

Article

# Integrated Transport Planning: From Supply- to Demand-Oriented Planning. Considering the Benefits

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**Abstract:** The idea of integrated transport planning is widely accepted in the research community as well as in the field of transport policy. However, the actual implementation is still lagging behind. Acknowledging the gap between concept and reality, the benefits of a demand-oriented approach have to be reconsidered by the various stakeholders in politics, the economy, planning and civil society. In order to address this issue, we created a factual use-case by redefining empirical data (qualitative interviews) from Berlin, which our department collected in 2013 for a research project on e-mobility. The initial objective was to find out what kind of charging infrastructure would be necessary to persuade on-street parkers in densely-populated inner city areas to switch to e-mobility vehicles in the future, basically following the conventional ‘predict and provide’-approach characteristic of traditional transport planning. In the course of the research, we decided to go against the directive and switched perspective completely in favour of a demand-approach, enquiring into people’s needs, which otherwise would have remained unidentified and invisible. Rather than creating the data to support proposed planning interventions, our method led to a much more sustainable, bottom-up planning strategy in line with the social and ecological benefits of an integrated transport planning approach and revealed the real mobility needs of people living in inner-city areas of Berlin.

**Keywords:** integrated transport planning; transport policy; demand-oriented transport planning; inter-discipline; mobility needs; sustainable urban mobility; qualitative research; Berlin

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## 1. Introduction

The idea of integrated transport planning is widely accepted in the research community as well as in the field of transport policy. As a concept, it is currently embedded in almost every masterplan for urban and transport development worldwide [1,2]. However, the actual implementation is still lagging behind. This is particularly true for the paradigmatic shift from a supply- to a demand-oriented approach, which is a core element of integrated transport planning. It means changing perspective in favour of the focus on people and their particular demands, rather than holding on to an outdated conception of transport planning as a tool for supplying the infrastructure required to maintain and/or increase traffic flow.

Acknowledging the gap between concept and reality, the benefits of a demand-oriented approach have to be reconsidered by the various stakeholders in politics, the economy, planning and civil society [3]. In order to address this issue, this paper will present a case study of an intervention in the framework of a research project on e-mobility, commissioned by the German Ministry of the Environment, where the research perspective was decisively changed mid-process—the initial objective was to find out what kind of charging infrastructure would be necessary to persuade on-street parkers in densely populated inner-city areas to switch to e-mobility vehicles in the future. Operating on the basic assumption that simply changing from combustion engines to e-vehicles would be advantageous,

the ministry itself followed the conventional 'predict and provide'-approach characteristic of traditional supply-oriented transport planning. Instead of enquiring into people's particular mobility needs, the ministry took it for granted that there would be a demand for private e-cars, narrowing down the research directive to determining the best possible charging infrastructure.

In the course of the research we decided to go against the directive and switched perspective towards a demand-approach, enquiring into people's needs, which otherwise would have remained unidentified and invisible. Rather than gathering the data to support the proposed planning interventions, our method led to different empirical results, revealing a preference to dispense with private cars altogether rather than switch to e-mobility vehicles. Consequently, the altered research directive created a much more sustainable bottom-up planning strategy in line with the social and ecological benefits of an integrated transport planning approach.

## 2. Integrated Transport Planning—The Concept and its Promise

Even though the idea of integrated transport planning goes back to the 1970s and is now widely accepted in the research community as well as in the field of transport policy, the actual implementation is still trailing behind [4]. Due to this lack of experience, it is still difficult to elaborate on the benefits of this approach, making it difficult to argue for integrated transport planning.

At the same time, in the face of climate change and the transformation from a fossil-based to a post-fossil mobility culture, we are experiencing a growing need for integrated approaches to policy and practice generally and a revival of integrated transport planning as an 'inter-discipline' in particular [5]. Therefore, before demonstrating the benefits of integrated transport planning, we will first reiterate its main aspects, contrasting them with the traditional approach to transport planning [6].

Unlike the conventional 'predict and provide'-approach, integrated transport planning is goal-oriented. While traditional transport planning focuses on traffic and reacts to the ongoing increase in volume by supplying appropriate infrastructure capacities to support the flow and speed of the traffic, the integrated approach, by focusing on people's needs, strives for a sustainable transport development. This is a paradigmatic shift from a supply- to a demand-oriented—that is, a people-oriented—approach to transport planning. This paradigm shift also requires a strong focus on stakeholder participation and empowerment, accessibility and ecomobility, as well as strategic planning to achieve sustainable urban mobility [7,8].

