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Article

New Mobility in Everyday Life - Perspectives From 20 Households Examined Over Four Months

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New Mobility in Everyday Life

Perspectives From 20 Households
Examined Over Four Months

The study examines the experiences of 20 households adapting their mobility behaviour with the goal of lower-emission mobility over four months, using, e.g., shared mobility products. The results of 13 targeted interventions are described and combined into three key perspectives that need to be considered when developing lower-emission future mobility products.

Jannis Linke, Dr. Philipp Scharfenberger, Jürgen Stackmann

As it accounts for a significant share of overall CO₂ emissions, the transport sector is currently in focus and will have to realise substantial reductions in the coming years (European Council, 2023).

Tackling climate change makes it necessary to adapt individual mobility behaviour, but the share of individual motorised transport in the modal split has remained the same in Germany (Umweltbundesamt, 2023) and Switzerland (Bundesamt für Raumentwicklung ARE, 2023) in recent decades. One solution that addresses overall efficiency improvement and resource reduction consists of new mobility services (Sarasini & Linder, 2018), which encompass shared mobility, i.e., the shared use of means of transport (Machado et al., 2018). In addition, the use of Mobility-as-a-Service (MaaS) apps (Hensher et al., 2021; Utriainen, 2018) links various modes of transport as an alternative to trips with a privately owned car.

The following study results from the tension between the need for lower-emission mobility in the future and the fact that there is as yet no significant adoption of available alternatives to a privately owned car as measured by the modal split despite new, primarily digital possibilities for making mobility more efficient.

Therefore, to find out what people experience when changing their mobility behaviour, e.g., by abandoning a private car and using public transport or shared mobility services, the following question was investigated in an explorative study with a user-centred perspective:

What do households experience when changing their mobility behaviour towards lower-emission mobility in everyday life?

The study is based on recent findings from studies such as Umparken (Kalkbrenner & Ritz, 2021) in Munich or Ottensen macht Platz (Berestetska et al., 2021) in Hamburg, in which changes in mobility behaviour were researched in the respective contexts. However, to the best of the authors' knowledge, the present study is unique with regard to the diversity of the mobility interventions implemented in the everyday life of 20 households in four different cities in Germany and Switzerland.

Research Design, Methodology and Sample

The study aimed to observe factors influencing mobility preferences, decisions, experiences, and changes in people's everyday mobility behaviour. Answering a call for participation on social media, 377 people stated their potential interest in the study.



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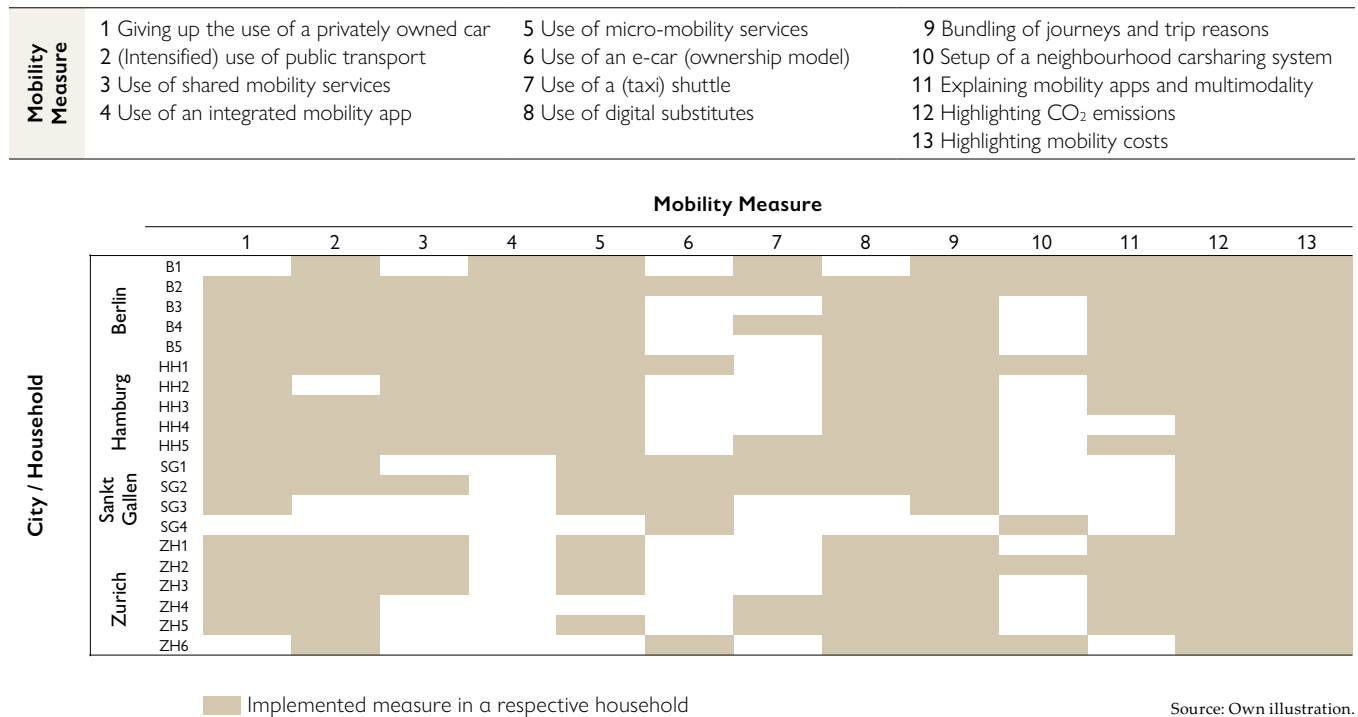
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After checking the applications, households in different cities, countries, and spatial contexts (a total of 10 urban, 5 suburban, and 5 rural households) were selected for data collection. Specifically, 20 households in or around four cities, i.e., Berlin (5 households), Hamburg (5 households), St. Gallen (4 households) and Zurich (6 households), were accompanied over four months (August to November 2022).

