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Mixed-method approach to facilitate the mobility transition in a dense urban neighborhood: A case study from Munich

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Abstract

Increasing car ownership over the last decades has led to a significant portion of public space in cities being allocated to cars. As a consequence, there is a strong competition for the use of public space, especially in dense urban neighborhoods with few private parking spaces. While many residents and experts advocate for a reduction of car dominance to make place for climate-friendly mobility, improve the quality of life, and mitigate the effects of climate change, car owners often specifically oppose the repurposing of on-street parking spaces, as they fear an aggravation of the already high parking pressure. To identify measures that could increase the acceptance of a reduction in on-street parking spaces, we applied an empirical three-stage mixed-method approach as accompanying research for a participatory mobility transition project in Munich's Dreimühlen quarter. The approach consisted of a longitudinal parking study, a travel behavior survey and a qualitative group discussion. Our results highlight the value of combining quantitative, qualitative, and participatory methods for identifying potentials and appropriate measures for the mobility transition in urban neighborhoods. Furthermore, we found that integrating our approach into a mobility transition project can enhance public acceptance of planned transformations.

Keywords: mixed-method; parking study; travel behavior survey; group discussion; mobility transition measures

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1. Introduction and related work

1.1. Competition for the use of public space in urban areas

The number of passenger cars in Germany and Europe has been steadily increasing for decades (ACEA - European Automobile Manufacturers' Association, 2025; Umweltbundesamt, 2024). In densely built urban neighborhoods with few private parking spaces and no parking garages, this has led to a significant portion of public space being allocated to cars and other motorized vehicles. Consequently, many residents advocate for a fairer distribution of public space and a reduction of car dominance to enhance the quality of life in their neighborhoods.

Among urban planners and other experts there is broad consensus that in inner-city areas, private car use must be curtailed in favor of more sustainable urban design. This is necessary to optimize the use of available space, promote climate-friendly mobility, improve quality of life, and mitigate the effects of climate change (Brand et al., 2021; Creutzig et al., 2020; Notz, 2017; Oostendorp et al., 2019; WBGU – German Advisory Council on Global Change, 2016). However, associated transformation measures often face opposition, especially when it comes to public on-street parking. Many car owners already experience high parking pressure and fear that the conversion of parking spaces into urban greenery, mobility hubs, or other uses will further exacerbate their parking difficulties (Agora Verkehrswende, 2019; Fleischer et al., 2024). Additionally, local business owners frequently express concerns that reducing the number of parking spaces near their businesses could lead to a loss of customers, even though empirical studies indicate otherwise (Keller, 2024; Schneidemesser and Betzien, 2021).

The resistance from these stakeholders oftentimes discourages municipalities from reallocating on-street parking spaces as a mobility transition measure due to concerns about a lack of public acceptance (Kirschner and Lanzendorf, 2020; Lanzendorf et al., 2024). Consequently, many experts and researchers agree that the involvement of local stakeholders is a fundamental prerequisite for the successful planning and implementation of mobility transition measures (Lindenau and Böhler-Baedeker, 2014; Schippl and Arnold, 2020).

1.2. Street experiments

An increasingly popular approach to involving residents and local business owners in mobility transition efforts in a neighborhood are street experiments. Existing literature suggests that street experiments can serve as a catalyst for mobilizing public support for transformation measures aimed at reallocating car-dominated spaces. The core idea is to make potential transformations and their associated benefits – such as improved quality of life through increased social interaction and more greenery – tangible for the public (Smeds and Papa, 2023).

Street experiments are particularly effective in fostering public acceptance when stakeholders are actively involved in the planning (Menny et al., 2018; Schippl and Arnold, 2020). Conversely, the exclusion of stakeholders from the planning process can lead to strong resistance and jeopardize the implementation of lasting transformation measures after the experiment. A notable example of such resistance occurred during a street experiment in Kolumbus street in Munich, Germany, where a section of the street and 40 on-street parking spaces were temporarily converted into a green space featuring benches, raised garden and flower beds, and a playground. This intervention sparked intense conflicts among residents and even resulted in legal action against the project (MCube, 2024; Stäbler, 2023).

