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Outgrowing the Private Car—Learnings from a Mobility-as-a-Service Intervention in Greater Copenhagen

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Abstract: This article discusses the potentials of reorienting traditional rational transport planning towards a mobilities approach that includes social perspectives of practices in everyday lives. Empirically, the discussion is based on results from a MaaS intervention project in two urban areas and one sub-urban area in Greater Copenhagen. This article argues that attention to context, experience, storytelling, identity, and inequality are fundamental in changing interlocked, non-sustainable practices. Achieving a sustainable transformation of transportation, including promoting shared mobility and MaaS solutions as alternatives to private car use, requires a holistic view of the role and organization of everyday mobilities as more than just a technological issue. This article concludes that MaaS has the potential to be a strong tool, but technologies and short experiments are not enough. New MaaS solutions need time to implement, and relying on the free market as a way forward is potentially problematic when this can lead to mobility inequalities between different areas.

Keywords: mobility-as-a-service (MaaS); everyday practices; rational transport planning; mobilities paradigm

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1. Introduction

Easy and accessible green mobility solutions for everyday life have, during the last few decades, increasingly been seen as an important tool to make cities and their mobility systems sustainable and reap benefits for society in terms of lower climate impact, less congestion on the roads, better local environments, and higher "livability" (quality of life) in cities [1]. Challenging car-based everyday transportation has been shown to be very challenging, and long-term investments in more sustainable modes are scattered. This paper suggests that a different focal point when promoting green mobility solutions could be sought through engaging with theories of practices and mobilities planning. This stands in opposition to traditional transport planning based on a rational planning outset. Empirically, this paper draws on learnings from the research project "Sustainable Innovative Mobility Solutions" (SIMS), funded by the Innovation Foundation Denmark. The project experimented with Mobility-as-a-Service (MaaS) solutions in three urban areas between 2019 and 2023. The outset was that MaaS solutions need to be understood and implemented by engaging with the bundles of practices that constitute the organization of everyday life. MaaS solutions, such as car sharing, bike sharing, and ride sharing, are fundamentally challenging—and challenged by—the way everyday life and urban transport systems are currently organized [2,3]. The aim of the SIMS project was to contribute new knowledge on the development and adaption of sustainable and multimodal mobility solutions into the everyday lives of citizens and understand how to tailor solutions to better integrate with specific urban contexts, i.e., to a city's physical layout and social relations. The SIMS project had four overall aims related to the implementation of MaaS: 1. To develop detailed

knowledge and conceptual mobility designs for the development of future sustainable mobility solutions. 2. To support collaboration between actors (municipalities, mobility operators, research institutions, and citizens). 3. Document the effectiveness of these solutions via experiments in three sites that also provide empirical knowledge for further improvements. 4. To challenge existing resource-intensive car driving and support the adaptation of the developed mobility solutions through complementary social and physical interventions in each site. Through the SIMS choice of theories and methodologies, there were two further academic aims: 1. To emphasize the importance of creating mobility solutions adapted to the everyday life of citizens by anchoring research and development within mobilities research and theories of practice. 2. To create solutions through the direct involvement of prospective users in the design solutions by combining the development of a new integration between transport modes and activating networks of citizens. More details on the research design and the experiments will be provided in section two. The findings from the SIMS project highlight how current car-based transportation systems are deeply rooted in everyday life and that changing towards more sustainable modes requires long-term investments and long-term exposure to alternatives before substantial practice changes can occur [4].

The concept of MaaS has gained a foothold in the mobility field in the last decade. MaaS is the term for a multimodal and seamlessly integrated transport system where users pay for access to mobility, rather than owning the mobility mode (typically a private car). There are many different interpretations of MaaS as a concept, but a common outset is to offer multimodal mobility options with users in the center, which is based on the integration of transportation services entailing information, payment, and ticketing. Also, goals like reduced private car ownership and sustainability are often part of the definition. Sochor et al. [3] define five levels of MaaS, 0–4, where 0–3 cover no integration (0) to different levels of integration (1–3) and level 4 focuses on integrating societal goals, such as sustainability and livable cities. Hensher et al. [5] offer the following definition for MaaS:

"MaaS is a framework for delivering a portfolio of multi-modal mobility services that places the user at the centre of the offer. MaaS frameworks are ideally designed to achieve sustainable policy goals and objectives. MaaS is an integrated transport service brokered by an integrator through a digital platform. A digital platform provides information, booking, ticketing, payment (as PAYG and/or subscription plans), and feedback that improves the travel experience. The MaaS framework can operate at any spatial scale (i.e., urban or regional or global) and cover any combination of multi-modal and non-transport-related multi-service offerings, including the private car and parking, whether subsidised or not by the public sector. MaaS is not simply a digital version of a travel planner, nor a flexible transport service (such as Mobility on Demand), nor a single shared transport offering (such as car sharing). 'Emerging MaaS' best describes MaaS offered on a niche foundation. This relates to situations where MaaS is offered on a limited spatial scale, to a limited segment of society or focused on limited modes of transport. The MaaS framework becomes mainstream when the usage by travellers dominates a spatial scale and the framework encompasses a majority of the modes of transport."

Through this definition, Hensher et al. [5] aimed to move towards a benchmark definition of MaaS when they argued that the concept "has been hampered by the lack of an agreed working definition" that results in "the on-going challenge of a fragmented evidence base". This definition frames what Jittrapirom et al. [6] defined as a MaaS concept (a new way of understanding mobility) and as a transport solution (new technical solutions, as well as new types of subscription models). What it fails to address is Jitter's third conceptualization; MaaS, a phenomenon (new forms of mobility habits and behaviors). Hersher et al. provided a definition that is very workable for particular developers of concrete MaaS solutions, who tend to focus primarily on the technical side of MaaS in terms of, e.g., developing new app solutions for smartphones that integrate different transport solutions [1,7]. From such a perspective, the challenge of creating the sustainable and seamlessly integrated MaaS system of the future is first and foremost for developing

coherent digital infrastructure and an attractive user interface. However, the experiences from MaaS trials in recent years, ours included, suggest that the main challenge for creating sustainable mobility based on MaaS is only partly related to developing technically advanced solutions. Least important are the "contextual conditions" for MaaS solutions in terms of the physical layout of cities and infrastructure, established habits and cultural understanding among citizens and businesses, the regulation of the private and public markets for transport services, the organization of mobility businesses and their competitive relationships, etc. [5]. When including these conditions in the understanding of MaaS, it describes a vision of an integrated transport system based on shared mobility with public transport as its backbone [2,8].