For these four months, 13 mobility interventions were defined by the study authors and challenged by industry experts. On the one hand, the interventions focused on specifying concrete changes in physical modes of transportation. On the other hand, they provided information on specific aspects of mobility behaviour like CO₂ emissions or the mobility costs of a mode used by the test households. An overview of the measures and the respective specifications can be found in figure 1.

At the beginning of the data collection, a status quo interview was conducted with the households. This interview focused on the modes of transport used for various trip purposes. In addition, households were asked how they currently decided on a mode for each trip purpose, whether they had ever used new mobility services, and what they generally expected from new mobility solutions. Throughout the data collection period the households used a tracking app (SBB MyWay) to record trip purpose, trip length and mode used.

Fig. 1: Mobility Measures Implemented per Household



The first month of data collection served as a reference. After obtaining the reference measurements, the study authors selected several out of 13 mobility interventions for each household. The selection was based on a household's previous mobility behaviour and the available mobility solutions in the respective city. After introducing the interventions to the households, their mobility behaviour was tracked for the following month. At the end of this period, experiences were discussed with each household in a semi-structured interview, and new interventions were introduced. This intervention selection/behaviour tracking cycle was performed three times over three consecutive months. At the end of the data collection period, a final interview was conducted with each household.

For the present study, data analysis focused on the households' ex-post descriptions of their experiences with the mobility interventions. Accordingly, the study authors clustered the stated experiences of all households by mobility intervention type. Subsequently, all findings regarding a particular intervention were analysed using an interpretative synthesis.

Among those directly involved in the study (i.e., interviewees and tracking app users), 42% were women, and 58% were men,

with ages ranging from 18 to 68 years. Two people had physical disabilities. Nineteen children were passively involved in the study. Participating households included 12 families with \geq three people in the household, four single-person households, and four couples. The economic situation of the households was average to above average compared to the population in their city of residence.

Results of the 13 Mobility Measures

In the following, the results of the 13 mobility measures are described in a summarised manner. The implemented interventions per household, which provided the base for the results, are presented in figure 1.

Giving up the use of a privately owned car. *Specification of the measure: affected one or all cars of the household (depending on the given household situation).* If a household had more than one car and a cheaper substitute was provided, households did not perceive giving up the use of the second car as a restriction of their daily mobility behaviour. Only in urban areas was it possible

to abandon the only car in a household without significantly changing daily routines (time efficiency in suburban and rural areas was low). In Switzerland, the accepted substitutes were public transport combined with the occasional use of sharing services. In Germany, the accepted substitutes were multimodal apps, including frequent usage of shared mobility services. But even when a substitute was available and found acceptable, it became clear in the ex-post discussions that no contextual factor would encourage the sale of a private passenger car. In this context, individuals described the potential sale of the vehicle as a personal expense and risky in terms of timing and optimal return.