1.3. Mobility transition project in Munich's Dreimühlen quarter

In this study, we accompanied the transformation project "Bestandsquartier der Zukunft – Dreimühlenviertel", which took place in the Dreimühlen quarter in Munich in 2023. The Dreimühlen quarter is a vibrant historic neighborhood located near Munich's city center, with approximately 6,300 inhabitants living in an area of just 37 hectares. Due to its dense development and the lack of parking garages, a significant portion of public space is occupied by on-street parking. The transformation project was initiated by the "Mobile Zukunft München" alliance, which includes the City of Munich's Mobility Department, the Bavarian State Ministry of Housing, Building, and Transport, and other partners. The project's goal was to identify and test mobility transition measures to improve the quality of life, promote climate-friendly mobility, and mitigate the effects of climate change in the quarter in collaboration with residents and local business owners.

The project was commenced with a kick-off workshop, where residents were introduced to the project and invited to share and discuss their ideas and wishes for the neighborhood's transformation. This was followed by a street experiment, in which on-street parking spaces were temporarily repurposed for alternative uses. These uses were developed and discussed in two prior workshops with residents. As a result, around two dozen on-street parking spaces were replaced with a mobility hub (with designated parking spaces for five carsharing vehicles and for shared bicycles and e-scooters), public lounges, raised garden and flower beds, and small trees for ten days during summer holidays. To partially compensate for the reduction in parking spaces, temporary reserved parking spots were set up on a supermarket parking lot close to the quarter to simulate a neighborhood garage. The residents authorized to use these reserved parking spaces were selected by lot. The insights gained from the project were to be evaluated, discussed with residents in a concluding workshop, and subsequently submitted to the municipal council for approval (MZM - Mobile Zukunft München, 2024).

Our role in the project was to conduct accompanying research to identify mobility transition measures that could increase public acceptance of the planned reduction in on-street parking spaces within the neighborhood.

1.4. Related work

Scheiner et al. (2020) investigated parking pressure in a historical neighborhood in Dortmund, Germany, using a household survey on private and on-street parking behavior. They found that private parking spaces are often unused when illegal on-street parking is poorly controlled, and that actual parking pressure is lower than perceived. The authors estimated that consistent use of private parking could reduce illegal parking by up to 49% and recommended measures such as resident parking fees, short-stay parking zones, varied parking space sizes, and stricter enforcement.

Kirschner and Lanzendorf (2020) surveyed residents of a district in Frankfurt, Germany, on their acceptance of restrictive (e.g., higher fees, extension of parking restrictions) and demand-oriented (e.g., mobility hubs, neighborhood garages) parking policies. Demand-oriented policies were generally more popular, though even many car owners supported restrictive measures, particularly those intending to reduce their car use. However, this was linked to the expectation that the freed space would be used for better mobility options (e.g., mobility hubs) or for uses increasing the quality of life (e.g., wider sidewalks or more greenery).

Lanzendorf et al. (2024) surveyed the residents of four Frankfurt neighborhoods to assess public acceptance of parking management, car-lane conversions to cycle lanes, and road closures. Acceptance was high when benefits were tangible, and influenced mainly by perceived effectiveness, daily travel practices, intentions to reduce car use, and built environment, with socio-demographics playing a minor role.

Gebhardt and Oostendorp (2021) and Gebhardt (2021) carried out an empirical mixed-method study on car use in an urban context in several neighborhoods of Berlin, Germany. Their goal was to characterize different mobility practices of residents and understand the underlying logics, especially for personal car use. To achieve this, they first conducted a quantitative survey, which asked respondents to report their everyday travel behavior and give context about their household. They then used the data as input for a combined factor and cluster analysis, which yielded a segmentation of residents into four distinct mobility types. Hereafter, they organized four workshops – one for each mobility type – to work out the underlying logics for personal car use with 8-10 representatives of each type in qualitative group discussions. To identify starting points for user-specific measures that could encourage a car-light lifestyle, the representatives were additionally asked to discuss ideas for new mobility concepts.

