terms of social and experiential value. This leaves room to further expand and adjust the current practices by mitigating the gap between the outcomes of the analysis completed and opportunities missed out regarding the focused matter. Potentials will be identified based on critical points during the discussion, section 7.1 on page 84, with pointing ahead to the last instruction of the CPC framework, which is outlined in the following.

5. *Suggesting initial recommendations for a re-design of Aalborg Station catering for the identified potentials*

Lastly, the CPC framework suggests transforming the identified potentials of point 4. into action while challenging the current status-quo of Aalborg Station and resulting in a tentative re-design of the mobility hub. In this project, however, the focus lies rather in providing initial recommendations for such a re-design as it suits the framing through the lenses of a mobilities approach rather than a designing project. These suggestions will be discussed within section 7.2 on page 89 and might be relevant to the various stakeholders involved in developing Aalborg Station to a representative mobility hub in Denmark which consist of the transport operators DSB, NT, and NJ, the shopping center Kennedy Arcade, as well as Aalborg Municipality. Further, it will provide inspirations for the development of mobility hubs both inside and outside Denmark.

Sketching these described points additionally into a visual concept, the following orchestration of the theoretical framework indicates the complementary research design which is worked with throughout the project, as seen in figure 4.2.



**Figure 4.2.** Operationalization of theoretical framework - mobility hubs as critical points of contact. Own representation.

Here, figure 4.2 displays the operational approach and how the theories interlink with each other. Putting these in words means briefly that the theoretical framework works reasoned in itself as well as it contributes to an in-depth understanding of the project's focus on wayfinding and user experience. Critical points of contact functions as the overarching concept where Jensen and Morelli touch upon the necessity of finding the way through the complex systems of everyday mobility while referring to it as 'life within networks' [Jensen and Morelli, 2011]. Wayfaring thereby is integrated within the wayfinding practices whereas Lanng and Jensen claim it as "*lives lived on the move*" [Lanng and Jensen, 2016, p. 249]. The resemblance is self-evident which argues for applying this above outlined integrated theoretical approach. Further, Lanng and Jensen's notion of 'wayfaring', originally derived from Ingold [Ingold, 2000], has its earlier reference within Vannini's ethnographic study terming it the 'wayfaring model' as opposed to transport [Vannini, 2012]. This is where the experiential layer from A to B comes even more into play and more specifically with the secondary focus on waiting time practices. To conclude, this project makes use of a theoretical frame coined by key thinkers within the approach of the new mobilities turn in the foreground as well as urban theories in the background, though, considered as influential contributions within the literature landscape since they were being cited amongst the researchers themselves arguing for a coherent and rational theoretical frame of this project.

# Methods 5

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In order to meaningfully support this project's research question, as outlined earlier in chapter 3, and in accordance with the 'new mobilities turn' introduced in chapter 4, a technological mixed-method approach has been completed consisting of mainly empirical research conducted in-situ. In developing a coherent methodological composition, the following sections provide an overview of its applications throughout this thesis.

## 5.1 Literature

Literature studies have been completed as a supplement to the main other methods outlined in the following of this chapter. Being structured around desktop search as opposed to methods conducted in-situ, this enables to acquire relevant data sources in advance, functioning as background information, as written in chapter 2 and the identified research question, while partly contributing to the theoretical and methodological framework. During this process of allocating relevant state-of-the-art sources, the search engines from Aalborg University's library and Google Scholar as well as online databases such as Scopus have been used since they appeared helpful in previous projects in gathering representative and reliable literature. The identified literature landscape ranges from books and book chapters to peer-reviewed journal articles which gain insights into the field of mobilities, more specifically are structured around the keywords of 'mobility hub', 'transit hub', and 'wayfinding' in combination with 'spatial behavior', 'eye-tracking', 'urban environment', 'design', 'waiting time', 'user experience', and 'intermodality'. Based on this initial literature search, further allocating literature has been completed by applying the so-called 'snowballing' method. In backward and forward snowballing of the identified literature, concerning which scholars does the literature cite and which scholars are citing the literature [Wee and Banister, 2016], it was possible to obtain rather specific and more detailed as well as in-depth knowledge of the project's focus on wayfinding and waiting time while being embedded within the topic of mobility hubs. Thereby, all literature gathered needed to be reviewed and critically assessed before taking it into account for this thesis. Besides academic literature, references that are case-specific, in this project Aalborg-related, have been acquired consisting of primarily municipality plans and visions of the current status as well as future development goals and procedures of mobility and hubs itself, including the restructuring of the area around Aalborg Station with regard to the planned BRT. This information got retrieved via official documents and websites of Aalborg Municipality and the transport operator NT which contributes to a thorough and coherent understanding of this project's focus area apart from the more general literature existing around mobility hubs. To conclude, some knowledge whether the general literature landscape or the more specific Aalborg-related references could not have been retrieved

from in-situ investigations which is why background information in form of literature search is essential as it ensures valid and considerable apprehension of this project's focus and research question concerning Aalborg Station.

## 5.2 Drifting and mapping

In the following, the methods of drifting and mapping will be introduced. Drifting is a phenomenological method that is about walking around in an area with primarily focusing on the experience and the atmosphere, to create a better understanding of the specific environment. The method was applied in the project's defined area of Aalborg Station where drifting around took place based on interest and curiosity. Within the methods application, it is possible to create themes one pays attention to when drifting around. [Marling, N.D.] In this case, this was about the usage of the area and to observe how people behaved while waiting for their mode of transport as well as how the everyday life and embodied performances took place in the area. In addition, the method drifting was also used to map the area. Mapping the area gives the opportunity to make a visual representation of the surrounding, and thereby a better understanding of the structure of the place and what functions are found on-site. Mapping helps to provide a better opportunity to create an understanding of the area and to be able to refer to specific infrastructural as well as embodied components. [Silva et al., 2019] The drifting has been carried out for multiple days on-site during fieldwork and took place throughout the day, in the morning and also in the afternoon.

## 5.3 Eye-tracking

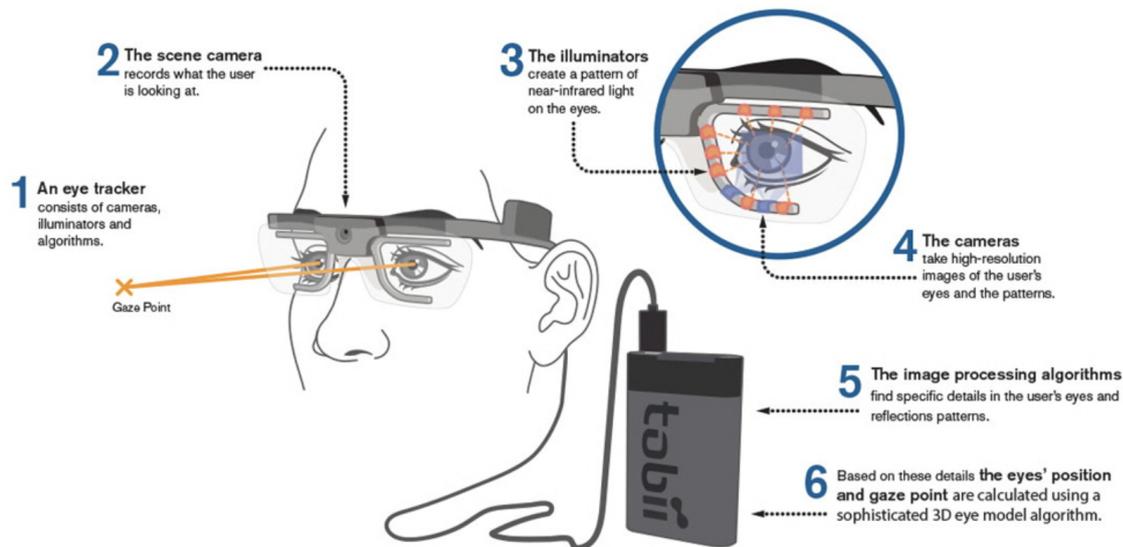
Eye-tracking is a technological method which draws awareness to the “*allocation of visual attention*” [Carter and Luke, 2020, p. 50] by documenting the eyes' movements as well as gazing spots throughout a time-related and task-specific undertaking. Therefore, it is used for understanding where people look at and how long they pay attention to these interest points which reflects the assumption of an interrelation between visually noticing and consciously perceiving. Thus, it can also be referred to as a psychological tool for gaining knowledge into peoples' behavioral and decision-making processes. [Carter and Luke, 2020]

At this point, it is needed to say that there are different approaches in research when referring to ‘eye-tracking’ which are however commonly used interchangeably. It is distinguished between the actual term ‘eye-tracking’ and ‘gaze-tracking’. The latter applies in this case, however for facilitating reasons, it is still referred to as ‘eye-tracking’ throughout the thesis. To clarify, this thesis does not study its literal translation of tracking the eyes' motions itself but rather focuses on tracking the ‘gaze’ of where people look at, implying the earlier explained visual attention. [Gnaneswar, 2021] Thereby, video-based eye-tracking was carried out in this study, which represents a widely accessible approach. Its function can be briefly described by a light source, commonly infra-red, shedding into the eye, which in turn, generates a corneal reflection calculated in relation to the pupils' center [Carter and Luke, 2020]. Further, Duchowski (2007) differentiates between three main types of eye movements observable on video-based tracking data which involves

fixations (a steady movement focusing on one point of interest), saccades (the in-between movement of points of interest usually within hasty velocity), and smooth pursuits (the follow-up with the eyes along a shifting object) [Duchowski, 2007].

In this context of gaze-tracking, several studies have been competed to investigate the interrelation of mobility and urban design as well as wayfinding procedures. To name a few, Breinholm Christensen (2020) explores the mobilities design of public spaces in an underground setting of everyday life mobilities in the transit assemblage of Copenhagen metro [Christensen, 2020]. Another study, completed by Hernandez-Bueno (2021), studies the passengers' experiences and situational mobilities when moving through Copenhagen Airport [Bueno, 2021], while Noland et al. (2017) draws into a solely urban design related approach in developing an understanding of peoples' attention and perceptions of the immediate urban street space [Noland et al., 2017]. With regard to wayfinding practices, Emo (2012) aims to examine the interrelation of physical infrastructure and its spatial attention in wayfinding tasks with help of tracking technologies whereas Kiefer et al. (2012) argue based on a comparative study in Zurich (Switzerland) that mobile eye-tracking data holds large potential in gaining deeper insights into the human-non-human connection between the wayfinder and wayfinding suppliers such as landmarks and orientational capabilities within an outdoor environment [Emo, 2012; Kiefer et al., 2012]. Therefore, they call for delving into the spatial awareness and mental processing when finding one's way through an urban surrounding.

From a technical point of view, *Tobii Pro Glasses 2* have been used in this study which were supplied by the C-MUS Lab from Aalborg University. In combination with the *Tobii Pro Glasses Controller* software (version 1.83.11324-RC1), the recording encompasses a video, the gazing samples of the user as well as an audio file. The *Tobii Pro Glasses 2* and the *Tobii Pro Glasses Controller* software are connected through a wireless signal. When utilizing, an beforehand one-point calibration setup was needed before starting the recording. The eye-tracking glasses were designed to look somewhat regular glasses alike in order to enhance natural behavior [Tobii Pro, N.D.b]. Figure 5.1 explains the different technical elements as well as visualizes the *Tobii Pro Glasses 2* in the following.



**Figure 5.1.** Wearable eyetrackers: The elements of Tobii Pro Glasses 2. Illustration from [Tobii Pro, 2021].

For analyzing the gathered eye-tracking recordings, ELAN functions as a suitable computer software for managing and evaluating the outcomes based on gaze time data [The Language Archive, N.D.]. That being said, the priority in this study is merely set to investigate the visual attention paid by the participants to the environment and physical surrounding with the focal point being within their embodied performances in terms of qualitative as well as numerical quantitative nature.

### 5.3.1 Think aloud

Besides the visual attention drawn on elements during a journey, an additional experiential layer was added through the concurrent think aloud approach representing a rather multisensorial practice of wayfaring as introduced in subsection 4.2.2. Since the Tobii Pro Glasses 2 come with an integrated microphone, it is possible to record the participants' voice which provides insights into their thoughts when moving through the environment as well as gives a greater understanding of individual choices and embodied performances for the researcher to make sense of. Therefore, this approach's advantage lies in the first place in the combination of having the visual video recording from eye-tracking synchronized with the spontaneous situation-based thinking aloud of the participant. This creates a detailed live experience shared on specific points on a route which might be rather precise than a retrospective think aloud approach. Critically awareness however needs to be driven to a possible distortion of the eyes' movements as thinking aloud might influence the natural behavior within the environment for some people, as well as it seems to potentially distract or prolong certain gazing activities during such an unconventional intervention for others. [Tobii Pro, N.D.a]

### 5.3.2 Route tracking

In addition to the eye-tracking application, tracking has been completed to supplementary understand the chosen embodied routes within Aalborg Station as a mobility hub. Since

the given task for the individual participants was to find their way from a predetermined point A to a predetermined point B, the precise path was however not determined. This resulted in having various opportunities to perform the fictional journey on an individual basis and was tracked with the help of the publicly accessible online app called *Strava* [Strava, 2022]. The sketched data of the routes from Strava was reviewed and compared to the empirically acquired video material of the eye-tracking application afterwards, whereas occurred errors in the positionings got adjusted. Using the mapping software *ArcGIS*, the adapted data has subsequently been transformed into meaningful own representations.

### 5.4 Interview

Another method that got applied in order to collect data were interviews which is “*the most common format of data collection in qualitative research*” [Jamshed, 2014, p. 87]. Interviews can be defined as collecting information of the participants’ opinion, their beliefs, and experiences regarding a particular research question [Lambert and Loiselle, 2008; Rubin and Rubin, 2005]. Hence, adding interviews in the methodology assists in understanding the interviewee’s point of view and contributes detailed information to the study [DiCicco-Bloom and Crabtree, 2006]. Moreover, Seidman (1998) points out that interviews should give researchers the possibility to critically reflect upon the participants’ point of view as well as their own [Seidman, 1998].

As interviews are advantageous for various types of research, there are different categories of the very, amongst others, structured and semi-structured interviews [Wilson, 2016]. Besides, as the desired outcome of interviews differs as well, there are different types of questions which can generally be classified into describing, exemplifying, and experience questions [Rytter and Olwig, 2018]. As one can already assume by the name, describing questions ask the interviewee to illustrate a specific situation etc. whereas exemplifying questions are aimed at getting a particular example. Lastly, experience questions look into personal experiences of the interviewee (ibid.).

An additional aspect that needs to be taken into consideration when conducting interviews are conditions such as the location where the interview takes place. Due to modern technology, interviews do not necessarily have to be in person, but can instead be conducted over the phone or in a video call. However, it should be considered that body language as well as facial expressions mostly play an important part in interviews which would get lost when doing the interview online. On the other side, some people feel more comfortable doing an interview over the phone than face-to-face and might speak more freely. Hence, the conditions in which the interview takes place should be in accordance with what data the researcher needs as well as what suits the interviewee best. [Wilson, 2016]

#### 5.4.1 Expert interview

In order to gain in-depth knowledge about the mobility hub Aalborg Station, an expert interview with Kristoffer Martens, one of the project leaders of NT, got conducted within the scope of a semi-structured interview. A semi-structured interview is characterized by a framework of certain topics and guiding questions that should help the interviewer to keep the red thread [Kvale and Brinkmann, 2009]. However, the semi-structured interview is

more flexible and hence allows the researcher to come up with other questions during the interview and follow subjects of interest [Wilson, 2016]. This is also one of the advantages of semi-structured interviews and the reason for selecting this type to get a comprehensive understanding of the topic and to not limit the results of the interview by conducting a structured interview and a therefore fixed set of questions. On the other hand, it is essential to remember the desired outcome of the interview to avoid wandering from the subject.

One of the reasons for specifically choosing NT as one of the operating public transportation company was due to the fact that they connect public transport across North Jutland. Moreover, NT is already working with hubs and thus striving to combine different modes of transport more easily. The interview was not recorded but instead transcribed for content. The interview guide for the expert interview is to be found in appendix A on page 115.

#### **5.4.2 Follow-up interviews**

In this thesis, semi-structured interviews got also applied during fieldwork for conducting the follow-up interviews after the participants finished the eye-tracking task. The purpose of these interviews were to understand the participants experience walking either Route A or B as well as possible problems that might have occurred on their walk. While the initial set of questions was the same for every participant, they were further asked, depending on their answers, to elaborate more on specific situations or questions have been added due to certain reactions while walking to understand their behavior. In contrast to the expert interview, these interviews were recorded and hence also transcribed. The interview guide for the follow-up interviews can be seen in appendix B on page 117.

#### **5.4.3 Structured interviews**

In contrast to the expert and the follow-up interview, the interviews to investigate the waiting time were structured interviews. As the name suggests, these types of interviews are fully structured and follow therefore a fixed collection of questions [Wilson, 2016]. The purpose of these structured interviews was to collect general data about people and their relation to spending their waiting time at Aalborg Station. As people got asked while actually waiting at various places at Aalborg Station for their next mode of transport, passengers did not have much time and hence the interviews got kept as short as possible. Even though the fixed structure of the questions helped to keep the red thread, the natural limit of this type of interview is that researchers cannot get in-depth with a topic as it is possible with semi-structured interviews [Wilson, 2016]. The interview guide can be seen in appendix C on page 119. After conducting the interviews on paper, the answers were uploaded to SurveyXact [Ramboll, N.D.], where the questions have been put in. Uploading the answers helps to analyze the data and to create an overview and later be able to sort the data and look at the individual respondents' answers.

## 5.5 Considerations of philosophy of science

A part of the research design is a review of philosophy of science in relation to the thesis' matter and hence its research question. This thesis is situated within the fields of mobilities, more precisely it refers to the new mobilities turn which acknowledges that mobility is more than a simple movement from A to B [Jensen, 2015]. Regarding this thesis, while the factor of physically moving from either the train station to the bus terminal or from one bus terminal to another gets examined, the element of experiences along the way as well as the perception of waiting at the mobility hub Aalborg Station will be added as an extra layer. In doing so, the understanding of wayfinding evolves into the practice of wayfaring which is considered as one of the essential concepts of this study. Moreover, Hannam et. al (2006) argue that through the viewpoint of the new mobilities turn, places such as airports can be seen as "*space of transition*" [Hannam et al., 2006, p. 6] as they connect places and in doing so forming networks [Hannam et al., 2006]. This argument can be applied to mobility hubs as well as they are characterized by a seamless transition between different modes of transport which link together places and hence form somewhat of a network around the very mobility hub, as written in subsection 2.1.1 on page 3.

As this study investigates the subjective experiences of people finding their way around the mobility hub Aalborg Station to a specific destination as well as being present at the hub, it can be argued for that the study is situated within the phenomenological philosophy. By applying a phenomenological approach, the "*lived experiences*" [Byrne, 2001] get examined in a qualitative way by e.g. incorporating semi-structured interviews which leave room for the interviewee to express their feelings and opinions. Further, studying peoples' individual experiences of moving around and being at the mobility hub assists in understanding the reality one encounters at this place [Byrne, 2001]. Thus, the phenomenological approach also argues that, due to subjective viewpoints in relation to a situation, researchers can only get an insight into the ontological understanding but never completely grasp it. In other words, instead of seeking one truth, the framework of phenomenology research encourages to look for several realities [Qutoshi, 2018]. That being said, wayfinding however has a slight resemblance to what e.g. Peirce (1982) termed 'pragmatism' which can in this case considerably be argued due to a rather technological approach of using eye-tracking glasses as well as striving for solving real-life problems and further suggesting improvements thereof [Barnes, 2008]. This aligns with what Brinkmann (2013) terms 'eclectic pragmatism' [Brinkmann, 2013] which argues for primarily foregrounding the findings while pragmatism generally considers a mixed method approach [Feilzer, 2009; Brinkmann, 2013]. This results in pragmatism being one layer of the philosophy of science which rather addresses the concept of wayfinding to understand real-life situations, whereas the notion of wayfaring and hence a phenomenological approach adds an experiential layer.

To conclude, by framing the thesis within the new mobilities turn, a pragmatic as well as phenomenological approach has been applied in relation to philosophy of science. The focus of the analysis will lie on solving real-life problems whereas investigating the individual person's experiences and feelings to interpret a general impression of Aalborg Station as a mobility hub while knowing that these are only few realities and that the ontological understanding of the place depends on a person's subjective mind.

## 5.6 Applying methodology

The following subsections deal first with the operationalization of the methods applied in relation to the theoretical framework and second with the conducted fieldwork performed on-site at the mobility hub Aalborg Station.

### 5.6.1 Operationalization of methodology

Within the theoretical framework of CPC, the chosen and in this chapter introduced methods function as supporting tools to investigate the project’s wayfinding and waiting time experiences. An overview of the applied methods is provided in the following table in figure 5.2, touching upon the various dimensions the methods contribute to as well as their overall purposes in this project.

<i>Method</i>	<i>What?</i>	<i>When?</i>	<i>Why?</i>	<i>Who?</i>	<i>How?</i>
<i>Literature</i>	research landscape (i.e. books, book chapters, peer-reviewed articles, municipality plans)	throughout the project period/ mainly in the initial stage	to acquire background information on mobility hubs	scholars in the field of mobilities (e.g. Glotz-Richter, 2016) and stakeholders (e.g. Aalborg Kommune, 2020)	qualitative desktop search (e.g. Aalborg University Library, google scholar, scopus)
<i>Drifting &amp; Mapping</i>	phenomenological, atmosphere, aesthetic and social structure, technical functions	throughout the day at multiple weekdays during fieldwork	to understand and experience the area (i.e. everyday life, embodied performances and waiting)	research group themselves	qualitative Walking and dwelling visual representations ArcGIS on-site
<i>Eye-tracking</i>	video-based, gaze-tracking, visual, subjective, eye-level, mobile	on weekdays during fieldwork in week 13 and 14 (i.e. morning and afternoon, rush hour and light traffic)	to capture visual attention to and meaning-making of infrastructural assemblages	14 pre-selected participants (i.e. no knowledge to good knowledge, Danish and non-Danish, age 21 to 80)	qualitative/quantitative Tobii Pro Glasses 2 ELAN on-site
• <i>Think aloud</i>	audio, sharing thoughts, multisensorial, wayfaring, experiential layer	conducted simultaneously with eye-tracking (see above)	to understand behavioral choices and mobile situations	same participants as for eye-tracking (see above)	qualitative audio recording Tobii Pro Glasses 2 on-site
• <i>Route tracking</i>	instrumental, walking lines, on-site		to visualize individually embodied routes		qualitative Strava ArcGIS on-site
<i>Interview</i>					
• <i>Expert interview</i>	professional knowledge	1 <sup>st</sup> April 2.30pm	To gain deeper knowledge about NT’s work with mobility hubs	Kristoffer Martens, project leader at NT	qualitative semi-structured phone call
• <i>Follow-up interview</i>	based on wayfinding task	during fieldwork after individual eye-tracking trip	To understand the participants’ experiences and critical points on the routes	same participants as for eye-tracking (see above)	qualitative Semi-structured on-site
• <i>Structured interview</i>	systematic, mainly closed-ended questions, waiting time practices	during fieldwork on 7 <sup>th</sup> April in the afternoon	To gain insights into passengers’ waiting time experiences	35 passengers found in-situ	quantitative structured on-site

**Figure 5.2.** Operationalization of methodology and its contributinal dimensions. Own representation.

In addition to this summary in figure 5.2, some general operationalizations and considerations concerning eye-tracking and the think aloud approach are going to be outlined in the following.

In order to analyze wayfinding at Aalborg Station, the visual attention by utilizing the eye-tracking glasses will be clustered according to possible elements that will aid the participants finding the way. This leads to the following classification into five identified categories based on the theoretical framework of wayfinding and partly wayfaring, which are listed below.

- Stopping & Navigating
- Moving & Navigating
- Embodied performances
- Unintentional stops
- Other

As follows, a short description of the five categories applied will be outlined to clarify the procedure of segmenting the gaze times within the software ELAN, explained earlier in section 5.3. Stopping & Navigating refers to segments in the video file where abrupt immobility takes place, meaning the movement entirely stops and participants look around while spatially navigating before continuing their journey. Moving & Navigating implies the same navigating procedures, however, the transition is more fluent where a kind of multitasking is performed while being on the move. For the mentioned cases, navigating is understood as a mixture of both cognitively wayfinding and understanding orientational signs, e.g. a map, as defined in subsection 4.2.1 on page 19. Embodied performances rather relate to the notion of wayfaring where the negotiation between the individual participant and other people in the area matters. This category is partly influenced by the daytime the eye-tracking trip was completed. Furthermore, unintentional stops are considered as immobility that is not necessarily needed for finding the way from A to B but is due to the physical layout of the investigated area. In this case of Aalborg Station, the present infrastructural components of e.g. traffic lights showing red and their produced immobility are considered unintentional stops. Lastly, the category of ‘other’ identifies performed practices from below that belongs to neither of the clusters outlined ut supra. This cluster concerning visual attention is paid to elements that are not assessed as being valuable to the wayfinding itself, which is e.g. looking at the ground.

For wayfaring, the eye-tracking recordings which embed a synchronized video and audio file got reviewed again and transcribed while edited as so-called ‘think bubbles’ to overlay and depict the thoughts the participants have in certain situations. According to Koutstaal’s (2011) book *“The Agile Mind”*, people think based on their senses which implies an active and flexible perception that is highly dependent on the external or surrounding environment [Koutstaal, 2013]. Thus, for thinking even relies on the human’s senses and is utterly intertwined with each other, this argues for the multisensorial approach of the notion wayfaring being covered with the think aloud approach reaching beyond the solely visual perception of the plain video recordings as other external influences are unconsciously taken into account by the participants. An additional layer to understand the participant’s experiences and thoughts on the completed fictional shift provide the follow-up interviews, thus, assigned to wayfaring rather than wayfinding. Last but not least, the conducted questionnaire for the structured interviews concerning the waiting time of travelers at Aalborg Station are quantitatively but also qualitatively aligned and belong to the rather experiential wayfaring concept in accordance with waiting time having previously been assigned to this theoretical approach in subsection 4.2.2 on page 22.

To conclude, understanding the operationalization of theory and methods evokes a holistic experience of Aalborg Station as a CPC and contributes to a coherent research design adding up on one another while creating a mentionable richness of data and variety to qualitatively as well as partly quantitatively investigating the topic in-depth.

### 5.6.2 Fieldwork

Prior to the fieldwork, two routes had been drawn up, on which the participants for eye-tracking had to make a fictitious shift. The routes were based on a shift from which it was not possible to see the destination point immediately, instead it required the participants

to maneuver in the area while wearing the eye-tracking equipment. As explained in chapter 3 on page 13, Route A went from the train station at track 1 to bus area C6 whereas Route B went from bus area C2 to bus area A1. The participants were not told to look for a specific bus but that they must shift to a bus leaving from a specific area, since different buses leave at different times from the terminal which makes it hard to predict their arrival and conduct research about it. This is also in accordance with the app Rejseplanen which besides the bus number states the specific bus area as well. Participants were searched for the experiment on the Facebook group AAU: Søg, find og bliv testperson (AAU: Search, find and become a test person), however, there was no response to the post, which led to the participants being friends and family both Danish and non-Danish and resulted in a manageable number to conduct the field work of 14 participants in total. These 14 participants were split on the two routes with seven on each to ensure an equal number of representatives on each route. The choice to pre-select participants was made due to a desire of having in-depth examinations using the eye-tracking equipment as well as time and opportunity to do a subsequent follow-up interview. That might not be the case when the participants were found at the location, as they probably do not have time to set aside 20-30 minutes to conduct an eye-tracking task and complete an interview. The selection of participants was done based on various factors, to get the best possible diverse respondents. For this reason, both Danish and international respondents in the age range from 21 to 80 were selected, as well as respondents with different knowledge of the area at Aalborg Station.