(Intensified) Use of public transport. *Specification of the measure: using rail, bus, and tram for any trip reason.* For individuals with little public transport experience, the use of public transport was initially challenging and not self-evident. Among other things, challenges pertained to the search for connections, the orientation in the train station and at the platform (i.e., at the departure, transfer and destination stations) as well as unfamiliar proximity to strangers and ‘free time’ on the train, compared to driving a car. Furthermore, it was observed that experiences with public transport tend to be generalised, especially in the German city households. This means that people transferred negative experiences in other places or from other contexts of use to the entire public transport system. This transfer was also made between different modes or lines of public transport in a city (e.g., bus to train or line 1 to line 2 and vice versa).

Use of shared mobility services. *Specification of the measure: station-based and free-floating car-, bike-, e-scooter-, scooter-, or cargo bike-sharing and ride-pooling.* In general, the households

in the study associated ownership with reliability and taking pleasure in property that adds value. Conversely, the negative side of sharing was associated with a lack of availability (while mobility hubs were described as counteracting this); the positive side of sharing was tied to using it for leisure activities and as a supplement to private motorised individual transport. For using shared mobility services, users had to acquire knowledge and skills regarding different functions, payment models, service levels, and rules of the sharing providers. Because usage ultimately fostered the emergence of one favoured service, an overall systematic optimum arising

“For using shared mobility services, users had to acquire knowledge and skills [...]”

from the use of multiple providers and therefore access to more offerings was not attained. Households also repeatedly mentioned a privately owned car as a space for storage. Therefore, it is not so much the transport of objects as the possibility of a storage space that cannot be substituted by shared mobility services (yet). Users cited the (initial) organisational hurdles, i.e., having to change established organisational/daily routines, as an argument for their willingness to incur additional costs for their individually owned car.

Use of an integrated mobility app. *Specification of the measure: mobility apps integrating multiple modes and providers.* In Berlin and Hamburg, integrated mobility apps were available and helped people who had previously used only one mobility

Management Summary

The experiences of 20 different households in Berlin, Hamburg, St. Gallen and Zurich that integrated lower-emission mobility solutions in their daily life show positive examples but also existing challenges for a change in mobility behaviour from a user perspective. To create a shift towards lower-emission mobility, existing mobility decision patterns have to be changed, and competitive substitutes, compared to the benefits of a privately owned car, must be offered. Furthermore, on an overarching level, a stronger focus on the differences in spatial contexts (urban, suburban, rural) and living situations, resulting in a demand for different mobility solutions, needs to be established.

Main Propositions

- 1 From a user’s perspective, multimodal mobility is a complex ‘product’, rarely self-explanatory, and must be learned proactively.
- 2 Despite the availability of a substitute that allows the same daily routine as before, a majority of the participants in the study is willing to pay an extra price for a privately owned car.
- 3 The reduction of CO₂ emissions is stated as a central motivator to adapt new mobility behaviour. Still, it loses out to factors such as travel time and comfort when it comes to actual change.

service to establish an understanding of multimodal mobility as well as intermodal travel chains and to lower the barriers to using new forms of mobility. Households stated that compared to apps from individual providers, integrated mobility apps (still) have a disadvantage regarding possible promotions and the app's usability for selected mobility services. Overall, users summarised that integrated mobility apps provide the first step toward reducing the complexity of 'multimodal mobility' as a product.

“[...] integrated mobility apps helped people to establish an understanding of multimodal mobility [...]”

Use of micro-mobility services. *Specification of the measure: integrating (e-)bike, e-scooter, scooter, cargo bike (all: sharing and/or ownership), and walking in intermodality.* A positive perception of micro-mobility services depended mainly on infrastructural factors (e.g., bicycle ownership requires theft-proof parking facilities, and e-scooter sharing requires parking areas as visible as possible). Moreover, users considered integrating micro-mobility solutions without existing rain protection in intermodal travel chains as a substitute for a car for the summer months only. In winter, the integration strongly depended on subjective comfort factors. Regarding cargo bikes as an alternative to transporting heavy goods with a car, the households perceived cargo bikes as apt either

for the occasional use at mobility stations or as a permanent substitute in case of specific trip purposes (e.g., bringing the children to kindergarten). The occasional use often required 'training' to counter fears about driving safety.