1.5. Research objective and structure of the paper

The objective of our research in the Dreimühlen quarter was to develop and test a method for identifying measures that could increase residents' and local business owners' acceptance of the planned reduction in on-street parking spaces within the neighborhood. Building on the study by Gebhardt and Oostendorp (2021) and Gebhardt (2021), the method was designed to combine quantitative and qualitative research while also incorporating elements from the studies of Scheiner et al. (2020), Kirschner and Lanzendorf (2020), and Lanzendorf et al. (2024).

The paper is structured as follows: First, we describe the empirical three-stage mixed-method approach we applied in the Dreimühlen quarter in the methodology section. In the results section, we present examples for how our

approach can be used to identify and assess the potential and acceptance of mobility transition measures. Lastly, we discuss limitations of the approach and draw a final conclusion.

2. Methodology

To identify measures that could increase residents' acceptance of the reduction in on-street parking spaces in the Dreimühlen quarter, we applied an empirical three-stage mixed-method approach. As a first step, we conducted a longitudinal parking study to gain a deeper understanding of the parking situation and to assess the effects of different parking policies. In the second step, we carried out a travel behavior survey with the aim of obtaining a comprehensive overview of residents' mobility routines and related attitudes and opinions. Similar to the approach of Gebhardt and Oostendorp (2021) and Gebhardt (2021), we then used the survey data to identify participants from a specific target group for a group discussion. Specifically, we aimed to identify the car owners least dependent on their vehicle. These individuals were then invited to discuss their mobility routines and their requirements and preferences for the mobility transition in the neighborhood in a group discussion. The objective was to determine which transformation measures would need to be implemented for this group to be able and willing to get rid of their private car. Finally, we presented the findings from our study to residents and members of the "Mobile Zukunft München" alliance at the concluding workshop of the project.

2.1. Parking study

The kick-off workshop of the "Bestandsquartier der Zukunft – Dreimühlenviertel" project revealed, among other things, that the perceived parking pressure in the neighborhood is very high. Residents reported that they regularly spend 20 to 30 minutes searching for a free on-street parking space (MZM - Mobile Zukunft München, 2024). As main reason for this, some residents presumed that, particularly in the evening, many visitors to the local restaurants and bars park their cars in the neighborhood.

To systematically analyze the parking situation (e.g., how severe the parking pressure is at different times, who parks in the neighborhood and for how long) we conducted a longitudinal parking study in the Dreimühlen quarter as the first step of our mixed-method approach. The objective was to provide residents and the city's mobility department with insights into the actual parking patterns and to assess the probable effects of various parking policies.

To achieve this, details on parked vehicles at around half of the 1,200 public on-street parking spaces in the quarter were recorded five times a day for five consecutive days (Friday - Tuesday) in July 2023 by two student assistants using prefabricated forms on tablet computers. Among the details captured for each vehicle were the vehicle type, parts (due to data protection regulations) of the license plate, and permanent parking licenses. It was also recorded when a parking space was not occupied or when a vehicle was parked illegally. Each data collection run lasted around 1.5 hours, with the first of each day beginning at 6 a.m. and the last ending at 10 p.m. Additionally, a one-time run was conducted two weeks earlier to make the detection of long-term parkers possible. To enable spatially differentiated and representative conclusions for the quarter, at least one side of every street with public on-street parking was included.

Following the data collection, the data was checked for plausibility and processed so that, in addition to the occupancy of the parking spaces, the approximate parking duration of each recorded vehicle could be determined.