The results from the SIMS project support the importance of working with MaaS as a vision and phenomenon, whereas the technical dimension is less significant. Rather, what is significant is how it interacts with and integrates into the city's infrastructural, cultural, and economic organization. As several participants in the study told us, they could easily navigate different smartphone apps. What was needed was not "another app" integrating those apps; rather, they needed reliability, accessibility, time, and practical experience to explore and transition to using alternatives to private cars. The learnings from working on a MaaS demonstration project highlight the importance of understanding and establishing attractive alternatives to private car ownership. As such, this paper argues for a more in-depth understanding of everyday mobility practices when the aim is changing practices toward a more sustainable mobility system.

To begin this article, we describe the SIMS research project, the sites of intervention, and the methodologies and theories used. The project was based on theories of practice, and this allowed for an in-depth understanding of the complexity and interrelatedness of the challenges of everyday mobility. But, at the same time, it also highlighted the challenges of introducing sustainable mobility systems within a rational transport planning paradigm. Therefore, this paper continues by digging into the understanding of everyday mobility within rational transport planning and mobilities planning. Based on this, we analyze the findings from the project to show how, within these two different planning paradigms, different models for pursuing sustainable mobilities arise. In the concluding remarks, we reflect on these findings and relate them to recommendations that can be used for future work with MaaS.

2. Materials and Methods—Researching Three Urban Areas

There is typically a long way from technological innovation to the actual implementation of new green transport solutions into busy everyday lives. Previous research on everyday mobility practices has shown how mobility is the glue that binds together the many tasks of everyday life [9–12]. It is an embedded part of everyday practices: going to work, shopping, picking up children, going to leisure activities, and meeting friends and family. Therefore, changing everyday transport modes means changing the organization of everyday life. Changing mobility practices is, thus, more than just a simple shift from one mode to another [10–12], and business as usual is, therefore, the easiest and often preferred model. This understanding of the everyday lives in which green mobility technologies are sought to be implemented is the outset for SIMS when considering how to introduce new mobility solutions to become attractive alternatives to car-based urban mobility.

2.1. The SIMS Project

The vision of SIMS was to develop sustainable mobility solutions that are workable (adapted to citizens' everyday practices), comprehensive (incorporating future and existing resource-efficient transport modes), robust (apply to a variety of user needs), and co-developed with wider urban physical development and social relations. This was realized through developing, trialing, and validating new mobility solutions integrating two or more types of shared and electrified mobility modes in three urban areas in and around Copenhagen. The core idea was that, because the different mobility modes address

different needs and activities in everyday life, their combination comprises a comprehensive alternative to current automotive everyday mobilities. The trials, therefore, sought to promote the modes together in a MaaS solution tailored to everyday life and all its facets. To support their implementation, research on the physical, social, and cultural attributes of the three areas and their residents was conducted before, during, and after the interventions to ensure higher adoption of the suggested mobility solutions. The interventions were developed in collaboration with local planners and policymakers, as well as three mobility partners, consisting of a shared car provider, shared bike provider, and a ridesharing provider.

The mobility packages were designed so that it was possible to link the solutions and use them in conjunction with public transport. The design of the mobility packages was based on detailed feasibility studies that provided insights into existing mobility patterns, habits, needs, and challenges in the areas. The aim was to offer a combination of different forms of shared mobility, which together could provide an attractive alternative to private car use. Based on learnings from the empirical work before the interventions, it became clear that it would not be possible or meaningful to roll out the same experiments across the sites. Even though the Copenhagen area and its population are relatively homogeneous from an international perspective, the differences in density, prosperity, and infrastructural configuration proved large enough to result in very different mobility patterns and, of significance for our purpose, influence mobility providers' propensity to invest [13]. A need for developing different mobility packages for the different areas emerged, and for one of the demonstration sites, it proved impossible to design a mobility package when the mobility providers were not interested in engaging in the specific site.

2.2. The Three Demonstration Sites

Nordhavn is an urban development project transforming the old industrial harbor into a new, sustainable port district. It is profiled as the sustainable district of the future. The development of the area began in 2013, and by 2022, the population of Nordhavn passed 3000, but there are plans for 40,000 people to live in the area when it is fully developed. It is a mixed urban area with residential, commercial, and recreational facilities. The area contains both rental and student housing, but most of the housing stock is privately owned and some of the most expensive housing in Denmark is located here. Nordhavn has a wide range of public transport, with an S-train station and two metro stations inside the area. Good public services are a crucial element of MaaS solutions [8], and Nordhavn excels in this respect. For the Nordhavn intervention site, SIMS designed two different MaaS-based mobility experiments based on the integration of mobility services. The first one was a one-year experiment with a flexible mobility package for shared cars, shared bikes, and ridesharing, and the second was a five-month experiment also including a subsidy for public transport. The first one-year mobility experiment in Nordhavn involved a total of 20 households. The 5-month experiment involved a total of 15 households.

Nærheden is a newly built area located about 20 km outside Copenhagen and touted by developers as the sustainable suburb of the future. It contains only privately owned housing. It is near a train station, with train departures to Copenhagen and Roskilde twice an hour. In Denmark, about 40% of the population lives in suburban areas outside the major cities, and many people commute to the larger cities nearby to work. The journey to Copenhagen Central Station takes about 20 min. In Nærheden, a collaboration between the developer and a car-sharing provider had already been established in 2018 (before the start of the SIMS project), guaranteeing the availability to residents of two shared cars in dedicated parking spaces for a period of three years. In 2020, in the context of the SIMS project, the shared car provider offered residents free membership for two years, and access to carpooling and shared electric bikes for last-mile purposes in Copenhagen was made available at reduced costs. The intervention was rolled out in three steps, gradually building on top of each other. In Nærheden, a total of 23 households participated in the mobility experiment.