Use of an e-car (ownership model). *Specification of the measure: used when no adequate public transport or sharing product was available.* A distinct majority of participants who drove an e-car in the study described the driving characteristics and the associated positive emotional component as superior to driving a car with a combustion engine. Besides these comfort and fun factors, ownership of an e-car was associated with the necessity of a charging infrastructure at home and/or at work. Most users described the complexity of the charging infrastructure (i.e., different cards and providers) as very challenging and a hurdle to buying an e-car as yet. When discussing a potential future purchase of an e-car with the households, purchasing an e-car and establishing the necessary charging infrastructure was described as an information-intensive purchase decision, requiring more attention than purchasing a car with an internal combustion engine, and with a high investment volume.

Use of a (taxi) shuttle. *Specification of the measure: discussing and testing shuttles as a public transport complement for intermodality.* Although using a shuttle would be an option for individuals who use their privately owned car only occasionally, no household had considered the regular use of a (taxi) shuttle to complement a public transport trip as a



Source: © Adobe Stock.

sustainable option in a mobility mix. Individuals who tested this measure indicated that the usage of (taxi) shuttles for the first and last mile came with a high level of convenience. However, the costs of current solutions were described as too high. Furthermore, the question of the availability of a service provider and, thus, the need for planning was challenging, especially in rural areas.

Use of digital substitutes. *Specification of the measure: discussing or intentionally testing a reduction of the number of trips realised and consequences for daily routines.* In a professional context, digital substitutes (such as video calls) led to a reduction in the number of journeys made and thus in emissions. Participants mentioned that such substitutes were very time-efficient and hence served an important mobility need. The perceived emotional distance to the social environment was highlighted as a common disadvantage of virtual versus physical forms of exchange.

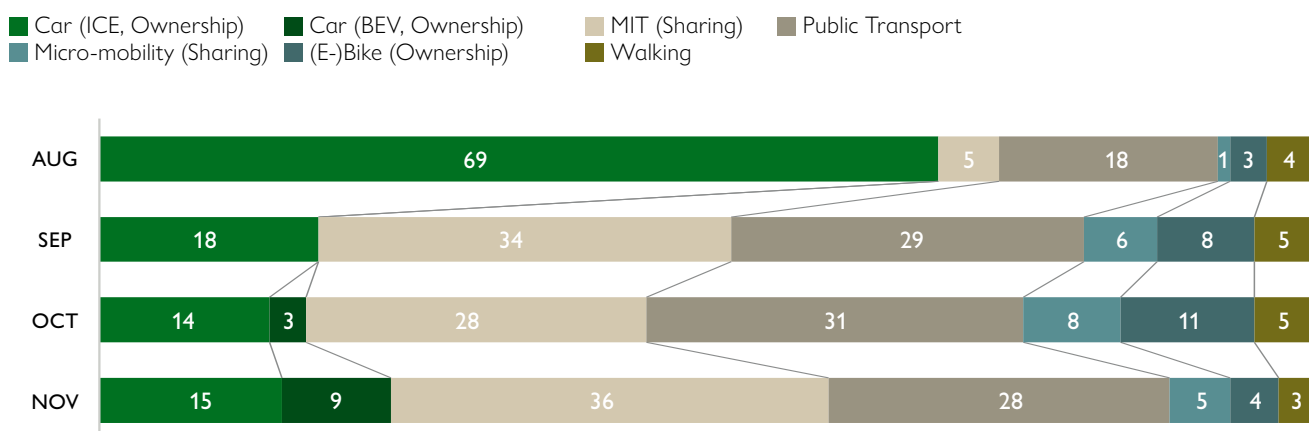
Bundling of journeys and trip purposes. *Specification of the measure: discussing whether a household's trip purposes can be combined when using a privately owned car.* Following the assumption of being easy to implement, combining or pooling routes was mainly utilised by the study households to organise leisure trips with children or hobbies. For other trip purposes, the households often described the efforts to combine commutes and running errands with the private car as time-consuming and adding a degree of uncertainty to the daily routine. Only a few households were aware of opportunities to combine

journeys with people outside their household, except for leisure journeys.

Setup of a neighbourhood carsharing system. *Specification of the measure: discussing relevant conditions and implementing a test setup.* In the context of this study, six neighbourhood carsharing setups were planned, four got started, but only two worked successfully. In retrospect, social interaction factors were the main differentiator between the positive and negative experiences. The challenges of sharing were described similarly to those of a residential community (e.g., cleanliness, establishing agreements, and determining times of use). To the knowledge of the study authors, no integrated product was available in the study areas that offered the implementation of neighbourhood carsharing. From the experiences in the study, an integrated product would need to include insurance, sharing of fuel costs, dealing with damage claims, cleaning the vehicle, and handing over the vehicle key (or a digital variant).

