New living concepts in the city: the potential impact of urban planning on travel behaviour

Julia Jarass
Institute of Transport Research
German Aerospace Center (DLR)
Rutherfordstr. 2
12489 Berlin
Germany
julia.jarass@dlr.de

Keywords

urban transport, urban planning, behaviour

Abstract

For the last decades, residents have moved to the suburbs in order to satisfy their desire for a house with a garden. Being far less accessible than residences in cities, these suburban areas often require longer commuting distances and motorised travel and therefore cause greater emissions and energy consumption than compact development. Recently, new living concepts that combine suburban housing types with urban amenities are emerging within the urban fabric. In this paper it will be discussed if these new living concepts promote energy efficient mobility and if they are an alternative to suburban residences. By analysing the daily mobility of residents living in a new inner-city area in Berlin, the results suggest that this area mostly attracts families who welcomed the combination of living in a central location with good public transport access and having a house with a garden. In the context of daily mobility, an interesting mismatch was found: over 80 % of the households have a car – this is highly above average in Berlin. However, the residents make more than half of their trips by foot or by bike. Nonetheless, the potential for sustainable land use and travel behaviour is not fully exploited. Simple urban planning measures, such as providing less private parking spaces, ensuring a fine mix of uses and proximity to public transport can – at least to a small extent – further promote non-motorised and public transport modes and therefore reduce emissions due to motorised private transport in urban areas.

Introduction

For the last decades, residents have moved to the suburbs in order to satisfy their desire for a house with a garden. Being far less accessible than residences in cities these suburban areas often require longer commuting distances and motorised travel, and therefore cause greater emissions and energy consumption than compact development (Naess 2003, Naess 2011, Buehler 2011, Arndt/Zimmermann 2012).

Recently, European inner-city areas are increasingly regaining their residential attractiveness and more people want to live in cities (Haase et al. 2010, Osterhage 2011). Besides a growth in the number of inhabitants, a diversification of the population structure can be observed. In particular, one-person households, groups of unrelated adults sharing an apartment, and young parents seek inner-city living (Buzar et al. 2007:662).

The influx of new residents and the diversification of the population structure within inner-city districts are oftentimes preceded or accompanied by a refurbishment of the building stock as well as an improvement in the quality of the residential environment (Haase et al. 2010:444). Municipalities support this process of reurbanisation as part of an intentional political strategy for urban renewal and economic revitalisation of the inner city: they try to attract households – in particular groups with higher spending power (Doucet 2010) – by increasing and upgrading the housing stock and offering new living concepts within the urban fabric. In a few cities, former industrial areas or brownfields have been converted into residential areas (e.g. Kop van Zuid, Rotterdam; Gilde Carrée, Hannover). Some of these areas combine suburban housing types with urban amenities – they suggest a rather suburban way of life in a central location.

Connected to concepts like 'new urbanism' or the 'smart city', studies have investigated how the design of new urban areas

supports objectives to reduce motorised travel and therefore emissions (Foletta and Field 2011). Their central location, density and mix of uses can provide the preconditions for short transport routes. Moreover, high accessibility of public transport and favourable design enable residents to make trips with public transport, on foot or by bike – thus offering alternatives to the car. This raises the question if this also holds true for new living concepts that combine suburban housing and urban land use characteristics. Using the development area Alter Schlachthof in Berlin as a case study, the following questions will be addressed:

- For which households is this kind of inner-city area an attractive location?
- What kind of travel behaviour can be attributed to the residents? Are there different groups of travel behaviour and to what extent are mobility-related motives relevant when seeking for a new residential location?
- What urban planning measures can be taken to further stimulate sustainable travel behaviour?

The interrelation of residential behaviour and travel behaviour

Households have various reasons to seek a new residential location. The motives for moving depend on external conditions (e.g. size of the apartment, public transport access) and individual requirements regarding the apartment and the living environment (Flade 2006:71). These individual requirements are based on lifestyles and personal circumstances of life. If changes in the life course occur or if the household is confronted with altered conditions concerning the apartment or the living environment, the household needs or wants to adjust the living situation and seeks a new residential location. These changes in the life course are mainly due to events in the household biography (e.g. the formation of a household with a partner, the birth of a child, divorce) and the employment biography (e.g. starting apprenticeship, choice of a profession or choice of a workplace) (Scheiner 2007:161).

