Bridging citizen and stakeholder perspectives of sustainable mobility through practice-oriented design

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ABSTRACT

Transitions toward more sustainable mobility are necessary and involve changes in complex constellations of mobility-related practices. To understand opportunities for moving in this direction, there is a need to explore both the consumption side of sustainable mobility practices and the perspective of stakeholders that provide products, services, infrastructures, and policies required for such practices. This article contributes to a discussion of critical aspects of sustainable mobility practices in relation to the responsibilities and concerns of stakeholders with power to influence these practices. We present four sets of design concepts for supporting car-free living which were formulated and co-created based on a practice-oriented analysis of a one-year study of three families in Stockholm, Sweden that replaced their cars with light electric vehicles. The design concepts bring forward elements of sustainable mobility with a focus on: trying out new mobility practices, cycling infrastructure, child-friendly public transport, and transporting stuff. Furthermore, we discussed the concepts with public and private sector stakeholders and examined their interests in particular practices. Also considered are how the responsibilities of different stakeholders may clash. Finally, we suggest that practice-oriented design concepts can support discussions and increased knowledge about responsibilities and potential conflicts related to sustainable practices, as well as provide means for supporting learning about sustainable practices among decision makers.

Introduction

The use of cars contributes to a significant part of global carbon emissions. In addition, automobiles cause local problems such as air pollution, with negative health impacts and congested cities. At the same time, the car offers, in some aspects, a convenient and personally adaptable mode of transport, allowing its users to travel independently. Over time, this capability has become part of a complex 'system of automobility', where autonomous movement is expected and users become increasingly dependent on cars (Urry 2004). While transitions to more sustainable systems of mobility are clearly needed, they are challenging to govern. Shove and Walker (2010) suggest that to understand patterns of mobility and to address their environmental impacts, governments need to consider mobility-related practices and how they are connected over space and time.

Several researchers suggest advanced practice theories as useful for understanding various forms of consumption and changes toward more sustainable consumption (Spaargaren 2003; Warde 2005; Hargreaves 2011). Sustainable practices are formed not only by lifestyles, but also by systems of provision and as such individual actions are directly related to socio-material structures (Spaargaren 2003). A practice approach to consumption supports a shift in focus from individual responsibility for making sustainable choices for the recognition of how materials and structures influence routines in everyday life (Kennedy, Cohen, and Krogman 2015). Addressing the unsustainability of consumption consequently requires an understanding of the configurations and possible reconfigurations of unsustainable (and sustainable) practices. Shove, Pantzar, and Watson (2012) conceptualize practices as comprising elements of meaning, competence, and materials, which are linked within and among practices. For the case of mobility, the car is a material element that is intertwined in various practices, such as commuting to work, visiting friends, and going shopping. These practices form bundles or complexes in which the practices are connected and
interventions to make them more sustainable, can take various forms with different impacts on the practices themselves. Spurling and McMeekin (2015) present a framework of three types of interventions: recrafting practices, substituting practices, and changing how practices interlock. First, recrafting mobility practices with the aim of making them less resource intensive could include policies that encourage the replacement of petrol-fueled automobiles with electric-powered cars. While this technological change can reduce the environmental impact of automobile-dependent practices, it does not challenge practices of driving or mobility demand. A strategy predicated on the substitution of practices seeks to replace unsustainable practices with more sustainable alternatives, for example, by taking measures to make car commuting less attractive and at the same time render travel by bicycle more attractive. Finally, changing how practices interlock requires interventions into multiple practices and reconsideration of needs for mobility, including consideration of questions such as where to work and how to do shopping.

In studies of consumption practices, the focus is often on understanding unsustainable practices, but it can also be valuable to explore positive aspects of sustainable practices (Spaargaren 2011). In keeping with this idea, we have investigated practices related to car-free living through a study of three families in Stockholm, Sweden, that replaced their cars with light electric vehicles for one year. Stockholm has a widely used public transport system, which is the dominating mode of travel for commuting trips. Nevertheless, and despite goals intended to reduce car use, overall automobile reliance is increasing in the city (Stockholms Trafikkontor 2017). However, for many people living in the Stockholm area, it would in theory be feasible to shift their mode of transport for commuting trips from cars to bicycles. It has been estimated that about 30% of car commuters in the metropolitan region could travel by bicycle to work in less than 30 minutes (Johansson et al. 2017). While this substitution of practices may seem rather straightforward, reducing car ownership and overall automobile use is a much more complex issue.