With the shift to a people-oriented approach to transport planning, the situation becomes complicated, because, along with the technical aspects, other dimensions now also demand attention, such as quality of life, sustainability, social justice, health and environmental quality and, not least of all, economic feasibility. Modal-focused traffic flow is no longer an end in itself but is rather linked to the higher goal of transport development that is people-designed, which leads to an intermodal perspective.

In order to meet the demands of different spheres such as society, technology, the economy, ecology and politics, integrated transport planning necessarily has to be interdisciplinary, as has the team. It requires an understanding of the society in which planning takes place, it requires knowledge of what is technologically feasible, economically effective and ecologically compatible, without forgetting an understanding of the relevance of politics for planning processes. This complexity has probably been the main obstacle so far to the successful implementation of integrated transport planning and the reason why many planners still prefer to keep things simple, since otherwise they—understandably—feel overwhelmed [9].

Summing up, integrated transport planning is based on three poles (cf. Figure 1). The first pole is infrastructure management, which includes all kinds of structural supply measures (e.g., construction of road infrastructure) as well as constraints (e.g., removal of road infrastructure). The second pole is traffic management, which includes all kinds of process supply measures (e.g., 'green wave' for public transport) as well as constraints (e.g., city toll). Lastly, the third pole is mobility management, which includes all kinds of action-related supply measures (e.g., free tickets for public transport) as well as constraints (e.g., commercial control over parking space). While the first two poles represent

the traditional transport planning approach, the third pole, with its people-oriented perspective, constitutes the innovative core of integrated transport planning as an ‘inter-discipline’ that everybody is talking about but which has yet to be established.

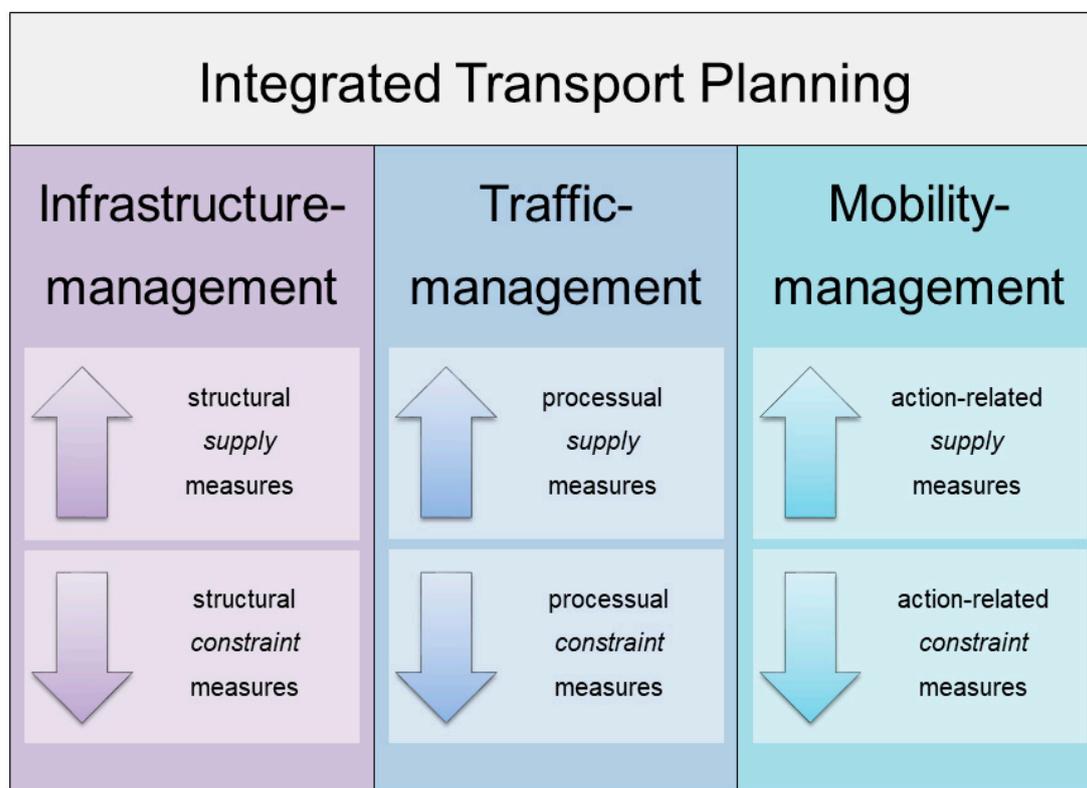


Figure 1. The Concept of Integrated Transport Planning (Source: own presentation).