2.2. Travel behavior survey

As the second step of our study, we conducted a quantitative travel behavior survey in the form of a voluntary online survey from August to October 2023. Respondents were recruited through posters displayed in the quarter, as well as through posts on social media and in a neighborhood chat group.

The survey was based on the so-called "travel skeleton survey" concept developed by von Behren (2021), which has been successfully applied in numerous cities worldwide (Institute for Transport Studies, 2025). In addition to collecting sociodemographic characteristics, the survey required respondents to report their travel behavior in a typical week. This pseudo-longitudinal approach to capturing daily travel patterns reduces the response burden in comparison to trip diaries, allowing for the inclusion of additional survey sections. To account for key determinants of car ownership and use, the survey incorporated sections on long-distance travel events and respondents' self-assessment

on psychological statements related to mobility (e.g., car orientation). The psychological statements were taken from the standardized items sets of Steg (2005) and Hunecke et al. (2021), with responses collected using a five-point Likert scale. For better comprehensibility, the components of the survey are illustrated in Figure 1.

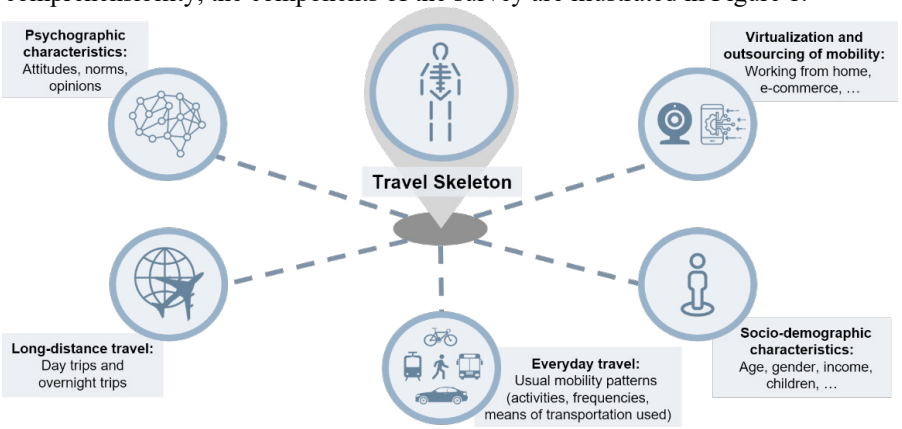


Figure 1. Components of the travel behavior survey; figure based on von Behren (2021)

The goal of the survey was not only to obtain a comprehensive overview of residents' mobility but also to assess the suitability and acceptance of various mobility transformation measures. Therefore, based on the ideas and concerns raised by residents and local business owners in the kick-off workshop, as well as drawing on the studies of Scheiner et al. (2020), Kirschner and Lanzendorf (2020), and Lanzendorf et al. (2024), the following additional topics and questions were included in the survey:

- Parking (availability of private parking spaces or permits for street parking, availability of bicycle parking)
- Satisfaction with public space in the neighborhood (quality of stay, presence of greenery)
- Satisfaction with mobility options in the neighborhood (parking situation, accessibility of public transport)
- Parking search duration at different days and times
- Requirements for parking spaces in a hypothetical neighborhood garage
- Considerations regarding a reduction of motorized vehicles in the household and underlying reasons
- Open text field for sharing further opinions or suggestions

A total of 161 individuals finished the survey. The median completion time was 28 minutes, while the mean completion time was 32 minutes. After data validation and cleaning, the responses of 155 individuals remained. This corresponds to 2.5% of the total population of the neighborhood. However, the youngest respondent was 22 years old, and only five participants were over the age of 55. Additionally, nearly 80% of respondents reported holding a university degree, and over 90% indicated being employed in a full-time or half-time job. As a result, it was concluded that the survey sample is not fully representative of the neighborhood's population.