Figure 1. Location of the research area within Berlin. Source: authors' own illustration based on Senatsverwaltung für Stadtentwicklung 2009.

In a next step, the attitudes of the household towards housing and neighbourhood characteristics play an important role in terms of the decision for a specific residence. When a household decides to relocate and seeks for a new residential location, the household members try to find a new apartment and living environment that fits to their housing, land use and mobility preferences. Particularly housing characteristics such as type, size and tenure status play an important role in the decision for a specific residence (Beige 2008:14). In contrast, the advantages and disadvantages of the living environment oftentimes are less recognised during the relocation process (Rohrmann 1993:145). In terms of mobility-related preferences, it was found that people self-select themselves in the context of relocation to be able to translate mobility preferences into actual travel behaviour (e.g. Schwanen/Mokhtarian 2005, van Wee 2009, Cao et al. 2010). Schwanen and Mokhtarian (2005) for example examined land use preferences and travel behavior in urban and suburban areas and found that land use preferences as well as physical attributes of the residential neighbourhood influence travel behaviour. This connection between residential behaviour and travel behaviour has to be taken into account when analysing the impact of land use on travel behaviour (Jarass/Heinrichs 2014:144).

Research area and data

Berlin is a growing city. A visible sign of the population growth is the recent rise of new residential housing estates in central locations. A number of new urban housing projects are being developed and they vary in size, style and location. One of these inner-city projects is the research area Alter Schlachthof. Alter Schlachthof is located in the east of the inner city and covers an area of about 58 hectares (see Figure 1). The area was used for different purposes and after a few years of lying idle, in the mid 1990s the area was declared as one of five development areas within Berlin (Senatsverwaltung für Stadtenwicklung 2007). The area today accommodates various types of multifamily buildings and terraced housing with garden. Still under construction, the area is characterised by a rather low-density urban structure with parks and green space. Though Alter Schlachthof is mainly residential, there are shopping facilities located within walking distance at the edge of the residential area. The area is well connected to several public transport facilities: light rail, tramway, bus and underground stations can be found in proximity to Alter Schlachthof. Even though the creation of an entirely car-free residential area was discussed, specific measures to reduce motorised private transport were finally not taken. Today, the area is fully equipped with private and public parking spaces (Jarass/Heinrichs 2014:145).

For a better understanding of the interrelation between travel behaviour and residential relocation in newly developed inner-city areas, we conducted a survey in the area of Alter Schlachthof. In October of 2012, 700 households were asked to fill in a paper-based questionnaire. The questionnaire was personally distributed to and later collected from the households (response rate was 45 %). In each case one household member aged 18 years or older was asked to fill in the questionnaire. The data set contains detailed information about the residents, the household structure, their decision process of residential relocation and daily mobility. In the following analysis, only data of

Figure 2. Terraced housing in Alter Schlachthof. Source: Jarass 2013.

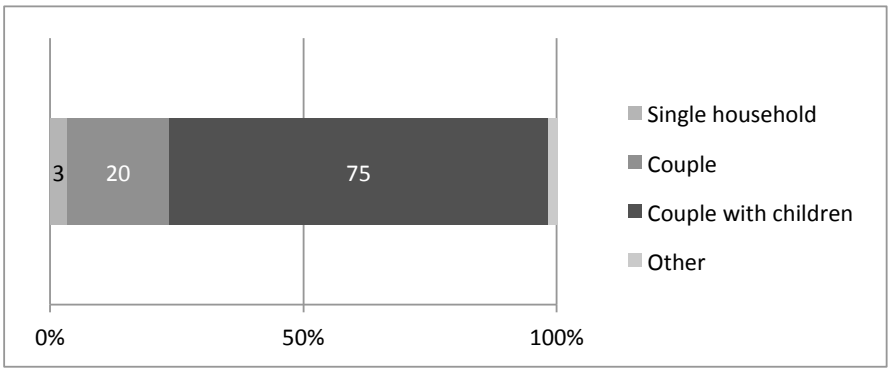

Figure 3. Household size in Alter Schlachthof (n=175 households). Source: authors' own analysis based on dataset 'Alter Schlachthof' (2012).

a total number of 178 residents living in the area with terraced housing will be part of the study (see Figure 2). Thereby, the combination of suburban housing types and urban land use structure will be taken into account.