### 3. The Case Study and Methodology

We refer to a case study, which was—like many others at the time—part of the emergence of e-mobility [10]. The Federal Ministry of Environment, Nature Conservation and Nuclear Safety wanted to know what kind of charging infrastructure people in densely-populated urban areas need, people who have to park their private car in the public street space, the so-called ‘*Laternenparker*’ (on-street parkers). The Ministry saw itself confronted with the typical chicken-and-egg problem—nobody buys an electric vehicle if there is no charging infrastructure and, inversely, nobody sets up a charging infrastructure if there are no e-cars that need charging. In this case, as in previous cases involving construction of transport infrastructure, politicians decided to take on responsibility for implementing a spatially inclusive and comprehensive public charging infrastructure. Because the infrastructure in question still does not exist, the topic remains highly relevant and is still being controversially discussed.

At the time, the Ministry took it for granted that in the future of e-mobility all the households in densely-populated urban areas who own a private car would change from a combustion engine vehicle to an electric vehicle. In doing so, the Ministry followed the ‘predict and provide’ approach characteristic of traditional transport planning. Even though it was already evident back then that the private car is the least sustainable transport mode in cities, the Ministry made the status-quo the basis for its policy intervention.

#### 3.1. Research Question

From an integrated transport planning perspective, things looked different. As explained above, integrated transport planning is a goal- and people-oriented approach. Therefore, from the outset the question has to be posed as to how to support a sustainable transport development that is economically

efficient, ecologically viable and socially just, and, further, what are the particular needs of the people? This leads to a quite different research question—instead of analysing how a spatially inclusive and comprehensive public charging infrastructure for all the on-street parkers has to be designed, which is what the ministry set out to do, an integrated planning approach enquires into the reasons why people own a private car in the city centre and whether they can imagine alternatives. The goal was to identify attractive transportation planning concepts in order to develop action plans and incentives that promote mobility, without needing to own a car. This rests on the assumption that some car owners do in fact also use other modes of transportation in their daily lives and retain their cars for special occasions only.

That was the reason we correspondingly changed our research design, going counter to the Ministry's intention and started an elaborated qualitative survey of car-owning households in Prenzlauer Berg, one of Berlin's most densely populated districts, with 161,192 inhabitants [11]. Additionally, people in Prenzlauer Berg own fewer cars than the average in Berlin and public transport infrastructure is highly diverse and accessible. Many people use bicycles for their daily journeys within the city generally, almost 20% but especially in inner-city areas like Prenzlauer Berg [12]. Furthermore, the district of Prenzlauer Berg agreed to serve as the location for all car-sharing companies that were active in Berlin at the time and also introduced more restrictive parking management in 2010 and 2013.

### 3.2. Research Methodology

Both the data collection as well as the data analysis were conducted by an interdisciplinary team of seven researchers, with backgrounds in transportation planning, sociology, political science and urban planning. This diversity ultimately helped to bring together broad and varying perspectives, reflected in the qualitative and explorative research design. Additionally, it was essential to meet qualitative research criteria such as intersubjectivity, validity and reliability through techniques of adequacy, openness, communication and triangulation [13]. A less diverse group of researchers (e.g., exclusively traffic planners), with more homogenous and prefabricated perspectives and methods, would have been detrimental to the objective of openness, whereas the objectives of communicative validation and triangulation depend greatly on a heterogeneous group of researchers, bringing their different perspectives, skills and opinions.