The fieldwork using eye-tracking was carried out in week 13 and 14 in 2022 between 10 am and 6 pm on weekdays. The specific times were determined by the individual respondent. For the respondents not to investigate the area prior to the survey, we agreed on meeting places in the area near Aalborg Station. For the respondents who had to make the shift on Route A, we met at the north-end of the train station, from where it was possible to enter track 1 without going through the whole area at Aalborg Station. The respondents who were chosen to perform the shift on Route B agreed on meeting at the corner of Jyllandsgade and Ågade, from where it was also possible to go to area C without the respondents walking through the wayfinding surrounding itself as well as not possibly seeing bus stop A1.

Upon arrival at the start area, all respondents were asked to read and sign a consent form, which can be seen in appendix D on page 121, regarding the use of data from the survey as well as information if they eventually have questions or wish to withdraw their participation. Subsequently, they were introduced to the equipment and explained what the task was about, asked to think aloud as they moved around the area, and put on a cap to reduce the sun's impact on the data collection. Before the participants were asked to perform the journey, the glasses were calibrated by an one-point calibration to align and adjust the individual position of the eyes in relation to the glasses. During the trip, it was possible to watch on the tablet where the participants were looking at which some individual follow-up questions were based on afterwards. Due to the established wireless connection, this meant that shadowing the participant during the shift was needed in order to not disconnect the signal, which they were made aware of and asked to ignore. If the participants had questions or faced unclarity during the execution of the shift, no answer was given but instead the task was repeated. In addition, the participants were handed

out a phone in their pocket with which the Strava app tracked their movements. Upon arrival at the destination, the eye-tracking and Strava tracking were stopped, after which the participants had to answer the short semi-structured follow-up interview that had been prepared in advance. As mentioned before, conducting a semi-structured interview leaves room for situational based questions, for which an example for passengers on Route B is why they went around or, vice versa, why they went through Kennedy Arcade.

Table 5.1 and 5.2 show the selected participants in the project, their age, their nationality, and their knowledge of the area. In addition, it is shown to what percentage it has been possible to track their eyes in connection with the change, referred to as gaze samples.

NO	Gender	Knowledge of the area	Age	Nationality	Gaze samples
PA1	Male	Good	24	Danish	38%
PA2	Female	To some extent	58	Danish	14%
PA3	Male	To some extent	58	Danish	20%
PA4	Female	To some extent	25	Non-Danish	35%
PA5	Male	No knowledge	25	Non-Danish	95%
PA6	Male	To some extent	21	Non-Danish	95%
PA7	Male	Good	29	Danish	96%

**Table 5.1.** Table of participants who performed a shift at Route A from the train platform 1 to bus area C6. Own representation.

NO	Gender	Knowledge of the area	Age	Nationality	Gaze samples
PB1	Male	Good	27	Danish	44%
PB2	Female	Good	27	Danish	91%
PB3	Male	No knowledge	24	Non-Danish	68%
PB4	Female	Good	27	Danish	80%
PB5	Female	Good	80	Danish	5%
PB6	Female	To some extent	26	Danish	3%
PB7	Male	No knowledge	36	Non-Danish	96%

**Table 5.2.** Table of participants who performed a shift at Route B from area C3 to bus area A1. Own representation.

As can be seen in the table, there are large differences in the percentage of how much it has been possible to track the participants' views. This can be due to several different factors such as weather conditions. It was experienced that the eye-tracking recordings made in cloudy or rainy weather have a higher percentage than those made on a day with sun. Lower gaze samples were being processed for the analysis by identifying what people talk of during their journey as well as their answers in the follow-up interviews to fill the missing gaze information on the recordings.

For investigating the waiting time practices at Aalborg Station, the structured interviews have been carried out during the second week of fieldwork on 7th April in the afternoon. In conducting the interviews across the bus areas A, B, and C as well as inside and outside the train station, most of the waiting spaces of passengers have been covered. However, due to a neglect from Kennedy Arcade to interact with passengers inside the shopping center and thus a lack of permission, the interviews could not be performed in this area. Generally, the structured interviews have been conducted paper-based, whereas a Danish as well as English version was provided by the research group in order to complete them in the passenger's preferred language. Keeping the interviews to a maximum of two minutes

made sure not to interfere a lot in their practices. Since the interviews were performed with passengers in a real-life environment at Aalborg Station when waiting for their mode of transport, not all interviews could be finished due to the bus or train having arrived during asking the questions. In total, 35 finished interviews were performed and could be used in relation to this thesis.

### **Ethnography diplomacy**

In connection with the surveys, the participants needed to be informed that their information was treated with respect. The participants were anonymized and their names will not be used in connection with the project, but they will instead be assigned letters and numbers depending on which shift they made, while their nationality will simply be described as being Danish or non-Danish.

In addition to preparing a statement of consent for the participants for eye-tracking, other retrieved data from the fieldwork has also been anonymized. This applied to images and videos being processed by blurring faces. Thus, it is not possible to recognize people on images from the area as well as the still images from eye-tracking videos. This has been done with the permission of DSB, NT, Kennedy Arcade and Aalborg Municipality to carry out investigations with a camera for use in the thesis.

# Analysis 6

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The following chapter analyzes the gathered data by implementing the theoretical framework, as explained in section 4.3 on page 25. More precisely, the second and third instruction of the CPC-framework will be applied to investigate and analyze the process and user experience of finding the way around Aalborg Station as the primary research focus as well as how waiting time is experienced at the very mobility hub as the secondary research focus. Throughout this chapter, the subquestions one and two of the research question will be answered.

## 6.1 Experiencing Aalborg Station

For understanding the area at Aalborg Station, the research group ‘drifted’ around to grasp initial impressions of everyday life mobility, networks and layers that occur. This is in accordance with the CPC’s second instruction of *2. Mapping technical, social and aesthetic dimensions of Aalborg Station as identified CPC* whereas first the atmosphere, aesthetic, and social components are experienced and later on the technical dimension explored based on infrastructural assemblages such as signs and furniture in the area. Appendix E on page 123 provides additional impressions of mobile situations occurring at Aalborg Station and its technical features which will be referred to throughout the text.

As stated, the drifting has been carried out for multiple days and at different time spans in the area at Aalborg Station. In this context, the different time periods, e.g. being there at rush hour, contributed to a changing atmosphere in the area. Hence, while drifting, it could be felt how the overall area was driven by busyness throughout the day, particularly peaking in the rush hours in the morning and the afternoon around 2pm until 5pm. This is based on the criss-crossing of passenger flows as well as traffic in the area, consisting of buses and trains which regularly arrive and leave the hub.

In general, the first impression gave an idea of the bus areas A and B being located in the center of the defined area at Aalborg Station, however, bus area C is hidden behind Kennedy Arcade and not visibly accessible from the geographical center at the intersection of John F. Kennedy Square. The aesthetic dimension is displayed in figure 6.1 whereas the social dimensions of the area are explored in the following.



**Figure 6.1.** The area at Aalborg Station with pictures of the area marked on the map. Own representation based on [Skråfoto, 2021] and [Kennedy Arkaden, N.D.a]. The scale bar does not apply to the overview map of Kennedy Arcade.

Starting at the train station, people were waiting both in and outside the building next to the tracks. Inside, people were sitting as well as standing in the hall waiting for their train. The actual waiting area was less used as it appeared as a smaller and darker room than the train hall. From the waiting room, it is possible to look directly at the tracks, however, it is not possible to exit directly onto the platforms. Outside the train hall, on the platform, people were mostly standing while they waited for the train to arrive.

In area A, which is placed both in front of the train station and next to Kennedy Arcade as seen in figure 2.6 on page 9, there was a frequent change of passengers waiting, since the area had a lot of buses arriving and leaving all the time. Bicycles were passing by the awaiting passengers as well as pedestrians moving around at different speeds. Two girls were seen running to catch the bus but lowered their speed as they realized they could not reach it in time. All of a sudden, they started running again due to a red traffic light keeping the bus a few meters down the road. But their hope stayed unfulfilled as they could not enter the bus outside regular stops. Hence, they joined the already waiting passengers in the area for the next bus to arrive. In area A1, a lot of redevelopment was taking place as a result of the upcoming BRT, this meant that a large area has been blocked due to redevelopment. The construction was blocked by wooden panels displaying art projects related to the municipality of Aalborg, as seen in figure 6.1. However, the sidewalk in the same area was narrow, which resulted in the pedestrians needing to use the cycle path like a sidewalk, and vice versa, were the cyclists biking on the pavement which got encountered as an inconvenience and danger for both user groups, as seen in figures E.1 and E.2 on page 123. At the elevator, between area A and the train station, it was observed how people used the surroundings of the elevator as a bench regardless of the railing that was placed, which can be seen in figure 6.1.

Going on to area B, it was not only influenced by the buses which were arriving and leaving the area but also by the buses going to and from area C. In this surrounding, passengers were waiting both in and outside as well as behind the shelters on the pavement, which

forced pedestrians to walk between the awaiting passengers, as seen figure E.3 on page 123. While drifting, problems were also observed with the secured bicycle parking behind B3, which is pictured in figure E.4 on page 123. Here was a person who did not have access to his bike, as this was parked inside the enclosed bicycle shed and he did not have the code to open the door. He went into the train station and came back after a while. Several calls later, he could access his bike. Behind the bicycle shed, there are stairs between the train platform and bus area B, where several people were sitting and waiting and enjoying the sun, as displayed in figure E.5 on page 124. However, due to the bicycle sheds in front of the stairs it is not possible to look directly at bus area B which felt like a narrow and enclosed space. Besides the passengers, a man came by and picked up a few bottles out of the trash bins in the area before he went to the train station. Further down the road in area B, it was observed how difficult it could be to cross the road depending on the traffic. The area was crowded with many buses, some bikes and people who were crossing the street from one side to another, despite the fact that traffic lights are placed a few meters further down the road. This created e.g. a dangerous situation and a possible collision between a passenger and a bus approaching bus area B3 since it was not possible in the very situation to see if a bus was coming because other temporarily stopped buses at the terminals obstructed the view of the person who wanted to cross the road. Furthermore, the infrastructural layout of the area was during the drifting experienced to be unpractical for those passengers who were coming from area C or Kennedy Arcade and went to area B on the opposite side of the street. The placement of the traffic light intends them to use the pedestrian crossing there, which meant they were forced to walk to the intersection and then walk back again.

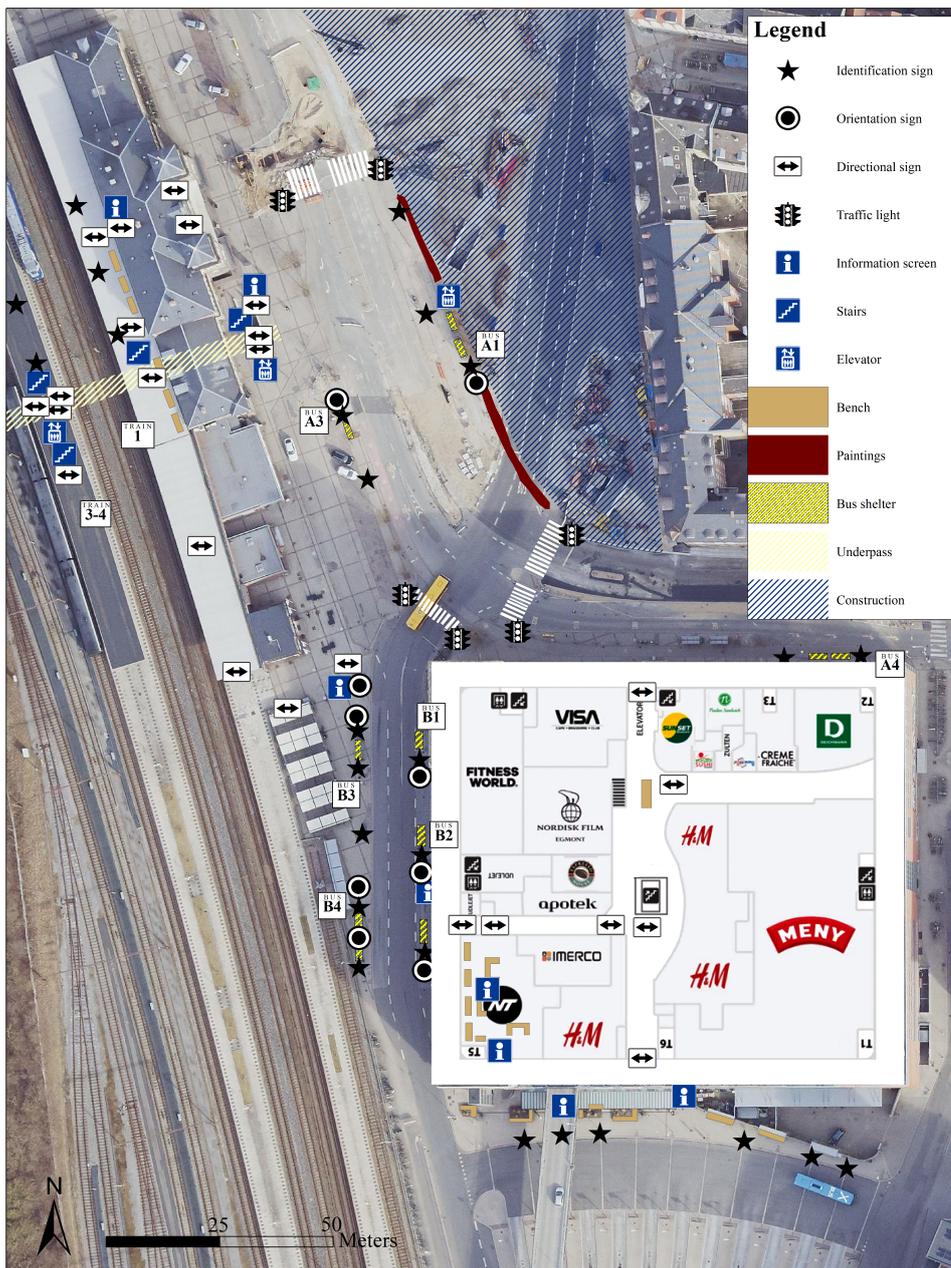
Further down the road, and partly hidden behind Kennedy Arcade, area C is to be found. During the drifting, many passengers were waiting in the sun, as seen in figure 6.1. Passengers were either standing in the area or sitting on the benches, from where it was possible to have a direct look at all platforms in the area. The relatively high number of awaiting people in the area meant that there were not a lot of empty places left, which resulted in an ephemeral flow of the seated passengers leaving while others made sure to quickly secure the newly available seat. For the persons who arrived and left area C by bus, it was necessary to cross the road which resulted in some buses having to stop to let the passengers safely cross the road, and vice versa, people needed to stop to let the buses passing by.

While drifting, NT's service center inside Kennedy Arcade was used by multiple passengers scattered across the waiting room. In general, the room was experienced as quiet besides a few passengers getting help at the service center's desk. Going further into Kennedy Arcade, the center was filled with people passing by either to pick up food, go into a store, or shop groceries. Suddenly, a group of children entered the building accompanied by an adult and later went up the stairs to the cinema. By the main entrance, several people were standing waiting while either looking out the doors to the traffic or looking at their phones. In addition, it was observed that the benches in the center were occupied. The only available benches were those that belonged to a coffee shop inside the center, which were not accessible to the people who have not purchased at the store.

The area can be described as a busy area with many people passing by. However, it is

possible to see differences in the speed of the people. Those who may know the area and have an idea of where to go are more determined in their movement and those who might not be that familiar with the area tend to be more seeking while they are moving.

The following structural map in figure 6.2 indicates the various elements of the physical setting as well as existing geosemiotics reaching from identification signs, orientation signs, directional signs to information screens. Thus, depicting the ‘technical’ dimension of Aalborg Station as a mobility hub within socio-technical systems.



*Figure 6.2.* ‘Technical’ dimension occurring at Aalborg Station. Own representation based on [Skråfoto, 2021] and [Kennedy Arkaden, N.D.a]. The scale bar does not apply to the overview map of Kennedy Arcade.

For those who need help to navigate across the area, the signs staged ‘from above’ are

located at multiple places across Aalborg Station whereas a series of pictures can be found in appendix E on page 123 starting from figure E.6 to E.12. From the train station to inside Kennedy Arcade, overall, directional signs are the predominant category. When drifting through the signage systems in the area, some observations could be made concerning wondering and critical situations of bus indexes pointing downstairs to the underpass, compare figure E.7 on page 124 and obscured visibility of the directional sign at the train station where its readability is limited due to bicycles parking in front of it, compare figure E.8 on page 124. When entering Kennedy Arcade from area A4 and following along the directional sign to area C, one gets led through a store before exiting the building, while even needing to pass the electronic article surveillance from the store, as seen in figure E.10 on page 125. This created an indefinite feeling and uncertain atmosphere of walking in or outside this mentioned store. When arriving at area C, the identification signs at the very platforms got removed so that the precise numbers belonging to each individual platform could not be identified, as indicated in figure E.11 on page 125. Further, identification signs and orientation signs are often combined on the poles of the various bus terminals A and B including the indication of the bus areas 1 to 4 and an overview map of the area of Aalborg Station. One more detailed information board can be found in between Kennedy Arcade and the train station which consists of several layers of guiding assistance. Having included information screens, orientation maps and directional signs to the areas A and B, these are distributed to both sides of the pole, as seen in figure E.12 on page 125.

Other than geosemiotics, the area contains three traffic light intersections and is dominated by construction work in the north-eastern part. To conclude, several networks could be identified and understood within this mobility hub as a socio-technical system, whereas some critical considerations were raised in identifying the aesthetic, social, and technical dimensions coexisting at Aalborg Station.

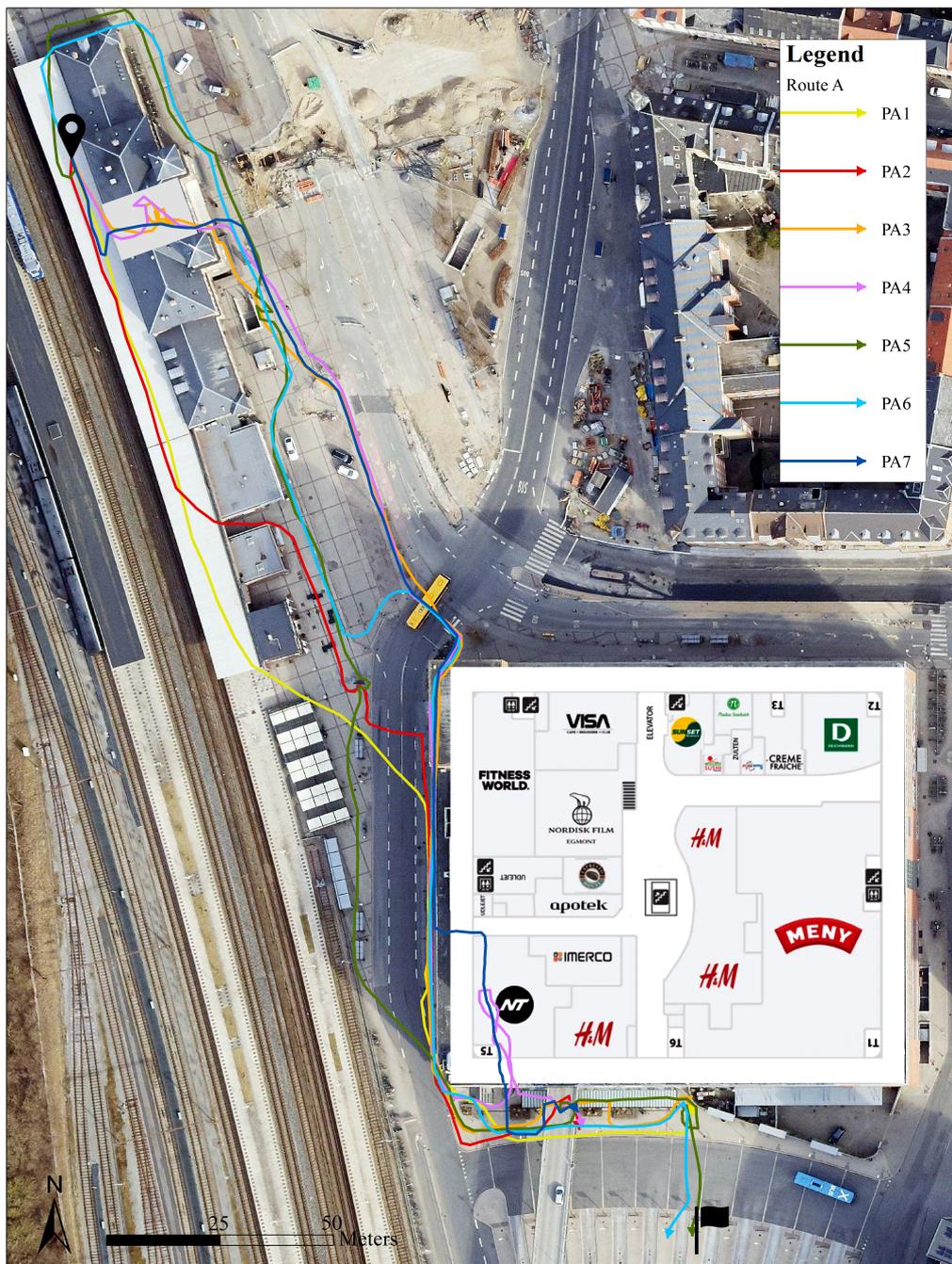
## 6.2 Analyzing the ‘life within networks’

In following the CPC framework, the third aspect *3. Making an analytical judgement of Aalborg Station in terms of the point of view of the user experience* is elaborated on in the upcoming subsections. As the thesis’ aim is to investigate how mobility is performed and experienced at Aalborg Station, the primary research focus will touch upon how people find their way around in the area as well as their waiting time experience as the secondary research focus.

### 6.2.1 Wayfinding on two selected routes

In investigating the two selected Routes A and B, the journey of the individual participants is going to be analyzed to deepen the understanding of the wayfinding process. In doing so, each participant’s journey will be touched upon to understand their thoughts, feelings and general experience, earlier also referred to as wayfaring. Thereby, this subsection aims at answering the research’s first subquestion: *How user-friendly is it for the individual passengers to find their way on two selected routes?*

## Route A - Train platform 1 to bus area C6



**Figure 6.3.** Mapping of the various routes the participants walked from the train platform 1 to the bus area C6. Own representation based on [Skråfoto, 2021] and [Kennedy Arkaden, N.D.a]. The scale bar does not apply to the overview map of Kennedy Arcade.

For Route A, the participants chose independently to walk various routes to find the destination C6 which is visible in figure 6.3. An enlarged view of the individual routes with its identified critical points occurring on the journey can be found in appendix G on page 131.

The first participant (**PA1**) for Route A knew the area beforehand and hence walked fast

and confident during the entire wayfinding task. Moreover, as he had already built up a cognitive map of the area around Aalborg Station, the process of orientation took only a few seconds before deciding to continue walking along train platform 1. While walking, he mentioned that he sees a sign which leads one downstairs to get to the buses, but he usually does not need that and hence continued walking without paying more attention to it. This implies that the guided route does according to him not suit his purposes and, as he knows the area, chose to walk the more direct route.

Moving further down the train platform, the participant pointed out that he can see the ramp on the horizon and that he knows that buses departing from C mostly drive up this street by saying *“I have also taken this bus before and I know that it drives up the ramp and I can see the ramp from here, so this gives me a sense of that I’m close”*. As PA1 automatically connects the ramp, seen in figure 6.4, with the mobility hub Aalborg Station and more precisely with the bus area C, it can be interpreted as a landmark.



**Figure 6.4.** PA1 thinks of the ramp as a landmark. Own representation.

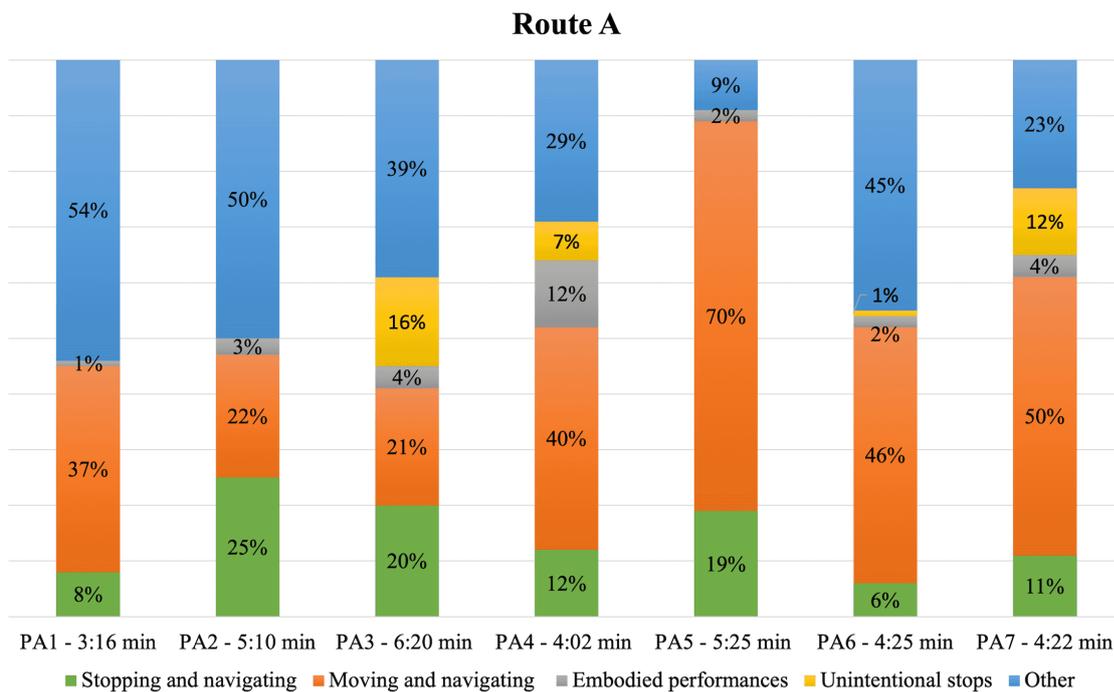
This moments of navigating while moving accounted for 37% of the total walking time. After having exited the train area, he automatically arrived in bus area B and continued there before watching out for traffic and crossing the street in a diagonal manner to shorten in and continued within a smooth movement. Afterwards, he walked on this side of the road and quickly scanned the digital bus schedule board but as he is familiar with the environment, he did not pay more attention to it. Then, PA1 turned around the corner of Kennedy Arcade and arrived in bus area C where he explained that he typically would look for the bus number to know if it is already there and not the number of the bus terminal. Hence, he went to one of the digital bus schedules to check which bus is driving within the next minutes from C6 and afterwards looks around in search for the very bus. As the participant noticed that there are about ten to twelve bus terminals, he would assume that C6 *“is one of those in the middle”*, as for the time of investigation no identification signs<sup>1</sup> were placed at the various bus terminals. This was also mentioned as the only problem

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<sup>1</sup>Disclaimer: during the time of fieldwork the identification signs at the platforms in area C were temporarily taken down, and have since then been put back up.