Results

The following analysis is structured in three parts. Firstly, the socio-economic structure of the residents as well as their travel behaviour will be characterised. Next, a cluster analysis will be computed in order to generate groups with similar daily mobility. Finally, these clusters will be described and special importance will be paid to the issue of land use and mobility preferences. It will be analysed if different mobility clusters have different preferences and requirements concerning their residential area, and if further urban planning measures could promote the use of environmentally friendly transport modes.

WHO LIVES IN THIS KIND OF URBAN AREA?

The respondents of the survey have an average age of 41 years and more women answered the questionnaire than men did (62 % vs. 38 %). Household size and structure show that this area is especially attractive for larger households, in particular for families (see Figure 3). A share of 75 % lives as a couple with children; more specifically, the majority of these households have at least 2 children (60 %). Only 20 % of the respondents live as a couple without children, and 3 % of the respondents live in single-households. This population structure is in sharp contrast to the composition of households in the inner city, where the majority of the households are one-person (more than 60 %) (Jarass/Heinrichs 2014:146).

Residents of the research area are highly educated: 90 % of the respondents indicated that they attained the general qualification for university entrance and almost 80 % graduated from tertiary education. Today, the vast majority (86 %) of the respondents are employed. However, there is a difference between men and women in respect to full-time and part-time employment: 83 % of the male and only 45 % of the female respondents work full-time.

The high employment rate and educational background is reflected in high incomes (see Figure 4). One third of the households dispose of a monthly net income of €5,600 and more. More than a quarter of the households have an income of €4,600 to €5,600, and 18 % of the households dispose of €3,600 to €4,600. Only less than one fourth of the households have an income of €2,600 or less.

Concerning mobility resources, a focus on the private car is apparent: the car ownership rate per household doubles the one in the inner city of Berlin: 88 % of the households dispose of at least one car. In contrast, only 44 % of the households in the inner-city areas of Berlin have one or more cars at home (Jarass/Heinrichs 2014:148). Overall, the households have almost no mobility constraints resulting from limited mobility resources. Besides a high car ownership rate, 80 % of the households have at least one bike and 42 % of the respondents also indicated that they have a monthly or annual ticket for public transport.

RESIDENTIAL MOBILITY

New residential areas are often developed with the expectation that inner-city households seeking to relocate can be prevented from leaving the city or that households living outside will be attracted to move to the inner city (Doucet 2010). For the case of this research area, the results indicate that a large majority of residents mainly moved from other inner-city areas within Berlin to this newly developed location.

The majority (75 %) moved from neighbourhoods within the inner city of Berlin and 11 % lived in other neighbourhoods of Berlin (but outside of the inner city). A share of 14 % moved from beyond the agglomeration of Berlin (another city in Germany or abroad) to Alter Schlachthof. The findings emphasise that it was a deliberate choice of the residents to stay in the inner city rather than a return of suburbanites to the city (Haase et al. 2010:444).

When asked for the main reasons to relocate, 59 % of the respondents stated that personal or family reasons played an important role in looking for a new residential location. In particular, a birth in the household and moving in together with a partner were the reasons for relocating. Personal or family reasons frequently coincide with needs in housing conditions (75 %): the respondents decided to look for a new apartment especially if the former apartment was too small, to purchase residential property or there was no garden available. A share of 42 % indicated that the prior living environment was no longer suitable.

DAILY MOBILITY

The high car ownership rate suggests high rates of car use. Whether the residents really use their car on a regular basis, or whether they keep it to cover the option of using it, will be analysed in the following section.

In the questionnaire, data was gathered about daily mobility: the respondents were asked to give detailed information about the transport mode they normally use for several purposes of trips (e.g. shopping, work, leisure). Depending on the frequency of the different purposes, a modal split was created for each resident by summing up the individual share of different transport modes. The transport modes are divided into walking, cycling, public transport, motorcycle, car (driver and passenger) and others (see Figure 5). Since the share of trips by motorcycle and by car as a passenger are very low, these transport modes will be added to the trips by car as a driver and referred to as motorised private transport in the following analysis. The modal split of the residents reveals that the high rates of car ownership do not automatically lead to high rates of car use: 25 % of all trips are made by motorised private transport. Walking and cycling account for more than 50 % of all trips and the share of public transport is high at 21 %. This shows that environmentally friendly transport modes are well represented despite the high rate of car-ownership.