The first step was to conduct research into the literature in order to support the development of the design for the qualitative analysis. The research focused on the use of cars, mobility patterns, parking issues and multimodal mobility. To investigate current mobility behaviour, the data sets of "System repräsentativer Verkehrsverhaltensbefragungen" [12] and "Mobilität in Deutschland" [14] were analysed. In order to then explore and investigate the mobility needs of the local citizens, the research team conducted 60 guided interviews in total. The interview guidelines consisted of questions regarding the interviewees' attitudes, motives and their use of modes of transport, as well as daily mobility routines and whether they considered a change in their mobility behaviour conceivable. Of 60 interviews, 30 were conducted with the officially addressed sample group of people who own a car and park it on the public street. Our initial interest was to investigate the particular, day-to-day mobility needs and to determine to what extent these are related to owning a private car. The other 30 interviews were conducted with a comparative group of people who already used several transportation options for their trips (multimodals) and did not own a car at the time. Their mobility behaviour provided relevant information for designing measures and developing a framework to encourage alternative choices of transport modes. However, the following empirical findings only refer to the first group of on-street parkers, while the second group of multimodals are only used to describe possible measures and parameters to promote car-free lifestyles.

The sampling procedure was divided into two stages—first, a randomized process (random-address and random-route) identified 1980 households that were contacted via a letter. Out of these 1980 households, 98 responded (a response rate of about 5 percent). Second, the research team selected 60 persons out of the 98 that met the theoretical requirements (on-street parkers vs.

multimodals) and more closely represented the demographic structure of the area under investigation. The sample then consisted of 32 men and 28 women, who were between 21 and 73 years old. 65% of the test persons had an academic degree, 50% were working full-time, the other test-persons were either jobseekers, students, part-time workers or pensioners. While half of the test-persons lived alone, one quarter lived in a relationship and the other quarter in a family structure.

The interview-data was coded with MaxQDA using the deductive as well as inductive approach of qualitative content analysis [15]. Our goal was to compare the two groups with a focus on similarities and differences regarding their mobility behaviour, attitudes, experiences, intentions and wishes.

#### **4. From Supply- to Demand-Oriented Transport Planning—Considering the Benefits**

Research projects are currently of undeniable political importance because in times of societal transformation such as ours they provide legitimacy for political action. On the one hand, by requesting advice from researchers, politicians exert influence on the research outcome and thus contribute to a politicization of research. On the other hand, by taking certain methodological techniques as a given, researchers exercise an influence on politics and contribute to lending politics an air of research-based science [16]. Our focus will be on the second mechanism, showing how the change of methodological perspective from an supply- to a demand-oriented transport planning approach leads to fundamentally different research results and consequently to very different policy advice.

Our empirical findings indicate that on-street parkers show diverse and varying mobility needs and practices—about half of the on-street parkers in Prenzlauer Berg who currently own a car show very similar mobility patterns to multimodals who do not own a car, meaning those in the first group do not use their car most of the time but take public transport or ride a bicycle instead. During the week, the car is parked on the public street and only used for certain purposes, especially on weekends or in the late evening. Only one third of all on-street parkers use their car as their primary mode of transport. Most of these car journeys are then made for work-related reasons, such as driving to external appointments, the transportation of goods as well as commuting. In some cases, the participants in our study valued the time-saving, spatial flexibility, reliability, speed and convenience of the car, especially when driving outside the city or during off-peak hours (this was investigated by Antje Flade [17]). However, these positive features count for less when it comes to heavy traffic, which obviously involves more stress and potential conflict and especially when it comes to difficult parking situations, causing additional costs and/or time spent looking for somewhere to park.

The sample group of on-street parkers was therefore divided in turn into four groups (see Figure 2), based on the individual attitudes and dispositions. Since demographic factors were regarded as less important for our study, the on-street parkers were first divided on the basis of their potential willingness to reduce car use as well as their potential willingness to dispense with their private car. In a second step, the on-street parkers were divided on the basis of their current transport behaviour, showing the intensity of their car use in contrast to their use of public transport/bicycle/walking.