Folehaven is an old working-class area on the outskirts of Copenhagen, which contains both single-family houses, as well as a large amount of non-profit housing, where the municipality can assign residents to between 25 and 30% of the units. Folehaven was, until recently, listed on the 'special disadvantaged neighborhoods' list, which neighborhoods with severe social problems qualify for. In response, Folehaven is currently undergoing a comprehensive urban renewal plan to improve the area. It is located in a pocket between three large and busy access roads to inner Copenhagen, and access to the closest train station involves crossing one of the large four-lane roads. The area is served by several bus routes, though they have been limited in the last few years due to the opening of a new metro line (located outside Folehaven). Within the area itself, conditions are good for cyclists and pedestrians, but leaving the area involves crossing or traveling alongside heavy traffic. In this neighborhood, no specific mobility solutions have been designed and tested. Early in the SIMS project, two of the project's mobility providers had trouble identifying business potential in establishing in the area. This was based on previous experience of investments in areas with similar social profiles and mobility coverage. In relation to the MaaS experiment, it meant that mobility interventions were not feasible, and therefore, a knowledge–strategy intervention that focused on raising awareness of the (mobility) challenges became the focal point of our work in the area.

The following two tables (Tables 1 and 2) give an overview of the offers from the mobility providers and the experiments in the three sites.

Table 1. Mobility providers in the SIMS project.

Mobility Provider	Membership	Price
Car-sharing operator is a fixed-stamp car-sharing scheme where cars have fixed parking spaces to be picked up from and returned to. It operates in Copenhagen, Aarhus, Odense, and Roskilde. Use of the carshare requires membership and they are reserved via the website or web app. A membership gives access to all cars across the country (total of 270 cars of different sizes, including minibuses and box vans, and with different fuel sources (electric, hybrid, and petrol)).	Membership costs a joining fee and then a monthly subscription. The price of the monthly subscription depends on the type of membership, which, in turn, determines the hourly rate and the mileage rate for using the cars. The price includes fuel, maintenance, and insurance.	The car sharing operator had six cars in Nordhavn and two in Nærheden with fixed parking spaces. During the test trial, the residents were offered: • Free registration (normal price 67 EUR) and free standard membership for all members in the household for the first 3 months (after that 32 EUR per month). • Hourly rate was 7 EUR, including fuel, parking, mileage, full excess insurance, roadside assistance, service and maintenance, and daily rate from 60 EUR (depending on car size). • 27 EUR welcome credit.
Carpooling solution is operated by FDM (Federation of Danish Motorists) that focuses on the daily commute to and from work.	The carpooling is organized in an app, which can be downloaded for free. Through the app, you can either offer or find a carpooling option. Drivers are given the opportunity to share the cost of the journey. You can charge a tax-free amount of €0.70 per kilometer to cover fuel, etc., and the app calculates the price. The membership includes taxi cover if the driver cancels last minute.	The carpooling service offered 7 EUR welcome credit for the first trips.

Table 1. *Cont.*

Mobility Provider	Membership	Price
The city bike is the official city bike system in the Copenhagen metropolitan area, which is rented through an app. All city bikes are electric, and they can be rented from 130 city bike stations spread across Copenhagen, Frederiksberg, and Rødovre. Forty-six city bike stations are located in connection with train and metro stations. The city bike no longer exists and ceased operation at the end of 2022.	Setting up a city bike account is free, after which you can choose between several price models according to your needs.	A new drop zone was established for the city bike at Nordhavn Metro Station. In Nærheden, the city bike was available at all larger stations in Copenhagen. The city bike offered 40 h of use of the bike for 7 EUR (normal price 120 EUR).

Table 2. The experiments in the three sites.

Site	Experiment	Participants
Nordhavn	1. One-year experiment with flexible mobility package for residents (August 2021–August 2022) 2. Five-month experiment with mobility package including public transport for residents (April 2022–August 2022)	The first one-year mobility experiment in Nordhavn involved a total of 20 households. The 5-month experiment involved a total of 15 households.
Nærheden	1. LetsGo's car sharing, Citycycle's bike sharing, and Ta'Med's carpooling solution were offered to residents. 2. The three offers were rolled out in three steps, thus gradually building on top of each other, 3. Car sharing (May 2021), followed by the city bike (June 2021) and carpooling (July and October 2021).	A total of 23 households participated in the mobility experiment
Folehaven	1. Working with the future workshop methodology to support local communities. 2. Having a stall at the neighborhood festival, where residents could express their opinions about the mobility opportunities in the area.	The future workshop was unfortunately canceled due to COVID-19, but about 60 residents participated in the activities of the SIMS stall.

2.3. Methodology

The SIMS project had a mixed-methods approach, where all in all, 50 semi-structured interviews with residents [14], 9 focus groups with residents [15], a survey study and a quantitative analysis of mobility provider data, and three workshops [16–18] with the different actors in the project were conducted. Of these, 27 semi-structured interviews and 4 focus groups with residents living in the three areas were conducted prior to experiments and aimed at informing the intervention design. The interviews focused on understanding mobility practices, sustainable living, everyday lives, and the significance of place. The focus groups focused on discussions of MaaS solutions and their integration in different urban contexts. A total of 48 families participated in a mobility experiment, focusing on implementing MaaS in their everyday lives. The interviews and focus groups were transcribed and coded using NViveo.

To recruit test families, different strategies were used. The municipality and developers, who were partners in the project, functioned as gatekeepers and established channels and contacts for recruitment. We also distributed flyers door-to-door and recruited through articles in local weekly newspapers and mentioning in the regional news. Local Facebook groups for residents were also used to advertise participation. As this short introduction to the methodology makes clear, there is a large amount of knowledge coming out of the SIMS project. In this paper, the focus is on the overall learnings and reflections from the

project, so much of the empirical work will not be discussed. For more readings into the project, see the following Table 3 for articles touching on various aspects of the project.

Table 3. Research coming out from the SIMS project.