Addressing sustainable consumption in a meaningful way needs to be a collective effort that targets the design of various aspects of practices (Røpke 2009). Such an undertaking requires the involvement of many stakeholders including governments, companies, organizations, and citizens. However, the power to influence elements of practices may not be equally distributed among stakeholders and their efforts may have different reach over space and time (Sahakian and Wilhite 2014). Furthermore, the initiatives of stakeholders such as policy makers or companies are not external to practices, but rather constitute practices in themselves (Shove, Watson, and Spurling 2015), and as such, they may need to be better understood in relation to sustainable mobility (Watson 2012). We should thus pay attention not only to practices performed by consumers or users of mobility, but also to practices carried out by providers of mobility services, infrastructures, and policies.

In this article, we address both the consumption and the provision sides of future opportunities for more sustainable mobility. With a design-research approach, we explore car-free mobility practices and bring insights from a study of car-free families to public and private sector decision makers. The purpose of this investigation was to probe what future car-free mobility practices might look like and to identify opportunities and challenges for different stakeholders to contribute to the diffusion of these practices. We describe how we synthesized the families’ experiences of car-free mobility practices into design concepts – as visualizations of ideas for how both tangible and intangible elements of prospective car-free living could be configured into more sustainable mobility practices. The design concepts are presented together with the outcomes of discussions of these ideas with decision makers about the challenges and opportunities they face to influence sustainable mobility practices. Finally, we describe critical aspects of sustainable mobility practices in relation to the responsibilities of various stakeholders, as well as occasions for using the practice-oriented design for researching different stakeholders’ interests and for supporting their learning about the consumption side of sustainable practices.

Methodology and methods

We employed a design-research approach in this study, where the intention was to create knowledge by applying design methods and creating design artifacts (Zimmerman, Forlizzi, and Evenson 2007). For this investigation, we were interested in conceptions about future sustainable mobility practices and how they could spread. These are complex questions with no simple answers, and design methods can in such cases be useful for ‘making sense of the future’ and exploring alternative ways of living (Sanders and Stappers 2014).

When exploring possible futures, participatory and transdisciplinary approaches can be useful to
open up plural possibilities for development (Robinson 2008; Stirling 2011). As Robinson argues, transdisciplinary approaches, where research participants are involved in the studies, are particularly appropriate for addressing sustainability challenges. A key characteristic is to work around an issue such as automobile-dependent practices in a problem-based way. In Robinson’s view, the engagement of research participants in transdisciplinary investigations involves considering them as collaborative partners – rather than audiences or target groups – who are involved in both making and interpreting the data. Accordingly, we used a participatory approach for both collecting data and generating possibilities for future sustainable mobility. Our research participants included families that lived without their cars for one year, a design agency to capture the respondents’ experiences in the form of design concepts, and decision makers and other stakeholders invited to further generate and discuss future possibilities for more sustainable mobility. Including research participants in the early stages of a design process can also be useful when bridging insights from the analysis stage to the generative stage of creating design concepts from which others can learn (Sanders and Stappers 2012).

In addition to taking a participatory approach, we applied practice-oriented design methods by using practices both as a unit of analysis and as a unit of design (Kuijer, De Jong, and Van Eijk 2008). We used practices as a unit of analysis by enforcing the emergence of new and more sustainable mobility practices and analyzing their compounding elements and linkages. We subsequently used practices as a unit of design by reconfiguring these elements, in combination with new ones, into design concepts for more sustainable mobility.

Our investigation of future sustainable mobility practices has been part of a research project entitled ‘A Car-Free Year’ where we first studied three Stockholm families with children that replaced their cars with light electric vehicles for one year (see Figure 1). We received applications from 74 families that wanted to participate in the project and, to capture a variety of mobility challenges, we selected three households with different living situations for

![Figure 1. The car-free families with their light electric vehicles: a scooter (top left), a four-wheeled motorcycle (top right), a cargo bicycle (bottom left), and a bicycle (bottom right).](image-url)
the study. The families had children of varying ages (2–15 years old) who were engaged in different types of after-school activities. Two families had summer houses. One family lived in a detached house while two lived in apartment buildings. All of the families lived in different areas of Stockholm. We met with the families once each month for interviews in their homes to discuss their experiences of car-free living. They also kept travel diaries and the written accounts were used during the interviews to trigger discussions about their car-free experiences. Using a practice-oriented analysis grounded in the families’ accounts, we designed in collaboration with the household members and a design agency concepts for car-free living. Furthermore, we discussed the concepts with decision makers within the public and private sectors with the aim of identifying strategies that could be implemented in Stockholm to encourage more families to adopt car-free lifestyles. In this article, we focus on the later stages of the research project, the concept design, and the stakeholder discussions. More information about the families’ experiences during the car-free year can be found in our previous work (Hasselqvist, Hesselgren, and Bogdan 2016; Hesselgren and Hasselqvist 2016).