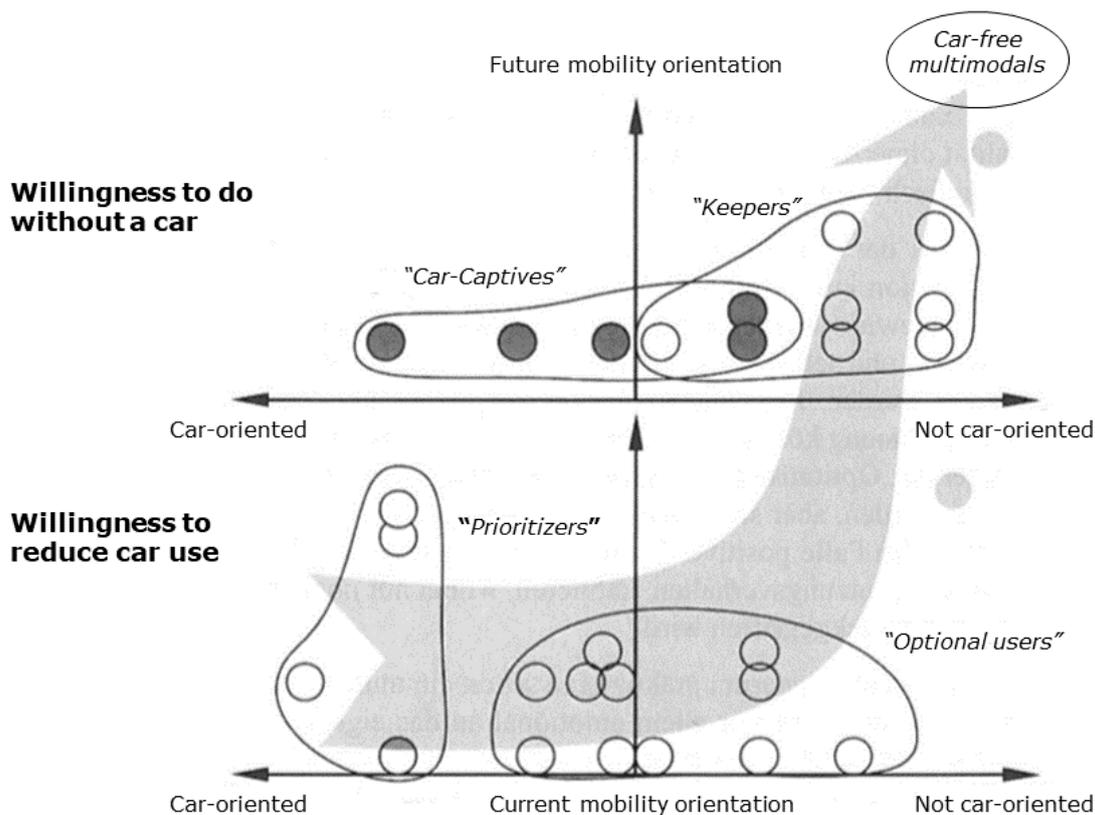


Figure 2. Potential Transformation of Car-Based Households (Source: own presentation).

#### 4.1. Households with a Tendency towards Doing without a Private Car

About half of the on-street parkers show a tendency towards doing without a private car. Within these two different groups one can differentiate between *car-captives* and *car-keepers*. While both of these groups display the attitude and willingness to get rid of their car and are sympathetic to public transport and bicycling, they display differences in their daily mobility patterns and requirements.

**Car Captives**—external structures forcing car-dependency.

The car-captives have a critical view of their car ownership. Most of them know that car use is the most unsustainable way of getting around in urban areas and they would also like to get rid of their car for financial reasons. Additionally, most of them show positive attitudes towards public transport, cycling and walking and would like to see an increase in these modes of transportation in the future. Still, these users point to certain structural parameters in order to explain or rationalize their car-dependency. For example, some of them have to commute to places outside the city which they cannot reach with any other mode of transportation. Other reasons given were financial concerns, health limitations and having to transport heavier goods for work-related purposes. Transportation researchers often call this “forced mobility” (*Zwangsmobilität*) [18] and discuss two fundamental problems—first, it is impossible for the people in question to change this situation on their own since they are captives of car-based mobility. Second, even if the reasons are structural, traffic planners and politicians do not have any short- or mid-term solutions to offer, since the reasons are either located in different fields of policy such as housing or economic policy or they involve planning periods of several decades (e.g., expanding the public transit network). This dead-end situation means that the car captives will be largely neglected by policy makers and planners, since there are no recommendations for action at hand.