Theoretical Discussion	Empirical Material	Article
Mobilities Mobile risk society Everyday life	Visionary workshops	Freudendal-Pedersen, M., Hartmann Petersen, K., Friis, F., Rudolf Lindberg, M., and Grindsted, T. S. (2020). Sustainable Mobility in the Mobile Risk Society—Designing Innovative Mobility Solutions in Copenhagen. Sustainability, 12(17), 7218. https://doi.org/10.3390/su12177218
MaaS Practice theory	Individual interviews	Christensen, T. H., Friis, F., and Nielsen, M. V. (2022). Shifting from ownership to access and the future for MaaS: Insights from car sharing practices in Copenhagen. Case Studies on Transport Policy, 10(2), 841–850. https://doi.org/10.1016/j.cstp.2022.02.011
Climate change Urban governance Smart cities Sustainable development goals	Desk research Survey	Grindsted, T. S., Haunstrup Christensen, T., Freudendal-Pedersen, M., Friis, F., and Hartmann-Petersen, K. (2022). The Urban Governance of Autonomous Vehicles—In love with AVs or critical sustainability risks to future mobility transitions. Cities, 120, 103504. https://doi.org/10.1016/j.cities.2021.103504
MaaS COVID-19 Practice change Mobility providers	Stakeholder workshop	Lindberg, M. R., M. Freudendal-Pedersen, K. Hartmann-Petersen, N.G. Kristensen, T.H. Christensen and T. S. Grindsted (2022): Pandemic detours or new sustainable pathways? Post-pandemic mobility futures in Danish cities. *Applied Mobilities* https://doi.org/10.1080/23800127.2022.2145081
Uneven mobilities Mobility justice Urban neighborhoods Storytelling	Individual interviews Focus groups	Kristensen, N. G., Lindberg, M. R., and Freudendal-Pedersen, M. (f2023): Urban mobility injustice and imagined sociospatial differences in cities. *Cities*, 137, https://doi.org/10.1016/j.cities.2023.104320
Sustainable transitions Inequality Urban Mobilities	Individual interviews Focus groups Interviews with mobility providers Workshops	Lindberg, M. R. (2022): Transitions for People: Locating Inequality in Sustainable Urban Mobility Transitions. Ph.D. thesis, Aalborg University, Copenhagen Campus. https://doi.org/10.54337/aau521482687
Reflexivity Mobility justice Epistemic justice	Individual interviews Focus groups	Lindberg, M. R., Kristensen, N. G., Freudendal-Pedersen, M. and Hartman-Petersen, K. (forthcoming): Despite the best of intentions: Inequality in the search for mobility justice. *Mobilities.*
MaaS Practice theory	Individual interviews	Lindberg, M. R., Christensen, T. H., Friis, F. and Grindsted, T. S. (Forthcoming). Comparative analysis of different car sharing schemes in the suburbs of Copenhagen.
Mobilities Everyday life practices Mobility transitions	Individual interviews and focus groups	Hartmann-Petersen, K., M. Freudendal-Pedersen, M. Rudolf Lindberg (writing ongoing). Becoming a mobilist through urban experience.

2.4. Theories of Practice as Theoretical Outset for the SIMS Project

As an outset for understanding the complexity of everyday life mobilities, the project applied a theoretical approach inspired by theories of practice [19–21]. With social practices as the unit of analysis [22], the sustainability challenge moves beyond questions of indi-

vidual behavior or structural lock-in. Instead, individuals' doings and sayings are seen as performances of social practices, that is, specific gatherings of materials (e.g., cars, fuel and roads, trains and tracks, and tickets), competencies (the ability to drive, to plan a journey, to buy a ticket, and to climb the stairs), and meanings (shared values, social expectations, and cultural conventions) [21]. A practice can thus be defined as "a 'type' of behaving and understanding that appears at different locales at different points of time and is carried out by different body/minds" [19]. Practices are seen as routinized types of activities that bring together and connect a range of elements. In the SIMS project, we engaged with practice to capture how everyday mobilities could be studied as concrete gatherings of materials, infrastructures, tools, competencies, embodied skills, values, and cultural norms. As such, the practice theoretical approach offers a way to conceptualize the interconnectedness of everyday life and the organization of the transport system, and its manifestations in everyday mobility practices. Further, this theoretical lens enables an understanding of how social practices are fundamentally interconnected and exist in configurations [23–25]. For example, socializing depends on the alignment of other practices, such as dining, cooking, and grocery shopping, which, again, requires money that is earned through work. And all these practices involve movement between homes, stores, workplaces, etc. In this sense, we never encounter practices in isolation [26], but instead, everyday activities interconnect into larger bundles of social activity—often 'glued together' by mobility practices. Complexes of social practices, infrastructures, and institutions develop together [25] and produce and reproduce mobilities across people and places. Following this line of thought, altering everyday mobility toward sustainability involves the reconfiguration of the whole system of practices that currently favors carbonized modes of transportation and combustion engine vehicles. Greening mobilities demand reweaving interconnections between everyday mobility practices and the systems of other practices, infrastructures, and institutions in which everyday mobilities are entangled. Scholars engaged with interventions in practices, therefore, suggest that transition efforts should focus on the temporal and spatial relationships between social practices to change current bundles and interconnections between practices and allow for new ones to emerge [27].

A practice is sustained when its materials, meanings, and competencies are reactivated again and again, day after day [21]. It follows that practices will discontinue if the elements stop being activated and that practices can be modified with displacements in the gathering of their elements. This was exactly the aim of the SIMS mobility experiments—to stir up people's current routinized pollutive mobility practices and provide the materials, meanings, and competencies for undertaking ('gathering') new mobility practices. Spurling et al. [28] and Spurling and McMeekin [27] developed a framing for how to investigate and facilitate interventions in everyday practices. They outlined three intervention times: recrafting practices, substituting practices, and changing how practices interlock. These three types of intervention represent different scales of planning and policy approaches. Recrafting a practice is achieved by changing one or more of the elements that constitute them [28]. This approach could, for instance, evolve around teaching car drivers skills to drive more eco-efficiently or changing their combustion-engine cars for electric vehicles. The second type, substituting practices, "focuses on discouraging current unsustainable practices and replacing them with existing or new alternatives" [27]. Examples of substitution interventions include campaigns, such as the Danish Cycling Federation's "We Bike to Work" campaign, which have been running since 1997, and encourages people to substitute other mobility practices for cycling to work. Such interventions focus on changing how we travel, but do not target how much we travel. But the third intervention type, changing how practices interlock, brings the present levels of "mobility need" into question, starting with an understanding of how mobility practices are bundled together with many other everyday practices. Moving around is mostly part of or a prerequisite for performing other practices, e.g., traveling to work or performing daily shopping. Understanding this spatial–temporal distribution of practices and how they interrelate provides an understanding of the experienced "need" for mobility and modes. "Infrastructures—which

influence where activities take place, and institutions—which influence when activities take place, play a vital part in how practices interlock and are therefore important targets for interventions" [28].