Explaining mobility apps and multimodality. *Specification of the measure: explaining available products and the use of mobile apps for inter-/multimodality.* For the optimal use of carsharing, e-scooters, and other modes of transport (e.g., in different areas of a city), people would have to install multiple apps. However, the installation and learning efforts for apps that offer an identical means of transport were perceived as too high. Moreover, mobility apps that enable one mode of transport only were predominantly linked to specific reasons for journeys and a selected period. They thus substituted these specific trips, but

Fig. 2: Changes in the Modal Split During the Implementation of the Mobility Interventions



Source: Own illustration. N=37 (people using the tracking app); % of ways per mode during study execution; reference measurement in August 2022; mobility measures undertaken from September to November 2022; flights excluded.

not a mode of transport in its entirety. Therefore, mobility apps that only include the mode of one service provider are rather not suitable for learning about intermodal travel chains or multimodal mobility as substitutes for motorised individual transport.

Highlighting CO₂ emissions. *Specification of the measure: highlighting the CO₂ emissions of specific transport modes (used) and discussing implications for mobility behaviour.* While one primary purpose of the study was to induce people to switch to lower-emission modes, the households perceived CO₂ emissions as highly abstract (e.g., asking what is the environmental impact of one gram/one kilo/one ton of CO₂?). Thus, highlighting CO₂ emissions had a limited effect with regard to changing individual mobility behaviour. Households stated that they weighted the reduction of CO₂ emissions via a (potential) change in behaviour in the mobility sector against potential reductions in other sectors. A personal preference was formed as to which shift in behaviour was subjectively 'easiest'. It can be summarised that highlighting CO₂ emissions as a stand-alone factor did not lead to changes in mobility behaviour.

Highlighting mobility costs. *Specification of the measure: calculating a household's mobility costs and discussing implications for mobility behaviour.* During the status quo interviews, nearly all households named mobility costs as a decisive factor for switching to another mode of transport. However, households had only limited knowledge of mobility costs. During interventions using multimodal mobility without subscription models, the in-

creased number of smaller monetary payments was perceived as expensive overall. It turned out that even when a substitute was provided with which everyday life could be realised in an identical form, people were willing to pay more for a privately owned car. Additionally, it was observed that as soon as a company car or the subsidisation of a mode of transport by the employer was available, substituting a journey with another mode of transport was difficult since users perceived these costs as purely additional.

Validating the Effectiveness of the Mobility Measures

In addition to the qualitative results described above, the data of the tracking app showed mobility intervention-related changes in the modal split (see figure 2).

The strongest shift manifested in a decrease in private car use by (on average) 49%. The respective trips were mainly replaced by motorised individual transport (MIT; carsharing, ride-pooling, and scooter; on average +27%) and public transport (on average +12%). Smaller increases were noted for the modes of micro-mobility (sharing; on average +5%) and (e-)bike (ownership, including households using a cargo bike in September and October; on average +5%). The increase in these modes was directly related to intensifying the use of intermodal travel chains, especially for the first and last mile in connection with public transport. The share of walking changed only slightly, which can be interpreted as being the first/last mile solution in connection with public transportation.