Analyzing car-free practices

The car-free year study can be seen as a disruptive intervention where automobile-dependent practices were reconfigured into new ‘proto-practices’ (Shove and Pantzar 2005), in which old elements of a practice were combined with new ones. The reconfigured and more sustainable mobility proto-practices were analyzed to understand the elements and their links based on the families’ experiences. While our focus was on automobile-dependent and car-free travel practices, these modes of mobility were bundled with other practices such as shopping and socializing. These bundles of practices were specifically identified and deconstructed with the intention to reconstruct new and more sustainable alternatives. As part of this process of deconstruction and reconstruction, we used the framework The Contextual Wheel of Practice (Mose Entwistle et al. 2015). This tool builds on Shove, Pantzar, and Watson’s (2012) division of elements into materials, meanings, and competences, but it splits material elements further into near materiality and infrastructure. This distinction was useful for our analysis as infrastructure is a very explicit component of mobility.

Designing concepts for car-free living

When designing concepts for more sustainable mobility based on the experiences of the car-free families, we used practices as a unit of design. To support the integration of practices in the generative design work, we created a workbook mapping out different elements of the respondents’ practices and whether they were related to positive or negative experiences (Figure 2). The practice-oriented workbook provided strategic guidance for the design process in which we focused on suggesting reconfigured practices by removing or replacing elements associated with negative experiences and highlighting elements associated with positive experiences. At this stage, a design agency was involved in the creative work of concept generation. Furthermore, in line with the participatory approach, the families took part in two workshops where we and the design agency generated possibilities for more people to shift to car-free living. In these events, the family members were encouraged to discuss details of their present car-free life, to reflect on their recent past
experiences, and to create and imagine future alternatives to car use that would also be viable for others. We also arranged workshops together with experts from the public sector (the Swedish Transport Administration) and the third sector (a nongovernmental organization (NGO) focused on promoting more sustainable mobility) to further discuss and develop the design concepts. In addition, we produced a 7-minute video in which the families told their car-free year stories. We enlisted a professional documentary filmmaker for this assignment and he was given specific instructions to highlight the concrete details from the families’ everyday contexts.

**Discussing sustainable mobility practices**

In the final stage of the study, we used the design concepts to discuss the experiences of the three Stockholm families of adopting more sustainable mobility practices and opportunities to support car-free living on a larger scale with decision-makers who influence, or could influence, mobility practices in the city. The concepts were considered in various contexts, including political gatherings, NGO meetings, and business workshops during 2016 and 2017 as we were regularly invited to discuss car-free living. As part of the research project, in 2016 we organized three stakeholder meetings with decision makers from the public and private sectors. Public sector representatives included local government officials and politicians from the city of Stockholm (in total 7 participants) with responsibilities for transport and environment and with one politician from the national government at the Ministry of Environment and Energy. Within the private sector, we met with one human-resources representative at a large company (more than 12,000 employees) responsible for an internal sustainable mobility project. We were interested in meeting with these stakeholders because they had, in different ways, the power to influence people’s mobility practices and currently worked on developing initiatives and policies related to alternative mobility options. Furthermore, they were all interested in sustainable mobility and thus highly engaged in the results of our research.

During each of the three stakeholder meetings, we first introduced our project by showing the 7-minute video featuring the car-free families. We subsequently presented the sustainable mobility concepts together with descriptions of key insights from the car-free year study. This was followed by discussions on how these concepts related to the work and roles of the different stakeholders. The meetings were audiorecorded and transcribed. We analyzed the interview material with a specific focus on opportunities and challenges for the participants to influence car-free practices.