Spatial planning plays an important role in changing how practices interlock, which, in the SIMS project, is sought through researching the context and everyday life of the experimentation sites. However, in an experimentation project like SIMS, it is only possible to target how practices interlock to a certain degree, because systemic changes demand long-term involvement beyond the scope of the research project. Therefore, the focus of the project's concrete experiments was primarily on substituting pollutive everyday mobility practices with sharing practices in MaaS solutions. However, in this paper, our aim is to move the discussion further and reflect on how MaaS solutions can be a part of changing how practices interlock and the roles that different planning regimes play herein. In the following, we will, therefore, use insights from analyzing everyday mobility practices with theories of practice in the SIMS project to discuss how different planning regimes enable the knowledge from the SIMS project to be activated.

3. Planning Regimes Enabling or Hindering Sustainable Mobility Practices

In the aftermath of the Second World War, planning for the movement of people and goods was high on the agenda as a pathway to restore healthy and developing societies. Transport planning developed into a science specifically focusing on facilitating the opportunity for the private car [29–31]. Historically, significantly inspired by Le Coubisier and his involvement in the CIAm doctrine, the main aim was creating infrastructure that focused on the speed and free accessibility of the private car. Through zoning, infrastructure systems were built that favored the car as the main mode of mobility in urban and rural landscapes [32–34]. Within science, this created transportation planning as a discipline, and several study programs for traffic planning with increasingly advanced simulation tools developed. This discipline and its experts have since grown very strong and are today dominating the field of movement [29].

3.1. The Rational Transport Planning Paradigm

The planning paradigm dominating this field was, and is, rational planning that originated in the field of economics. The aim is efficiency, and the understanding of behavior is based on the idea of the rational economic man. Through access to information, regulation of price, and calculations of risks, behavior can be modified [35–37]. The rational planning model was developed in the 1950s and 1960s, with the aim of selecting knowledge as quantitative data to achieve a desired outcome. By using quantitative data, technical analysis gives the ability to gain control of the environment at hand. It rests on a belief of objectivity and efficiency, where the decision-maker should achieve complete knowledge about possible outcomes [38]. With efficiency as the main goal, the transportation sector, where efficiency is paramount, quickly made this approach the way forward [39]. The models used in rational transportation planning have developed and contemporary socio-economic models take into consideration some environmental and social impacts, besides the economic factors of the proposed transportation solutions. As such, there is a strong belief among governmental institutions that this should secure the most sustainable projects [40].

Critiques of rational planning began in the 1960s and pointed to the problem that this type of planning oversimplified the problems and had too much reliance on science and technical reasoning. One problem is that planning is not based on democratic decision-making processes [38], and it creates a bureaucratic management style where the solving of problems becomes too abstract for citizens to understand and comprehend [41]. Also, it can be argued that people and their practices consist of complex reasoning and norms that are not captured by simplified methodology. In this sense, the ambiguities and paradoxes that are also part of the lives lived in the planned environment are sought through rationalization technologies. Another issue that is not captured by rational planning is the power in the

process. Someone decides the data that are made available through rational planning models—even if rational planning presents this as objective.

Already with Jane Jacobs's famous book 'The Death and Life of Great American Cities' from 1969 [42], the call for knowledge that departs from more than just simple problems and statistical approaches emerged. Transport planning is focused on statistically observed movement patterns where people and vehicles are simply objects in a closed system. In contrast, Jacobs's argument was to focus on the people and process, and not a predetermined goal. The main critique was that a careful analysis of the problem was missing and that there was a need to develop a set of alternatives [38].

3.2. The Mobilities Paradigm

A new development following this critique came with the mobilities paradigm that started growing by the end of the last century. Urry [43] pointed out that there is:

> "...too much transport in the study of travel and not enough society and certainly not enough thinking through their complex intersecting processes (...). In examining those interconnections over time, it is necessary to avoid what we might describe as either a 'society first' or a 'transport technology first' approach and develop formulations of a new mobilities paradigm that will transcend such a divide."

As such, the mobilities paradigm is a fundamental shift in how to analyze the role of movement in society. The outset is that movement is not only about the physical movement of people, objects, and information, because just as crucial for understanding local and global mobility flows are the social, cultural, political, and economic dimensions of movement—why and how things and objects move around the world. What makes the new mobilities paradigm significantly different from transportation planning is its interdisciplinary approach to understanding movement as intertwined with all aspects of human lives that shape and reshape our identities and experiences. It rejects movement as a one-dimensional phenomenon and insists on its "multi-dimensional and multi-scalar" character. Mobility is "inter-dependent, inter-related, and inter-twined", as Sheller and Urry [44] stated. Guittet [45] describes it as an ecology of mobilities understood as a set of interrelated processes constantly interacting and influencing each other. Mobility means the opportunity to engage in activities, travel to new places, and interact with others. As such, it facilitates and constrains modern lives [46]. The world is in a constant state of flux and is constantly being shaped and reshaped by mobility. Thus, an important accomplishment of the mobilities paradigm is challenging the classic understanding of mobility as a passive process and instead focusing on it as an active process. It is not something that simply happens to people, but something that both shapes and is shaped by society [47].

Within the contemporary research in the new mobilities paradigm, the focus is on the emotional and normative understandings of movement, such as the freedom associated with the car [48]. Also, within the mobilities paradigm, the argumentative turn within planning and policy has inspired research on how storytelling shapes and reshapes the significance of the car as that which connects everyday practices [49,50].

4. Transport Planning and Mobilities Planning in Conflict—Learnings from SIMS Interventions

In the following, we will discuss the learnings from the SIMS project in relation to transport planning and mobilities planning. The interventions in the three areas are very different. This reflects one of the findings made early in the project, that Nordhavn emerged as a more attractive urban context to experiment and invest in for several of the project's mobility partners than the suburban and less central demonstration areas. This entails both elements of what is perceived as an interesting business model, which is directly related to socio-spatial differences and unequal mobilities [13,51,52], the perception of the possibilities entailed in MaaS [2], and everyday life practices in a mobile risk society [53,54]. Under four headlines, constituting key learnings from SIMS, the different approaches the

rationalist transport planning and interdisciplinary mobilities planning means for changing how practices interlock are analyzed.

4.1. Context Matters

One of the significant differences between transport planning and mobilities planning is how much emphasis is put on context, and what context means at all. Meanwhile, traditional transport planning represents an understanding of context as something that determines accessibility, for example, where to place a bus stop and the frequency of busses, based on an economically cost-efficient analysis of an area; mobilities planning looks at the activities and potential of an area, focusing on how to support the lives of people living in the area, and then on which connections are important to establish.