#### 4.2. Keepers—Keeping a Car for Opportunity's Sake

In common with the group of keepers, car captives view car ownership critically and also have a positive view of sustainable mobility. The main difference is that the keepers live their daily lives without using a car and display aspects of multimodal behaviour by using public transport, cycling and walking, instead of using their car. Still, owning a car comes in handy for certain situations, such as buying things in bulk, the transportation of heavy goods, weekend trips or holidays, where they do not see their mobility needs met by public transport, car-sharing or forms of active mobility. While the keepers certainly still feel the need to own a private car for such occasions, they reveal many starting points as to how the external parameters might be altered, so they could effectively use alternatives instead. Most relevant here are improvements in public transport, extending car sharing opportunities, as well as increases in the cost of owning an automobile (e.g., increasing the costs of parking in urban areas). The following quote nicely illustrates the paradox of owning a car in order to avoid the negative impacts of automobility:

“Car sharing is only useful in the city, in Berlin, more or less. And we bought the car to get out of the city or to go bulk shopping, which we only do very rarely, actually. So, our car is primarily for our son, I would say, so that we can drive him out into the countryside and he isn't just restricted to seeing the city or the same playground again and again, which is surrounded by cars. And yes, this is the main reason.” (quote of Participant 6 in our study)

#### 4.3. Households with a Tendency towards Reducing Car Use

The group of on-street parkers who have a tendency towards reducing their car use cannot imagine completely doing without their car just yet. In this sense, the groups that we present next display attitudes much more rooted in car-based mobility than the previous groups. However, they do show considerable openness to reducing their car travel on certain occasions, some are already offsetting their car-trips by using public transport, cycling or walking.

#### 4.4. Optional Users—Keeping a Private Car due to Emotional and Symbolic Bonds

Being the largest group in the study (11 persons in total), the *optional* users share the positive attitudes towards sustainable mobility with the groups of *car captives* and *car keepers* and mostly they also display a multimodal mobility pattern. The main difference is that *optional users* cannot imagine relinquishing their car and replacing it with a functional equivalent. The reason is that the *optional users* do not see the private car as a functional tool for getting around but rather as a meaningful object in itself. The people concerned have a strong emotional bond with their car, which they even personify. The car is thus not used and owned out of rational motives but rather out of emotional and symbolic motives, making it difficult to challenge this status-quo through policy or planning measures [19]. However, the *optional users* could be persuaded to make less use of their car if there were improvements in public transport and cycling infrastructure or gasoline costs were to rise.

#### 4.5. Prioritizers—the Car as First Choice

This second group also cannot imagine relinquishing their car and are much more focused on car travel due to their daily routines and negative attitudes towards alternatives. Public transport for example is considered as unreliable and cycling as too exhausting. The *prioritizers* are thus the group of people who have “the car in their head” [20] and always use their car as their first option. Still, some of these households could imagine using their car less often and eventually turn into *optional users* themselves, should the structural parameters change accordingly. The *prioritizers* therefore share the emotional and symbolic bonds to automobility, plus a rational motive and a markedly routinized use of the car, as one participant explains:

[asked if he could imagine dispensing with his private car] Definitely not [ . . . ]. Only if I were no longer able to drive a car. If I were—let's say - physically and mentally unable to do it. But apart

from that, yes, I am quite a fan of automobiles. As I already said, it means an element of freedom and flexibility to me, at least in my head and which I simply don't want to do without." (quote of Participant 13 in our study)

## 5. Discussion of the Empirical Findings

Considering the varying attitudes and types of use, there are several ways a sustainable development could be fostered. While the group of *car captives* are the ones where political influence is not possible on a short- or mid-term timescale, the potential for influencing the *keepers* and *optional users* is considered to be high. Even some firmly convinced and routinized car drivers such as the *prioritizers* could be influenced and targeted by policy and planning measures. With the right amount and mixture of push- and pull measures (see below) some of them could at least be introduced to alternative modes of transport for certain trips. This means the *prioritizers* would still own and use their car for most purposes but they show a more multimodal mobility pattern, potentially turning them into *optional users*, who still have an emotional and symbolic bond with the car but on rational grounds also use other transport modes as well.