PA1 encountered while walking from the train to the bus. However, as he still knew that he is at the right location due to his beforehand spatial knowledge of the area, the element of closure, the last part of wayfinding, was still completed.

In general, the participant rated the wayfinding experience with seven out of ten possible points as, besides with the struggle of a missing identification sign for C6, he did not encounter any problems and he felt *comfortable* and *secure* while walking. Still, he criticized that bus area C is somewhat more hidden behind the shopping center and no obvious spatial element shows pedestrians the way. Additionally, it should be mentioned that he walked Route A within the fastest time, as seen in diagram 6.5, which can again be attributed to his understanding of the area.



**Figure 6.5.** Percentage distribution of participants on Route A divided into categories. Own representation.

The second participant (**PA2**) for the eye-tracking task on Route A knew the area around Aalborg Station to some extent, as she has been there a few times before but not on a regularly basis. Hence, the process of orientation in the beginning took her a bit longer than from PA1 as she looked a bit around in the beginning while slowly starting to walk. In doing so, she also took a quick look on the departure screen on train platform 1 while continuing towards the southern end of the platform, as seen in figure 6.3 on page 46.

The participant passed the entrance to the train station without recognizing the directional sign with a bus icon above the doors pointing straight as well. As she passed the entrance doors and the signs close by, it is possible that she did not notice it due to the high adjustment of the sign. Moreover, while continuing walking she also did not pay much attention to another index sign which showed her the way downstairs to get to the buses or might simply think it is weird to go downstairs to get to a bus. After passing the stairs, she noticed an orientation sign on the wall but while getting closer, she noted that there

is no necessary information on it. Afterwards she decided to follow the sign and to walk through a gap between two buildings to search for an information plan. Being now on the other side of the building, she recognized a bus station in area B and an information panel, but got frustrated when the obvious indexes only pointed towards bus terminals in area A and B. However, PA2 took a second and closer look and found an overview map of the entire area where she after a few more seconds located area C which can be seen in figure 6.6. Next, she quickly searched for her own position on the map before she proceeded walking more confidential and no longer focused on searching for visual cues.



*Figure 6.6.* PA2 found bus area C on the map. Own representation.

Before crossing the street, she noticed a bus coming around the corner from behind Kennedy Arcade which assured her that another bus terminal is located behind the shopping center. Arriving in bus area C, she looks around more intensively again in search for cues that would tell her which specific terminal is C6. For that reason, PA2 took another look at the digital bus schedule and identifies which bus should be departing from C6 but as the bus had not arrived yet, she then admitted being confused now, because of the missing identification signs at the various bus terminals in area C as mentioned before, by saying “*I cannot see number six because I think that there should be signs all the way down*”, as seen in figure 6.7. Therefore, the aspect of closure of the wayfinding experience could not be completely finished as the participant ended up being a bit confused when having found the destination.



*Figure 6.7.* PA2 wonders where C6 is. Own representation.

To sum up, participant number two evaluated the convenience of finding the way with eight points because all terminals are located close to one another. She used almost the same amount of time for both stopping and navigating (25%) and moving and navigating (22%) while she did not have an unintentional stop as the participant did not wait at the pedestrian light. When being asked about problems that occurred to her, she mentioned the missing identification sign at C6 as well as an earlier and bigger overview map when coming from the train station.

The third participant (**PA3**) who had to walk to bus terminal C6 had also only a bit knowledge of the area and after explaining the task to him, he quickly decided to go through the building of the train station. Inside, he spent some time looking for cues of the various bus terminals but after reassuring twice that there is only information about the trains' arrivals and departures, hence, the participant went outside. There he noticed some buses coming from the right side, consequently, he decided to walk in the very direction. On his way he passed a bus terminal, where he caught side of an orientation sign in form of a small map. Scanning the map a few times, he finally recognized the letter C in the bottom for the bus area, as seen in figure 6.8 and continued walking.

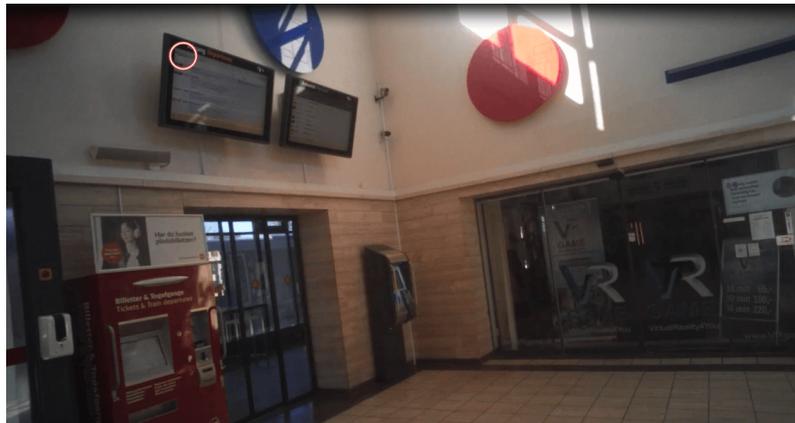


*Figure 6.8.* PA3 found bus area C on the map. Own representation.

Unlike the first two participants, PA3 had an unintentional stop at the pedestrian light for about 16% of the total amount of time, where he gazed around and noticed a big letter E on the other side that he assumed being bus area E. However, this identification sign does not illustrate another bus area as there are only the bus areas A to C at Aalborg Station but is instead connected to the entrance 1E into the building of Kennedy Arcade. This shows, that too many similar signs based on the letters of the alphabet, and other various geosemiotics at one place can also cause difficulties in understanding where the element belongs to. After crossing the pedestrian light the participant passed bus area B and continued straight to area C as he now knew that it is placed behind the shopping center. Reaching area C, he looked intensively at the various bus terminals but as he cannot spot any identification signs, he walked to a digital information board which displays the departure times of all buses, and therefore, according to him, no useful information at that point. Standing there, PA3 looked again over to the bus terminals and decided to walk a bit further but stopped then and said that he is trying to figure out the exact terminal for C6. Thus, participant number three is missing the precise moment of closing the wayfinding journey.

Generally, PA3 rates the wayfinding trip with eight points as he found it mostly *easy* to find the way and emphasized positively that the bus terminals are not located far away from the train station. However, he missed some guidance in the beginning to point out the way to the bus terminals and that the small overview map he looked at only indicates C in general and not specifically all bus terminals in area C, like it is illustrated for bus areas A and B. Furthermore, as seen in diagram 6.5, he also spent about the same time for moving and navigating as well as stopping and navigating, just like participant number two did.

Next, participant number four (**PA4**) knows Aalborg Station to some extent as she had taken the buses from here two to three times and has therefore a cognitive understanding of the general areas where buses arrive and depart. Therefore, she started walking immediately after receiving the wayfinding task and did not need much time to orientate herself. Without looking at the indexes over the entrance to the train station, she directly entered the building. Inside the train station she looked for information on the screens for departure, as seen in figure 6.9, but realized that it does not include buses and then left the train station through the main entrance.



**Figure 6.9.** PA4 looked at the digital screens at the train station before continuing outside as there is no information for the buses on it. Own representation.

PA4 continued to the right and looked around in search for spatial elements when remembering that there are also some buses departing behind the building of Kennedy Arcade. Consequently, she walked straight to the pedestrian light to cross the street and after waiting shortly, continued and passed bus area B. Arriving at area C, she looked around for more visual cues about the specific bus terminal but decided to go inside the service center of NT as she assumed there might be more helpful information she could not acquire from the outside environment. PA4 then searched the digital screen inside, which can be seen in figure 6.10, for more information for a few moments and found a specific bus that should leave from C6 within the next minutes.



*Figure 6.10.* PA4 looked at the digital screens at NT's service center. Own representation.

The participant exits the service center again and double-checked on the digital bus schedule outside if the information from the screen inside is coherent with this one, which she confirmed. Afterwards, she looked again at the bus terminals and admitted that she is not exactly sure which one of the terminals is C6 but she would theoretically just wait there for the arrival of the bus as she says *“And now I would probably just stay here and wait for the bus”*. Again, the aspect of closure at the end of a wayfinding process eclipses due to the missing identification signs.

Summing up, PA4 assessed the convenience of finding her way around Aalborg Station with six points. She mainly criticized a lack of signs at some places leading her to the bus area and missed indexes inside the train station that would point the way more specifically to the various bus terminals. Moreover, she missed geographical information on the digital bus schedules to see where the named area is located. Besides, the missed identification signs at the bus terminals were mentioned as well. Another impression was that she felt the area is *crowded* which was also reflected in the number of embodied performances as they accounted for 12% of the entire time. As the eye-tracking task was conducted in the afternoon around 2.30pm it could be the reason for a more crowded area, but it is also a personal sensation if one understands a place as being crowded or less crowded.

Participant number five (**PA5**) is not familiar with the area as he had never been there before. Therefore, it can already be noticed that the overall length of moving and navigating was 70% of the entire process of wayfinding as seen in diagram 6.5. When getting told the task, he first turned and looked around in all directions to orientate himself from the surroundings before slowly starting to walk around to the northern end of the train station and then around it, as seen in the map in figure 6.3 on page 46. As PA5 noticed that the buses are more driving to the right side and as he additionally can see some bus stops, he assumed that bus terminal C6 must be located over there by saying *“Okay, it looks like buses over there (..) and I think it should be in this direction, not sure”* as seen in figure 6.11.



*Figure 6.11.* PA5 saw buses and bus stops when walking around the train station. Own representation.

The participant started to walk to the right, passed the main entrance of the train station and reached a digital board where he stopped and searched for information, which can be seen in figure 6.12. At this moment, he has not noticed the two directional signs right at his left side, a reason for that could be because they are approximately placed only half a meter over the ground and also partly covered by a bicycle that stands in front.



*Figure 6.12.* PA5 searched for information on the digital screen without recognizing the sign in the lower left corner. Own representation.

Disappointed by only figuring out which bus is leaving from C6 within the next minutes, but not getting more hints of the geographical location, he continued walking, suddenly though abrupt his movements and turning back to where he just looked at the screen. He might have unconsciously noticed a cue he did not pay attention to in the first place. When turning around he looked at the indexes to the left, which can be seen in figure 6.13. Hoping for helpful information, he scanned it quickly, however, discovered that there are only directional hints for the bus terminals of A and B, hence not C. While taking a second look, he assessed that the information hidden behind the bicycle is not useful for him either.



*Figure 6.13.* PA5 noticed the directional sign, partly hidden by a bicycle. Own representation.

Afterwards, the participant turned around in search for other visual cues and kept walking to where he identified bus stop A3. Continuing further, he saw bus area B and is now assuming, following the alphabet, that C might be in this direction. While walking further he saw an information pole and while approaching laughed frustratedly because on the first look it seems as it is only pointing the directions to B, as seen in figure 6.14.



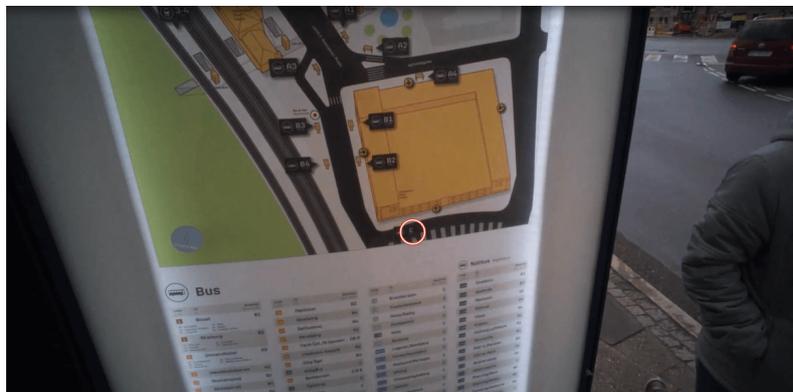
*Figure 6.14.* PA5 noticed the directional signs to the various bus terminals B, however, area C is not indicated. Own representation.

Figure 6.15 then shows that after turning to the other side of the pole he recognized directional signs for bus area A. Given that this does not contain any useful information to him either, he took a closer step to the orientation sign in form of an overview map on the pole.



*Figure 6.15.* PA5 noticed the directional signs to the various bus terminals A. Own representation.

The participant read the map intensively when recognizing the letter C in the bottom and getting an idea of where to go, which can be seen in figure 6.16.



*Figure 6.16.* PA5 noticed the bus area C on the overview map. Own representation.

Continuing his walk now more secure and confident, he passed the bus terminals B3 and B4 where he reassured himself a second and a third time on the location of area C on the orientation maps provided at the mentioned bus terminals as seen in figure 6.17.



*Figure 6.17.* Reassuring look to the orientation sign at B3 and B4. Own representation.

After passing a narrow walking passage behind bus shelter B4 and thus the end of bus area B, he started to see some buses in area C which gave him the hint to cross the street and continued walking on the other side. When arriving at area C he thought “*Okay, I hope this is area C*” which can be seen in figure 6.18 and implied thereby that he is not entirely sure and convinced to be at the right location. In this context, he also mentioned later in the follow-up interview that a sign to identify the bus area would be helpful.



*Figure 6.18.* PA5 reaches bus area C. Own representation.

While moving along, he looked over intensively to the various bus terminals in search for

specific identification signs. As he did not find any visual cues there, he walked to one of the digital bus schedules but cannot find the information he need there either. Frustrated and confused, he looked over to the bus terminals again and recognized that there is no physical information given. He continued in search for spatial cues and took another look at the digital screen in front of Kennedy Arcade, which showed the same information as the other screen a few moments before, consequently he decided to just walk over to one of the platforms to take a closer look. While moving to the platform, he announced “*It feels like the signs got removed... I think I’m lost*”, as seen in figure 6.19. That being said, he unintentionally walked up to the correct platform and was the only participant from Route A who technically completed the task as he arrived at C6. However, he was not aware of himself having found the destination as he, as mentioned, had coincidentally chosen a random platform. Therefore, it can be concluded that he did not entirely finish the wayfinding process as he did not realize and recognize that he reached his destination.



*Figure 6.19.* PA5 wondering and feeling lost in area C. Own representation.

Even though PA5 thought the way would be better signposted, he rated the wayfinding experience with eight out of ten points. When asking about his choice of going around the train station instead of through, he answered that it was a personal preference to avoid possibly crowded and confusing situations within indoor spaces such as the train station. He emphasized that he got annoyed a few times when he mostly encountered geosemiotics of bus area A and B along his way but no directional signs for area C. However, he still took these spatial information as hints where area C might be located. Moreover, he mentioned that the somewhat smaller pavement at the end of bus area B made him wonder if he is still walking in the right direction as well as felt *weird* in crossing the street as it did not feel as coming natural to him. Lastly, due to the missing identification sign at C6 he finished the wayfinding task a bit confused.

The following participant (**PA6**) had little knowledge of the surroundings as he does not often take public transport. In the same way like PA5 did, he was first looking around and orientated himself in the environment before walking to the north end of the train station and around the building. While continuing to the right side, he looked around thoroughly to make sure he is on the correct way and did not miss any spatial elements. As he saw bus stop B3 further ahead and A1 on the other side of the street, as seen in figure 6.20, he naturally considered bus area C being further down the way.



*Figure 6.20.* PA6 sees bus terminal A1. Own representation.

Moving further, he decided to cross at the pedestrian light which immediately turned green and therefore only accounted for 1% of the wayfinding time. As buses came driving from behind the shopping center, which is illustrated in figure 6.21, the participant's thought of bus area C being in the very direction got strengthened.



*Figure 6.21.* PA6 saw buses driving around the corner of Kennedy Arcade and assumed that area C is in the very direction. Own representation.

Turning around the corner of Kennedy Arcade, he scanned all the bus platforms intensively to look for visual cues for where C6 exactly is. Not getting the needed information, he went to a digital screen, seen in figure 6.22, to check there but did not find the needed information either. Being confused, PA6 continued walking slowly towards the bus platforms to make sure he had not overlooked some important geosemiotics before he stopped at platform C5 and confusingly confessed that he is not sure if he was somewhat close to the correct completion of the task. PA6 was the second participant who actually attempted to search for the correct end destination of C6, however, he ended up being at the neighboring platform C5.



*Figure 6.22.* PA6 looked for information at the digital bus schedule. Own representation.

In general, participant six rated the wayfinding experience with eight points as he did not encounter significant problems or challenges. Nonetheless, he mentioned his confusion when searching for a hint which bus terminal C6 is and emphasized that it would be helpful to add wayfinding tools e.g. in form of icons or indexes in area C.

The last participant (**PA7**) for Route A knew the area well as he has been there earlier, and had therefore developed a cognitive map beforehand, but had not used public transport in a longer time. Hence, the process of orientation in the beginning of the wayfinding experience only lasted a few seconds before the participant decided to go through the building of the train station. As he knew the overall areas where buses leave, he did not look at any signs inside the train station but quickly exited it again and turned to the right. While walking, he noticed bus terminal A3 in front of him and had to make a short unintentional stop in front of the bus terminal as a car entered the parking lot when PA7 intended to cross the street. Next, he passed the orientation sign at bus stop A3 without paying further attention to it and shortly after already noticing bus area B which let him come to the assumption that bus area C might be over there as well. After he had to stop at the pedestrian light, he passed area B when noticing an index on the left building side of Kennedy Arcade leading him inside the service center of NT, as seen in figure 6.23.



*Figure 6.23.* PA7 noticed a directional sign to C which lead him inside NT’s service center. Own representation.

He is the only participant noticing this directional sign which might be related to his

physically higher appearance than the other participants as it is mounted over the entrance of Kennedy Arcade in a ninety-degree angle when arriving from the train station. Thus, it might be more visible from an elevated level of perspective than for the other participants. PA7 followed the directional sign inside and tried to orientate himself on the digital screens, seen in figure 6.24, but is only scanning them and not looking thoroughly.

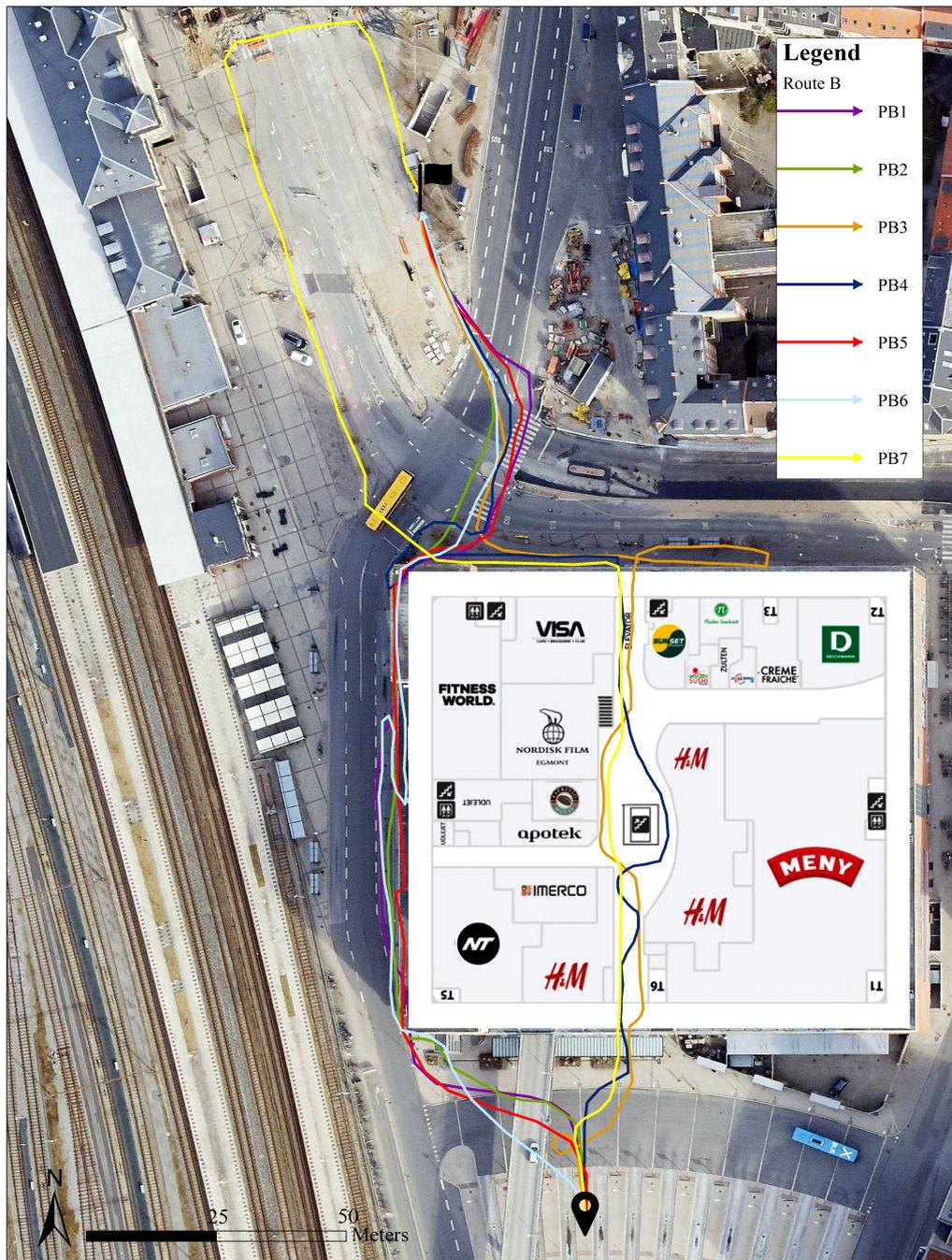


*Figure 6.24.* PA7 tried to orientate himself at the digital screens. Own representation.

While passing through the service center he wondered why there is not more spatial information inside before exiting the center at the other end, and therefore arriving in area C. Being outside again, he looked around in search for some identification signs, showing him that he is in the correct area, and got a bit disappointed when he could not find any. PA7 was also criticizing this aspect later and wondered why there is no identification or orientation sign in the area. Looking more intensively at the bus terminals, he got confused how he should know which bus terminal C6 belongs to. Again, the participant missed a clear closure of the wayfinding process in order to realize and recognize surely that he reached the destination.

Summing up, participant seven rated the convenience of finding the way to bus terminal C6 with six to seven points. As already mentioned, he missed more guidance inside the service center as well as at the bus area C. Furthermore, PA7 pointed out that his beforehand knowledge of the area has helped as he knew that there is another bus area behind Kennedy Arcade, even though he did not know that this would be bus area C.

Route B - Bus area C3 to bus area A1



**Figure 6.25.** Mapping of the various routes the participants walked from the bus area C3 to the bus area A1. Own representation based on [Skråfoto, 2021] and [Kennedy Arkaden, N.D.a]. The scale bar does not apply to the overview map of Kennedy Arcade.

As showed in Route A, participants at Route B did also not follow a predetermined path but instead chose diverse routes to complete the task of finding the destination A1 which is visible in figure 6.25. An enlarged view of the individual routes with its identified critical points occurring on the journey can be found in appendix G on page 131.

The first participant (**PB1**) who walked from bus station C3 to the bus area A1 knew

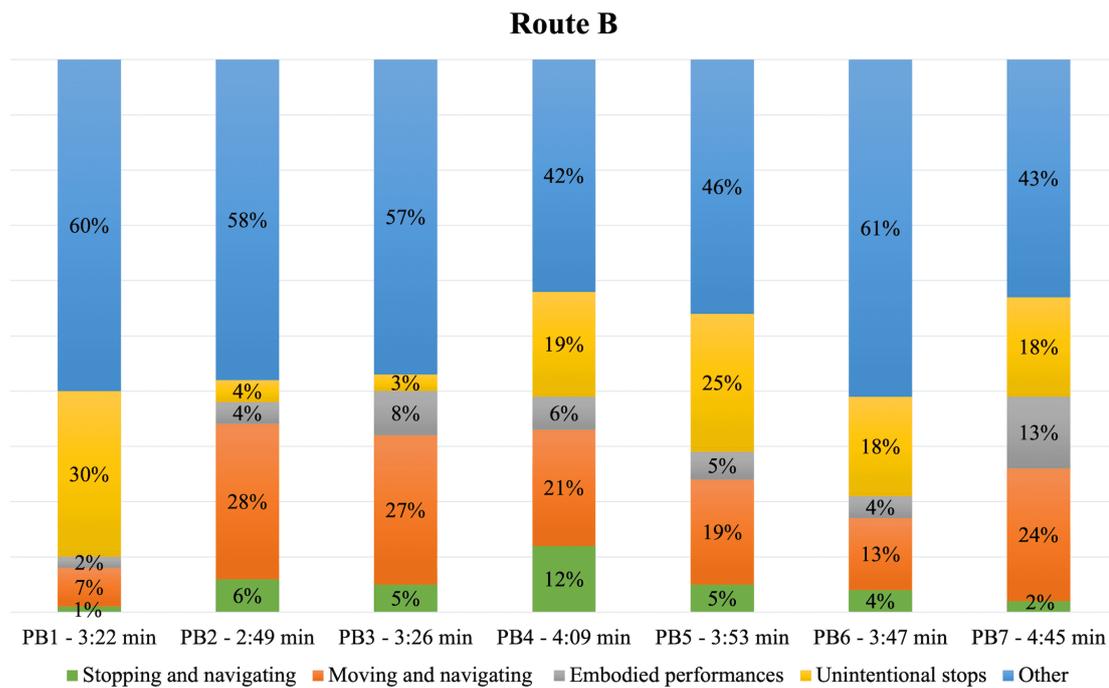
the area, and hence, the process of orientation to find the geographical position in the environment took only a few seconds before the participant decided to walk towards bus area B. Later, in the follow-up interview, when the participant was asked why he chose to walk outside and not through Kennedy Arcade, he answered that he knew that bus stop B1 is outside and hence assumed that A1 would also be in this direction. Besides, in his understanding it would be strange to walk inside a shopping center to get to a bus station which was another reason for him not going through Kennedy Arcade.

While moving away from bus area C and towards the left, PB1 noticed the identification sign of bus terminal B1 and recognized it as such, as he mentioned *“I found B1”*. As the participant knew, that he just came from bus area C, he then tried to make sense of the area and his position and hence naturally assumed that bus area A would be after passing the bus terminals of B. Therefore, PB1 continued walking and after passing bus area B, he arrived at the intersection at John F. Kennedy Square where he looked over to the construction work and bus terminal A1, as seen in figure 6.26, which the participant recognized by saying *“I think A1 is located on the other side”*.



**Figure 6.26.** PB1 thinks he found A1. Own representation.

This notion of looking around and navigating while walking can be seen as ‘moving and navigating’ in the diagram in figure 6.27, where one notices, that participant one only did that for about 7% of the entire wayfinding walk. However, this can be explained by the beforehand knowledge of the area and hence a wayfinding advantage compared to others, as explained in the theory subsection 4.2.1 on page 19.



**Figure 6.27.** Percentage distribution of participants on Route B divided into categories. Own representation.

The participant continued the walk to the traffic light, in order to cross the street, where he needed to wait and had therefore an unintentional stop for 30% of the entire time he used for walking the route. During waiting at the crosswalk, he looked a few short times over to bus station A1, which can be interpreted as reassuring looks to know for sure that he is on the right path. These gazes filled only 1% of the entire time, as one can see in the diagram 6.27. As the crosswalk light turned green, he crossed the street and already looked and moved to the left as it is the destination’s location. PB1 walked on the temporary pavement and passed the construction work before seeing the identification sign and realizing that he reached the destination, by saying “*And I found A1*”. This closure is an important component of wayfinding as otherwise people would keep searching for their destination, even if they might have already reached it.