In the SIMS project, the mobility packages developed for two of the intervention sites consisted of different share-based transport solutions (share bikes, share cars, and carpooling) and how they integrated into existing mobility patterns and worked in interaction with other modes of transport were investigated. SIMS designed and implemented packages adapted to everyday life in a densely built, centrally located urban area, Nordhavn, and a dense low-rise and newly built suburban area, Nærheden. The planning of these two areas is quite different. The newly developed area is part of the City of Copenhagen's strategy for creating livable cities and, as such, much focus has been on providing for other modes than the car. As an internal joke in the project, the area was referred to as a candy store for mobility solutions, since it was definitely the place where living without a car was supposed to be easy. But, despite the accessibility of various mobility alternatives, many families in this area still have their own private cars parked in the parking garages in the area. However, they expressed how the experiment had made them aware of car sharing as an option that was economically viable as compared with owning a car, especially because parking is expensive in Nordhavn. Further, the participants in the SIMS mobility experiments expressed that it was easy and timesaving to find a shared car when car-sharing had a fixed parking space. Participants also pointed out that the number and spread of cars were important so that they did not have to travel too far to reach one. Thus, in densely populated urban areas where parking a private car close to home is not necessarily an option, car-sharing has particularly good potential for uptake. To promote car-sharing, it would, therefore, be useful to work with both enhancing the conditions of users, e.g., by distributing cars densely around the city, but also by making conditions less favorable for private cars, e.g., through reducing parking availability and raising parking costs.

Throughout the project, participants and stakeholders expressed how parking in Copenhagen is very cheap when you consider the amount of space car parking takes up and how relatively cheap parking licenses are. These are major barriers to creating more sustainable mobility in the city. This came along with the fact that they also appreciated the urban space being less congested with cars and emphasized that it is much nicer and safer to move around in the streets and that it would mean less noise and pollution. This was one example in the project of how everyday mobility practices relate to other practices, interlink with the wider urban context, and build upon elements from other practices, such as parking practices in the wider Copenhagen area and their organizations. These linkages with elements of the wider context render it more difficult for the MaaS solution to recruit participants. This is one of several examples in the SIMS project of how the qualities and elements of the wider context shape the mobilities in Nordhavn in more and more diverse ways than what is recognizable from a rational transport planning perspective, where solutions are made more generalized. It is not to say that the SIMS project brought this about, but what it did, through its emphasis on mobilities planning, was that it opened up the questions of why and how, and gave space to all the contextual elements that should also be included when developing new areas and planning their mobilities.

In Nærheden, the planning was quite different and, for the developers, one of the major success criteria was to establish only one parking lot for each household. Even if most residents used their private cars, we saw how the participants in our experiment

talked about the shared cars as a positive quality of the area—also for those who did not use the cars themselves. Inhabitants in Nærheden described how the car-sharing scheme contributed to the area's 'green image', and more residents mentioned that it was included as a factor in their considerations about moving to the area, because the availability of shared cars presented an alternative option and potential solution to expected future changes in mobility needs. Some talked about car sharing as something that was part of their long-term plans, for example, when they retired and could no longer afford or need a private car for commuting. However, because the material and social conditions of the suburbs are different from those of the big city, it is important that sharing schemes are adapted to the concrete context—the suburban communities, physical planning, and infrastructure. The planning of Nærheden challenges the rational transport planning automobile regime due to a reduced parking norm, which meant a longer walking distance to reach cars. Therefore, it challenges the reproduction of everyday car practice. Costain et al. [55] found that people more inclined to use car sharing were also more positive toward frequent use of public transportation. In its initial strategy, Nærheden made attempts to redefine the interdependence between owning a car and suburban living. From a theory of practice point of view, or with a mobilities planning strategy, they changed the material, as well as the meanings, of driving private cars. In Spurling et al.'s [28] terms, this would be recrafting a practice of private car automobility. To move further and change how practices interlock, the contexts of the areas would need to be taken more into consideration.

4.2. Experiences and Storytelling Matter

Already from pre-intervention studies, we learned that stories and prejudices about the disadvantages of sharing mobility are widespread and that they are often not related to concrete solutions or experiences, but are generalized to all kinds of sharing technologies. For example, there was a widespread perception among residents in Nordhavn that having a shared car available when needed would be a problem (as opposed to having their own private car). Widespread (mis)perceptions about car-sharing among residents presented a barrier to even considering car-sharing as an alternative to owning a car. This shows another difference between rational transport planning and mobilitiies planning. Within the rational planning paradigm, the concept of the rational economic man is prevailing and, as such, price and communication should be the reason for people to change their mobility behavior. With mobilities planning in mind, we devoted several resources to communicating the possibilities and qualities of the solutions to residents and local businesses, as well as creating experiments that gave them an experience of different mobilities connecting their everyday lives. It also strengthened the argument for conducting comprehensive experiments with relatively few participants, as the methodological reflections behind the experiment design were that 'ambassador families' in the communities could be created through intensive experiments. These families would gain actual long-term experiences with the sharing solutions, and they could thus spearhead challenging mobility (mis)perceptions in the community.

Among the 20 families who challenged prejudiced perceptions and obtained their own experiences with sharing solutions through participation in the SIMS experiment, we saw that new stories emerged. They then told us how they experienced the same freedom of movement and flexibility as if they had their own car. The freedom to move has historically and culturally often been linked to the private car [48,56,57], and this understanding was reflected in pre-intervention interviews. Interestingly, in the post-intervention interviews, we saw new stories emerging, linking freedom to exactly the opposite, highlighting the values and freedoms related to not owning a car. These stories highlight the freedoms connected to liberation from obligations (e.g., changing tires), wasted time (e.g., finding parking), and costs (e.g., parking costs). Participants talked about the freedom to plan one's day and use the means of transport that make the most sense in specific situations. Further, several participants emphasized the joy of having a mobility practice that is better in line with their values and environmental concerns. Participating in the experiment established

new powerful experiences and stories about mobility. They were powerful in providing the opportunity to move beyond the taken-for-granted ideas about how mobility and systems work. The idea of freedom as linked to the private car, which has historically and culturally been dominant, has been underpinned by rational transport planning, as their calculation models are based on a predict-and-provide system [12,58]. The logic built into such calculation models is that, when many people use cars, we must provide more—more cars, more parking, and more infrastructure—instead of looking into the possibilities for new habits to emerge. But thinking about mobility futures from a perspective informed by practice theory and the mobilities paradigm, and understanding the findings of the SIMS project applying such a lens, we discovered a need to also be looking for other qualities—not only efficiency and accessibility in the traditional way. To promote car-sharing, it would, therefore, be useful to work both on spreading cars around the city, but also to work strategically on spreading positive stories about new forms of freedom related to car-sharing among citizens. What is interesting is that, given the opportunity to try things out, most participants adjusted their original ideas about the need for their own car and saw the combination of public transport and car-sharing as the most relevant mobility solution to their everyday lives.