**Results**

In this section, we present the concepts for supporting car-free mobility together with key insights from our study. The concepts include a range of different types of design: from policy and infrastructure to products and services. They should not be regarded as proposals for implementation but rather as illustrations of potential configurations of meanings, competences, and materials pertaining to various car-free practices. The concepts are divided into four sets with the themes: (1) trying out new mobility practices, (2) cycling infrastructure, (3) child-friendly public transport, and (4) transporting stuff. Each set is followed by the perspective of stakeholders who could possibly influence elements of car-free mobility practices.

**Trying out new mobility practices**

Many families that applied to the car-free year study expressed a desire to eliminate their cars while they at the same time were concerned about how to manage everyday life without a personal or household automobile. For the three participating families, the study supported them in forming new mobility practices that they eventually came to consider as normal. Without such assistance, the prospect of selling her or his car is likely to have been regarded as a big leap and investing in a light electric vehicle, on top of the expenses of owning an automobile, would have been too costly. Therefore, our first set of concepts presents ways of supporting people who are experimenting with new mobility practices without the need to make a significant investment or definite commitment (Figure 3).

Central to the idea is a product-service system with light electric vehicles, such as electric cargo bicycles that can be leased from workplaces in a similar manner as cars, where a monthly fee is deducted from the salary as part of employee-benefit schemes. The leasing contract is connected to service partners – for instance, local bicycle shops – that can provide relevant expert knowledge (e.g., how to make winter cycling pleasant and safe), as well as hands-on support with changing to winter tires or repairing the bicycle. Finally, to further facilitate car-free mobility practices in the longer term, one concept introduces a reward system in which cyclists collect points that can be used to pay for related services, such as fixing a flat tire. This arrangement can be viewed in relation to congestion...
charges for cars that are already implemented in Stockholm and involve the imposition of a fee on automobile use in central parts of the city. The bicycling-points concept suggests that, in addition to taxing the use of unsustainable modes of transport, mobility practices that are beneficial for society – both from environmental and health perspectives – could be rewarded.

During the concept discussions, the company representative expressed interest in offering bicycles to employees, but the company had already invested in other, higher-priority, mobility solutions. Although our intention was to discuss how workplaces could assist people interested in trying out a car-free life in general, the company representative was mostly concerned about supporting commuting trips, both in terms of being an accessible and attractive workplace for people living in Stockholm and of making it easier to get to and from the workplace in a more sustainable way. The company, therefore, implemented a dedicated bus for employees and promoted a car-sharing app developed by a group of employees.

The local government representatives considered the municipality of Stockholm as a potential testbed for mobility interventions and suggested that they could arrange a car-free week for their employees. Beside this idea, the discussion here mainly focused on how to pragmatically support people who were trying out new mobility practices. The concepts touch upon the responsibilities of a large number of different stakeholders and, when considered as proposals for implementation, they may be in conflict. The local government representatives commented that ‘taxes are state [national] business’, which would make the concept of congestion charges (taxes) and bicycling points impossible for a local government to implement on its own. They also highlighted that costs and potential benefits, such as reduced healthcare expenses from increased bicycle use, could be unevenly distributed among different stakeholders: ‘What the City of Stockholm invests will not come back to Stockholm in money, it might rather be the Stockholm region [in charge of healthcare] that gets a better economy if the public health is improved’.

Nevertheless, the Stockholm municipal government has found other ways to support people who would like to experiment with new cycling practices. For instance, during the winter of 2017–2018, it assisted citizens who were interested in trying out winter cycling by providing both practical help with seasonal tires and knowledge useful for cycling at this colder, darker, and sometimes snowy time of
the year. The focus was, however, on commuting practices rather than replacing the car, which is in line with the city’s goal of increasing bicycle use to 15% of all rush hour trips by 2030.

**Cycling infrastructure**

One overall change for the car-free families was that they all traveled more by bicycle: either with regular bicycles, electric bicycles, or electric cargo bicycles. The children either used their own bicycles, by themselves or accompanied by their parents, or were carried in the boxes of the cargo models. However, the bulky cargo bicycles did not always fit on the bicycle paths and traffic lights that needed to be pressed were not designed for models with a box mounted in the front. Furthermore, automobile traffic and other cyclists who traveled at high speeds or ignored rules sometimes made the use of urban bicycles feel unsafe, particularly when accompanying children. The first two concepts address this problem through the introduction of ‘bicycle highways’, already in use, for example, in Copenhagen, with space for cargo bicycles and cyclists of different speeds (Figure 4). One aspect of the concept is that by making it clear that the infrastructure is designed for bicycles, cyclists can also be expected to adhere to the rules to a greater extent. This is complemented by a concept with dedicated road signs for cyclists, extending beyond today’s bicycle-path signs and also displayed in Figure 4. The information not only focuses on practicalities like directions and warnings, but also on highlighting positive aspects of bicycle travel, such as the opportunity of taking a scenic route. To enjoy an attractive route on the way to work, or simply to be outdoors in the daylight, were some of the reasons why the participating families appreciated traveling by bicycle rather than by car. The final cycling concept pictured in Figure 4 incorporates these types of values as digital tools for travel planning which customarily focus on optimizing trips based on time or distance.