2.3. Group discussion

The aim of this study was to identify measures that could increase acceptance of the planned reduction of on-street parking spaces in the Dreimühlen quarter. Consequently, a main focus was on exploring measures that could reduce car ownership in the neighborhood, thereby preventing an increase in parking pressure despite the reduced number of parking spaces. We therefore processed the data from the quantitative survey to identify car owners least dependent on their cars, who might be willing to give up their vehicle or one of their vehicles. These individuals were then invited to participate in a group discussion, where they were asked to talk about their mobility routines and needs, and collectively explore what changes in the neighborhood's mobility offerings would be necessary for them to voluntarily get rid of their car. We opted for a group discussion, because this qualitative discussion format is particularly effective in identifying both individual and collective rationales that guide people's behavior. Additionally, the reflection process during the discussion allows for the identification and questioning of actions that may not be based on rational

decisions (Bohnsack et al., 2010; Fraedrich, 2018). Fraedrich (2018), Gebhardt and Oostendorp (2021), and Gebhardt (2021) have successfully applied this format to understand the logics behind car use of different groups.

To find suitable participants for the group discussion, we had to identify the car owners with the lowest car dependence from the data of the quantitative survey. In doing so, it was important to consider that individuals with multimodal travel behavior and infrequent car use can still perceive owning a private vehicle as indispensable (van Eenoo et al., 2022). Therefore, we applied the two-dimensional definition of car dependence by von Behren et al. (2018), which is based on a similar travel behavior survey conducted in the cities of Berlin, San Francisco, and Shanghai. In this approach, a score for both subjective and objective car dependence is calculated for each car owner. For the subjective dependence, individuals' assessments of various aspects of their mobility from the psychological questions are aggregated into a dependence score ranging from 0 (low) to 1 (high). Specifically, the affinity for driving and the perceived need for a car are incorporated. The corresponding psychological items are presented in Table 1 of von Behren et al. (2018).

Similarly, an objective car dependence score ranging from 0 (low) to 1 (high) is calculated for each car owner. Analogous to von Behren et al. (2018), the following aspects were considered: distance and duration of commute, time loss or savings when using alternative means of transportation for commute, multimodality, age of children and need for chauffeuring, day trips, trips for errands and everyday leisure activities, parking situation, ODM usage, and car ownership and use of the household.

Figure 2 illustrates the objective and subjective car dependence scores of the 100 car owners from the survey sample. It shows that there is a broad spectrum of car dependence in the Dreimühlen quarter and that many car owners are relatively independent of their car, both objectively and subjectively. 17 of these individuals, who had also indicated in the survey that they had thought about getting rid of their car before, were invited to participate in the group discussion. To encourage participation, free food and beverages during and after the event were advertised. A total of six residents – five men and one woman aged between 24 and 58 years – responded positively to the invitation and ultimately participated in the group discussion.

Figure 2. Objective and subjective car dependence scores of the 100 car owners from the survey sample

The group discussion took place in a restaurant in the Dreimühlen quarter in November 2023, two months after the street experiment. The event was started off by a member of the "Mobile Zukunft München" alliance, who provided information about the goals of the transformation project. Following this, we presented findings from the travel behavior survey to offer a comprehensive overview of the different mobility patterns, attitudes and opinions of the neighborhood's residents. Participants were then asked to share their mobility routines and reflect on why they continue to own a car despite their low car dependence. This resulted in a multifaceted, multi-hour discussion about the mobility options in the neighborhood, as well as potentials and the participants' desires for transformation.

3. Results

The suitability and acceptance of mobility transition measures largely depend on the local specifics of a quarter or city (Lanzendorf et al., 2024). Since we only applied our mixed-method approach in Munich's Dreimühlen quarter, this section only provides examples for how the approach can be used to identify and assess the potential and acceptance of mobility transition measures. In accordance with the associated project, the focus for these examples is on measures that could increase acceptance for the reduction of on-street parking spaces.

3.1. Parking study

The analysis of the parking study data indicates that parking pressure in the quarter is very high as per the definition of Steinmeyer et al. (2012). The mean occupancy rate of public on-street parking spaces in the quarter over the five observation days was 91%. Including illegally parked vehicles, the occupancy rate exceeded 100% on all nights.