Generally, PB1 rated his wayfinding journey with seven points out of ten possible as he did not encounter significant problems, also because he knew the area and hence had a spatial understanding and an idea of where to go, but mentioned that the current construction work could cause some confusion as well as that bus terminal A1 is located a bit more far away from the others. Moreover, he pointed out that other people have asked him some other times where the bus terminal A1 is placed.

The next participant (**PB2**) also mentioned that she knows the area quite well, however, it can already be seen in the diagram 6.27 that she, with 28%, spend more time on navigating while walking. When first being confronted with the task of finding the way to bus terminal A1, the participant was initially confused and wondered where one could find it. To then orientate herself and get an understanding of the spatial environment, she looked around at bus terminal C before deciding to walk to the left as she knew that there are some buses arriving and departing from this direction. Hence, she did not walk through the shopping

center. While passing the service center of NT she thought that “A1, that might be the city buses” which helped her in figuring out in which direction she needs to walk, as city and regional buses leave from different areas. Turning around the corner to the bus area B, PB2 immediately saw the identification sign of B3, as seen in figure 6.28 and also pointed out that there are no indexes showing her the way.



**Figure 6.28.** PB2 recognized bus terminal B3. Own representation.

Walking further towards the identification sign of B3, she noticed that there is a small orientation sign, in terms of a map. While looking at the map and finding out where she and the destination is located, she moved her head a bit and when asked later in the interview, PB2 specified that it was because the map is turned upside down. This means, the the north arrow is pointing south according to the position the map is placed in the environment, as seen in figure 6.29, and in order to get a mental image of the place and understand where buildings are placed, she had to tilt her head.



**Figure 6.29.** PB2 had to tilt her head to make sense of the orientation map because it is turned upside down. Own representation.

After using the map as a spatial element to orientate herself, PB2 had more information where to go and continued walking where she then recognized an identification sign of bus terminal B2 and could deduce that area A will be there shortly after, due to the spatial information she got from the map. Going further, the participant noticed the identification sign of bus station A3 and while walking towards John F. Kennedys Square, looked over

to where A1 is located before continuing to the closest pedestrian light, as seen in figure 6.30.



*Figure 6.30.* PB2 took a reassuring look to A1 while walking to the pedestrian light. Own representation.

Due to these many small actions of looking at signs at bus terminals and taking reassuring looks around while walking, the percentage of moving and navigating is higher than for the first participant in the diagram. Moreover, due to the stop at the orientation sign and short assuring gazes to A1 while waiting unintentionally at the crosswalk, which can be seen in figure 6.27, the participant spend 6% of her time stopping and navigating. After only waiting a few seconds at the pedestrian light, she crossed the street while also looking and moving the body already to the left in the same way as PB1 did. At arrival at A1, she announced that she found the destination she got sent to.

In general, PB2 rated the user experience of walking Route B with six out of ten points and evaluated that it was *okay* to find, but that she would not have found it without the icons, especially the small overview map at one of the bus stations in area B. In the same context, the participant criticized the size of the map, as it was too small, and the wrong direction the map is placed at the bus station. In comparison to participant one, who also said of having knowledge of the area, she admitted that she needed the signs as her beforehand knowledge was more related to having a mental image of the place but without knowledge of the exact placement of the bus terminals. Additionally, she was also *annoyed* by the construction work.

Participant number three (**PB3**) has taken a bus from Aalborg Station twice but did not have a spatial understanding of the hub beforehand and got therefore classified as ‘no knowledge’ in the table in figure 5.2 on page 39 in subsection 5.6.2. After getting told where he needs to go, he looked around at the bus area C to orientate himself in the environment, just like PB2 did. While doing so, he saw a sign on the door at Kennedy Arcade and decided to walk towards it, as seen in figure 6.31.



*Figure 6.31.* PB3 found the directional signs at the entrance to Kennedy Arcade. Own representation.

This directional sign led PB3 inside where he looked at the plan of the building, seen in figure 6.32, while passing and said later on that he missed something like that for the entire area of Aalborg Station.



*Figure 6.32.* PB3 looked at a plan of Kennedy Arcade when searching for the spatial location of the bus areas. Own representation.

Further on, he followed the indexes that are on the ceiling inside Kennedy before exiting the building on the other side. Nonetheless, PB3 did not recognize the last directional sign, right before the exit which its arrow leading one to the left to get to A1. Hence, he looked around after exiting the shopping center to find his location in the area and to search for icons or indexes again. As there is a bus stop to the right, he continues in this direction and as there is no identification sign which bus stop it is, PB3 inspects the bus schedule to identify the number of the bus terminal, as seen in figure 6.33.



*Figure 6.33.* PB3 looked at bus schedule in search for cues which bus stop this is. Own representation.

This moment of navigating is represented as the 5% of stopping and navigating in the diagram. As he cannot figure out which bus terminal it is, he expected it to be the wrong one and criticized later that there is no identification sign at this bus stop. PB3 then turned around and continued in the opposite direction where he then found A1 by walking slower and looking around. After a reassuring look to A1 he walked a bit faster and stopped shortly at the pedestrian light, only 3% of the entire wayfinding time, before crossing and at the same time looking over to his destination. Finally, he reached the bus terminal and realized that it is the correct one.

In general, PB3 walked at a slower pace than the two previous participants since he is missing the cognitive map of the area as he has only been at Aalborg Station twice. In addition, he actively searched for visual cues along the way, which is another reason for him walking slower as well as that 27% of his wayfinding time was used on moving and navigating. Moreover, due to the fact that there were more people in the area during his eye-tracking task, he had to navigate around more people, consequently his embodied performances was with 8% higher than from the first two participants. Moreover, he considered the wayfinding experience being a six or seven out of ten as he missed a clear identification sign at the bus terminal right outside of Kennedy as well as a general overview map of the place to find his location to start with but also to see the path he needs to walk visually beforehand or during the assignment.

The next participant (**PB4**) evaluated herself of having good knowledge of the area. After the eye-tracking task started at bus platform C3, she first looked over to bus area B, as seen in figure 6.34, before noticing the index at the entrance of Kennedy and deciding to move in this direction.



*Figure 6.34.* PB4 looked over to bus area B before deciding to go through Kennedy Arcade. Own representation.

While moving towards the entrance she looked around before taking a glance at the directional sign, in front of the entrance, again, which is seen in figure 6.35, and walked inside.



*Figure 6.35.* PB4 looked at the directional sign at the entrance of Kennedy Arcade. Own representation.

In the interview after the eye-tracking task, PB4 specified that she chose to walk through the shopping center, as the geosemiotics were the only spatial information she could find. Inside Kennedy, the participant noticed the other directional signs pointing to A1 as well and follows their direction, as seen in figure 6.36, before walking out of Kennedy again. As the last sign inside Kennedy pointed to the left, she confidentially continued in the very direction.



*Figure 6.36.* PB4 looked at the directional signs inside Kennedy Arcade. Own representation.

In search for more visual cues she quickly gazed at a map at an entrance, seen in figure 6.37, before realizing that it does not belong to the area. Continuing her search for cues, she looked around but did not see the bus terminal A1 on the other side, next to the construction.



*Figure 6.37.* PB4 looked at this map outside of Kennedy Arcade. Own representation.

Hence, she kept walking until she finally stopped and looked around in search for A1. This moment is defined as stopping and navigating in the diagram 6.27 and accounts for 12%

of her total amount of time. First, PB4 looked into the opposite direction where she came from, before taking a look around the corner to area B and also to the other side where she then noticed bus terminal A3 which gave her a hint to keep looking in this direction. After a few more seconds, she then recognized A1 and walked back to the pedestrian light which she had passed. While every person encounters decision-points during wayfinding, some consciously others unconsciously while walking, PB4 had to stop and while searching for spatial information, re-orientate herself in the area. In other words, she missed a wayfinding element at the pedestrian light, showing her that she needs to cross there in order to get to bus stop A1. As seen in figure 6.38, she is also pointing that out during her unintentional stop at the crosswalk by saying “*I think there is missing a sign, showing that one needs to cross here*”.



**Figure 6.38.** PB4 missed a sign signalling to cross the road to get to A1. Own representation.

As PB4 had to wait at the pedestrian light for some time, she looked over to A1 several times. Besides, after crossing, she was the first participant on Route B who appreciated the art on the construction fence on the way to A1, seen in figure 6.39. To close her wayfinding task, she recognizes her arrival at bus stop A1 by saying “*There is A1*”.



**Figure 6.39.** PB4 appreciated the art panels on the way to A1. Own representation.

Even though PB4 was a bit confused at the decision-point of crossing at the pedestrian light to walk to A1, she still rated the convenience of finding the way with eight points

as it was the only problem she encountered. According to her, the geosemiotics inside Kennedy Arcade as well as other signs were easily understandable whereas she only missed a directional sign at the crosswalk. Moreover, she consciously looked for spatial cues while walking, about 21% of her journey, and specified that these tools helped her finding the way.

Participant number five (**PB5**) knows the area at Aalborg Station as well and has also taken buses several times. Hence, she started walking confidentially to bus area B after she got told the assignment at bus terminal C3. When getting asked later on why she did not walk through Kennedy Arcade, she mentioned that she prefers the fresh air and only walks through the shopping center when it is raining. While walking along bus area B, she found an orientation sign at the marker of the bus station and quickly found the destination she needed to go to, as seen in figure 6.40.



*Figure 6.40.* PB5 found A1 on the map. Own representation.

This moment of stopping and navigating only lasted a few seconds and accounts in general for 5% of the total amount of time, before she mentioned “*Now I think I know where to go*”. Unlike participant number two, she did not have an issue with the wrongly turned overview map and instead could quickly adapt the orientation sign to the spatial environment and therefore continued straight ahead. As the participant now reassured her knowledge of the spatial area at the map, she moved straight to the pedestrian light where she had to wait for 25% of the total amount of time. While waiting unintentionally, she looked over to where bus station A1 is located, even though it is difficult to say if she already saw the bus terminal or just gazed over there, due to low gaze-samples and additional sunshine. When crossing the pedestrian lights and hence moving towards the construction work, she mentions that she is *annoyed* by it and hopes that they will finish it soon. Walking on the temporary pavement, PB5 also looked at the art panels that were put up which she later pointed out as *cozy*. As she then moved further, the participant saw the identification sign of A1 and recognized that she successfully reached the destination and hence finished the wayfinding task.

To sum up, PB5 evaluated her wayfinding experience with eight points as she did not encounter any problems, also due to her beforehand spatial understanding and cognitive map of the area, but referred to the construction work as *annoying* and *confusing*. However,

she also mentioned that she missed some green area since the construction work started. When being asked about which tools she used to find her way around she also mentioned intuition in addition to her knowledge of the area. This can be interpreted that it was natural for her to make sense of the environment, including its spatial elements and possible architectural cues, without really thinking about it.

The next participant (**PB6**) of the eye-tracking task had only little knowledge of the area around Aalborg Station, consequently she first was unsure if she should go through Kennedy Arcade, as illustrated in figure 6.41, or if she should go around the building.



*Figure 6.41.* PB6 wondered if it is necessary to go inside Kennedy Arcade. Own representation.

Even though she saw and recognized the directional signs, which point inside the building, she decided to go around and hence walked along bus area B. This, she mentioned in the follow-up interview, was because it usually does not make sense for her to enter a shopping center to get to a bus station when one can see that several buses are arriving and departing all around the area outside. In deciding to walk around the building, she passed a digital information board where the departing times of the different buses that leave from the various areas get constantly updated. While she first only glanced at it while passing, PB6 then stopped and turned around again to take a quick look on the information board. However, as it is only indicated where each bus is leaving, there is no further spatial element helping to find the way to specific bus terminals. Hence, the total amount of stopping and navigating was low, compared to the entire duration of wayfinding. The participant continued walking straight as she, like some others, naturally assumed that bus area A would then be located straight ahead and therefore passed the bus terminals of B before entering the intersection at John F. Kennedys Square where she noticed A1 on the other side of the street. Moving further to the pedestrian light, she had to wait there for almost one fifth of the entire wayfinding time. Like the others, she looked over to bus stop A1 while crossing the street and already walked to the left where she continued on the temporary pavement. Then, she reached A1.

Summing up, participant number six evaluated the convenience with ten out of ten points as she did not encounter any problems. According to her, the identification signs of the bus terminals at area B helped her to figure out that bus area A might be straight ahead as well as the knowledge that there are several buses leaving around the corners of Kennedy

Arcade.

The last participant (**PB7**) for Route B had no knowledge of Aalborg Station as he had never been there. Hence, it took him a few more seconds to orientate himself at bus terminal C3 and figure out where to go. The participant slowly started walking while searching for spatial elements that give him a hint where to go and as he saw the directional sign at the entrance of Kennedy Arcade, he walked more confidently towards the shopping center. Getting closer, he looked at the index several times to check if it is the correct way, as seen in figure 6.42.



*Figure 6.42.* PB7 looked at the directional sign pointing into Kennedy Arcade. Own representation.

Inside Kennedy Arcade he reassured himself that he was walking in the right direction by looking at the indexes on the ceiling while at the same time needing to navigate his way around several pedestrians. Consequently, 13% of the wayfinding time were used for embodied performances. Moving towards the exit, he looked again at the directional sign and also at a floor plan of the building as PB7 first thought it might be an orientational sign of the entire mobility hub. Outside of Kennedy Arcade he walked straight to the left, as the last index indicated to do so. While passing the sign at the entrance of Kennedy Arcade called 1K, the same map as PB4 noticed, he looked at it for a while to identify if there is information about the area and his destination, as seen in figure 6.43. When realizing that there is not, PB7 continued walking faster while looking around for other visual cues.



**Figure 6.43.** PB7 looked at the same sign as PB4, next to the entrance 1K of Kennedy Arcade. Own representation.

As he reached the end of the pavement, he still did not notice A1 and hence looked to the left to bus area B where he realized at the identification sign, that this would be the wrong direction. Besides, as no other directional sign showed him to cross the road to the right, he crossed the pedestrian light straight ahead and continued this way. After he crossed the street, he walked slower and looked intensively around in all directions and one could notice that at this point the participant was confused as if he had missed a sign or maybe already accidentally passed the bus stop A1. However, he kept walking slowly and after a few meters he saw A1 on the other side of the road, as seen in figure 6.44. The participant then took another assuring look to the bus terminal and continued walking at a faster pace. All in all, the moments of moving and navigating accounted for 24% of the entire time. When stopping at another pedestrian light to get to the right side of the road, he looked over to the bus stop, just like the other participants did at the other crosswalk before crossing the street and arriving at the destination.



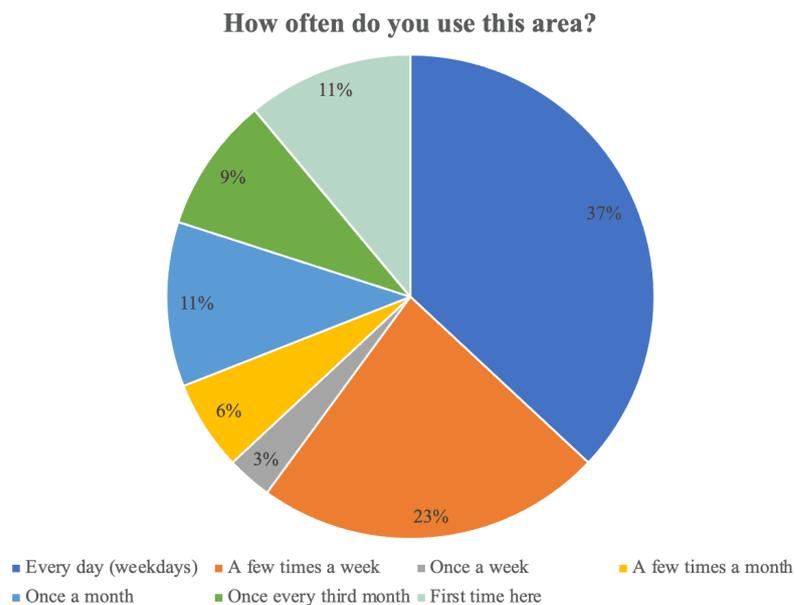
**Figure 6.44.** PB7 saw A1 and realized that he needs to cross the street. Own representation.

In general, participant number seven rated the convenience with five points as he thought of it as kind of a *neutral* experience, neither really positive nor negative. He clarified that due to the many directional signs, it was an easy task in the beginning whereas he then missed another index to illustrate that one needs to cross the street in order to arrive at A1. As there was no such spatial element, he walked all the way around as described and seen in the map in figure 6.25 on page 61.

### 6.2.2 Passengers experience of waiting time

The following subsection will examine and analyze the experience of bridging the time gap between two modes of transport at Aalborg Station. As it is part of the shifting journey and the secondary focus of the research, this subsection will be shorter.

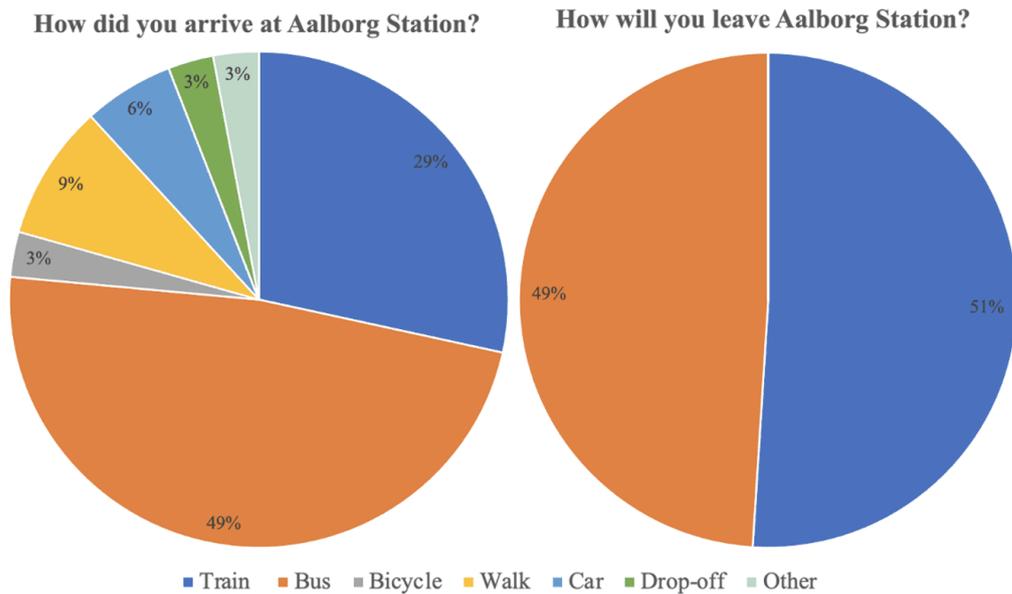
To be able to answer the second subquestion, a survey including 35 interviews with passengers at Aalborg Station has been completed. The interviews were performed inside and outside the train station as well as the bus areas A, B and C. An overview of the results of these stop interviews can be found in appendix H on page 139, whereas the main outcomes are pinpointed in the following.



*Figure 6.45.* Diagram of frequency of interviewed passengers using the area. N=35. Own representation.

One of the first questions was how often the passengers visit the area. As visualized in figure 6.45, 37% use the area every day or every day on weekdays and 23% use the area a few times a week. A total of 60% of the interviewed passengers are frequent users, while 11% were visiting the area for the first time. This shows, that the hub is mainly used for daily purposes and hence is accommodating a high amount of peoples’ flows, especially during rush hour. Just under half, 49%, had arrived at the station by bus while 29% arrived by train. Only 9% of the interviewed passengers walked to Aalborg Station and 3%, equivalent to one respondent, used another mode of transport since the person arrived on a Segway, as seen on figure 6.46. Referring back to the 29% of passengers who arrived by train, 90% of those passengers continued their travel by train and 10% by bus. The same pattern can be seen in the 49% of passengers who arrived by bus; of those did 82% continue their travel with the same mode of transport, bus. The remaining 18% combined the bus with the train. As seen in figure 6.46, the passengers did only use either the bus or the train to leave Aalborg Station on their further travel. This implies an impression of Aalborg Station used as a hub for not only coming to and departing from but actively shifting transport whereas train and bus are the main modes. Moreover, it emphasizes the

relevance for investigating the transfer, as within this project, between the two modes of public transport, train and bus.



**Figure 6.46.** Diagram of how passengers arrived to and left Aalborg Station. N=35. Own representation.

The majority of passengers, 37%, had 5-10 minutes of waiting time in the area, whereas a total of 12% had more than 30 minutes of waiting time, as seen in figure 6.48. During the wait, the passengers mainly used their phones to play games, text messages or listen to music. In addition, several respondents spent their waiting time walking around the area and talking to friends, as seen in figure 6.47.

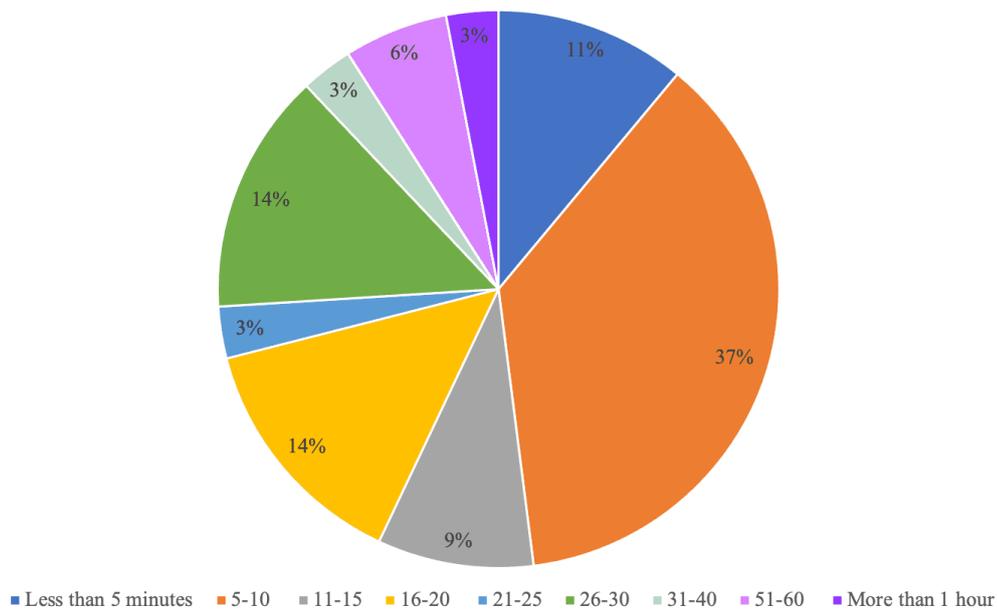


**Figure 6.47.** Word cloud of how passengers steal their time back. Own representation.

This qualitative visualization illustrates how passengers spend their time according to the statistical mode where the highlighted practices refer to the most responded answers.

Thereby, these practices can be in a broader sense referred to as stealing the time back which got initially stolen by the transport operators [Vannini, 2012]. Looking at the results, most of these practices or as Vannini would call it ‘tactics’ [Vannini, 2012], are not specifically place-related activities such as using technological devices. This implies that passengers do not necessarily need to transfer at Aalborg Station to undertake these tactics, hence it is not immediate related to the surrounded environment but can be performed elsewhere. The only tactics which are highly connected to Aalborg Station as a mobility hub are getting some food, grocery shopping and visiting the stores. Only three out of the 35 respondents used the indoor waiting facilities in Kennedy Arcade, whereas one of the three took advantage of the opportunity to combine the waiting time with everyday chores in the form of grocery shopping while waiting for the next mode of transport. This may be due to the majority of respondents having only between 5-10 minutes waiting time, which makes it limited of what one can accomplish during that time. This needs to be taken into consideration when thinking about improving the experience of bridging the time gap for passengers. The 6% who used their waiting time to complete work-related tasks had between 16-25 minutes of waiting, which they spent in the train hall, before both respondents continued their traveled by rail. This activity can also be put in relation to the concept of stealing time back. As the passengers had to wait anyway for their connecting transport, they decided to spend it productively by working instead of feeling that they wasted time for simply waiting [Vannini, 2012; Bissell, 2018]. When relating the time period of passengers waiting for their mode of transport with the areas they had been waiting in, no specific pattern could be identified. However, the waiting time at the train station was slightly longer than for passengers at the different bus stations but due to the comparably little amount of conducted interviews, the data cannot be considered as representative instead depicts a sliver of the passengers’ experience.

#### If you have waiting time, how long is it?



**Figure 6.48.** Diagram of how much waiting time the interviewed passengers had at Aalborg Station. N=35. Own representation.

Further, the respondents were asked how they would rate their waiting time on a scale from 1 to 10, where 1 relates to a ‘bad’ experience, 6 refers to a rather neutral experience, termed ‘okay’, while 10 implies having a ‘fantastic’ experience. A total of grades between 4 and 10 were given, with 34% of the passengers grading their waiting time to 7 on the scale. On average, the waiting time at Aalborg Station was graded to be 6.7, which is according to the scale above average and better than ‘okay’. While a rather neutral experience might sound fine as it is ‘only’ a transfer, it needs to be taken into consideration that there is still room for improvements, especially in a time where people expect more than the absolutely necessary in order to rate their experience higher. The 11% who gave the waiting time a grade of 4 justified this with the fact that the waiting time was generally *long* and experienced as *boring*. Particularly those passengers who need to wait for more than 5-10 minutes, the waiting time could be considerably improved and instead of feeling bored, it will change to an enjoyable experience which would also lead to a feeling that time flies. Furthermore, others criticized that there were not enough benches and the existing ones at the train station were not comfortable to sit on. In addition, it was mentioned that it was particularly *cold* due to the automatic doors at the entrance to the train station as these often opened and that there was very *poor acoustics* in the waiting area. Furthermore, it was pointed out a total of five times that there was a desire for more benches or shelters. This can also be referred back to drifting, where it was observed that those who waited kept their distance from each other and there was, therefore, an empty seat among those waiting. Besides, it can be stated that there were not many benches or chairs inside the train station, and those that are present were in use. However, it needs to be considered that by simply adding more benches or shelters, the waiting time experience might not necessarily be automatically improved while more urban furniture could also give one a feeling that the place is crammed full, and therefore evoke the opposite feeling. Another consideration that was mentioned in the question of what could make the wait better were station-based activity games that could be set up in connection with the establishment of the new BRT. Inside the train station, two respondents answered their waiting time would be better if there was a coffee machine or a restaurant. The two respondents who had this wish were both first time visitors in the area and graded their waiting time to 10 on the scale. Since it was the passengers’ first visit, they might not know the possibility to e.g. visit Kennedy Arcade, where it is possible to visit a restaurant, get goods and buy a cup of coffee.

In general, there was general content with the opportunities that were in the area, also that as a passenger you have the opportunity to use Kennedy Arcade during the wait, although only one mentioned that he had used the same opportunity.

### 6.3 Summary - Analytical judgement

This last section of the analysis will shortly summarize the findings from wayfinding in subsection 6.2.1 and the waiting time experience in subsection 6.2.2 while clarifying how both subquestions have been answered throughout the chapter. Maps outlining the critical points during the individual journeys can also be seen in appendix G on page 131.