Similarly, the *optional users* already show a more diverse and multimodal mobility pattern but remain attached to their car because they enjoy driving it or see it as status symbol. Relatively many of those who rate these non-instrumental motives higher than rational ones are young men [21]. Still, these emotional and rational motives are socially constructed and are dependent on a complex configuration of sociocultural attributions. These attributions are not fixed once and for all but are rather always negotiated and influenced by underlying changes in mobility cultures and mentalities. Changing norms, attitudes and values can have a significant effect on these motives and eventually reduce the symbolic or emotional capital that the private car offers to certain people and to their quality of life. For example, a representative study conducted by the German Environment Agency (*Umweltbundesamt*) indicates that 91% of Germans would be in favour of being less dependent on cars [22]. On a local level, a survey based in Prenzlauer Berg found that 60% of the households are in favour of transforming their neighbourhood into a car-free area [23]. Through this process, *optional users* could develop a more functional and pragmatic relationship to their car, leaving them open to improvements in alternative mobility, as European case studies about car-free developments suggest [24].

In particular, the groups of *keepers* are susceptible to effective intervention, making it likely they will dispense with their car in the long run. The motives mentioned were financial in nature, such as increasing maintenance costs or falling household income but non-financial reasons were also mentioned, such as the effort involved in finding parking spaces and traffic jams. By contrast, ecological reasons only play a subsidiary role. An exemplary instance here is one study participant who, for financial reasons, had already gotten rid of his car just prior to the interview. This shows that political interventions offering forms of alternative mobility and/or restricting car-based mobility can have a significant effect on this group. The following graphic (Figure 2) shows the interconnections between current mobility orientation and possible future mobility orientation in terms of the participants' willingness to reduce car use or even to dispense with their private car altogether. Additionally, the illustration indicates the tendencies within the groups towards a more sustainable form of urban mobility. Each circle indicates a participant of the study, while the connecting bubbles indicate the groups of *car-captives*, *keepers*, *prioritizers* and *optional users*.

### Recommendations for Action

To promote future sustainable mobility, recent transportation policies have focused increasingly on the reduction of individual motorized transportation in urban areas and the promotion of active modes of transport and public transport. Our results emphasize that multimodal mobility is already predominant in densely populated urban areas and even traditional car owners already display aspects of multimodal behaviour and have experience with different mobility alternatives. This reveals a potential for alternative mobility solutions without needing to own or use a car and should be used by

politicians and planners to develop strategies that help car-based households to meet their mobility needs without a private car, even a private electric vehicle. A German mobility survey also shows that multimodality is increasing—there are more and more multimodal people using at least two different modes of transport in the course of a single week, usually a combination of car, bicycle and public transport. It is therefore relevant to study mobility patterns in the current use of modes of transport and to create alternatives that meet the needs of the users [25].

To generate a shift towards multimodal mobility it is necessary to combine push and pull measures, which promote the development of alternative modes of transport and, at the same time, make car ownership unattractive for urban dwellers. These so called “travel demand management” [26] measures can be incentive-based (pull measures) or restrictive (push measures). Some studies show that a single measure is quite ineffective on its own, while a useful and smart combination of push- and pull measures has the best impact [27,28]. Therefore, in order to promote sustainable mobility in the future, it is essential to make car use and ownership less attractive, while promoting active modes of travel and public transport. This transformation requires long-term political action and a goal- and people-oriented approach, to make push-measures both effective and acceptable for all kinds of users.

Another interesting result is the heterogeneity of the on-street parkers regarding their use of and attitudes towards cars. The on-street parkers we studied can be differentiated on the basis of their desire to keep their private car and willingness to reduce the frequency of its use in favour of alternative transport modes. There are, as we explained, four groups: *car captives*—those who are willing to live without a private car but whose personal situation (work, family, etc.) make them dependent on their cars. *Keepers*—those who are willing to live without a private car, provided there is an improvement in alternative forms of transport, making it possible to transport goods within the city and to make trips to the outskirts. The latter argument was the main reason why car sharing was considered inappropriate (along with the absence of car seats for children and leasing costs). *Optional users*—those who are not willing to live without a private car but who would be willing to use it less if there were improvements in alternative forms of transport. *Prioritizers*—those who use their own cars without considering the possibility of using other modes of transport. They are not willing to give up their own car or use it less, regardless of the circumstances.