On average, 76% of parked vehicles had a permanent parking permit for the Dreimühlen quarter, while another 5% only had a permit for a neighboring quarter and were thus parked illegally in the Dreimühlen quarter. The remaining vehicles had a one-time parking ticket or a parking disc for short-term parking. At approximately 90%, the share of vehicles with a permanent parking permit for the Dreimühlen quarter was particularly high in the central part of the neighborhood. This finding was unexpected, as this area hosts the quarter's restaurants and bars that attract guests from outside the neighborhood. It suggests that visitors only have a minor impact on the high parking pressure perceived by many residents in the center of the quarter. Furthermore, concerns raised by local business owners regarding potential customer losses due to the repurposing of parking spaces could be alleviated, as few nearby parking spaces are available to non-residents anyways.

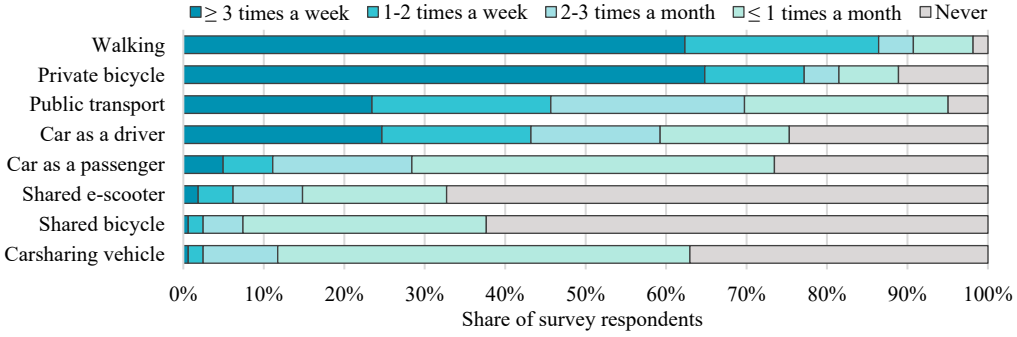
An analysis of license plate and vehicle type data revealed that 5% of parking spaces were occupied by vehicles parked in the same spot for more than two weeks. Half of these were camper vans, motorhomes, or classic cars.

The exemplary findings from the parking study suggest two parking policies that could allow for the repurposing of a significant number of on-street parking spaces in the Dreimühlen quarter without worsening the parking situation for most car owners. First, stricter enforcement of parking permits could prevent approximately 5% of parking spaces from being illegally occupied by residents of adjacent neighborhoods. Second, the introduction and enforcement of maximum parking durations could encourage owners of camper vans, motorhomes, and rarely used classic cars to park their vehicles elsewhere. However, both measures would result in a shift of parking pressure from the Dreimühlen quarter to other parts of the city, if parking spaces for the displaced vehicles are not created elsewhere.

3.2. Travel behavior survey

Of the 155 respondents of the travel behavior survey, 148 reported having access to a functional bicycle, e-bike, and/or cargo bike. Only 100 individuals reported that their household owns at least one car. Among those without a car in the household, 69% indicated having a public transportation subscription, whereas only 38% of people from households with a car have one. Surprisingly, over 60% of participants have an account with a carsharing provider – two-thirds of them despite having a private car in their household.

Figure 3 illustrates the self-reported frequency of usage of different means of transportation in respondents' everyday travel. It shows that a large portion of everyday trips are made on foot or by personal bicycle. In contrast,



only 44% of individuals use a private car as a driver at least once a week. An intrapersonal analysis reveals that only 5 of the 155 respondents are monomodal car users, with all others being multimodal to varying degrees. A comparison of the commonly used means of transportation for different trip purposes shows that the car is the dominant mode only for less frequent trips, such as transporting relatives and friends (common mode for 81% of respondents), day trips (64%), and overnight trips (44%). For more frequent trips in everyday life, such as commuting to work (common mode for 27% of respondents), leisure trips (22%), child transport (16%), and shopping trips (12%), the car is the commonly used mode for only a minority of individuals.