Starting with subquestion one, *How user-friendly is it for the individual passengers to find their way on two selected routes?*, on average, the participants on Route A rated their

wayfinding experience with around 7 points with no definite relation to their knowledge of the area. This means that even though e.g. PA5 had no beforehand knowledge of the place and struggled a bit while finding the way, he rated the experience with 8 points, while PA7 who knows the surroundings well, graded the route with 6 to 7 points. Hence, no connection can be seen when putting the knowledge of the area in relation to their estimated experience. Besides, the rating is also dependent on a person's attitude towards situations of confusion, some get stressed easily while others are still relaxed and keep a positive mindset. A personal preference can also be seen when comparing the various routes the participants walked to C6. While three participants went through the train hall, the remaining four decided to either walk along the train platform in the northern or southern direction. Especially, PA5 pointed out, that in order to prevent needing to walk through crowded areas, he would always prefer to walk around the building, even though important wayfinding information could have been inside. The participant PA4 on the other hand also mentioned that she experienced the area as crowded but had no issue with that and walked both through the train hall and the service center of NT. This can also be seen in the diagram 6.5 on page 48, as the percentage of embodied performances is higher than not only of PA5 but all the other participants. Besides, people walked with a different pace whereas PA1 was the fastest and PA3 needed the most time to complete the task to the destination. On average, the participants walked approximately 4 min 30s to bus terminal C6. Moreover, an interesting aspect when looking at the different routes they walked is that only four people waited at the pedestrian light to cross the street safely, while the other three did not and instead preferred the more direct way by diagonally crossing the street. This was also due to the aspect that they might not have known on which side of the road bus area C will appear and hence did not immediately cross the pedestrian light but continued straight ahead. Even though all participants mentioned of feeling secure and comfortable while walking, it needs to be considered that activities such as crossing the street without a crosswalk or pedestrian light can lead to dangerous situations especially in an area where several buses are arriving and departing within minutes. Referring to the various wayfinding tools the participants used to find their way, most pointed out that they missed a sign leading to bus area C in the beginning, only PA6 and PA7 did not criticize this inconvenience. During the walk, three participants needed to stop at an overview map to both get an understanding for the composition of the environment as well as a hint where area C is located. Related to that, all three needed more than just a few seconds to find bus area C on the map, as it is only shown as a tiny letter at the bottom of the map. Hence, their stopping and navigating percentage is higher than of the other participants. Another aspect which especially helped PA2, PA5 and PA7 was the logical naming of the various bus areas (A, B and C), giving them an idea that bus area C might be located close to area B even though it is not directly visible when continue walking. However, during investigation it became apparent that every participant needed some sort of geosemiotics, either icon or index, to find the way, no one mentioned that the architectural surroundings as well as the urban settings alone helped them. This was most noticeable during the aspect of closure where all participants missed an identification sign for C6, which was taken down during the time of investigation, to realize for sure of having reached the destination.

Participants for Route B, on the other hand, were not confronted with the problem of

closing the wayfinding task, instead a bit confusion amongst some of the participants was caused by the visual blockade of Kennedy Arcade when fictionally arriving at C3. In this situation, the main decision participants had to make was about either walking around the shopping center or walking through it. Three of the participants, two of them having no knowledge of the area, decided to walk through Kennedy Arcade which passengers are intended to do, as there is a directional sign above the entrance pointing inside. Another participant also saw the index but did not understand the meaning of walking into a building when wanting to get to a bus area and therefore decided against it. The same consideration was mentioned by PB1, showing that even though signs should help guiding people to their destination, they are not always alone reason enough to follow them. Moreover, in the same context like in Route A, PB1 and PB6 made logical sense of the environment by following along bus area B to get to A. Besides, all participants took advantage of some sort of signs, either directional, identification or orientation sign, to find their way. However, while for participants of Route A an information pole with overview maps was placed kind of in the middle of their wayfinding journey and helped some to clarify their path, PB3 criticized a missing map inside Kennedy Arcade to get an idea of where to go before exiting the building. Having seen directional signs pointing to the precise area A1 before leaving the shopping center, this might have caused a sense of feeling of being close to A1 which led to a more detailed look and the assumption of the next upcoming bus stop being the one which had been searched for. This disorientation did on the other hand not occur once the participants were exiting the other indoor facility of the train station on Route A. Thereby, the general and intuitive direction of going towards the buses first has prevented from walking into too specific directions whereas participants made sense of the alphabetical order of the terminals afterwards. Another aspect which was pointed out as challenging by two participants on Route B was a missing wayfinding tool after exiting Kennedy Arcade to show where one needs to cross the street to get to A1. While PB4 figured that out after passing the pedestrian light and looking confused around, PB7 however did not see the identification sign of A1 and hence a cue where to go. Therefore, he continued straight ahead and in doing so chose unintentionally a longer path to arrive at A1. In other words, if he had gotten a hint of crossing the street, he would have chosen a different and shorter route, thus, the established wayfinding elements were not clear enough for him. On average, the participants walked approximately 3 min and 30s while PB2 was the fastest and PB7 was the slowest. In this context however it needs to be considered that the unintentional stop in front of the pedestrian light needs to be taken into account which implies that PB2 was not actually the fastest in wayfinding but spent less time waiting at the traffic light. Hence, PB1 can be considered at finding the destination the most effortless but had to wait 30% which accounts for approximately one minute of the journey. Taking a look at the rating of the wayfinding experience, the average was 7 points, which is the same as for Route A. Moreover, there was again no definite pattern of a better rating if the participant knew the area or was new to it. In general, the passengers experienced the route as neutral to positive, but mentioned the ongoing construction as annoying as well as a few situations confusing.

The secondary research focus with its subquestion *How do passengers experience the in-between time at Aalborg Station while waiting for their choice of transport?* got mostly illuminated by the subsection 6.2.2. Most passengers use Aalborg Station on a daily basis

and the primarily used transportation options are train and bus, which were also the preferred modes of transport to travel further. Additionally, over half of the interviewed passengers had only five to ten minutes of transit time, which makes it difficult to actually think differently of the area than a means to an end. Nonetheless, some of the passengers that had to wait more than ten minutes experienced their waiting time as *boring* and *too long*, showing that there is potential to unfold. This suggests that passengers had a neutral feeling towards the area as they rated it with 6.7 on the scale, implying that they do not envision Aalborg Station as spectacular, but instead meeting their needs. Furthermore, it can be discussed that Aalborg Station is rather considered as a transit node than a mobility hub due to the passengers missing a layer of experience and placemaking. In this context, the applied tactics can be identified as being primarily independent from the infrastructural furniture. One could further argue that the transport operators, due to the staged schedules from above, presently act as time thieves since potential in waiting time experiences remains unfulfilled.



# Discussion 7

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After analyzing the area at Aalborg Station, its wayfinding practices and waiting time experiences, this chapter aims to discuss the interplay of the previously seen independent components occurring on a journey of shifting. Thus, wayfinding and waiting time will be put into context, first with some general considerations of their interrelation affecting each other, followed by the remaining instructions of the CPC framework with the fourth touching upon the potentials that can be identified, section 7.1, and the fifth and last instruction giving a perspective for future improvements of the current practices to further evolve and meet the expectations of the user's needs, as elaborated in section 7.2.

Before touching upon the site-specific potentials based on the investigation at Aalborg Station, some general considerations of the interrelation of wayfinding and waiting time will be raised, or rather how wayfinding does affect waiting time, and vice versa, when setting the frame of "*mobilities do not just happen or simply take place*" [Jensen, 2013, p. 7] but are rather staged 'from above' and practiced 'from below' (ibid.). Besides the infrastructural assemblages and staged networks that occur at CPCs, the aspect of time during a shift is highly influencing both procedures, wayfinding and waiting. The shorter the shifting time the more efficient needs the shift to be performed while less time is spent with waiting. Sometimes, waiting is not even a thing, and another time, the amount spent on finding the way is greater than the actual shifting time available. Therefore, depending on the staged time schedule of public transport operators, people develop different habits in making use of the in-between time of shifting from one mode of transport to another, also by adapting one's own pace to strolling and looking around or determined walking.

By referring back to the perspective of seeing wayfinding and waiting as one journey of intermodal shifting, one needs to question at this point, what might be more desirable for mobility hubs: Users spending time in finding the way or spending time waiting? The answer for mobility hubs might actually be neither as the concept they pursue lies in satisfying people's mobility needs, not only touching upon spatial flows but to complete other purposes during the trip as well. Instead of reducing the waiting time, it may be rather aimed to transform the shifting time to productive time respectively. Thus, if wayfinding would be designed efficiently while being effortless for the user to make sense of the environment, this in turn enhances the remaining time of the intermodal shift and opens up taskscapes [Vannini, 2012] for doing activities at the mobility hub, as far as possibilities are provided. Initially declared as waiting time, it is however not understood as plain immobility but rather as dwelling and interacting with the physical setting or developing meaningful practices based on the user's personal preferences. This comes with reproducing the time to other than waiting in the first place, making the remaining time an experience itself while speaking of affording [Gibson, 2015] certain activities or fostering

undertakings in a social sense which might be economically relevant for stores in the area selling goods and groceries.

This comes with a change in perspective of not only seeing the shift consisting of the wayfinding procedure as the first incident and then the waiting time which applies once the user has arrived at the destination but the other way around, or rather that the shifting process is generally regarded as the waiting where wayfinding is only a small part of it. This implies that waiting time practices could further already be performed during the wayfinding task by deciding to stop by at facilities laying on the way one need to walk anyways or when a time-task assessment takes place if one is familiar with the area. Thus, productively used time could also be transpired at the beginning of the shifting journey or on half-way to the destination. One prerequisite could thereby be that one already has a sense of being close to the departure point of the next transport mode which could be due to e.g. visible accessibility of the destination, the perception of whether a detour is feasible or not, or the pre-knowledge of an area. Surely one needs to reach the transport mode one intends to take in time, though, the focus of mobility hubs lies rather on providing a stress reducing, convenient, and enjoyable transfer time to induce a more attractive usage of alternative transport options in compliance with a wayfaring approach.

## 7.1 Identifying potentials for the shifting journey

Based on these considerations put into context of wayfinding and waiting time, their interrelation at Aalborg Station is going to be reviewed in outlining potentials, in accordance with the fourth aspect of CPC termed *4. Identifying potentials (for social and experiential value) that have not been fulfilled at Aalborg Station (yet)*. Thereby, it will be drawn on the analysis' results, including the individual routes walked by the participants with the marked critical points on each route, compare appendix G on page 131 as well as the outcomes stated throughout the waiting time analysis. This results in the following map in figure 7.1 of spatially displaying potentials detected of finding their way across Aalborg Station as a mobility hub and waiting for further travel with public transport options.



**Figure 7.1.** Categorized potentials at Aalborg Station based on critical points identified. Own representation based on [Skråfoto, 2021] and [Kennedy Arkaden, N.D.a]. The scale bar does not apply to the overview map of Kennedy Arcade.

As shown in figure 7.1, besides a mobility hub being considered as a CPC, there are additional small-scale critical points occurring within the existing and investigated networks itself of wayfinding and waiting which got distinguished into six clusters to take departure from these potential identified. The categories are based on the introduced theories in chapter 4 on page 17 and put into relation to the investigated Routes A and B as well as waiting time practices at Aalborg Station. Thus, the following clusters of *facilitating decision-making*, *mitigating confusion through path integration*, *minding the closure*, *transitioning from indoor to outdoor environment*, *enhancing ephemeral qualities*, and *affording spare tactics* got pointed out and are going to be discussed regarding their

potentials, and hence, what is lacking at Aalborg Station. Based on what has been identified by the individual users' experiences to be critical and keeping in mind the human performances behind the instrumental assemblages, these can be generally seen as subjective however research-based potentials.

### **Facilitating decision-making**

Outlined as the first potential, *facilitating the decision-making* during a journey is indicated with yellow stars in figure 7.1, whereas it got classified due to a stopping and navigating phase of the participants. This can be considered as an intentional stop where the participants needed to orient themselves in front of a map or directional signs and therefore caused disruption of their previous walking flow. As it can be seen, these critical points mainly occurred within the open street space at the area between the major buildings of the train station and Kennedy Arcade whereas the urban setting might be not sufficient for spatial or intuitive wayfinding, thus, additional guidance is needed and already provided in the area. The potentials seen as facilitating the decision-making points are to be found on both Routes A and B, whereas the architectural appearance and location of Kennedy Arcade play a significant role in acting as a physical as well as visible barrier for Route A during the last part of the wayfinding journey and for Route B at the beginning of the trip. Given that the destinations of both routes cannot immediately being seen as well as the journey is influenced by the open urban environment with everyday mobility, this makes these to critical points when one needs help finding the way. This applies especially to those who are new to the area or have little knowledge about the divided bus terminals. According to the theory, 'decision points' [Passini, 1984; Weisman, 1981; An et al., 2019; Vandenberg, 2016] arise when a person needs to physically stop and orient themselves, the outlined decision-points from the analysis caused insecurities by the wayfinding participants which is why a potential at these orientational stops lies in reducing or even eliminating the time spent in front of the mounted signs and maps in order to facilitate the orientation and thus decision-making process at these locations.

### **Mitigating confusion through path integration**

The second potential which got identified is termed *mitigating confusion through path integration*, which refers to the red stars indicated in figure 7.1. This category discusses the challenges one encountered during the journey in terms of searching for specific cues however not initially finding them which resulted in confusing and inconvenient situations as well as unintentionally taking detours due to unclarity. The missing guidance where a potential of path integration occurs are spatially located inside the train station and the service center of NT, while two confusion points are found north-sided of Kennedy Arcade in the outside environment and one at the south end of bus area B4. During the movement of looking and searching, this meets the theoretical aspect of 'path integration' [Chrastil et al., 2017], whereas the participants continuously adapted and orientated themselves while being on the move with more or less success. These located points of path integration in the area stood out as critical towards the wayfinding while significantly deviating and not being aligned with an ideal route when completing the task of walking from the arrival to the departure point. Thus, this pointed ahead to the potential lying in the provision of additional visual cues in these locations, especially valuable for passenger who have no or

little pre-knowledge of the area, in order to mitigate unintentional detours and establish a more secure feeling for the users of following the correct path.

### **Transitioning from indoor to outdoor environment**

The third identified potential deals with the *transitioning from indoor to outdoor environment* as a critical point within the networks, displayed with a purple star in figure 7.1. Located at the north-sided exit of Kennedy Arcade, this potential is highly to be seen in relation to the critical points of path integration outlined ut supra and especially applicable to one participant who chose to continue walking into the opposite direction of the aimed destination of A1. This got identified as an individual challenge of finding the way at Aalborg Station. When stepping out of the shopping center, one encounters the transition in form of being channeled through the main path of the indoor facility of Kennedy Arcade before arriving in the outdoor urban environment being confronted with an open street space. From being to a certain extent passively guided by the architectural layout of the building, one has now to actively engage with the surrounding as no pre-determined path is initially visible which would facilitate the orientation in the outside setting. Even though a directional sign is placed at the exit pointing towards the destination, it has been overlooked by the mentioned participant which might be due to distraction of this transition and the focus on infrastructural elements that comes with it, i.e. opening doors. This transitioning during a wayfinding journey from indoor to outdoor environment is not taken into account within the various scholarly argued components of wayfinding [Vandenberg, 2016; An et al., 2019; Lynch, 1960; Passini, 1984; Weisman, 1981], as introduced in subsection 4.2.1 on page 19, however, included within the overall decision-making and path integration approach. Though it is only a minor potential as one participant got obstruct by this critical point, the transgression of spatially changing environments can be taken into account.

### **Minding the closure**

*Minding the closure* is the fourth potential identified and indicated with a green star in figure 7.1, while being the last one for wayfinding considerations. In assimilating to what Vandenberg terms ‘closure’ [Vandenberg, 2016] or Downs and Stea term ‘recognition’ [Farr et al., 2012], this element proved to be a challenge during wayfinding practices on Route A and thus a potential can be identified located in bus area C. In not having consciously recognized the area C or the final destination of C6 itself, this element remained unfulfilled for most of the participants and leaves room for improvements. The aim is to provide effortless and worriless wayfinding even without the bus having arrived yet. Making sure that one has reached the relevant terminal will lead to less confusion and disoriented walking performances at the area, which reduces the passenger flows in between the ongoing street traffic, making it more safe and clear as well as opens up opportunities to fill the possibly applying waiting time with other practices.

### **Enhancing ephemeral qualities**

The fifth identified potential refers to *enhancing ephemeral qualities* of wayfaring and waiting time practices while envisioning the experiential layer to be strengthened. Indicated with blue stars in figure 7.1 and spatially located within the train hall and on

platform 1, this calls for unfolding potentials in these areas whereas the remaining areas at Aalborg Station have not been perceived by the users as currently having the need to be improved. In touching upon the theoretical notion of ‘ephemeral qualities’, derived from Lanng and Jensen [Lanng and Jensen, 2016], and further resembling the wording termed ‘ephemeral moorings’ [Vannini, 2012] and ‘temporary congregations’ [Jensen, 2013], the aim is to provide an increased positive experience of the indoor facilities as well as furniture available to dwell during waiting habits. Ephemeral qualities thereby encompass to enhancing the snapshot experience that passengers have in relation to the physical setting but also with other embodied practices performed by users in the area, in short, to create a pleasant atmosphere and surrounding one feels comfortable in while traveling. The potentials seen in that regard, also in accordance with the wayfaring approach [Lanng and Jensen, 2016; Vannini, 2012], include the sensorial aspects of touching and hearing in terms of sound features as well as temperature conditions prevailing in the train hall. Furthermore, seating possibilities are spartan and perceived uncomfortable, thus, inhibiting as opposed to affording [Gibson, 2015], the dwelling during the journey. To conclude, multisensorial perceptions are utterly intertwined with how affording and encouraging the use of infrastructural furniture is, which calls for enhancing the ephemeral qualities occurring at the train station in order to increase the acceptance of the present furniture as well as willingness to wait.

### **Affording spare tactics**

Utterly intertwined with the previous potential is this identified last category of *affording spare tactics*, shown as orange stars in figure 7.1. While *enhancing the ephemeral qualities* aims to upgrade the momentary lives of individuals at the station, the category of affording spare tactics, inspired by Gibson [Gibson, 2015] and Vannini [Vannini, 2012], aims to actively trying to make sense of the environment when a longer waiting time applies, hence, transforming power-driven strategic and stolen timespaces by the timetable dependency of the transport operators into tactical taskscapes [Vannini, 2012]. Two potentials got identified based on the passengers’ answers being spatially located inside the train station as well as at the area which is currently under construction due to the upcoming BRT. This includes primarily the affordance of engaging with the environment in a more creative and playful way and comes with the fostering of social interactions while waiting at bus stations which are at the current state rather designed for efficiency. Being part of tactics to steal back time and make it more enjoyable, this results in waiting time being an “*establishment of place*” [de Certeau, 1984, p. 38] which induces an “*erosion of time*” [de Certeau, 1984, p. 38] as Vannini refers to De Certeau (1984).

To sum up, potentials for socio-economic value lie implicitly in the increase of the experiential layer regarding embodiment, social interactions as well as smoothing the gap between the technical dimension and the humans behind these assemblages performing the mobility. As only minor but essential potentials have been identified at Aalborg Station, a combination of wayfinding and wayfaring including the productive use of waiting time should stand in focus. Thereby, the claim of ‘tempo rubato’ [Vannini, 2012] could be considered as an assimilation of wayfinding and the in-between time being performed with rhythmic freedom, meaning productive activities can be undertaken throughout the way to reduce the actual waiting time itself. Common areas where both participants walked

through and passengers were waiting can be identified as occurring at the various bus stops, inside the train station, and inside Kennedy Arcade.

## 7.2 Suggestions for re-designing Aalborg Station

Based on the analysis, its identified problems and potentials, this section will illuminate on recommendations to make Aalborg Station more user-friendly and attractive in accordance with the last CPC's instruction of 5. *Suggesting initial recommendations for a re-design of Aalborg Station catering for the identified potentials.* However, it needs to be considered that the aim of this thesis is not to provide complete design solutions but instead to develop an understanding of the performed mobility when finding the way around and bridging the time gap at Aalborg Station. Hence, as within this mobilities project, recommendations for re-design are to be understood as suggestions of how to improve the current situation but does not function as complete thought-out design guide.

To start with the area around the train station, especially potentials within the category of *enhancing ephemeral qualities* have been identified and hence, recommendations include straightforward approaches such as putting up more comfortable benches on the train platforms. Moreover, the automatic doors at the entrances to the train hall have been criticized as well as they not only open when a person wants to walk through but also when someone is passing by. Hence, depending on the weather, it can get colder than one would expect when theoretically being inside a building. However, the purpose and intention of automatic doors for the train hall is to be accessible for every person without needing help or similar. Besides, it is not intended for passengers to wait a longer time in the train hall, as there is a specific waiting room in one part of the building as well. Therefore, no recommendation for improvement will be suggested. The same applies for the mentioned lousy acoustic within the train hall as one would need to investigate if it is because it is a bigger room without much furniture or also because of the speaker as the technical component. However, this topic should get addressed in the future, as currently announcements are not always clear to listen to. Another suggestion that was mentioned belongs more into the category *affording spare tactics* as it is a coffee machine on the platforms or in the train hall. While this idea might be understandable in the first place, a shop which also sells coffee is already located within the train hall but as the interviewees were the first time at the train station, they might not have known of the possibility to fetch some coffee inside the hall. Moreover, as they had a one hour stay at Aalborg Station, they would have had the time to walk over to Kennedy Arcade, where more coffee shops are placed inside. However, to call their attention to this option, the advantages of the mobility hub, which includes getting some beverages close by, need to be make clear. This applies especially to a surrounding such as the train station where one cannot necessarily look over to the rest of the hub and hence understand that there is more to its location than just a train station. Another recommendation for improvement could be a digital bus schedule as well as a sign over the exit door at the train hall pointing to the bus areas A, B, and C, as this part had caused minor hesitation for some persons during wayfinding, related to the category *mitigating confusion through path integration*. On the other hand, more signs are not always the solution for better and more comfortable wayfinding and putting up another sign should be well-considered. As mentioned in subsection 4.2.1 on

page 19, geosemiotics of all kinds do not necessarily clarify a way but can cause even more confusion if there are too many or put up without a clear purpose. Now, the directional sign hanging above the entrance to the train hall is guiding passengers for the buses straight to continue on platform 1, until being guided downstairs. However, when arriving by train and needing to continue by bus, people might act more on assumption that they first need to leave the train station before walking to the buses and therefore, without more considerations, enter the train hall where there is no guidance to the buses. For the same reason, it might seem strange to continue on the platform wanting to get to a bus as well as taking the stairs down. Hence, a suggestion is to change the directional sign to the buses when entering the train hall from platform 1, to point through the building. Another sign is then necessary before exiting the building to make passengers aware of the direction they need to continue towards.

When exiting the train hall via the main entrance and continuing to the right, a directional sign on a fence was part of the *decision-making* of one of the participants of where to find bus area C. However, as already mentioned earlier, this index did not include a guidance for area C, hence, a suggestion for improvements is to add a direction for area C1-C11 on the already existing sign to accommodate this decision-point, as suggested in figure 7.2. Another consideration for improvement is to place the sign higher, so that it is easier seen when being on eye-level as well as distraction such as a parked bicycle in front can be more easily prevented.



**Figure 7.2.** Added index to bus terminals in area C1-11. Own representation.

Moving further to area B, another recommendation for *facilitating decision-making* takes place at the two information poles where a direction to bus area C should be added which is suggested in figure 7.3. In doing so, it can be discussed if the arrow should be pointing straight ahead, meaning one would pass area B, or to the left with the intention to guide passengers through Kennedy Arcade. From the point of view of guiding passengers to the more straightforward direction, an arrow straight to bus area B would be the more transparent option. Another reason for choosing this route is that it naturally adds up to pass area B to get to C as it is the next alphabetic character. On the other hand, when guiding passengers through Kennedy Arcade the purpose of a mobility hub of being more than transit hubs is more comprehensible and people might spend their waiting time inside, buying some food or going window-shopping before exiting the shopping center at area C, which was also pointed out by Martens. Hence, this option makes them aware how

they could spend the rest of their time before taking the next mode of public transport. In order to decide the direction of the arrow to area C, all stakeholders should be involved and discuss if their intention is to send passengers simply to their destination or if they should consider possible waiting time and try to make the person aware of the options they can find at the mobility hub.



*Figure 7.3.* Added directional information to bus terminals in area C. Own representation.

Continuing along bus area B, the problem of the tilted overview map at the identification sign of B3 is easily solved by turning it around which will contribute to a more user-friendly decision-making while finding the way. Moving on to the other side of bus area B, the bus shelter B4 is located almost at the end of the pavement which gives passengers, who might have walked this way, the feeling of having reached the end of the buses and hence the mobility hub, also because the bus area C being first visible when one has passed the very bus shelter. Hence, one could argue for developing a more inviting and pleasant environment to prevent people from doubting that no buses are departing further along. Another aspect which adds to possible confusion at this point, which applied to one of the participants during wayfinding, is the narrow pavement as it gets smaller before ending completely. However, the decision about re-designing this surrounding is consistent with choosing to guide passengers to area C on this path or through Kennedy Arcade instead. By pointing people straight ahead to area C, the passenger flow of people passing area B on both sides will likely increase which opens another discussion if this flow is actually desirable as well as realizable in this environment. Including in this conversation would also be a crosswalk at the end of bus area B to safely switch the sides of the street which could however potentially disturb the flow of buses arriving or departing from area C. All these aspects need to be taken into consideration when both deciding to guide passengers pass bus area B to get to C as well as a consequence from re-designing this part of the area to give pedestrians the feeling that they are still on the right way to get to area C and are not approaching the end of the mobility hub.

Arriving at bus area C, the aspect of *closure* was earlier identified as a problem due to missing identification signs. However, as these signs had been put up again after conducting fieldwork, there will be no recommendation for this encountered complication. Nonetheless, a suggestion would be to place an identification sign at the corner between bus area B and C, as suggested in figure 7.4, to make it visible from further down that bus area C is located behind the shopping center and hence confirm passengers of the placement of bus area C while walking towards it. This should also be in accordance with the discussion of whether leading people around Kennedy Arcade or through it.



*Figure 7.4.* Added crosswalk and identification sign to bus area C. Own representation.

Moving inside the service center of NT, while there is a directional sign leading through the exit doors to area B, this signage is missing for the exit to area C. Nonetheless, one could argue that it is visible from the inside that the non-indexed exit at C leads to a bus area as well, but passengers might not be sure of the exact area and platforms before exiting the service center. Therefore, it is open for discussion if it is necessary to put up a sign, which is suggested in figure 7.5, or if rather another wayfinding tool could be useful, keeping in mind that the already high amount of screens and signs inside the service center would not be the perfect setting for simply adding another sign. Instead, tools such as nudging colored footsteps on the ground or similar might be more appropriate and easier to see on the first glance.



*Figure 7.5.* Added directional sign to bus area C. Own representation.

At the other end of Kennedy Arcade which exits almost directly to bus platform A4, some participants took a look at the overview map of Kennedy Arcade, thinking it might provide them with useful wayfinding information of the entire mobility hub. In connection with the passengers knowing that they are now *transitioning from the inside to the outside environment*, they searched for a map that might give them a heads up about what the surroundings will look like and to get an idea of where to go further without having to stop and orientate oneself immediately when leaving the building. While for this purpose a map next to the entrances might sound as an adequate idea, it needs to be considered that areas such as entrances and exits should always be kept free, not just for emergency purposes but also to keep up the natural peoples' flow. It is not a place to put up geosemiotics for which one would need to stop up and stand a few seconds or minutes to comprehend the information. Hence, the placement of such wayfinding tools needs to be considered carefully which leaves room for discussion if they would be even necessary at this critical point, also concerning the fact that at the exit of Kennedy Arcade, directional signs already show the way to specific bus terminals of A and B. Stepping outside of the shopping center and while looking around, the nearby bus stop to the right falls into sight as one of the first things. As the identification sign is missing due to the bus terminal being only temporarily set up, passengers who do not know the area cannot be sure of the number of this terminal. One could of course argue that due to the temporality of the placement a sign might not be profitable, however, a clear sign stating the number of the bus terminal is inevitable.