4.3. Identity Matters

Another issue we often encountered was identity issues. A male participant in his 50s in Nordhavn pointed to the need for "nice" mid-range cars in the car-sharing scheme. He perceived the current offers targeting a younger segment, because many of the cars are either city cars for young people going on short trips or station wagons for families with children going on weekend trips. He himself appreciated driving a "nice" car when he occasionally bought access to a car for trips out of the city. Others mentioned that "nobody bothers with manual gears" when you only drive occasionally, and that you must be indifferent to cars and their specific connotations and social markers to find the shared cars attractive. The statements suggest that the car-sharing scheme in its current form does not appeal to an older segment who have opinions about car appearance and comfort levels and who place identity in what car they drive. What we can learn from this is the need to work with the image, social understanding, and narratives of car-sharing. This also includes considering the types of cars available to car-sharers—not only in terms of size and fueling, but also in terms of labels, decoration, and logos. This is because, in the SIMS project, we also saw that car-sharing users were, to a large extent, embedded in the same symbolic and social logic that surrounded the private car. Namely, the car is a marker of identity and social status—as demonstrated in many previous mobilities studies [56,57,59–61]. In focus groups with intervention participants, many discussions revolved around the labels and logos of the cars. For some car-sharing drivers, driving a car-sharing vehicle could signal concern for the climate and the environment and be an attractive marker of an active choice against the private car. But for many others—and especially those who would not choose a car-share for environmental or ideological reasons—the very symbolic meaning of the car-share may act as a deterrent. The car-sharing narrative needs to relate to more than just the environmental benefits, and also consider the symbolics, identities, and social logic tied to the car, as the symbolics are currently hindering the recruitment of practitioners who are less concerned with the environmental and climate issues of mobility.

Another of the often-named challenges of performing shared mobility practices was the lack of possibility to, for example, lend a car to your adult children, as you would with your own car. Also, driving older family members to their doctor's appointments and picking up grandchildren from daycare were mentioned. The recurring mentioning of such events can be related to the significance of mobilities of care as an important element in car ownership [62–64].

The bundles of practices connected to caretaking differ among specific life phases in everyday lives. What is clear in the stories from the participants is that an important identity and meaning are embedded in providing mobilities to maintain communities and

to support friends and family in their daily needs. This identity is often connected to a privately owned car that is accessible all the time.

4.4. Inequality Matters

As mentioned earlier, the mobility providers turned out not to be interested in taking part in an intervention in Folehaven, the older and less advantaged neighborhood as compared with the other two test sites. We made several attempts to secure other funding that could fund the trial period, but we were unsuccessful. Already in the early stages of the project, we began to see how comparing the cases we had chosen for this project showed evidence of mobility inequality between the people and places we investigated. Mobility inequality is about unequal access to transportation and the unequal possibilities resulting from differences in mobility supply [65]. Research-wise, it allowed us to pursue insights into the dynamics of mobility inequality and how it manifests, even in a relatively socio-economically equal city, such as Copenhagen, with an extended mobility system and relatively good public transport services as compared with other capital regions.

Comparing Folehaven with other urban areas, we found large differences in residents' perceived mobility opportunities. One of the main issues affecting the mobility of the residents of the area was the major roads surrounding the area and the consequences in terms of unfavorable conditions for pedestrians, cyclists, children, and the elderly, as crossing the heavily trafficked roads was more or less impossible outside of pedestrian crossings, and noise and air pollution were causes of poorer health, especially among the inhabitants of the periphery of the area. The roads have high-speed limits as compared with other Copenhagen roads and give cars priority over all other forms of mobility. The intersections and traffic lights also prioritize cars; for example, the green light is on for a shorter time than it takes many pedestrians to cross. This creates an experience of isolation, with the roads acting as walls of traffic cutting off exchanges and separating the area from its surroundings. This is especially detrimental to already mobility-limited groups, such as the elderly and children in the area. These roads were put in place as part of the zoning system within the rational transport planning. They were built at a time when easy access to the inner city of Copenhagen was a main priority of traffic planners, and when the car was prioritized above all other traffic modes. This is because the car performs well in time-saving-oriented cost–benefit models, where, e.g., health and inclusion were invisible parameters not included as relevant or valuable outcomes in traffic planning.

Mobility limitations were, by inhabitants, perceived to be exacerbated by a recent restructuring of public transport in the area, including the closure of the closest train station (a new station one kilometer further away was opened in proximity to a new development area) and discontinuance of a local bus route in the area. Whether shared mobility, e.g., in the form of electric bicycles and shared cars, can play a role in addressing some of the mobility challenges of Folehaven has unfortunately not been possible to investigate under the auspices of the SIMS project. Instead, and ironically, the SIMS project itself ended up as an example of how mobility inequality is produced, because it successfully brought shared mobility solutions to the two other neighborhoods while failing to operate in Folehaven, where the inhabitants already thought of themselves and their area as being underprioritized in terms of transport and mobility [13]. Storytelling played a key role in reproducing mobility inequalities, as mobility providers referred to generalized stories about the area when justifying (dis)investment decisions [13]. This points to the power of narratives in mobility investment and planning, leading to an increase in mobility supply in, e.g., the Nordhavn area, while sustainable mobility alternatives remained inaccessible to Folehaven residents.