Although cycling with children was an important part of the story connected to the concepts, youngsters were rarely mentioned in the discussion about cycling. For cycling as a commuting practice, the focus was naturally on employees. The company representative reported that many of the firm’s
employees cycled to work, and in her experience, they often traveled longer distances than expected: ‘But those cyclists who make their voices heard, are those with at least 20 kilometers to work. They don’t think it is worth biking if the distance is too short’. The representative from the Swedish Transport Administration also commented on the practice of cycling to work as a form of exercise which has spread in Stockholm over the past few years. She noted that these individuals, described as typically being men with expensive bicycles, are the ones who are the loudest voices in the public debate.

It is, however, problematic if this debate has an overly narrow focus on what cycling is and for whom it is a viable travel mode. Different cycling practices have varying meanings or values and they also have distinctive requirements with respect to cycling infrastructure. For bicycle commuters who travel long distances and regard this mode as an opportunity to exercise, going fast with a limited number of stops might be a central consideration. In contrast, for parents accompanying children, well-designed cycling infrastructure should enable a slow pace and provide a sense of safety. In the same way, the types of bicycles that people envisage affects shared ideas of what cycling is and what is required from the infrastructure. However, the local government representatives reported that the public office implementing and maintaining Stockholm’s cycling infrastructure was already struggling to provide facilities for regular bicycles which made them doubt that they could manage to accommodate the specific requirements of cargo bicycles or electric bicycles.

The local government representatives could also see risks in focusing on new types of bicycles such as cargo bicycles: ‘I’m thinking if it couldn’t be that you can scare people because they think that if you’re going to do this you have to have a box bike. You have to have something bigger and longer. That you push away what people are used to and what might be simpler and has worked before.’ From a perspective of commuting practices, larger bicycles may indeed not add much value unless they are needed for dropping off children on the way to work. However, from the vantage point of displacing the car, we found in our study that cargo bicycles could replace many car trips that would not be possible to supplant only with a regular bicycle (Hasselqvist, Hesselgren, and Bogdan 2016).

**Child-friendly public transport**

Before the car-free study, the families frequently used their cars for taking their children to sports activities. Without a personal automobile, they either arranged for rides with other families (notably without being able to return the favor) or the children traveled by themselves via public transport. However, even though the families found that this alternative worked reasonably well for the children, other parents questioned this choice and insisted on driving the children home after practice sessions. This outcome prompted one of the parents in the study to doubt the safety of public transport. This was not an unreasonable determination because it is not obvious from the design and communication of public transport services in Stockholm that children are welcome to travel by themselves, which the first two concepts (see Figure 5) address with a child-centered redesign of busses and subway trains. The first concept includes dedicated seats for children in the front of the bus, with easy access to the driver in case they need support. Similarly, the second concept has a section of the subway train designed for children and ‘child-friendly’ staff on the platform. The final concept detailed in Figure 5 addresses the expectations of car use for sports activities through a shared, digital public transport pass for sports teams. The pass can be used by different parents to take several children to athletic events by public transport and in this way contribute to ride-sharing without having access to cars.

While many of the concepts during the discussions triggered personal reflections about mobility practices, respondents raised their ideas for child-friendly public transport almost exclusively from the perspective of their own personal experiences rather than in relation to their professional roles. Encouraging children to take public transport, or other more sustainable modes of travel, was to a great extent perceived as a parental responsibility. For instance, the company representative described how she used to persuade her children to go by public transport. This mode was supported by one of her children’s sports teams where the team leaders traveled together with the youngsters by public transport. In this case, the team leaders did not assume that all children would be driven by car to the activities. However, in Sweden it is common for parents to drive their children both to school and after-school activities, which was criticized by the national politician who participated in our study: ‘You know people drive 13-year-olds a distance that would be 25 minutes of walking – that’s nothing. And then you have built in a behavior that is completely unsustainable’.