Moving further to the left and in direction of the intersection at John F. Kennedys Square, another recommendation would be to guide passengers across the pedestrian light to get to bus terminal A, as this was also part of *confusion* during wayfinding. The first option that might come to mind is another directional sign, however, as already mentioned, they are not always the best and clear solution. Instead, passengers could get nudged to cross the pedestrian light by following a line or footsteps on the ground. Considerable in this regard, when simply putting up a directional sign before the pedestrian light, and due to the narrow pavement, the placement of it can interrupt the passenger flows which always occur but especially during rush hours. For people that do not need the sign, it can therefore be seen as a disturbance and one should keep in mind that one convenience for others, e.g. by putting up a sign on the pavement, should not be an inconvenience to others. In other words, the various parties of people walking this way should be taken into consideration before deciding on a solution.

On the other side of the pedestrian light, the current construction for the upcoming BRT leaves room for discussion and suggestions as well. As it is visualized in figure 2.7 on page 10, the plan for this part of the area includes green zones. This could in regard to potentials facilitate spaces for *affording spare tactics* such as various small activity games, e.g. tic-tac-toe or hopscotch. Moreover, by establishing urban furniture, the mobility hub will increase its function as a meeting point as well as a destination in itself, which both have been identified as components of mobility hubs in subsection 2.1.1 on page 3. In doing so, the hub will be seen as an experience in itself and becomes more than a transit node. Inspiration for that can also be sought from airports as the basic idea is the same of giving passengers an extra layer by adding experiences, even though implemented on a different scale.

Furthermore, other suggestions to recognize the various segments of the bus areas more could be to color-code the mobility hub. In other words, each bus area would be connected to a color (e.g. bus area A is red, B is blue, and C is yellow) to easier distinguish between the areas. Architectural elements such as benches or bus shelters could be designed according to the specific color as well as other additional added design elements, though keeping in mind the overall guidelines in accordance with the vision of NT båndet. In connection with this idea, passengers could get nudged with colorful lines on the ground, according to the color-coded bus area, to the various bus terminals. To color-code areas and use this as an element to improve wayfinding is also mentioned by Gibson [Gibson, 2009]. Nonetheless, it is important to mention that each area and specific bus terminal will still be recognizable through geosemiotics as well. The colors should simply add another unobtrusive layer to the experience to increase the user-friendliness of Aalborg Station. Regarding the user-friendliness, while taking a look at the point-scale of the experience of bridging the time gap at Aalborg Station, most participants answered with a more neutral rating which is coherent to the rating of the wayfinding. This rating reveals that passengers think of the mobility hub as being useful and nice for their trip, but nothing more, it is simply a normal transit space for them. However, Aalborg Station could be more than that. By tapping the full potential of this mobility hub, this place could become a memorable interstation on a passenger's trip via Aalborg Station which is not only a means to an end but instead an outstanding place for shifting modes of transport. In doing so, passengers will positively remember their transit at Aalborg Station and the next time when they need to decide to either travel by car or public transport, they are more likely to choose the public transport option via Aalborg Station due to their great transit the last time they had been there. Besides, they are more likely to talk to their friends or family about their experience at the mobility hub and hence, might also convince others to take public transport instead of the car which increases the possibility of Aalborg Municipality to reach the sustainable goal of reducing car traffic as shortly introduced in chapter 1.

### **Rebranding of Aalborg Station**

In accordance with the gained knowledge and insight to the mobility hub of Aalborg Station, one can discuss if the name "Aalborg Station" is still suitable or if the place should be rebranded. Having the background knowledge that the entire area does not have one coherent designation, as it seems that the transport modes are more coincidentally coexisting next to one another, one can even discuss that it might not be a process of rebranding but instead branding the place for the first time. Depending on the person that got asked, the area got e.g. referred to as 'Kennedy' or 'Aalborg Station'. However, as names are creating pictures in one's mind, the integration of a mobility hub starts with a collective term for this area. This should be thought of to get people to understand that it is one connected area and not to be seen as separate places. In doing so, it should also be made clear which advantages this place as a mobility hub has for them by making sure to communicate all elements that identify Aalborg Station as a hub and not "just" as a node of transit. Moreover, part of the branding should focus on the aspect of using this mobility hub as a place to meet. Furthermore, the possibilities that differentiate a mobility hub from a transit node, such as cafés and shopping, should be communicated as well in order to let passengers transferring at Aalborg Station understand that there are various opportunities to spend their time waiting instead of simply staying at the platform.

This results in the suggestion of rebranding the area to *Aalborg Mobility Hub*. Besides, communicating the term Aalborg Mobility Hub to passengers, instead of the other different names, gives them also a feeling that everything is close by. Generally, a rebranding to a common name such as Aalborg Mobility Hub enhances the attractiveness of the place on various levels.



# Conclusion 8

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Referring back to the initially introduced quote from Lanng and Jensen, mobility hubs reflect a complex transfer node in the immediate daily life of people on the move [Lanng and Jensen, 2016]. Within the new mobilities turn and the background agenda for developing mobility hubs across North Jutland and Denmark, this master thesis investigated these multilayered networks within the CPC framework. Finally, this chapter will conclude on the findings and results that have been determined throughout the analysis and discussion to answer the in chapter 3 on page 13 stated research question:

*By applying the critical points of contact approach, also referred to as ‘life within networks’, how is the transfer between two public transports performed and experienced at the multimodal mobility hub at Aalborg Station area, and what improvements could be suggested?*

As the two natural parts of transferring at a mobility hub are finding the way to the next mode of transport as well as in most cases bridging the time gap until the next public transport arrives, the two subquestions which have earlier been answered, focused on these topics. More precisely, while wayfinding was the primary research focus in this study, the aspect of waiting time got added as another layer to complement the wayfinding and in doing so, the transferring wayfaring experience. Having answered these subquestions allow to answer the main research question where, as stated ut supra, the overall theoretical setting was the framework of critical points of contact with its division of the research up into five phases. In regard to the third instruction of making an analytical judgement, wayfinding and wayfaring unfolded both the physical performance as well as the psychological experience of finding the way. Lastly, theoretical considerations about bridging time and also steal it back during waiting have been included to illuminate the secondary research focus. These considerations led to an application of a mixed methods approach with the various qualitative and also quantitative methods complementing each other.

When investigating and analyzing the collected data, it became apparent that Aalborg Station, where a rebranding to *Aalborg Mobility Hub* should be considered, might not be the most critical place for wayfinding. However, as the CPC framework suggests, this thesis engaged with the multilayered systems at the hub before they collapse, in which context an understanding of how passengers find their way around and which wayfinding tools are applied got identified. All participants made use of geosemiotics to recognize where they are within the environment and to figure out where the destination of their wayfinding journey is located. In doing so, they built up a cognitive mapping of the environment and

additionally tried to intuitively made sense of the surroundings by e.g. considering that bus area C might be located close to bus area B. However, the research also showed how important the element of closure is during wayfinding as passengers are otherwise left with confusion and the hope of being at the right place. Moreover, the study also revealed that passengers rely on signs of all kinds when searching for the way and approach orientation signs, such as maps, immediately when being in doubt. In this context, it also became apparent that directions to all bus areas should be included on the signs, especially if areas such as C are hidden behind view-blocking buildings and hence are first visibly accessible when actually entering the bus area. This implies that urban layout matters in mobilities. Moreover, as there is currently construction going on at Aalborg Mobility Hub, it needs to be considered that wayfinding might be more difficult due to visual barriers and temporarily moved bus terminals. However, generally wayfinding at Aalborg Mobility Hub evoked a more 'neutral' feeling and was experienced as secure and comfortable with only short moments of confusion or a feeling of being lost. Kind of the same feelings got aroused when asking passengers about their waiting time during transfer between two modes of transport. Most answered that it is okay or fine to transfer here while others emphasized on feeling bored or perceiving the waiting time as too long. Besides, as it got identified in subsection 6.2.2, more than two third actually transferred at Aalborg Mobility Hub which indicated that this research is valuable to the stakeholders to understand the current transferring situation. Besides, it got identified that even though the hub leaves room for various opportunities what one can do during their waiting time, most people used their phone, messaged friends and family or listened to music. Only a small share made use of the shopping center and its options.

To sum it up, transferring at Aalborg Mobility Hub is experienced as neither unpleasant nor excellent. Hence, in order to develop further and increase the attractiveness of this hub and therefore using public transport, recommendations have been pointed out. These ideas range from practical suggestions with a creative touch such as nudging passengers with lines or footsteps on the ground to a destination to more creative ideas like color-coding the various bus areas to easier identify where the bus terminals are located. Additionally, the upcoming BRT needs to be taken into consideration as well and green areas can function as meeting places as well. Nonetheless, one of the most essential aspects is to rebrand the entire area of the hub to make people understand that all the facilities are not coincidentally located next to one another, but that the intention is to develop an area where people both have various public transport options as well as a place to meet and spend their leisure which is part of the definition of being a mobility hub. Pointing out the different possibilities one has at this mobility hub also improves the waiting time and in offering them an experience while bridging the time will not only increase satisfaction but also make time appear shorter. Hence, it will increase the likeliness of the passengers traveling via Aalborg Mobility Hub again and in doing so, strengthen public transport which not only the City of Aalborg is striving towards to make the city more sustainable but many other cities and regions not only in Denmark but around Europe as well. Thus, in improving Aalborg Mobility Hub and going the extra mile to enhance satisfaction and comfort, the city could also become a role model for other cities as the main concept can be copied and applied elsewhere.

Finally, it can be mentioned that transferring at Aalborg Mobility Hub is experienced as

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acceptable but can be considerably improved and developed further when keeping in mind that the hub should not only work as a place of transit and hence a means to an end but instead be an experience in itself. In doing so, the city is not only working towards its sustainable goals but can become representative for an attractive and user-friendly mobility hub.



# Reflections 9

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This final chapter of the thesis takes its point of departure within the focus point and identified outcomes completed on wayfinding and user experience at Aalborg Mobility Hub while being structured in three reflecting sections. First, the methods applied will get critically reviewed as well as considerations of limitations unfolded. Second, a brief reflection on Aalborg Mobility Hub as the investigated hub will be given, whereas third, this leaves room for further research that can be conducted based on the project's findings as only one piece of the puzzle could be investigated within the project's scope.

## 9.1 Reflecting upon methodology

Moving on to a brief reflection upon the methodology applied, its advantages and limitations, one can say that eye-tracking as the main method chosen depicts a suitable approach to gain insights into the visual attention paid by the participants to their surroundings as well as covers the attention paid to elements the participants themselves are not aware of recognizing. Thus, they unconsciously notice and look at certain details however might not recall it during a following-up interview which is why eye-tracking delivers valid real-time gaze data based on their subtle vision. This method of eye-tracking allows for an independently performed trip where the influences of the researcher are kept to a minimum while still being as deemed benefiting the study's purpose of investigating the 'life within networks'. Thus, an interactive approach of the researcher actively engaging with the participants on their journey, such as during the walk-and-talk, has been neglected for this study. However, the following behind the participants due to the wirelessly established signal between eye-tracking glasses and tablet might have caused a somewhat non-avoidable passive distraction, e.g. them turning around to the research group.

One of the most influential limitation of the method eye-tracking was related to the acquired gaze sample percentage on the video recordings. As already touched upon in subsection 5.6.2 on page 37, the retrieved gaze sample rate varies heavily throughout the completed fictional trips. Never reaching 100 percent (which might be utopian), the highest percentage achieved lies at 96% while the lowest gaze sample only reaches up to 3%. This range is arguably mainly evoked through the weather conditions prevailing during the fieldwork in March and April, ranging from sun to rain to snow. Thus, as this study was being conducted mostly in an outside environment, the extremely low gaze samples are caused by the sun disturbance making the reflection of the pupil's motion technically impossible to register. Beside this main reason, smaller influences that might have occurred unintentionally are due to regularly blinking with the eyes or squeezing them due to the

blinding sun. The squeezing could also be related to trying to look at some elements in the surrounding in case the participant may be slightly near- or far-sighted. Speaking of the different prerequisites of the ability to 'see', participants got chosen to not necessarily need to wear glasses to navigate in the environment due to not being compatible with eye-tracking glasses. In case of an elderly participating in this study (PB5), it became rather difficult to calibrate the eye-tracking glasses which was caused by just recently having recovered from an eye surgery which had an additional impact on the acquired data. Her gaze sample rate was accordingly low (5%). However, eye contacts proved to be no problem.

When it comes to the evaluation of the data by manually annotating the categories within the ELAN software, slight deviations might have occurred resulting in minor distortion of the outcomes. Due to this manual procedure of categorizing, even though the speed of the recording had been slowed down to visually grasp the gazing as precise as possible, it left room for the researcher to interpret the situation which needs to be taken into account. Fixations thereby have been mapped uncomplicatedly whereas for the other eye movements, e.g. saccades, it has been challenging to identify the accurate starting and stopping point of the participant's visual attention to specific objects. In this regard, it was possible to compensate the earlier missing gaze data samples with knowledge acquired through the complementing methods of think aloud and the follow-up interview. Further, male participants tended to keep their heads down and look at the ground which challenged the evaluation of their recordings as opposed to the video files completed by female participants looking attentively around in the environment. That being said, the identified categorization has been undertaken as carefully as possible and thus meets the purpose for this project where it functions as a general overview on the routes, the participants' performance, and their comparison.

In terms of participants wearing eye-tracking glasses, which might be a new experience for them in itself, this may have caused some distortion of natural behavior. Given that one knows that one is being recorded, this made some participants more self-conscious of what to look at, what not to look at, and behaving differently in the environment, thus, might have influenced their ordinary undertakings to a certain extent. Also, distracted by their new appearance in the environment and dealing with the situation, for example, participant PA7 looked at reflections in windows at Kennedy Arcade which mirrored his new and exciting look with the glasses. Even though the Tobii Pro Glasses 2 look similar to regular glasses, they appear a bit more clunky on the nose and might caused an unfamiliar feeling for both glasses wearers and non-glasses wearers.

Touching briefly upon the structured interviews on waiting time which have been conducted at the bus terminals and train platforms in the area, these spots have significantly influenced the answers of the people in the area. Depending on where they waited, their answers were related to the immediate surrounding. As it was concentrated on completing the interviews on public space, due to the privatization of Kennedy Arcade, people who might have waited inside the shopping center for their transport could not be considered in this research. The only possibility to reach this user group was when they by coincidence would have come across the entrances after leaving Kennedy Arcade. This however was not the case and also says something of the (non)likeliness of waiting inside. In general,

it was important to approach passengers with an open-mindset and respect their privacy, therefore an beforehand observation was necessary in assessing their gestures and body language towards being approachable or not. As it is an overall theme of mobility related studies at hubs, passengers only had little time to answer the questions as it was likely that their mode of transport arrived within the interview time. Surveys that could have not been completed due to this situation got abolished and instead re-done to ensure validity of the research. Due to this reason, actually more passengers than the resulting 35 have been interviewed, overall, the number of conducted interviews cannot be considered as representative, however, gives insights into the waiting time experiences.

In summarizing some methodological considerations, it needs to be mentioned that for the different investigations, the wayfinding and the waiting time, different individuals were part of the study, meaning that not a conclusive journey with people completing wayfinding and waiting time within a given time slot and journey has been examined which also comes with a limit to this study of having a discrepancy between a fictional shift performed (wayfinding) and a real life experience of actual passenger (waiting time). This is due to the complexity of time schedules of public transport and different infrastructural layouts which would have led to a relatively low comparability and even more staged investigation whereas the aim was also not specifically to explore only two routes within Aalborg Mobility Hub but instead to generate and delve deeper into the overall experience of the hub.

## 9.2 Reflecting upon Aalborg Station as a mobility hub

The many different definitions of a mobility hub, as explained in chapter 2 on page 3, entail being critical towards the chosen area Aalborg Station. The area meets the assumption that a suitable hub is more than just traveling from A to B, whereas an extra experience layer [Jensen, 2013] can be identified which is in this case e.g. Kennedy Arcade. In terms of wayfinding, directional signs to the diverse bus areas got integrated within Kennedy Arcade which was a conscious choice made by NT, as Martens stated. However, when comparing Aalborg Station as a mobility hub with the previously mentioned nodes established in other European countries, e.g. mobil.punkt, mobil.punktchen, and mobipunt, the researched area does not have a coherent design across the actors in the area as well as is not in line with identification markers placed at other mobility hubs within North Jutland and Denmark (yet). Thus, no hub sign is to be found at Aalborg Station. Further, administrative and regulative reasons of setting up signs in public street space is an additional concern, as outlined by Martens. He continued that it is anticipated to establish a marker but there is a need for discussing the circumstances. Besides not being officially referred to as 'hub', based on the missing marker, the area provides and fulfills however several qualities that allow to be defined as being a mobility hub as explained in section 2.2. Though, one significant feature that is missing at Aalborg Station, which played a major role in mobility hubs for the mentioned cases of mobil.punkt, mobil.punktchen, and mobipunt, is the lack of car sharing opportunities. Hence, bike sharing is the only representative of station-based shared mobility in this network, while the focus lies more within individual and public transport modes.

Speaking of network, Aalborg Municipality defines the area as being a network node, as earlier introduced in section 2.2, which is consistent with the fact that an additional

mode of transport, the BRT, is being established in the area. In connection with that establishment, the municipality is also working on creating a new urban space that invites people to linger in the area, which is also another aspect that NT is working on in their initiatives with hubs. This also leads up to the following section where suggestions made for researching further on Aalborg Station as a mobility hub are going to be explored.

### 9.3 Further research

A completed study never reaches its end but instead opens up new possibilities and perspectives for researching further. As an important part for future development of Aalborg Station as a mobility hub, this thesis revealed several anchor points as well as it provides inspiration for upcoming project suggestions based on considerations and findings outlined throughout this research. As this thesis consists of a primary and secondary research focus, the latter one being waiting time practices as natural parts of the transfer, an in-depth investigation only focusing on the waiting and thus in-between time is suggested. Based on a rather representative amount of passengers asked, thereby, it would be interesting to explore how they perceive the time spent and what could be possible affecting components of its erosion in relation to the different shifting times available. However, what is advocated by the research group, is a rather qualitative approach in order to understand and delve into the lives of the shifting passengers, their habits and lifestyle in form of ethnographic research as undertaken by Vannini at the ferry terminals [Vannini, 2012].

In addition to this possible elaboration on waiting time performed at Aalborg Station, the following suggestions are initially rather general considerations of the affiliation between urban design and mobilities whereas to grasp the different approaches more precisely, two main suggestions have been identified as valuable within the field of mobility research at Aalborg Station. It is thereby distinguished between a short-term suggestion concerning research that can be conducted in the near future while contributing a deeper understanding of what has been identified so far as well as a long-term suggestion which brings up the background agenda of mobility hubs and is more to be found in the experiential part of this project.

#### **Short-term suggestion: Changing multilayered complexity through BRT**

As a short-term suggestion based on this project, further research could concern the wayfinding practices between the remaining transport modes which have been put aside within this study due to the argued timetable dependency of public transport as well as the site-specific case being under construction. The latter thus justifies an updated and adjusted study in terms of the then newly introduced BRT in 2023 which will significantly change Aalborg Station as the current CPC by adding an additional layer of complexity to the wayfinding procedures and pedestrian flows within the hub, which got also mentioned by Martens. The infrastructural layout will visually and physically alter, including not only an above ground but also relevant underground connections between the transport modes as well as bus terminals might develop to being even more divided than it is the case nowadays. Therefore, it could be interesting to investigate how wayfinding will be performed at Aalborg Station after the restructuring with the BRT took place. Besides, the

supplementing mobility options available at Aalborg Station, referred to as individual or shared mobility modes could be taken into account for exploring the wayfinding procedures within slightly adapted research design. Since specifically shared mobility options are undeniably considered as belonging to the concept of mobility hubs, further research should encompass bike sharing options which would contribute to a broader understanding and insights at Aalborg Station. This however would call for an approach enclosing digital wayfinding as bike sharing stations are mapped and operated through an application by the company Donkey Republic [Donkey Republic, N.D.].

#### **Long-term suggestion: Aalborg Mobility Hub as a place**

In a long-term view, Aalborg Station as a mobility hub is aimed to be integrated in a coherent network of a variety of mobility hubs in North Jutland and also aims to meet the background vision and principles of mobility hubs derived from other inspirational countries, e.g. the Netherlands or Germany to be successfully implemented. Based on this agenda as well as multiple times touched upon in this thesis, mobility hubs represent more than simply being a transit space or space of connectivity but rather one of place making. Since this aspect of Aalborg Station being a place (or rather the debate of being a *space*, *place* [Cresswell, 2004] or *non-place* [Augé, 2004]) depicts a limitation of this study, the entire subject if and how Aalborg Station develops a *sense of place* [Massey, 1991] as well as how to manage the mobility hub as a place evolves in a further study delving in-depth into the previously outlined secondary focus of waiting time practices while touching upon mobility-related place theories such as the *Mobilising Place Management Approach* by Lassen and Laursen [Lassen and Laursen, 2004]. This would take the point of departure in the assumption of Aalborg Station being seen as a destination in itself, while it instead has been defined for this project as a mobility hub in the sense of continuing the journey further. This would add upon the experiential layer a mobility hub aims to provide but additionally expand its multimodality to a broader understanding of multifunctionality of facilities and placemaking approach.



# Bibliography

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- Aalborg Kommune, N.D.a.** Aalborg Kommune. *Knudepunkter*.  
[https://aalborgkommune.viewer.dkplan.niras.dk/plan/18?fbclid=IwAR0uhxkVV3GyNDcfqDlfoL-IvgD8Vq0cinppq90ym\\_D-oZb\\_w9xXjRgVUoQ#/89793](https://aalborgkommune.viewer.dkplan.niras.dk/plan/18?fbclid=IwAR0uhxkVV3GyNDcfqDlfoL-IvgD8Vq0cinppq90ym_D-oZb_w9xXjRgVUoQ#/89793),  
N.D.a. Visited: 26-03-2022.
- Aalborg Kommune, 2020.** Aalborg Kommune. *Lokalplan 1-1-137, John F. Kennedys Plads, Aalborg Midtby*.  
[https://dokument.plandata.dk/20\\_9532029\\_1599131994275.pdf](https://dokument.plandata.dk/20_9532029_1599131994275.pdf), 2020. Visited:  
31-03-2022.
- Aalborg Kommune, N.D.b.** Aalborg Kommune. *Midtbyen*.  
<https://plusbus.dk/midtbyen/>, N.D.b. Visited: 19-03-2022.
- Aalborg Kommune, N.D.c.** Aalborg Kommune. *Midtbyen*.  
<https://plusbus.dk/linjefoering/>, N.D.c. Visited: 19-03-2022.
- Aalborg Kommune, N.D.d.** Aalborg Kommune. *Planer for mobilitetsudvikling*.  
<https://www.aalborg.dk/politik/strategier-og-politikker/planer-for-mobilitetsudvikling>, N.D.d. Visited: 26-03-2022.
- Aalborg Kommune, N.D.e.** Aalborg Kommune. *Lej et el-løbehjul*.  
<https://www.aalborg.dk/trafik-og-transport/trafik/lej-et-el-loebehjul>,  
N.D.e. Visited: 19-03-2022.
- An et al., 2019.** Dadi An, Junnan Ye and Wei Ding. *HCI in Mobility, Transport, and Automotive Systems*. Chapter: Spatial Features and Elements Affecting Indoor Wayfinding - A Case Study in a Transit Hub. Editor: Heidi Krömker. ISBN: 978-3-030-22666-4. Springer, 2019.
- Aono, 2019.** Saki Aono. *Identifying Best Practices for Mobility Hubs*.  
[https://sustain.ubc.ca/sites/default/files/Sustainability%20Scholars/2018\\_Sustainability\\_Scholars/Reports/2018-71%20Identifying%20Best%20Practices%20for%20Mobility%20Hubs\\_Aono.pdf](https://sustain.ubc.ca/sites/default/files/Sustainability%20Scholars/2018_Sustainability_Scholars/Reports/2018-71%20Identifying%20Best%20Practices%20for%20Mobility%20Hubs_Aono.pdf), 2019. Visited: 24-03-2022.
- ArcGIS, 2022.** ArcGIS. *OpenStreetMap*. Geografisk InformationsSystem, 2022.
- Augé, 2004.** Marc Augé. *Non-Places: An Introduction to Supermodernity*. ISBN: 1-85984-956-3. Verso, 2004.
- Barnes, 2008.** Trevor J. Barnes. *American pragmatism: Towards a geographical introduction*. *Geoforum* 39, pages p. 1542–1554, 2008.
- Bissell, 2007.** David Bissell. *Animating Suspension: Waiting for Mobilities*. *Mobilities*, Vol. 2 Issue 2, p. 277–298, 2007.

- Bissell, 2018.** David Bissell. *Transit Life - How Commuting Is Transforming Our Cities*. ISBN: 9780262037563. Massachusetts Institute of Technology, 2018.
- Brinkmann, 2013.** Svend Brinkmann. *Kvalitativ udforskning af hverdagslivet*. ISBN: 9788741256634. Reitzels Forlag, 2013.
- Bueno, 2021.** Andrea Victoria Hernandez Bueno. *Becoming a passenger: Airport design and situational passenger experiences in Copenhagen Airport*. *Mobilities*, Vol. 16 Issue 3, 440–459, 2021.
- By og Landskabsforvaltningen, 2019.** By og Landskabsforvaltningen. *Mobilitet 2040*. Aalborg Kommune, 2019.
- Byrne, 2001.** Michelle M. Byrne. *Understanding life experiences through a phenomenological approach to research*. *AORN Journal*, Vol. 73 No. 4, p. 830–832, 2001.
- Carter and Luke, 2020.** Benjamin T. Carter and Steven G Luke. *Best practices in eye tracking research*. *International Journal of Psychophysiology*, Vol. 155, 49–62, 2020.
- Castells, 1996.** Manuel Castells. *The Rise of the Network Society*. ISBN: 1557866163. Blackwell Publishers, 1996.
- CF Møller Architects, 2020.** CF Møller Architects. *NT Båndet*. <https://ipaper.ipapercms.dk/NordjyllandsTrafikselskab/knudepunkter/koncept-for-store-knudepunkter/?page=1>, 2020. Visited: 22-03-2022.
- Chrastil et al., 2017.** Elizabeth R. Chrastil, Katherine R. Sherril, Irem Ascelcioglu, Micheal E. Hasselmo and Chantal E. Stern. *Individual Differences in Human Path Integration Abilities Correlate with Gray Matter Volume in Retrosplenial Cortex, Hippocampus, and Medial Prefrontal Cortex*. *eNeuro*, Vol. 4 No. 2, p. 1–14, 2017.
- Christensen, 2020.** Cecilie Breinholt Christensen. *Moving Underground Understanding Mobile Situations in the Copenhagen Metro*, Aalborg University Press, 2020.
- Cresswell, 2004.** Tim Cresswell. *Place a short introduction*. ISBN: 978-1-4051-0672-6. Blackwell Publishing, 2004.
- Cresswell, 2006.** Tim Cresswell. *On The Move: Mobility in the Modern Western World*. ISBN: 9780415952569. Routledge, 2006.
- de Certeau, 1984.** Michel de Certeau. *The Practice of Everyday Life*. ISBN: 0-520-23699-8. University of California Press, 1984.
- DiCicco-Bloom and Crabtree, 2006.** Barbara DiCicco-Bloom and Benjamin F. Crabtree. *The qualitative research interview*. *Medical Education*, pages p. 314–321, 2006.
- Dogu and Erkip, 2000.** Ufuk Dogu and Feyzan Erkip. *Spatial Factors Affecting Wayfinding and Orientation: A Case Study in a Shopping Mall*. *Environment and Behavior*, Vol. 32 No. 6, p. 731–755, 2000.