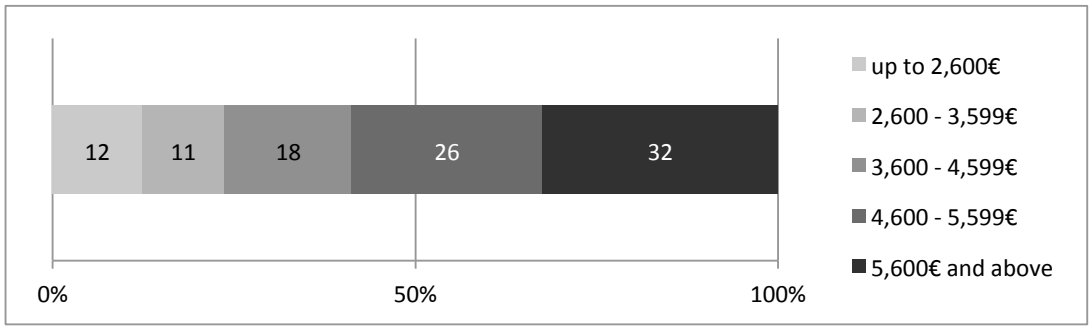

Figure 4. Monthly household net income in Alter Schlachthof (n=114 households). Source: authors' own analysis based on dataset 'Alter Schlachthof' (2012).

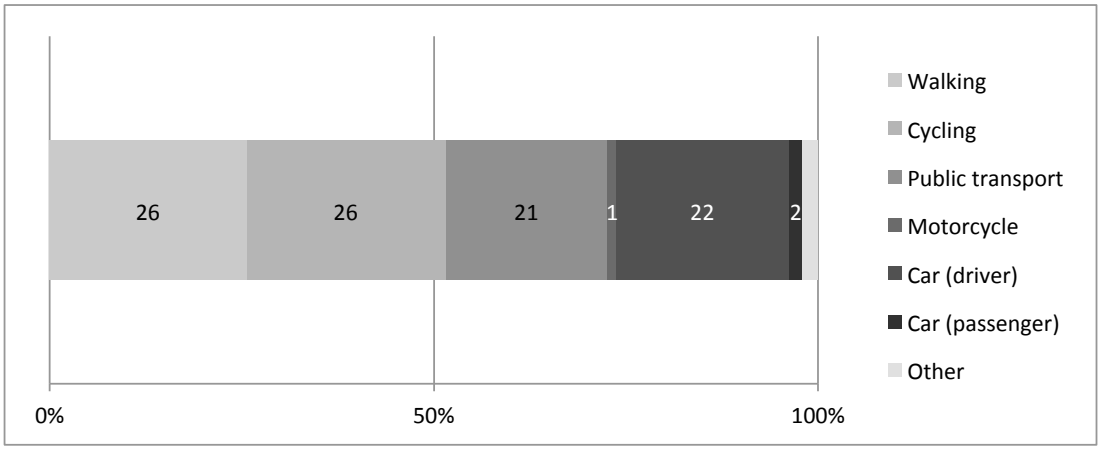

Figure 5. Modal split in Alter Schlachthof (n=178 persons). Source: authors' own analysis based on dataset 'Alter Schlachthof' (2012).