Given that many residents primarily need a car for infrequent activities and that over 60% have a carsharing account, it is surprising that so many households still have their own car and that only a few use carsharing vehicles regularly. This suggests that one of the central objectives of the transformation measures in the Dreimühlen quarter should be to make carsharing more attractive. However, concrete measures cannot be derived from the travel behavior survey, as the data does not provide insights into why carsharing is used so infrequently.

The determination of subjective and objective car dependence, as described in sub-section 2.3, is another analysis of the travel behavior survey data which indicates that many car owners in the Dreimühlen quarter could manage their daily lives without a private car. This is supported by the fact that nearly two-thirds of car owners (the majority of whom have low car dependence scores) reported in the survey that they had previously considered getting rid of their car or one of their cars. The most frequently mentioned reasons (multiple selection were allowed) were conscious renunciation (42% of car owners), the low necessity of owning a car (31%), the difficult parking situation in the neighborhood (29%), and the costs associated with owning a car (24%). This analysis shows the potential to offset the loss of parking spaces in the neighborhood by incentivizing individuals with low car dependence to give up their vehicles. However, the specific requirements of individuals for this cannot be derived from the survey data.

When asked about a hypothetical neighborhood garage, 81% of car owners without a private parking space stated that they could envision renting a parking spot in such a facility. Half of these individuals made their interest dependent on a maximum walking distance from their home. The stated acceptable one-way duration was 6.5 minutes on average and 10 minutes at maximum. However, the study by Puhe et al. (2024) suggests that initial intent to use a neighborhood garage often does not lead to actual (frequent) use when a walk of several minutes is required – even if the parking space is free of charge. Thus, the high level of interest in parking spaces in a neighborhood garage does not necessarily imply that the construction of such a facility would reduce parking pressure in the quarter.

In summary, the analysis of the data from the quantitative travel behavior survey shows, that the survey can help reveal potentials for change. Though, in order to derive concrete transformation measures to realize these potentials, qualitative discussions with stakeholders seem to be indispensable.

3.3. Group Discussion

In the group discussion, the six participants debated what changes in the neighborhood's mobility offerings would be necessary to make it realistic for them to give up their cars. The first topic discussed was the availability and quality of public transportation. The participants agreed that the neighborhood’s exclusive connection by bus was unattractive, as buses often experienced delays due to traffic congestion during peak hours and the lack of priority lanes. Consequently, they found public transport in the Dreimühlen quarter to be particularly unattractive for commuting to work. One participant also reported that he would like to use shared e-scooters to reach a more distant subway station, but these were usually rented out in the mornings and evenings, when he needed them for his commute.

Since all participants agreed that they occasionally require a car, carsharing became the central topic of the discussion. The following points were raised by the participants:

- No station-based carsharing vehicles are available in the neighborhood or its vicinity. Free-floating vehicles are rarely available, and often, one has to walk a long distance to access them.
- Due to parking pressure, free-floating vehicles often cannot be returned within the neighborhood after use, forcing individuals to park them elsewhere and walk long distances to their home.
- Some participants find carsharing stressful, because they get a different car every time and have to adjust to it. Also, it is annoying to them that they need to configure the cars (e.g., seat position, mirrors) before each drive.

- For some participants it is unattractive that they need to have user accounts with multiple providers to access all carsharing vehicles in the city. Many were not aware of existing meta-app integrating multiple providers.
- Due to the various pricing models of different providers, some participants often find it difficult to determine which provider is the most economical for a given situation.
- Some participants struggle to assess the cost carsharing in comparison to a private vehicle, since they are unaware of the total cost of ownership of their vehicle.
- One participant did not know whether it is allowed to drive to other countries in a carsharing vehicle.
- All participants agreed that the five reserved carsharing parking spaces set up as part of the street experiment were a significant improvement in the quality of service in the Dreimühlen quarter.