- Donkey Republic, N.D.** Donkey Republic. *Lej en cykel i Aalborg*.  
<https://www.donkey.bike/da/byer/cykeludlejning-aalborg/>, N.D. Visited:  
19-03-2022.
- DSB, N.D.a.** DSB. *Vores formål: Plads til alle på rejsen mod det bæredygtige*.  
<https://www.dsb.dk/om-dsb/virksomheden/>, N.D.a. Visited: 26-03-2022.
- DSB, N.D.b.** DSB. *Tog*. <https://www.dsb.dk/globalassets/pdf/trafikinformation/21x21-dsb-linjekort-k22.pdf>, N.D.b. Visited: 26-03-2022.
- Duchowski, 2007.** Andrew Duchowski. *Eye Tracking Methodology*. ISBN:  
978-1-84628-608-7. Springer, 2007.
- Emo, 2012.** Beatrix Emo. *Spatial Cognition VIII*. Chapter: Wayfinding in Real Cities: Experiments at Street Corners. Editor: Cyrill Stachniss and Kerstin Schill and David Uttal. ISBN: 978-3-642-32731-5. Springer, 2012.
- Engel-Yan and Leonard, 2012.** Joshua Engel-Yan and Amanda Leonard. *Mobility Hub Guidelines: Tools for Achieving Successful Station Areas*. ITE Journal, pages p. 42–47, 2012.
- Farr et al., 2012.** Anna Charisse Farr, Tristan Kleinschmidt, Prasad Yarlagadda and Kerrie Mengersen. *Wayfinding: A simple concept, a complex process*. Transport Reviews, Vol. 32 No. 6, p. 715–743, 2012.
- Feilzer, 2009.** Martina Yvonne Feilzer. *Doing Mixed Methods Research Pragmatically: Implications for the Rediscovery of Pragmatism as a Research Paradigm*. Journal of Mixed Methods Research, pages p. 6–16, 2009.
- Fian and Hauger, 2020.** Tabea Fian and George Hauger. *The Human, the Built Environment and the Technology: Identifying Key Configurations for a User-Friendly Wayfinding System at Transport Hubs*. IOP Conf. Series: Materials Science and Engineering 960, pages p. 1–9, 2020.
- Frank et al., 2021.** Laura Frank, Nicolas Dirks and Grit Walther. *Improving rural accessibility by locating multimodal mobility hubs*. Journal of Transport Geography, Vol. 94, p. 1–12, 2021.
- Gibson, 2009.** David Gibson. *The Wayfinding Handbook Information Design For Public Spaces*. ISBN: 978-1-56898-769-9. Princeton Architectural Press, 2009.
- Gibson, 2015.** James J. Gibson. *The ecological approach to visual perception*. ISBN: 9781315740218. Psychology Press, 2015.
- Glottz-Richter, 2016.** Michael Glottz-Richter. *Reclaim street space! - exploit the European potential of car sharing*. Transportation Research Procedia, Vol. 14, p. 1296–1304, 2016.
- Gnaneswar, 2021.** Villuri Gnaneswar. *Iris Movement and Eye Gaze Tracking*. International Journal of Scientific Engineering Research, Vol. 12 Issue 4, p. 1224–1233, 2021.

- Hannam et al., 2006.** Kevin Hannam, Mimi Sheller and John Urry. *Editorial: Mobilities, Immobilities and Moorings*. *Mobilities*, Vol. 1 No. 1, p. 1–22, 2006.
- Ingold, 2000.** Tim Ingold. *The Perception of the Environment. Essays on Livelihood, Dwelling and Skill*. ISBN: 9780203466025. Routledge, 2000.
- Jamshed, 2014.** Shazia Jamshed. *Qualitative research method-interviewing and observation*. *Journal of Basic and Clinical Pharmacy*, Vol. 5 Issue 4, p. 87–88, 2014.
- Jensen, 2015.** Ole B. Jensen. *Introduction*. Chapter: Introduction. Editor: Ole B. Jensen. ISBN: 9781138021198. Routledge, 2015.
- Jensen, 2013.** Ole B. Jensen. *Staging Mobilities*. ISBN: 978-0-203-07006-2. Routledge, 2013.
- Jensen and Morelli, 2011.** Ole B. Jensen and Nicola Morelli. *Critical Points of Contact - Exploring networked relations in urban mobility and service design*. *Danish Journal of Geoinformatics and Land Management*, Journal 46/2011, p. 36–49, 2011.
- Jonuschat et al., 2015.** Helga Jonuschat, Korinna Stephan and Marc Schelewsky. *Sustainable Urban Transport Volume 7*. Chapter: Understanding Multimodal and Intermodal Mobility. Editor: Maria Attard and Yoram Shiftan. ISBN: 978-1-78441-615-7. Edward Elgar Publishing Limited, 2015.
- Kennedy Arkaden, N.D.a.** Kennedy Arkaden. *Centeroversigt*. <https://kennedyarkaden.dk/>, N.D.a. Visited: 27-03-2022.
- Kennedy Arkaden, N.D.b.** Kennedy Arkaden. *Om arkaden - Kennedy Arkaden er for alle*. <https://kennedyarkaden.dk/om-os/>, N.D.b. Visited: 31-03-2022.
- Kennedy Arkaden, N.D.c.** Kennedy Arkaden. *Aalborg får et nyt, moderne privathospital*. <https://kennedyarkaden.dk/aalborg-far-et-nyt-moderne-privathospital/>, N.D.c. Visited: 31-03-2022.
- Kidmose and Kamp, 2020.** Line Lund Kidmose and Anine Kamp. *Knudepunkter kæder mobilitetsformer sammen*. *Trafik & Veje*, pages p. 4–6, 2020.
- Kiefer et al., 2012.** Peter Kiefer, Florian Straub and Martin Raubal. *Location-Aware Mobile Eye Tracking for the Explanation of Wayfinding Behavior*, Institute of Cartography and Geoinformation, 2012.
- Kollektivtrafik, 2020.** Kollektivtrafik. *Samkørselstjeneste og mobilitetsselskab vil samarbejde i Nordjylland*. <https://www.kollektivtrafik.dk/samkoerselstjeneste-og-mobilitetsselskab-vil-samarbejde-i-nordjylland/1338>, 2020. Visited: 26-03-2022.
- Koutstaal, 2013.** Wilma Koutstaal. *The Agile Mind*. ISBN: 9780195367188. Oxford University Press, 2013.
- Kvale and Brinkmann, 2009.** Steinar Kvale and Svend Brinkmann. *Interviews - Learning the Craft of Qualitative Research Interviewing*. ISBN: 978-0-7619-2541-5. Sage Publications, 2009.

- Lambert and Loiselle, 2008.** Sylvie D. Lambert and Carmen G. Loiselle. *Combining individual interviews and focus groups to enhance data richness*. Journal of Advanced Nursing, 62, pages p. 228–237, 2008.
- Lanng and Jensen, 2016.** Ditte Bendix Lanng and Ole B. Jensen. *Community Wayfinding: Pathways to Understanding*. Chapter: Linking wayfinding and wayfaring. Editor: Rebecca H. Hunter and Lynda A. Anderson and Basia L. Belza. ISBN: 978-3-319-31072-5. Routledge, 2016.
- Lanng and Olesen, 2020.** Ditte Bendix Lanng and Mette Olesen. *En ny generation af knudepunkter uden for storbyerne*. Byplan Nyt 3, pages p. 36–37, 2020.
- Larsen, 2020.** Gunvor Riber Larsen. *Handbook of research methods and applications for mobilities*. Chapter: Applying multiple and multi-scalar methods to mobilities hub research. Editor: Monika Büscher and Malene Freudendal-Pedersen and Sven Kesselring and Nikolaj Grauslund Kristensen. ISBN: 978-1-78811-545-2. Edward Elgar Publishing Limited, 2020.
- Lassen and Laursen, 2004.** Claus Lassen and Lea Holst Laursen. *Mobilising Place Management*. ISBN: 978-0-367-18891-7. Routledge, 2004.
- Latour, 2005.** Bruno Latour. *Reassembling the Social*. ISBN: 9780199256051. Routledge, 2005.
- Loomis et al., 1999.** Jack M. Loomis, Roberta L. Klatzky, Reginald G. Golledge and John W. Philbeck. *Wayfinding Behavior: Cognitive Mapping and Other Spatial Processes*. Chapter: Human Navigation by Path Integration. Editor: Reginald G. Golledge. ISBN: 0-8018-59993-x. The John Hopkins University Press. Editor: Reginald G. Golledge, 1999.
- Lynch, 1960.** Kevin Lynch. *The Image of the City*. ISBN: 0-262-62001-4. The M.I.T. Press, 1960.
- Marling, N.D.** Gitte Marling. *Fænomenologi byanalyser*. <https://www.byplanlab.dk/sites/default/files/Faenomenologsheet281210.pdf?0.5700555501971394>, N.D. Visited: 11-04-2022.
- Massey, 1991.** Doreen Massey. *A global sense of place*. Marxism Today, Vol. 38, 24–29, 1991.
- Matthijs and Meulemann, 2017.** Jeffery Matthijs and Angelo Meulemann. *New concept in Flanders "Mobihubs"*. <https://share-north.eu/2017/09/new-concept-in-flanders-mobihubs/>, 2017. Visited: 20-03-2022.
- Matthys and Meuleman, N.D.** Jeffrey Matthys and Angelo Meuleman. *Presentation: "Mobihubs in Flanders"*. <https://northsearegion.eu/media/3329/mobipunt-english.pdf>, N.D. Visited: 24-03-2022.

- Metrolinx, 2011.** Metrolinx. *Mobility Hub Guidelines - For the Greater Toronto and Hamilton Area*. [https://www.metrolinx.com/en/docs/pdf/board\\_agenda/20110218/MobilityHubGuidelines\\_optimized.pdf](https://www.metrolinx.com/en/docs/pdf/board_agenda/20110218/MobilityHubGuidelines_optimized.pdf), 2011. Visited: 25-03-2022.
- Mobil.punkt, N.D.** Mobil.punkt. *Identifying Best Practices for Mobility Hubs*. <https://mobilpunkt-bremen.de/mobil-punkte/>, N.D. Visited: 20-03-2022.
- Montello and Sas, 2006.** Daniel R. Montello and Corina Sas. *Human factors of Wayfinding in Navigation*. <https://eprints.lancs.ac.uk/id/eprint/42335/1/MontelloSas.pdf>, 2006. Visited: 09-03-2022.
- Noland et al., 2017.** Robert B. Noland, Marc D. Weiner, Dong Gao, Michael P. Cook and Anton Nelessen. *Eye-tracking technology, visual preference surveys, and urban design: preliminary evidence of an effective methodology*. *Journal of Urbanism: International Research on Placemaking and Urban Sustainability*, Vol. 10, 98–110, 2017.
- Nordjyllands Trafikselskab, 2020.** Nordjyllands Trafikselskab. *Nyt samarbejde mellem NT og Voi giver øget mobilitet i Aalborg*. [https://www.nordjyllandstrafikselskab.dk/media/presse/pressemeddelelse\\_\\_\\_voi\\_og\\_nt\\_samarbejde\\_1.0.pdf](https://www.nordjyllandstrafikselskab.dk/media/presse/pressemeddelelse___voi_og_nt_samarbejde_1.0.pdf), 2020. Visited: 26-03-2022.
- Nordjyllands Trafikselskab, N.D.** Nordjyllands Trafikselskab. *Om NT*. <https://www.nordjyllandstrafikselskab.dk/Om-NT>, N.D. Visited: 26-03-2022.
- Nordjyske Jernbaner, N.D.** Nordjyske Jernbaner. *Om Nordjyske Jernbaner*. <https://nj.dk/om-os/om-nordjyske-jernbaner/>, N.D. Visited: 27-03-2022.
- NT1819Aalborg, 2019.** NT1819Aalborg. *Oversigtskort for Aalborg Busterminal med busstop (2018) Nordjyllands Trafikselskab*. [https://issuu.com/nt1819aalborg/docs/aalborg\\_busterminal2018](https://issuu.com/nt1819aalborg/docs/aalborg_busterminal2018), 2019. Visited: 02-04-2022.
- Passini, 1984.** Romedi Passini. *Wayfinding in Architecture*. ISBN: 0-442-27590-0. Van Nostrand Reinhold Company Inc., 1984.
- Qutoshi, 2018.** Sadruddin Bahadur Qutoshi. *Phenomenology: A Philosophy and Method of Inquiry*. *Journal of Education and Educational Development*, Vol. 5 No. 1, p. 215–222, 2018.
- Ramboll, N.D.** Ramboll. *SurveyXact by Ramboll*. <https://www.surveyxact.dk/>, N.D. Visited: 19-04-2022.
- Rubin and Rubin, 2005.** Herbert J. Rubin and Irene S. Rubin. *Qualitative Interviewing: The Art of Hearing Data*. ISBN: 9781452226651. Sage Publications, 2005.
- Rytter and Olwig, 2018.** Mikkel Rytter and Karen Fog Olwig. *Antropologiske Projekter - En Grundbog*. Chapter: At snakke om det: Måder at interviewe på. Editor: Helle Bundgaard and Hanne Overgaard Mogensen and Cecilie Rubow. ISBN: 978-87-593-3045-6. Samfundslitteratur, 2018.

- Schreiner et al., 2018.** Hannes Schreiner, Claus Grimm, Uta Kurz, Dr. Bodo Schwieger, Stephanie Kefler and Dr. Guido Möser. *Analysis of the impacts of car-sharing in Bremen, Germany*. [https://share-north.eu/wp-content/uploads/2018/08/Analysis-of-the-Impact-of-Car-Sharing-in-Bremen-2018\\_Team-Red\\_Final-Report\\_English\\_compressed.pdf](https://share-north.eu/wp-content/uploads/2018/08/Analysis-of-the-Impact-of-Car-Sharing-in-Bremen-2018_Team-Red_Final-Report_English_compressed.pdf), 2018. Visited: 24-03-2022.
- Schwering et al., 2017.** Angela Schwering, Jakub Krukar, Rui Li, Vanessa Joy Anacta and Stefan Fuest. *Wayfinding Through Orientation*. *Spatial Cognition & Computation*, Vol. 17 No. 4, p. 273–303, 2017.
- Scollon and Scollon, 2003.** Ron Scollon and Suzie Wong Scollon. *Discourses in place*. ISBN: 0-203-42272-4. Thomson Learning, 2003.
- Seidman, 1998.** Irving Seidman. *Interviewing as Qualitative Research*. ISBN: 0-8077-3697-X. Teachers College Press, 1998.
- Sheller and Urry, 2006.** Mimi Sheller and John Urry. *The new mobilities paradigm*. *Environment and Planning A*, Vol. 38, p. 207–226, 2006.
- Silva et al., 2019.** Elisa Diogo Silva, Ditte Bendix Lanng and Simon Wind. *Material Mobilities*. Chapter: Mapping unknown knowns of transit infrastructures. Editor: Ole B. Jensen and Claus Lassen and Ida Sofie Gøtzsche Lange. ISBN: 9780367726676. Routledge, 2019.
- Skråfoto, 2021.** Skråfoto. *SDFE Skråfoto*. <https://skraafoto.kortforsyningen.dk/oblivisionjssoff/index.aspx?project=denmark&id=BRFIKF>, 2021. Visited: 27-03-2022.
- Strava, 2022.** Strava. *The #1 app for runners and cyclists*. <https://www.strava.com/>, 2022. Visited: 02-04-2022.
- The Language Archive, N.D.** The Language Archive. *ELAN*. <https://archive.mpi.nl/tla/elan>, N.D. Visited: 03-04-2022.
- Tobii Pro, 2021.** Tobii Pro. *How do Tobii Eye Trackers work?* <https://www.tobii.com/learn-and-support/learn/eye-tracking-essentials/how-do-tobii-eye-trackers-work/>, 2021. Visited: 03-04-2022.
- Tobii Pro, N.D.a.** Tobii Pro. *Combining think aloud methods and eye tracking in usability tests*. <https://www.tobii.com/learn-and-support/learn/steps-in-an-eye-tracking-study/design/combining-the-think-aloud-method-and-eye-tracking/>, N.D.a. Visited: 02-04-2022.
- Tobii Pro, N.D.b.** Tobii Pro. *Tobii Pro Glasses 2*. <https://www.tobii.com/product-listing/tobii-pro-glasses-2/>, N.D.b. Visited: 22-05-2022.
- van der Hoeven and van Nes, 2014.** Frank van der Hoeven and Akkelies van Nes. *Improving the design of urban underground space in metro stations using the space syntax methodology*. *Tunneling and Underground Space Technology*, Vol. 40, p. 64–74, 2014.

- Vandenberg, 2016.** Ann E. Vandenberg. *Community Wayfinding: Pathways to Understanding*. Chapter: Human Wayfinding: Integration of Mind and Body. Editor: Rebecca H. Hunter and Lynda A. Anderson and Basia L. Belza. ISBN: 978-3-319-31072-5. Springer Cham, 2016.
- Vannini, 2012.** Phillip Vannini. *Ferry tales*. ISBN: 9780415883078. Routledge, 2012.
- VRGame, N.D.** VRGame. *Oplev Virtual Reality i Aalborg*. <https://vrgame.dk/>, N.D. Visited: 29-03-2022.
- Wee and Banister, 2016.** Bert Van Wee and David Banister. *How to Write a Literature Review Paper?* Transport Reviews, Vol. 36 No. 2, 278–288, 2016.
- Weisman, 1981.** Jerry Weisman. *Evaluating Architectural Legibility: Way-Finding in the Built Environment*. Environment and Behavior, Vol. 13 No. 2, p. 189–204, 1981.
- Wilson, 2016.** Virginia Wilson. *Research Methods: Interviews*. Evidence Based Library and Information Practice 2016, Vol. 11 No. 1, p. 47–49, 2016.

# Interview guide of expert interview with NT



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Questions for the expert interview with Kristoffer Martens from Nordjyllands Trafikselskab.

## **Theme 1) Framing**

1. Can you please introduce yourself and your work with nodes?
2. How do you understand nodes and what is their purpose? What makes it a node and not “just” another bus stop?
3. What is your understanding of a mobility hub and what is the purpose of it?
4. Which specific guidelines are you following within the work with mobility hubs at Aalborg Station?
5. Where do you see a difference between a mobility hub and a transport hub/node?
6. How is the development in Denmark proceeding with mobility hubs? Where does Denmark take inspiration from?
7. What role does Kennedy Arcade play within the hub?
8. What role will the new BRT play within the hub?

## **Theme 2) Mobility hub sign (How do you work with branding?)**

1. Can you please elaborate on the purpose of the newly introduced mobilities sign a bit?
2. Why is there no mobility hub sign visible at Aalborg Station?
3. Would it make a better understanding for people if a sign is placed there?
4. Do you see Aalborg Station as a mobility hub in your work with mobility hubs even though there is currently no sign established?

## **Theme 3) Wayfinding**

1. Did you experience any problems with customers/users regarding wayfinding in the area at Kennedy Arcade?
2. What role does wayfinding play within mobility hubs? What does this mean for Aalborg Station?

## **Theme 4) Waiting Time**

1. Do you have any information on what passengers do while waiting for their transport?
2. How do you envision users to experience Aalborg Station as a hub while waiting for their transport?
3. Do you nudge them to do something specific or stay somewhere specific?

## **Theme 5) Future Development/Goal with implementing mobility hubs**

1. What are your plans for developing Aalborg Station towards a mobility hub in the near future? How can it evolve further as a mobility hub?

# Follow-up interviews

# B

Participant number: \_\_\_\_\_

## Interview participants

Route A (train to bus)

Route B (shopping mall)

Age: \_\_\_\_\_ Gender: \_\_\_\_\_ Nationality: \_\_\_\_\_

1. Are you familiar with the area around Aalborg Station?

- Yes  
 No  
 A little bit/to a certain extent

2. On a scale from 1 to 10 (1 - inconvenient; 10 - convenient), how would you rate your wayfinding journey?

1    2    3    4    5    6    7    8    9    10

3. How would you describe your experience about finding your way from ... to ...?  
Please elaborate.

\_\_\_\_\_

4. What helped you to find your destination, e.g. signages, people, environment?

\_\_\_\_\_

5. How did you feel while walking through the area, e.g. (un)comfortable, (un)safe, etc.?

\_\_\_\_\_

6. Did you encounter any problems or confusing situations that stood out to you?  
Please elaborate.

\_\_\_\_\_

7. Was there a situation where you would have needed more guidance/information?  
Please elaborate.

\_\_\_\_\_

8. Do you have some ideas or wishes to improve the wayfinding in the area? Please elaborate.

\_\_\_\_\_







# Consent form

# D

Participant number: \_\_\_\_\_

## Consent to take part in research at Aalborg Station

I, \_\_\_\_\_, hereby voluntarily agree to participate in this research study.  
Full name

- I understand that participation involves wearing eye-tracking glasses, which will visually register my eyes' movements and focus points within the environment, including an audio recording and transcription thereof.
- I understand that this research is followed up by a short interview on my experiences when accomplishing the task and that extracts from this interview may be quoted in the master thesis from the student group.
- I understand that all information I provide for this study will be treated confidentially and my identity will remain anonymously according to GDPR procedures.
- I understand that I will not benefit directly from participating in this research.
- I have had the purpose and nature of the study explained to me and I have had the opportunity to ask questions about the study.
- I understand that I am free to contact any of the people involved in the research to seek further clarification and information.
  - Contact information:
    - Lara Posingis, [lposin20@student.aau.dk](mailto:lposin20@student.aau.dk)
    - Finja Heinisch, [fheini20@student.aau.dk](mailto:fheini20@student.aau.dk)
    - Laura Vangsgaard Jensen, [lvje17@student.aau.dk](mailto:lvje17@student.aau.dk)
- I understand that even if I agree to participate now, I can withdraw at any time or refuse to answer any question without any consequences of any kind.
- I understand that I can withdraw permission to use data from my eye-tracking recording within two weeks after the interview, in which case the material will be deleted immediately. In this case, an email should be send to [lposin20@student.aau.dk](mailto:lposin20@student.aau.dk)
- The recorded data will be deleted after 1st of July 2022.

By signing this consent form, I agree to the above terms.

*Signature of research participant*

*Signature of researcher*

\_\_\_\_\_  
Signature of participant, Date

\_\_\_\_\_  
Signature of researcher, Date



# Mobile situations at Aalborg Station

# E



*Figure E.1.* Combined bicycle lane and sidewalk due to the construction at area A. Own representation.



*Figure E.2.* A bicycle biking on the sidewalk at area A. Own representation.



*Figure E.3.* Passengers waiting at the sidewalk in area B. Own representation.



*Figure E.4.* The secured bicycle parking and normal parking at area B. Own representation.



*Figure E.5.* People waiting on the stairs between the train and bus area B behind the bike parking. Own representation.



*Figure E.6.* Signs in front of the entrance to the train station pointing straight for buses. Own representation.



*Figure E.7.* Signs above the stairs pointing for buses down to the underpass at the train station. Own representation.



*Figure E.8.* Bikes parked in front of the directional sign at the train station obscuring its visibility. Own representation.



*Figure E.9.* Directional sign inside Kennedy Arcade pointing to area A, B and C as well as the train and service center. Own representation.



*Figure E.10.* Directional sign inside Kennedy Arcade pointing to area B and area C going through a store. Own representation.



*Figure E.11.* Identification signs at the bus terminals in area C had been put down. Own representation.



*Figure E.12.* Information screen at area B looking north. There is information at both sides of the signs. Own representation.



# Permissions for eye-tracking application

# F

## Aalborg Municipality



ma 21-03, 10:45

Laura Vangsgaard Jensen; Finja Martha Lina Heinisch; Lara Alexandra Claudia Posingis ↕

↻ Svar til alle | v

Indbakke

Du svarede den 21-03-2022 10:46.

Hej med jer.

Sikke et spændende projekt.

Jamen drejer det sig vel bare om at vi giver jer accept til at i må benytte Aalborg Kommunes arealer, og det må i gerne.

Venlig hilsen

Teknisk designer  
Tlf. [redacted]

## Nordjyllands Trafikselskab (NT)

Nordjyllands Trafikselskab · [REDACTED]

ti 22-03-2022 12:52

Til: Laura Vangsgaard Jensen <lvje17@student.aau.dk>;

Kære Finja, Lara og Laura

Tak for jeres henvendelse af 18-03-2022.

På baggrund af de foreliggende oplysninger vurderer NT, at I som studerende og/eller AAU selv vil være dataansvarlige, fordi behandlingen foretages til Jeres formål og med hjælpemidler som I selv fastsætter. Deraf følger også den konklusion, at NT ikke er dataansvarlig.

Angående optagelse på offentligt tilgængeligt område, skal vi henlede Jeres opmærksomhed på, at det vil være op til Jer og/eller AAU at vurdere, om optagelserne har karakter af tv-overvågning efter tv-overvågningslovens § 1, stk. 1, hvorefter private ikke må foretage tv-overvågning af vej, plads eller lignende område, som benyttes til almindelige færdsel. Samtidig skal I også selv foretage en vurdering af, hvorvidt TV-overvågningen skal registreres hos politiets POLICAM, og hvad der ellers skal overholdes af lovgivning i denne sammenhæng.

### Kender du NT's produkter?

El-løbehjul kan medbringes gratis, hvis det kan slås sammen og opbevares i en taske/pose

Du kan læse mere om el-løbehjul [her](#)

Med venlig hilsen / Best regards



Nordjyllands Trafikselskab  
John F. Kennedys Plads 1T, 3. Sal  
9000 Aalborg

*E-mails til NT må ikke indeholde persondata. Persondata er oplysninger, som kan identificere dig som person. For yderligere information [se NTs privatlivspolitik](#).*

---

## Kennedy Arcade



to 24-03, 11:24

Laura Vangsgaard Jensen; Lara Alexandra Claudia Posingis; +3 flere

Svar til alle | v

Indbakke

Du svarede den 29-03-2022 10:21.

Hej Laura

Jeg kan give tilladelse til at I benytter de skitserede briller/teknologi inde i Kennedy Arkaden – men der må alene ”filmes” i centergangene og ikke inde i butikker eller butiksfacader, da dette vil kræve særlige tilladelser fra de enkelte butikker.

Jeg ved ikke om det er tanken, at den interne wayfinding i centret skal bruges til formålet – vi har digitale skærme ved 3 af de 4 indgangspartier – men dette kan selvfølgelig også godkendes i givet fald.

Hvis der er resultater/”learnings”/konklusioner der kan være interessante for os som centerejere/udlejere i forhold til vores egen wayfinding mv. og/eller skiltningen i og omkring centret i almindelighed, så hører vi selvfølgelig gerne om disse resultater efterfølgende i det omfang det er OK i forhold til GDPR regler mv.