5. Concluding Remarks and Recommendations for Future Work with MaaS

The SIMS research showed how the physical layout of the area and the prioritization of public transport play major roles in daily mobility and can present either a barrier or an opportunity for promoting sustainable mobility. Which and how much mobility services

are available have implications for how easy or difficult everyday life is for residents and the opportunities that different groups of residents have for participating in activities outside of the area (work, social activities, shopping, etc.), which constitute a dimension of mobility poverty [65]. The failure to launch a MaaS experiment in Folehaven, while several initiatives were successfully launched in Nordhavn, confirms, and reinforces, the mobility inequalities between the urban areas. Such mobility inequalities are not only problematic from a social perspective, but they also have a negative impact on the possibility of creating sustainable future mobility, because sustainable alternatives are only made available to certain people and places. Here, storytelling plays an important role when it both proves important for the willingness to try out MaaS solutions, as well as if mobility providers in the first place are willing to provide MaaS solutions. The results from the SIMS project emerged because of the use of the theory of practices within a mobilities planning ontology. The project has shown that the private car, as the ideal for everyday mobility, is still prevalent among many urban and suburban residents. This is a strong cultural narrative that plays a major role in citizens' understanding of their own mobility needs, as well as in the way the city is planned and designed. It is very much in line with decades of rational traffic planning favoring the car. Our cities and built environments are shaped by decades of planning for private car use, and as long as this continues, it is difficult to see how alternative, sustainable solutions can become significantly more widespread; or, with Spurling's framework, to change how practices interlock requires more than experiments dependent on a successful business model of smaller mobility providers. The role and paradigm of planning need to come into question.

More generally, the experience of the SIMS project group of partners shows that in creating integrated MaaS solutions across private, as well as public, sharing solutions, organizational–practical challenges are of key importance. There was a widespread willingness among the project partners to seek common solutions and collaborations. In practice, however, this was challenged by the fact that integration across solutions and providers proved extremely challenging, because different solutions are built upon different business models, software, user interfaces, data flows, etc., resulting in a lack of interoperability. But MaaS, as a unified application, was surprisingly also not something that the SIMS participants expressed interest in. Quite the contrary, they expressed that they were fine with navigating different Apps and, as such, it becomes more important to think about MaaS as a concept and framework, than as a technological solution. Thus, the SIMS project shows that it is not enough to develop another application or learn that alternatives exist—they need to be experienced. This aligns with the first step in Spurlings 'changing how practices interlock'. New possibilities become possible for people when they have everyday experiences. This highlights the importance of understanding everyday life practices, identity, and storytelling when aiming to disseminate MaaS solutions.

Learnings for Implementing MaaS Solutions

In relation to the everyday practices of residents, MaaS has the potential to be a strong tool, but technologies alone do not change practices. As an example, the Danish travel planner is an important tool for shared solutions, but it primarily works for those already searching for new modes and connections. Software is often not context-specific (enough). For instance, when the Danish Travel Planner suggests a free-floating shared car from the central station in Copenhagen to a home inside the city, the amount of traffic and the search for a parking space are not taken into consideration, which is making public transport the easier solution, even if it means walking 10 min. The travel planner is programmed with the outset that walking is a time-consuming hassle—something that should be avoided. For the experienced user, it is easy to see through the suggestion the travel planner makes and weigh the benefits of walking compared with locating, unlocking, and parking a free-floating shared car. For the inexperienced user, though, this results in a bad experience and a reinforcement that using a private car is easier. The SIMS project clearly shows that those with opportunities close by and experience with using MaaS are

much more inclined to change mobility practices than inexperienced users without the skills to navigate technology, without familiarity with the materials, and without environmental awareness. This might seem like an obvious point, but still, everyday life and users' skills and understandings are something that seems to be forgotten when thinking about MaaS solutions as mere technology.

In relation to mobilities planning, it is very clear from the SIMS project that context matters. This is not only on a national or city level, but also, importantly, the planning of the local neighborhood. The connections possible and opportunities available varied significantly between the three areas in the project, and this had a large impact on everyday practices. This is also an argument for being careful with 'importing' best cases without understanding the context. Even if Nærheden was built as a sustainable neighborhood in proximity to a station, it was still located in a suburban environment, rather than a big city. In Nærheden, the amount of space provided to facilitate the private car is much larger than that in an inner-city neighborhood, and this has a large impact when it is already seen as the mode that connects practices in everyday life.

Another important point is that new solutions, like MaaS, take time to implement. The prevalent idea that they can start out on a free market is problematic. In Folehaven, there was no willingness from the mobility providers to even try to make shared solutions work. In Nærheden, the availability of shared cars stopped when the financial support stopped. Only in the Nordhavn neighborhood, close to the Copenhagen city center, are shared cars still available today, after the project period has ended. After more than 100 years of traffic planning supporting people in driving their own car, it is not an easy practice to change. Especially not if car driving is completely intertwined with everyday life's many other practices. Relying on the implementation of MaaS solutions on the free market and the expectation that these solutions should be profitable from the outset is very problematic when seeing that changing mobility practices is a long and complex process involving the acquisition of new skills, understandings, and materials. Also, in working with mobility providers, it became clear that, in a relatively new market, the mobility providers' main interests were a strong business case when investing in a specific area. This is not a surprise, but the issue here is that their perception of what could make a strong business case was focused on the white middle class. When performing the initial interviews at the beginning of the project period, the largest number of interviewees who knew about the shared car provider lived in Folehaven, the neighborhood that the providers were not interested in experimenting in. This is not the same as saying that it would be a success there, but not even considering this neighborhood is based on perceptions related to socioeconomic status (use) and vandalism of cars (costs). In a new market, trying to provide alternatives to the deeply embedded private car makes these small companies competitors in relation to the economy, and not collaborators in creating sustainability. This reinforces mobility inequalities and, as Lindberg argues, there is no transition toward sustainable mobility if specific socio-economic groups and neighborhoods are not offered sustainable alternatives.

Finally, the challenges of implementing MaaS solutions in Folehaven were an unexpected, but illuminating, experience of how semi-private actors can be reluctant to invest in areas associated with resource deprivation—both in terms of socio-economic and mobility resources. The SIMS project thus highlighted the mobility inequalities that exist between different areas—even in a relatively equal and integrated city, like Copenhagen—with implications for how easy or difficult it becomes for residents to move around. Mobility inequality and its consequences are generally under-studied phenomena, but nevertheless important to consider when working on future sustainable mobility systems to ensure that we develop solutions that are appropriate for all areas of the city. It is important to focus on avoiding reproducing and increasing mobility inequality in our cities and transport systems. Good mobility planning should not only deal with the environmental and climate aspects of sustainability, but also with creating a socially sustainable mobility system.

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