In summary, it can be said that the qualitative, interactive group discussion successfully provided explanations for specifics of the mobility patterns of the Dreimühlen quarter's residents, which were identified in the travel behavior survey (e.g., many individuals with a carsharing account but infrequent usage). Additionally, concrete measures to facilitate the mobility transition could be derived. For example, with regard to carsharing, it became clear that reserved parking spaces in the neighborhood are necessary to make the use more reliable and attractive and that educational efforts are required (e.g., meta-apps integrating multiple providers, cost comparison with private vehicles).

4. Discussion and conclusion

In this paper, we present an empirical mixed-method approach comprising a parking study, a quantitative travel behavior survey, and a qualitative participatory group discussion, which we applied in Munich's Dreimühlen quarter to facilitate a mobility transition project in the neighborhood.

The insights gained from the parking study enabled us to identify and quantify the expected impact of two parking policies that could facilitate the repurposing of a substantial number of on-street parking spaces in the Dreimühlen quarter without worsening the parking situation for most car owners. However, our analysis of parking durations is only an estimation, mainly due to the 3.5-hour gaps between successive data collection runs. These likely prevented the detection of some short-term parked vehicles and of vehicles moved and reparked in the same spot between two runs. Another source of inaccuracy lies in the risk of confusing vehicles with similar license plates, as full license plate numbers could not be recorded due to data protection regulations. The most significant drawback of the parking study, however, is its high resource consumption. Although the use of prefabricated forms on tablet computers greatly facilitated the data collection process, two student assistants had to walk through the neighborhood for almost eight hours per day over five consecutive days to collect the data.

The data from the quantitative travel behavior survey enabled us to analyze the mobility routines and related attitudes and opinions of residents, and hence identify suitable participants for the group discussion. However, for many residents, the data did not provide a comprehensive understanding of the underlying logics driving their travel behavior. Thus, while the survey allowed us to identify potentials for the mobility transition in the neighborhood, it was mostly not possible to derive concrete transformation measures to realize these potentials. A positive aspect of the survey was the simple and cost-effective recruitment of 2.5% of the neighborhood's residents as respondents. However, the recruitment did not yield a representative sample, which limits the validity of our findings and prevents the derivation of quantitative conclusions about the neighborhood as a whole.

The qualitative group discussion helped us understand the underlying rationales of the least car-dependent respondents from the quantitative survey – who had also previously considered giving up their car – for still owning a car. Moreover, the discussion enabled us to pinpoint measures that these individuals perceive as prerequisites for voluntarily giving up their private car. To further facilitate the mobility transition in the neighborhood by identifying more feasible transformation measures, it would have been beneficial to also conduct group discussions with representatives from other mobility types. In this regard, the approach of Gebhardt and Oostendorp (2021) and Gebhardt (2021) can serve as a blueprint, which could be emulated with the data from our travel behavior survey.

Overall, our study highlights the added value of combining quantitative, qualitative, and participatory methods in a mixed-method approach. The methods complement each other in identifying potentials for change and in finding and evaluating corresponding mobility transition measures.

Lastly, we can conclude that our study was able to support the transformation project in the Dreimühlen quarter by fostering its public participation approach. Many residents perceived the travel behavior survey and the group

discussion as a positive signal that their needs and opinions are being considered in the mobility transition process. Additionally, the presentation of the study's findings in the project's concluding workshop contributed to a better mutual understanding among residents and facilitated a more informed and less emotionally charged discussion on the mobility transition measures that should ultimately be submitted to the municipal council for approval. However, our contribution to the project would likely have been even more effective, if the travel behavior survey and the group discussion had taken place before the street experiment. This could have allowed for more of the identified measures to be tested in the experiment, thereby enabling a more thorough evaluation of their feasibility and public acceptance.

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