Both in our study of the car-free families and during the concept discussions, respondents closely associated the travel practices of children with their opinions about what it means to be a good parent. This relationship is, however, not necessarily
straightforward. On one hand, good parenting might involve safely taking children to sports activities by car and possibly assisting other families by sharing the task of driving. On the other hand, a good parent might teach her or his children healthy habits of walking or cycling or help the youngsters to ‘grow’ by gradually introducing them to using public transport on their own. This distinction is related to various norms around mobility, which we deliberately aimed to question in many of the concepts. However, while researchers might be free to discuss norms, the national politician stressed that it is not strategic for politicians to do the same. This individual noted that, ‘To sell this [concepts for car-free living] I shouldn’t talk about norms. Then I’ll end up in the news and they will say that you shouldn’t tell us how we should live our lives’. Nevertheless, the respondent did appreciate how the car-free mobility concepts could fit into the existing national transport strategy which has a four-step principle for development. According to the plan, the steps should be prioritized in the following order: (1) rethinking mobility needs, (2) optimizing existing infrastructure, (3) rebuilding existing infrastructure, and finally and only if there is no other option, (4) building new infrastructure. Questioning norms could be regarded as a way of rethinking needs for mobility and considering actions that influence mobility demand in terms of both number of trips and transport mode.

**Transporting stuff**

Transport is not only necessary for moving people between places but it is also essential for conveying stuff. During the car-free year, the families in the study used delivery services for items such as groceries, home-renovation materials, and household appliances. There were many options available to facilitate home delivery, often at low or no additional costs, but when things needed to be moved away from the home, the options were fewer and more expensive. The concept for transporting stuff connects home delivery with the removal of recyclable or bulky waste from homes (Figure 6).

The local government representatives were involved in a large sustainability project in which one objective was to explore how home delivery could be supported by storage containers with cooling capacity for groceries. However, since the families in the study reported that home delivery worked effectively and there was already strong commercial interest for improving these services, it could be more useful for the city to spend its resources on developing new

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Figure 5. Concepts for child-friendly public transport: dedicated seats for children travelling by bus (top left), friendly staff supporting children in the subway (top right), and a digital public transport pass for sports teams (bottom).
options for recycling and waste management. Stockholm’s municipal government is in charge of recycling bulky waste, which mainly takes place at recycling stations, often located in the suburbs, and to which people normally need to drive. In addition, the city has mobile recycling stations that visit mainly the central parts of the city, and the local government representatives explained that they were looking into possibilities to extend this service to the city’s outer districts. Recyclable packaging, however, involves other stakeholders and it has been difficult for the city to influence the availability of facilities for these materials. In the future, new services based on notions of a circular economy may increase commercial interest in and responsibility for the entire life cycle of products (Ghisellini, Cialani, and Ulgiati 2016), including waste management, and supporting these alternatives could be a way for policy makers to indirectly facilitate more sustainable mobility.

**Conclusion**

In this concluding section, we consider the concept discussions with decision makers and highlight insights important for the support of future sustainable mobility practices, with a particular focus on the conflicts that may prevent action. Furthermore, we discuss how practice-oriented design concepts can support deliberations around responsibilities for more sustainable mobility as well as provide means for decision makers to learn about sustainable practices from the perspective of ordinary people.

**Commuting practices or car-free living**

Efforts to reduce car use have implications for many practices and some of them notably receive greater attention than others. Commuting was such a practice that received significant emphasis during the concept discussions in our study, despite being only one of many practices mentioned in the stories of our respondent families. There is also an increasing number of business and municipal initiatives in Sweden that aim to promote more sustainable modes of commuting. Commuting may be of interest for stakeholders since it is a rather straightforward case of substituting a more resource-intensive practice with a less resource-intensive alternative (Spurling and McMeekin 2015). However, while attention to commuting practices can be crucial for reducing some types of car use as well as for very immediate problems such as congestion and local air pollution, it is also important to recognize that addressing this form of travel is not the key to support car-free living – at least not in Stockholm and similar urban regions. In a city with a well-functioning public transport system, it is generally easy to commute to work without using a car. Rather, it is practices of more occasional character, for example, related to taking children to sports activities, going to a summer house, visiting family, or managing a house, that require the use of cars. However, when an automobile is readily accessible, it may be used for more trips than what is perceived as absolutely necessary (Hasselqvist, Hesselgren, and Bogdan 2016). Furthermore, when the fixed costs of car ownership are pre-paid, alternatives to automobile use, such as train trips, may be regarded as expensive compared to the cost of fuel.