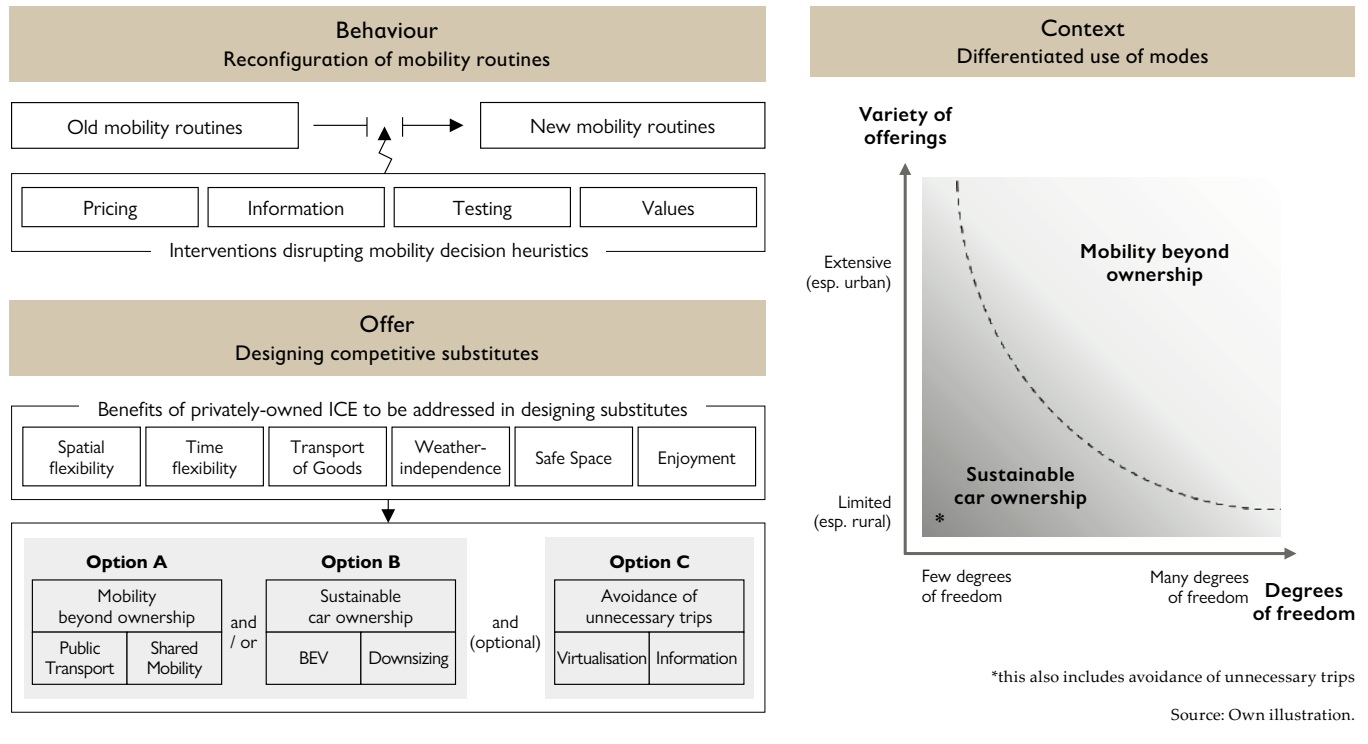
Weather conditions proved to be a noticeable external factor influencing mode choices in November (more rain, cooler temperatures) compared to September and October. There was less use of micro-mobility (sharing) and (e-)bike (ownership). Additionally, car use (ownership) increased compared to September and October (on average +6,5%), which was also due to four households using an electric car (BEV, ownership) as a mobility intervention in November. It needs to be noted that the modal split does not reflect the realised changes in CO₂ equivalents for the usage phase. Despite the increase in car usage it can be assumed that the CO₂ equivalents from the usage of vehicles did not rise significantly in November because the increase of car usage as shown in the modal split was mainly driven by battery electric vehicles that emit fewer CO₂ equivalents during the use phase.

In summary, changes in the modal split reflect two things. First, the applied mobility interventions led to behavioural changes that show up in the modal split. Second, a more homogeneous mode distribution emerged. The latter is particularly relevant

Lessons Learned

- 1 A mobility product intended to gain a permanent share of the modal split means a significant change in a person's everyday life routines and, therefore, must meet individual expectations.
- 2 New mobility services will only be adopted if a product's digital and physical components are convincing.
- 3 Collaborative mobility planning – an interplay between administrations, businesses, science, and citizens – is required to implement 'push and pull'-measures that will orchestrate change.
- 4 Suitable mobility solutions for trips outside the urban area and a better understanding of already available solutions must be provided.

Fig. 3: Key Perspectives Integrating Lower-Emission Future Mobility Products



with regard to efforts that entail learning about multimodal mobility and intermodal travel chains.

For the quantitative validation in the context of this paper, the focus was placed on the measure of the modal split since an analysis of trip purposes, trip lengths and the number of trips as well as respective correlations with measures could only have been valid for the analysis of individual cases considering the small study size of 20 households and different study contexts.

Deriving Key Perspectives for Developing Lower-Emission Future Mobility Products

In a qualitative process, the findings from the 13 mobility measures were consolidated in a conceptual framework with three dimensions (see figure 3).