Vi skal vide på hvilke dage/tidspunkter i gerne vil gennemføre jeres test, således at vores daglige driftsleder og vores vagter er instrueret omkring dette og de tilladelser der er givet. Vil I vende tilbage omkring dette.

God dag 😊

Med venlig hilsen / Kind regards

Fund Manager



Bomhusvej 13, 1  
2100 Copenhagen Ø T +45 70 10 00 75  
Denmark W [Fokusasset.dk](http://Fokusasset.dk)

## DSB

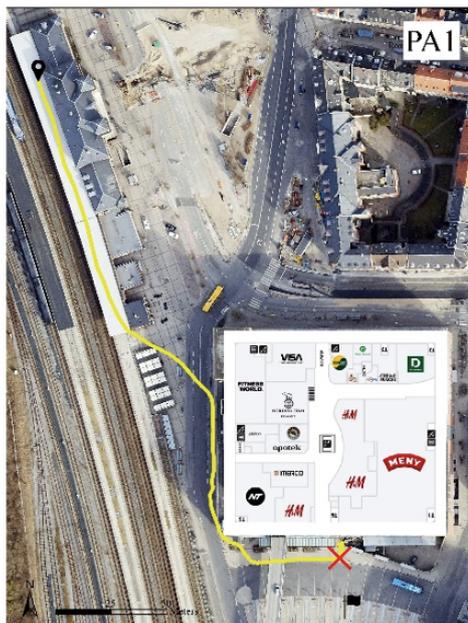
Approval from DSB to make recordings in connection with investigations was given by telephone after emailing and having a conversation with DSB’s press adviser.



# Critical points on each individual route



## Route A

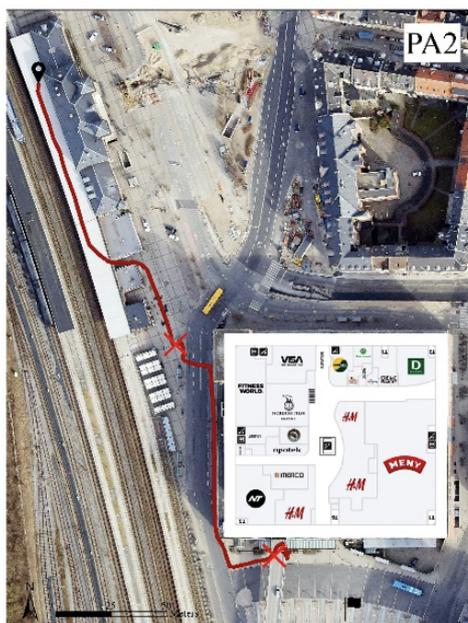


### PA1

24 years old  
Danish, male  
*Time:* 29<sup>th</sup> March at 11.30am  
*Knowledge:* Good  
*Duration:* 3:16 min  
*Gaze samples:* 38%

*Critical points following the journey:*

- ✗ Trying to allocate C6 in area C



### PA2

58 years old  
Danish, female  
*Time:* 29<sup>th</sup> March at 12pm  
*Knowledge:* To some extent  
*Duration:* 5:10 min  
*Gaze samples:* 14%

*Critical points following the journey:*

- ✗ Using guidance in form of orientation map
- ✗ Trying to allocate C6 in area C



**PA3**

58 years old

Danish, male

*Time:* 29<sup>th</sup> March at 1pm

*Knowledge:* To some extent

*Duration:* 6:20 min

*Gaze samples:* 20%

*Critical points following the journey:*

- X** Searching for guidance in the train station
- X** Using guidance in form of orientation map
- X** Waiting a longer time at the traffic light
- X** Trying to allocate C6 in area C
- X** Trying to allocate C6 in area C, as it has still not been recognized



**PA4**

25 years old

Non-Danish, female

*Time:* 30<sup>th</sup> March at 2.30pm

*Knowledge:* To some extent

*Duration:* 4:02 min

*Gaze samples:* 35%

*Critical points following the journey:*

- X** Searching for guidance in the train station
- X** Waiting a longer time at the traffic light
- X** Searching for guidance in NT's service center
- X** Searching for guidance in NT's service center, as C6 has still not been allocated



**PA5**

25 years old

Non-Danish, male

*Time:* 4<sup>th</sup> April at 4pm

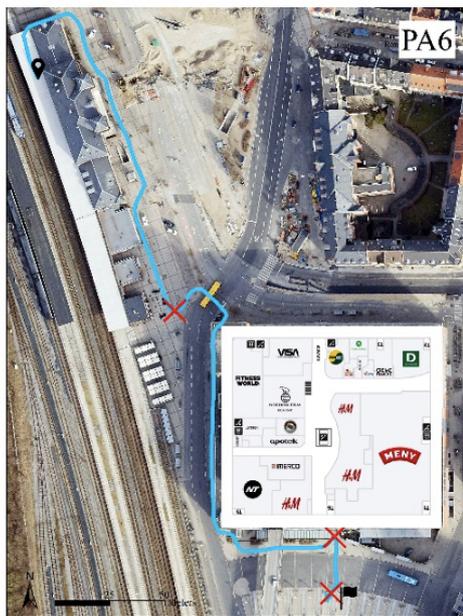
*Knowledge:* No knowledge

*Duration:* 5:25 min

*Gaze samples:* 95%

*Critical points following the journey:*

- X** Longer orientation phase at the beginning
- X** Finding guidance that is not sufficient for further allocating C6
- X** Using guidance in form of orientation map
- X** Walking through narrow space
- X** Trying to allocate C6 in area C
- X** Trying to allocate C6 in area C and walking to it coincidentally



**PA6**

21 years old

Non-Danish, male

*Time:* 6<sup>th</sup> April at 4.30pm

*Knowledge:* To some extent

*Duration:* 4:25 min

*Gaze samples:* 95%

*Critical points following the journey:*

- X** Recognizing traffic light and adjusting walking direction
- X** Trying to allocate C6 in area C
- X** Ending up at C5 instead of C6



**PA7**

29 years old

Danish, male

*Time:* 6<sup>th</sup> April at 5.30pm

*Knowledge:* Good

*Duration:* 4:22 min

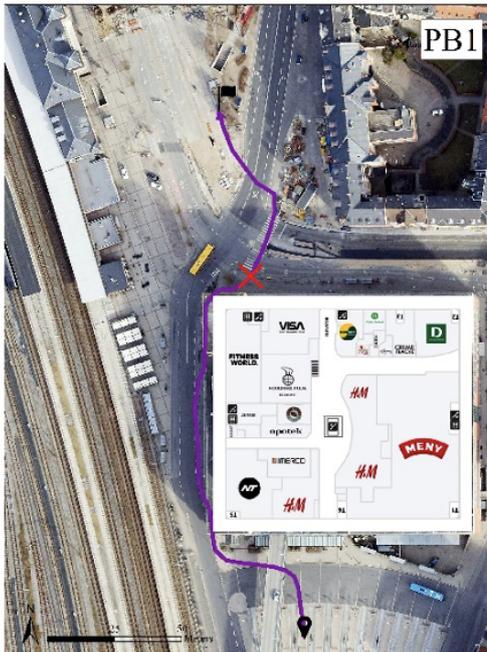
*Gaze samples:* 96%

*Critical points following the journey:*

- X** Short orientation phase at the beginning
- X** Stopping to let a car passing by
- X** Waiting a longer time at the traffic light
- X** Searching for guidance in NT's service center
- X** Trying to allocate C6 in area C

---

## Route B



### PB1

27 years old

Danish, male

*Time:* 31<sup>st</sup> March at 2.30pm

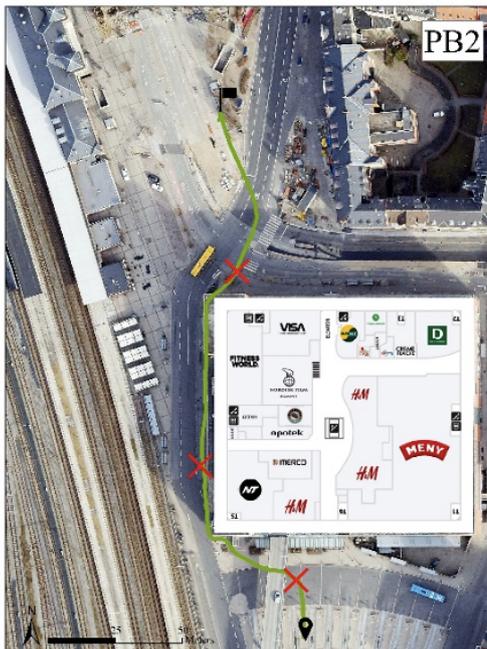
*Knowledge:* Good

*Duration:* 3:22 min

*Gaze samples:* 44%

*Critical points following the journey:*

- X Waiting a longer time at the traffic light



### PB2

27 years old

Danish, female

*Time:* 31<sup>st</sup> March at 5pm

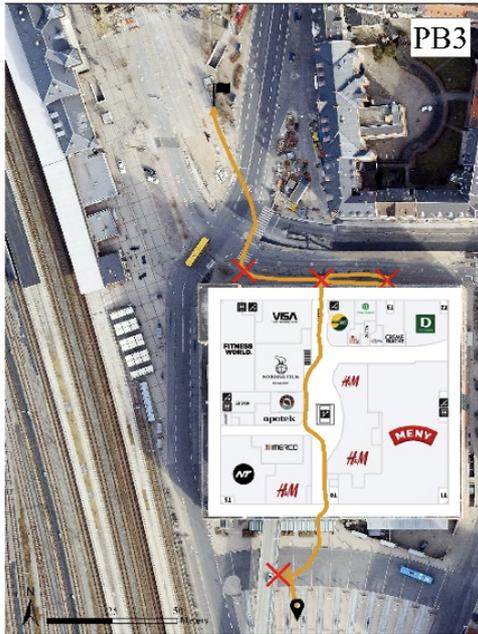
*Knowledge:* Good

*Duration:* 2:49 min

*Gaze samples:* 91%

*Critical points following the journey:*

- X Short orientation phase at the beginning
- X Using guidance in form of orientation map
- X Waiting a longer time at the traffic light



**PB3**

24 years old

Non-Danish, male

*Time:* 1<sup>st</sup> April at 1pm

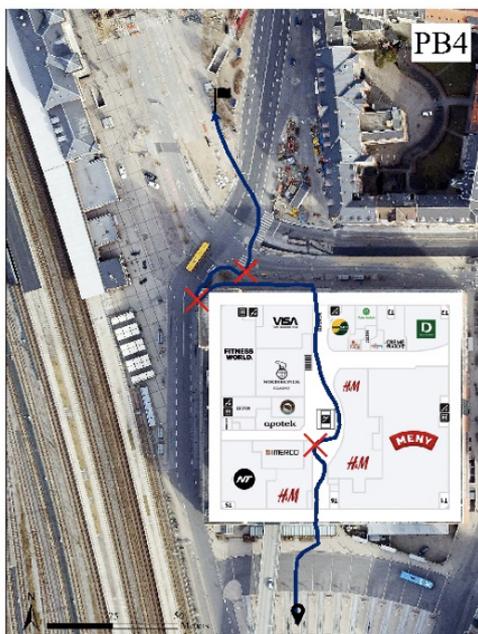
*Knowledge:* No knowledge

*Duration:* 3:26 min

*Gaze samples:* 68%

*Critical points on the journey:*

- X** Longer orientation phase at the beginning
- X** Short orientation phase when exiting Kennedy Arcade and continue walking in the wrong direction
- X** Searching for guidance and realizing that this is a wrong bus area (A4)
- X** Waiting a longer time at the traffic light



**PB4**

27 years old

Danish, female

*Time:* 1<sup>st</sup> April at 3.30pm

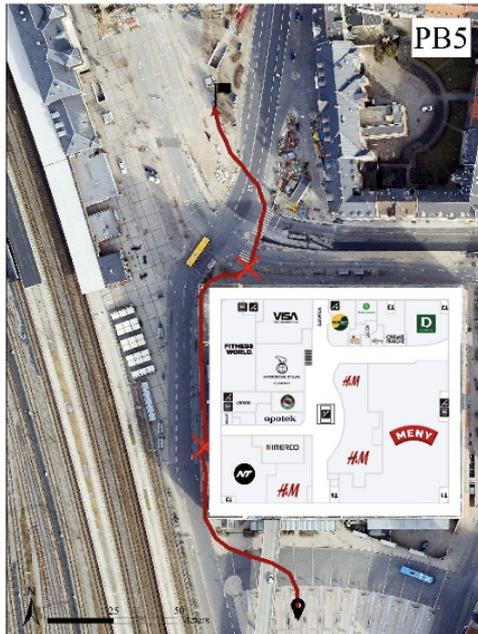
*Knowledge:* Good

*Duration:* 4:09 min

*Gaze samples:* 80%

*Critical points on the journey:*

- X** Negotiating around other people in Kennedy Arcade
- X** Searching a longer time for guidance in the urban street space before continuing on the correct path
- X** Waiting a longer time at the traffic light

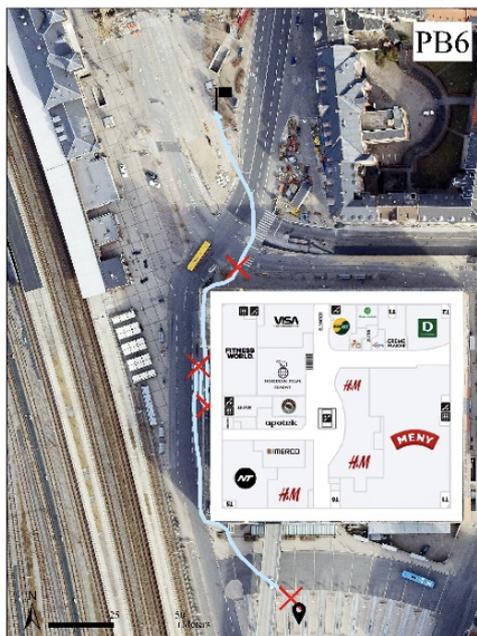


**PB5**

80 years old  
 Danish, female  
*Time:* 5<sup>th</sup> April at 10am  
*Knowledge:* Good  
*Duration:* 3:53 min  
*Gaze samples:* 5%

*Critical points on the journey:*

- X** Using guidance in form of orientation map
- X** Waiting a longer time at the traffic light

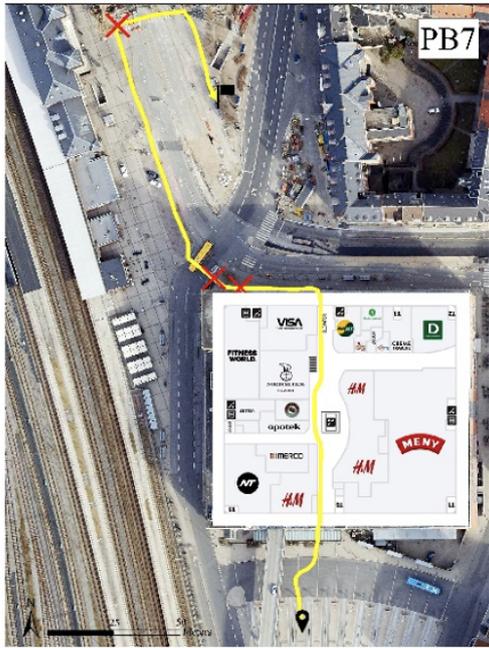


**PB6**

26 years old  
 Danish, female  
*Time:* 5<sup>th</sup> April at 4.30pm  
*Knowledge:* To some extent  
*Duration:* 3:47 min  
*Gaze samples:* 3%

*Critical points on the journey:*

- X** Short orientation phase at the beginning
- X** Returning and searching for guidance
- X** Waiting a longer time at the traffic light



PB7

**PB7**

36 years old

Non-Danish, male

*Time:* 6<sup>th</sup> April at 5pm

*Knowledge:* No knowledge

*Duration:* 4:45 min

*Gaze samples:* 96%

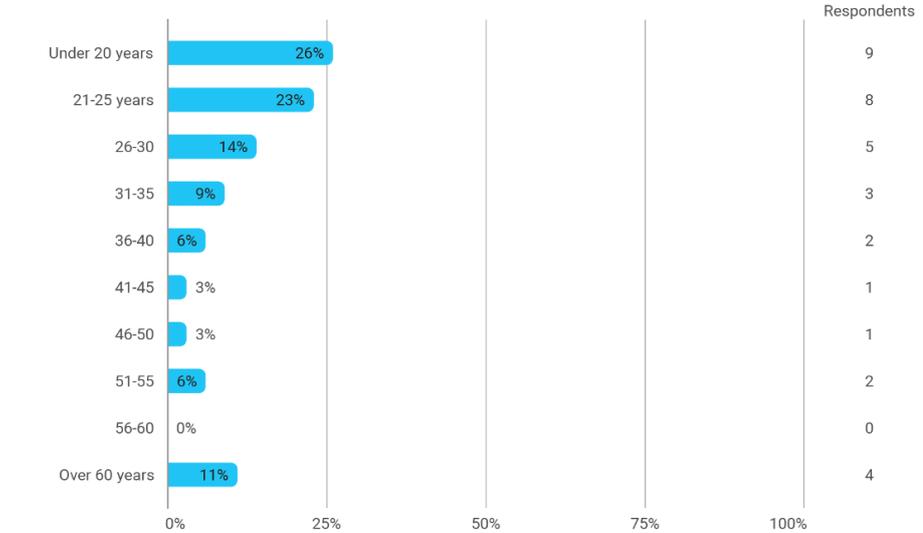
*Following the journey:*

- X** Searching for guidance and continuing the way on the opposite street side of A1 without having recognized the destination
- X** Waiting a longer time at the traffic light
- X** Waiting a longer time at the traffic light

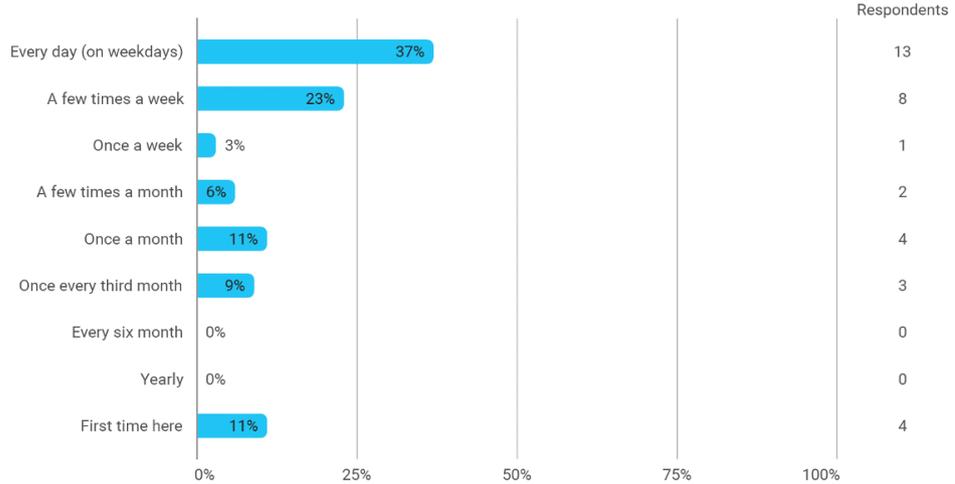
# Results of waiting time interviews



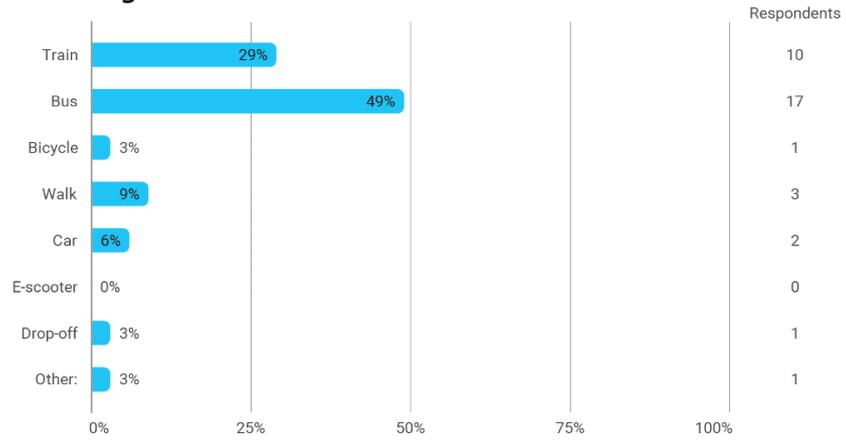
## How old are you?



## How often do you use this area?



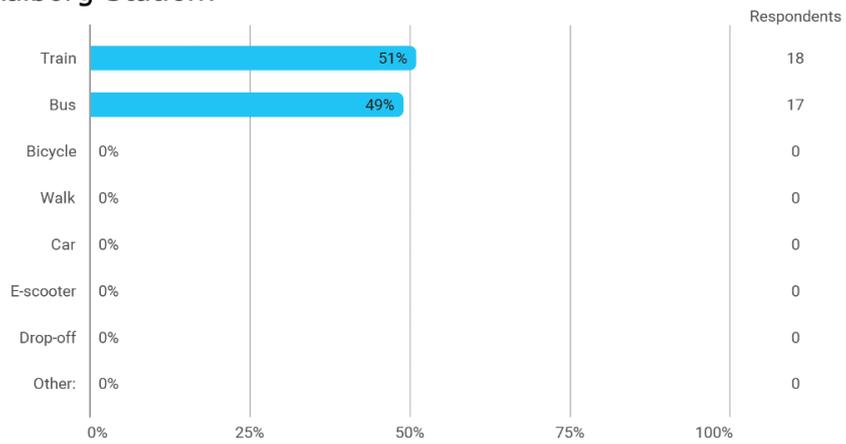
How did you arrive at Aalborg Station?



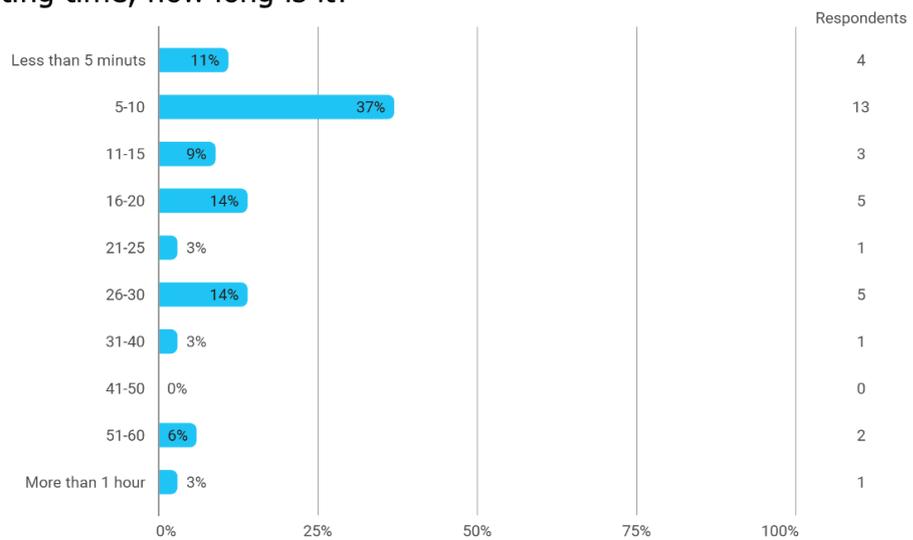
How did you arrive at Aalborg Station? - Other:

- Segway

How will you leave Aalborg Station?

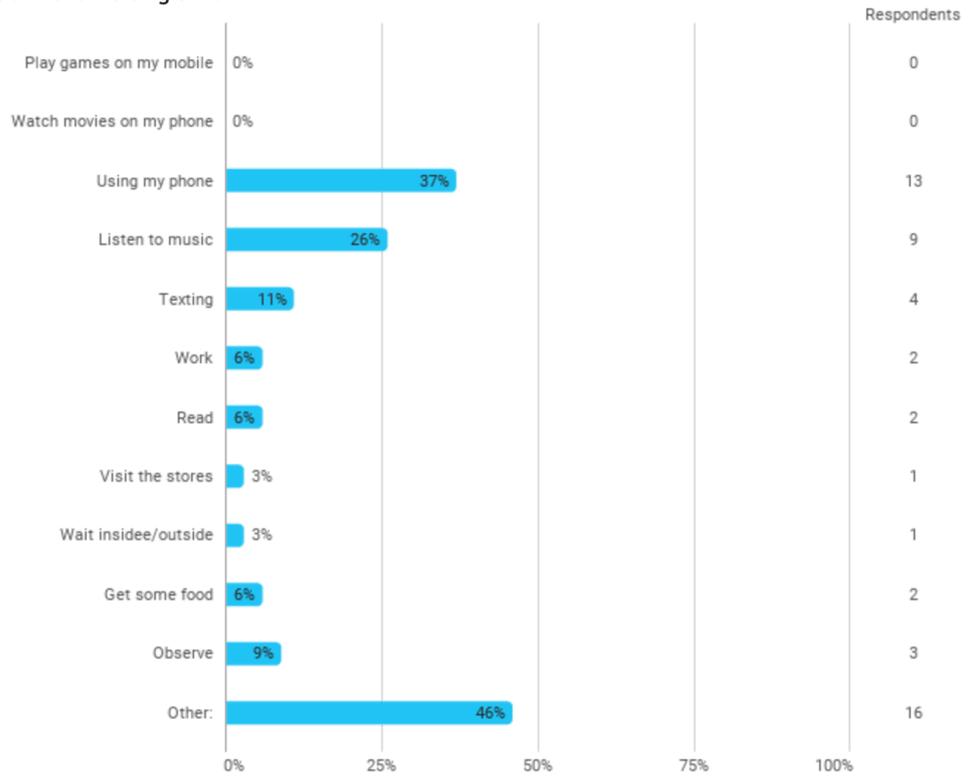


If you have waiting time, how long is it?

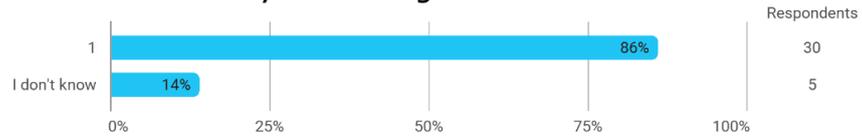


---

### What do you do in the waiting time?



Is there something that would make your waiting time better?



Is there something that would make your waiting time better?

- Weather issues
- Some games in the area
- no, it's fine
- There are good facilities but there could well be more benches, more confrontable benches, and chairs
- No
- More benches inside, it can be unsafe at night, I have experienced fights a couple of times at night
- no, there is a possibility to go shopping if I want to, it is just a long time waiting
- The possibility to charge your phone
- It's very cold because of the automatic doors that keep opening, there is a really bad acoustics
- More benches, it's cold
- More benches both in and outside
- Screens with data so it's possible to see the exact time for thee busses and with changes
- no
- it is just long and boring
- no, it is fine, it is cold, but I don't wait that long
- no, it's cold but if I have more time I will just go inside
- no, it's fine
- no
- no
- no
- more benches
- More shelters
- more busses, and Kennedy is a small shopping center
- boring
- No so many trains cancelled and less road and construction work
- No, but it would be nice with a cafe at the train station
- Talking with friends
- A coffee machine or a restaurant
- A coffee machine or a restaurant
- Less pollution

On a scale from 1 to 10, how will you consider your waiting time in the area?