When designing the concepts for our study, our ambition was to emphasize car-free living rather than changed commuting practices. However, we could have further stressed the complex bundles of practices related to mobility by including more
practices related to less regular trips and leisure activities. Since much of the focus of decision makers already is on commuting practices, there is a need to balance this emphasis by highlighting other aspects of automobile dependency to support discussions of car-free living.

**Challenges of responsibilities**

One reason why commuting practices are addressed to a greater extent than many other automobile-dependent practices may be that these practices are less controversial for stakeholders compared to those related to vacations or children’s sports activities. It may be less acceptable for governments or companies to express responsibility for aspects of practices that are considered personal or private (Strengers 2012). This interpretation has parallels to challenges of addressing norms and values related to different lifestyles, which was mentioned by the national politician in our study. However, even if certain topics are sensitive for some stakeholders to discuss, it is important that these less articulated elements of practices are understood and made more explicit. Since elements are linked and influence one another (Shove, Pantzar, and Watson 2012), there are risks of, for example, reinforcing norms underlying unsustainable practices through the design of infrastructure, services, and products if politically awkward topics are not discussed. When grappling with change, it is also useful to remember that what is personal or sensitive is not inherent in a practice but rather a determination that arises out of socially constructed processes that vary across contexts and over time.

Another aspect of responsibility revealed in our study was that many of the design concepts appeared challenging to implement due to dependence on a wide array of stakeholders. While our intention was not to suggest that these concepts should be effectuated in the exact form in which we presented them, they included important elements of sustainable mobility practices that particular stakeholders had distinct opportunities to influence. Thus, the practice-oriented design concepts were useful for considering and mapping responsibilities related to supporting future mobility practices. Furthermore, the discussions highlighted central conflicts among responsibilities, such as the tension between investments in cycling infrastructure (a responsibility of the local government) and subsequent health benefits that might ensue (related to responsibilities of the regional government). Since collaborative efforts are needed to address sustainable consumption (Røpke 2009), it is important to be aware of potential friction among the responsibilities of different stakeholders. Practice theories can be useful to understand organizational dependencies (Feldman and Orlikowski 2011) and further analysis could point to necessary actions. Not only is practice theory useful for getting a better grasp of the issues, but we also contend that there are opportunities to specifically use practice-oriented design concepts both to reveal these organizational conflicts and dependencies and to support discussions directly among stakeholders.

**Learning through practice-oriented design**

We generated the practice-oriented design concepts with the purpose of bridging the configurations of sustainable mobility practices from the grounded micro-dynamics in the families’ car-free year to decision makers with possibilities to influence mobility practices. To act as bridging devices, we designed the concepts by deconstructing the families’ past experiences of the car-free year and then reconstructing them into future opportunities for car-free living. In this process, we strategically balanced the design choices for the concepts to support bridging [for more details, see (Hesselgren, Hasselqvist, and Sopjani 2017)]. For example, we combined an abstract visualization style for the concepts with the concrete details of the family members in the video. We selected the former approach to communicate that the design concepts were ‘unfinished’ and should rather be treated as suggestions on which to build while the purpose of the video was to convey the actual lived experiences of the families. As we discussed the concepts with decision makers, they were brought into the present to describe current possibilities to influence mobility practices and their existing responsibilities. When researching complex issues such as sustainability, it is important to not only explain how things are but also to open up discussions of possible futures (Robinson 2008; Stirling 2011). With the intention of serving as prospective scenarios, we deployed the concepts to engage the decision makers in generating future possibilities by opening up spaces for discussions of how more sustainable mobility could be organized. Thus, working with the practice-oriented design concepts supported us in learning about sustainable mobility practices in all three temporalities – past, present, and future – on which we elaborate below.