Therefore, it is highly recommendable to design transport policy measures and transportation planning measures to address specific target groups. The findings of this analysis enable us to identify the needs of users and to formulate recommendations, such as the promotion of car sharing (institutionalized as well as private), the implementation of smart parking management, increasing the costs of owning a car (e.g., taxes, insurance) and developing existing public transportation so that it becomes a form of ‘public mobility,’ enabling the public to use all kinds of transportation modes instead [29]. Furthermore, improvements in cycling infrastructure would strengthen the extant local bicycle culture and serve as a cheap but nevertheless effective pull-measure.

## 6. Conclusions

In the face of the transformation from a fossil-based to a post-fossil society, the transport sector has to play its part [30]. For this reason, the old idea of integrated transport planning and policy is experiencing a revival, which involves the integration of infrastructure, transport and mobility management to meet both societal needs as well as transport policy goals. Because sustainable transport development necessarily depends on a change in mobility behaviour, the people-centred perspective is of foremost interest. Especially for traditionally-educated transport planners, who often have a background in engineering and lack professional knowledge in the social sciences and qualitative research, this human perspective can be very challenging. In widening the perspective to include different topics like society, technology, economy, ecology and politics, as well as examining the ways in which the latter are interdependent, integrated transport planning is a complex ‘inter-discipline.’ This also explains why, even though the idea is widely accepted, the practice is still trailing behind. To the extent that different disciplines have to work together, an interdisciplinary approach is always a

venture. That is why we have to provide an answer to the question of why one should embark on the adventure of integrated transport planning, even though the initial effort is considerable.

We provided one answer with respect to the topic of e-mobility, which to date is very much technology-driven. Within the framework of a research project commissioned by the German Federal Ministry of Environment, Nature Conservation and Nuclear Safety, politicians wanted to find out how to design a charging infrastructure for on-street parkers in densely populated inner-city areas. By altering the research question in favour of the goal-oriented approach of integrated transport planning, we enquired into people's mobility needs, instead of simply assuming the existence and uptake of the private e-car. Finally, in light of the finding that most people in densely populated inner-city areas do not use their private car during the week, we came up with very different policy recommendations, contrasting with the Ministry's initial idea to establish a comprehensive public charging infrastructure for private electric cars. (The research project was conceptualized as a one-year pilot with the option of follow-up financing. Because we did not fulfil the ministry requirements, the follow-up financing went elsewhere. This demonstrates once again the close coupling of research and politics, as well as the difficulties that result from this established relationship, particularly in times of major transformation. Against this background, researchers have a responsibility to decide between accepting funding and remaining true to their own professional convictions, which raises the issue of the relations between ethics and research, which we cannot go into here [31]).

The example demonstrates a further difficulty in implementing the integrated transport planning approach. Apart from the above-mentioned challenge of embarking on the adventure of an inter-discipline, the established relationship between politicians and researchers in times of change is an additional obstacle. As we showed, politicians, policy makers and researchers are still very much focused on technical solutions, in this case the electric vehicle and the necessary charging infrastructure. On the one hand, transport policy makers traditionally go looking for technical solutions (politicization of research) and on the other hand, research into transport is used to offer primarily technical solutions (thus bestowing an air of research science on politics). Neither side is prepared for new challenges, which require above all a change in mobility behaviour. In fact, in the field of transport policy and planning we are confronted with a typical deadlock, where both sides obstruct each other.

What is required is nothing less than a paradigm shift in transport policy and planning, as classically described by Thomas Kuhn [32]. In this spirit, researchers have a responsibility to break with what is generally considered to be a matter of course, even at the risk of upsetting political expectations. In this sense, as our case demonstrates, this paradigm shift in transport planning and policy from a supply- to a demand-oriented approach is a conflictual process. On the one hand we have arguments in favour of integrated transport planning as an inter-discipline; on the other hand, we have traditional planners who argue against the paradigm shift because it is associated with a conflictual process and a normative perspective, conflicts that they want to avoid.

In contrast, we argue that societal progress necessarily involves political conflict and consider research to be an inherent part of this process. Therefore, by showing the potential of integrated transport planning and policy as an inter-discipline to promote sustainable transport development, as researchers we are making a conscious contribution to the recent political struggles regarding appropriate transport policy.

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