The first dimension, behaviour, targets the behavioural aspects of changing mobility routines. Importantly, existing mobility

routines must be reconfigured to accept new mobility products. Mobility routines entail preferred modes (today mostly privately owned cars) for specific trip purposes. Routine stability and, thus, the effort required for change can vary. External factors influencing such changes range from 'hard factors', such as pricing, to 'soft factors', such as fundamental value system alterations that, e.g., emphasise the issue of climate change.

The second dimension, offer, highlights the need to develop substitutes that encompass the benefits currently perceived by most users of a privately owned combustion engine vehicle. These include quantifiable dimensions such as spatial and temporal flexibility, the transport of goods, and all-weather capability. Factors that entail more emotional components are safe space and enjoyment. The users' subjective perceptions mainly influence the weighting of factors and must be addressed in a value proposition for each user group. The factors can be addressed through different options. Option A focuses on public transport use and shared mobility services. Here, MaaS apps have the potential to create a seamless, cross-modal user experience. Based on the study's findings, people describe a combination of public transport and shared mobility as 'complex', especially when considering it as a substitute for

a private car. Option B addresses contexts where using a car is unavoidable, e.g., in certain spatial contexts (i.e., rural areas) or for people with disabilities. Increasing the market share of battery electric cars and downsizing should attain resource and space usage efficiency.

When purchasing an electric car, users expect a private or nearby charging infrastructure solution. Also, the complexity of the charging infrastructure in terms of payment processes and services needs to be decreased to a level comparable with that of today's gas stations. Lastly, regarding the avoidance of unnecessary trips, Option C addresses the possibility of active avoidance, e.g., by virtualising jobs or using the possibility of remote work. Therefore, information as well as education on the topic need to be fostered by employers and employees.

The third dimension, context, addresses the fact that aspects of product development, mobility beyond ownership, and sustainable car ownership are context-dependent. Regarding the variety of product offerings, supply differs significantly across various contexts (e.g., urban vs. rural). Thus, differences in user groups or vehicle utilisation emerge, which need to be addressed, e.g., by new business models.

The contents of the framework introduced here are to be understood as overarching guidelines to consider when integrating sustainable mobility solutions into everyday life. For example, this article's main propositions and lessons learned can be seen as an input and a consequence of the three key perspectives mentioned above. In any case, it is important when using the framework to design the integration of sustainable mobility solutions to consider context- and user-specific factors to meet expectations and demands of mobility, making mobility available for everyone in everyday life.

Conclusion

Findings from this study show that mobility behaviour changed based on the applied mobility interventions. The participating households realised that a broad range of mobility products for reducing emissions and engaging in shared mobility already exists, especially in urban areas.

The participants' experiences with the mobility interventions show how multifaceted and interdependent mobility-related decision-making is and how complex and difficult it is to induce persistent changes in mobility behaviour. Furthermore, mobility is both driven by and enabling lifestyles. This circumstance must also be considered in the development of future mobility products. In sum, mobility service use is influenced by various personal, situational, and infrastructural factors. Hence, users

will only successfully adopt new mobility solutions if they benefit from them in the context of these factors.

Finally, the limitations of the study also have to be highlighted. Our findings are based on the experiences of 20 households. Considering the overall characteristics of the countries and cities involved in the study, the sample needs to be categorised as rather homogeneous. For this reason, no generalisation of the results is possible. Given these limitations, the study is intended as a starting point for future research and product developments and as a call to continually shape the development of future mobility from a user-centred perspective. ■

Note

This article builds on an earlier German version: Linke, J., Scharfenberger, P., & Stackmann, J. (2023): Nachhaltige Mobilität in den Alltag integrieren – Eine wissenschaftliche Begleitung von 20 Haushalten über vier Monate. Projektbericht der Studie "New Mobility Buddys" des Future Mobility Lab. This study was supported by members of the Future Mobility Lab (imo.unisg.ch/de/future-mobility-lab) in the form of ideational and financial contributions to its execution. The Future Mobility Lab was founded by the Institute for Mobility at the University of St. Gallen and FischerAppelt. For the study "New Mobility Buddys" the Future Mobility Lab encompassed the following members: Berliner Verkehrsbetriebe (BVG), City of St. Gallen, City of Zurich (Tiefbauamt), carvelo, Civey, Clyde, DB Regio Bus, Deutschland – Land der Ideen, Friends of Friends, Lots*, micro, mobility, Mobility Allstars, New Mobility Solutions Hamburg, Riverty, SBB CFF FFS, Sozialverband VdK, Volkswagen Group, voi.

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