First, when we used practices as a unit of analysis to deconstruct the car-free proto-practices that the families formed during the car-free year, we learned from their past experiences. While the respondents actively tested car-free living, they also reflected on their new practices, encouraged by research devices
such as the travel diary and the contextual interview. This ‘reflection in action’ (Schön 1983), or ‘experiential learning’ (Kolb 1984), created both new knowledge about the concrete experiences of the family members and general insights into car-free living. As practices are linked in complexes and bundles (Shove, Watson, and Spurling 2015), studies of practices may result in an overwhelming number of practices, elements, and linkages to analyze. With our one-year study, we had many potential directions to take when reconstructing sustainable mobility practices and creating the design concepts. When prioritizing which insights and opportunities on which to focus, we chose to primarily address practices, as well as elements of practices, that were connected to strongly positive or negative experiences, such as the joy of taking a beautiful bicycle route and the awkwardness of repeatedly having to ask other people for help with rides to sports activities. With this information, we aimed to support discussions not only of concrete material aspects of practices, such as what is the suitable width for a bike path, but also of more abstract elements of practices such as norms and emotions.

Second, when we used the design concepts in discussions with decision makers, we learned about their present situations as the concepts triggered reflections around sustainable mobility practices and revealed potential conflicts related to professional responsibilities of supporting these ideas. On one hand, obligations connected to material elements, such as cycling infrastructures, were easier to discuss as they were less provocative and more in line with what the decision makers expressed they could influence. By contrast, accountability for elements belonging to shared meanings, such as encouraging alternative norms to develop, were more difficult to engage because they raised more challenging issues, particularly if the norms were related to personal aspects of life rather than to commuting to work. On the other hand, certain parts of meanings, most notably regulations and rules, were clearly within the ambit of the decision makers. However, when the concepts were too unconventional, such as rewarding points to cyclists as inverted congestion charges, they were simply dismissed as impossible to implement. Important to us, but difficult at this stage, was to identify what was not discussed or considered to be responsibilities of the decision makers. The specific choice of respondents to include in the study, of course, affected our results and with a more diverse group of stakeholders, we might have found additional opportunities and challenges to influence sustainable mobility practices. Analyzing what was not discussed and what were considered to be responsibilities of other stakeholders helped us to identify additional participants who would be useful to include in future work on this issue.

Finally, when the design concepts were discussed as future scenarios, they acted as ‘learning machines’ that supported further elaborations of potential futures together with critical self-reflections (Berkhout, Hertin, and Jordan 2002). The design concepts both enabled the decision makers to elaborate on possibilities for future sustainable mobility and provoked them to reflect on their responsibilities for contributing to such futures. For stakeholders working on issues pertaining to urban planning, the use of scenarios can complement strategic work such as assessing possible future climate impacts of selected interventions as scenarios can be designed to specifically support learning as a process. Kolb (1984) describes this process as movements in two dimensions: between having concrete experiences and turning them into abstract concepts, and between reflecting on past experiences and actively testing new ones. Design concepts in the form of future scenarios can provide support by bridging between the concrete and abstract, as well as by initiating reflections and encouraging experimentation. In this study, the concepts, together with the short video telling the families’ stories in their own voices, acted as platforms on which the decision makers could build to flesh out the specific form of more sustainable mobility practices. The local government representatives, for example, started to discuss the prospect of conducting car-free trials at their own workplace. At the same time, they also reflected in very personal ways related to their own experiences on how to persuade children to use public transport. While the concepts provided everyday contexts that opened up spaces to generate ideas about future possibilities, concrete personal experiences sometimes hindered generation of more general ideas. Even though we tried to strategically balance tangible details on car-free living with more abstract generalizations to open up for own speculations, it was challenging to generate future possibilities. It is imperative to devote careful attention to the design material – in our case the design concepts – to stimulate a co-creative discussion that encourages new options that are salient and workable (Sanders and Stappers 2012). Another barrier was perception among the decision makers of limited power to influence certain aspects of mobility. This obstacle can be overcome by including in the discussion stakeholders with very different responsibilities.

To conclude, we find the practice-oriented design approach helpful for learning about the complexity of car-free life and sustainable mobility practices, both when it comes to the everyday life of people who want to adopt more sustainable lifestyles and to decision
making around the systems that structure and enable these alternatives. Moreover, it is possible to use the practice-oriented design concepts as ‘learning machines’ as they bring relevance from sustainable proto-practices as well as support future making of provisioning systems for sustainable practices. Further development of this practice-oriented design approach could contribute to bridging the sustainability perspectives of ordinary people and other stakeholders for various types of sustainable practices.

Note

1. The video can be viewed at youtu.be/lYaXuUIXsww and is also available as supplementary material to this article.

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