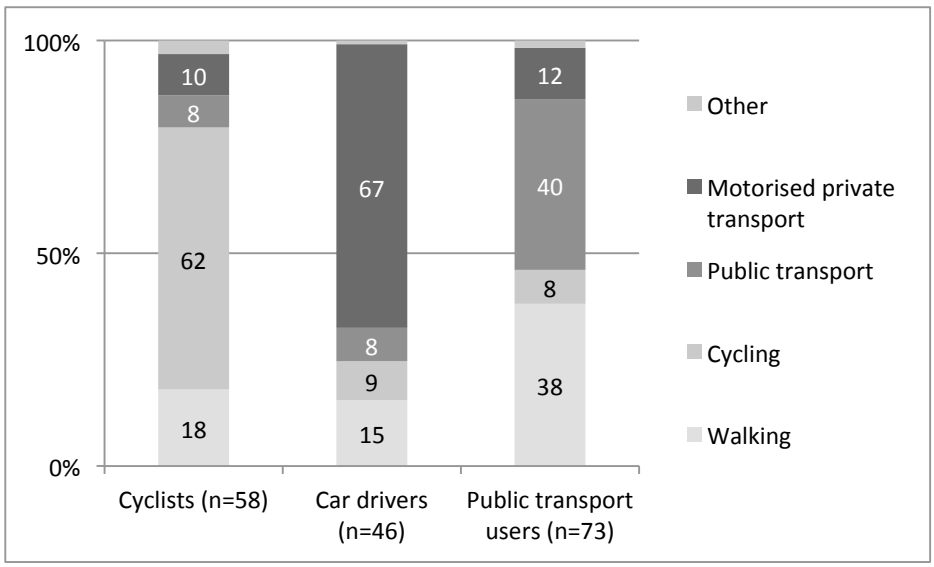

Figure 6. Modal split of the three clusters. Source: authors' own analysis based on dataset 'Alter Schlachthof' (2012).

CLUSTERS OF TRAVEL BEHAVIOUR

In the following section it will be analysed if different groups of travel behaviour can be identified and if these groups differ regarding mobility-related motives and land use preferences in terms of residential relocation. In order to create homogenous groups regarding daily travel behaviour – in a first step – we applied a hierarchical cluster analysis by applying the Ward method to the sample of 178 residents. The elbow-criterion (high increase of the error sum of squares) and content considerations suggest a solution with three clusters (Backhaus et al. 2008:430). In a second step we applied a cluster analysis (k-means procedure), to optimise the assignment of the residents to the three clusters. The combination of the two methods finally leads to an assignment of 58 residents to the first cluster, the second cluster includes 46 residents and the third cluster consists of 73 residents.

Figure 6 shows the modal split of each cluster: the first cluster can be characterised by a high share of trips by bike. In this group almost two thirds of the trips are done by bike, another 18 % on foot, public transport accounts for only 8 % of the trips and driving by car accounts for 10 % of their trips. Overall, this cluster therefore represents the group of *cyclists*. The second cluster can be clearly characterised by users of motorised private transport: More than two third of all trips are done by motorised private transport, public transport modes account for a share of only 8 %, cycling accounts for 9 % of all trips and 15 % are walking trips. This group will therefore be referred to as *car drivers*[1]. The last cluster is dominated by a high share of trips by public transport with 44 %. However, the share of trips on foot is not negligible: residents of this cluster walk for 37 % of all trips. Bearing in mind that public transport stations can oftentimes only be reached within a certain walking distance, the use of public transport modes is mostly combined with walking (Thomas/Schweizer 2003). Therefore it is not surprising that residents of this cluster have a high affinity with walking. The share of biking is low at 6 % and individual motorised transport accounts for 13 %. This cluster is therefore named *public transport users*.

Despite the differences in the modal split between the three clusters, the car-ownership rate is high in every cluster: every single household in the group of the *car drivers* disposes of at least one car, almost half of them (46 %) have two cars or more. This is hardly surprising, but even the *cyclists* and the *public transport users* have high car ownership rates: 88 % of the cyclists have at least one car, as do 82 % of the public transport users.

MOBILITY AND LAND USE PREFERENCES AMONG THE CLUSTERS

In this section, the pull-factors that ultimately explain the choice of the new residential location will be looked at for each cluster. Figure 7 shows the importance of various neighbourhood characteristics among the residents for their decision to move to Alter Schlachthof.

Concerning mobility-related motives, there are similarities as well as important differences between the clusters: Overall, living in a central location and access to public transport were rated as very important, but for *car drivers* these characteristics appear to be less important. Since the majority of the residents had already been living in inner-city areas of Berlin before they moved to Alter Schlachthof, these aspects of good accessibility and central location still seem to be important at both the new and the previous residential relocation. Consequently, staying in the inner city and benefitting from the advantages of inner-city living appears to be a deliberate choice.

A more differentiated picture emerges by taking a closer look at car-related motives. Accessibility by car and parking facilities are very important for car drivers. For *cyclists* and *public transport users*, these characteristics were not important for the decision to move to Alter Schlachthof even though they have high rates of car ownership. They don't use the car on a daily basis, and characteristics of car accessibility did not play an important role in their decision of residential relocation. This leaves scope

1. Since the share of trips by motorcycle and by car as a passenger is negligible, we will subsume these transport modes under the term *car drivers*.

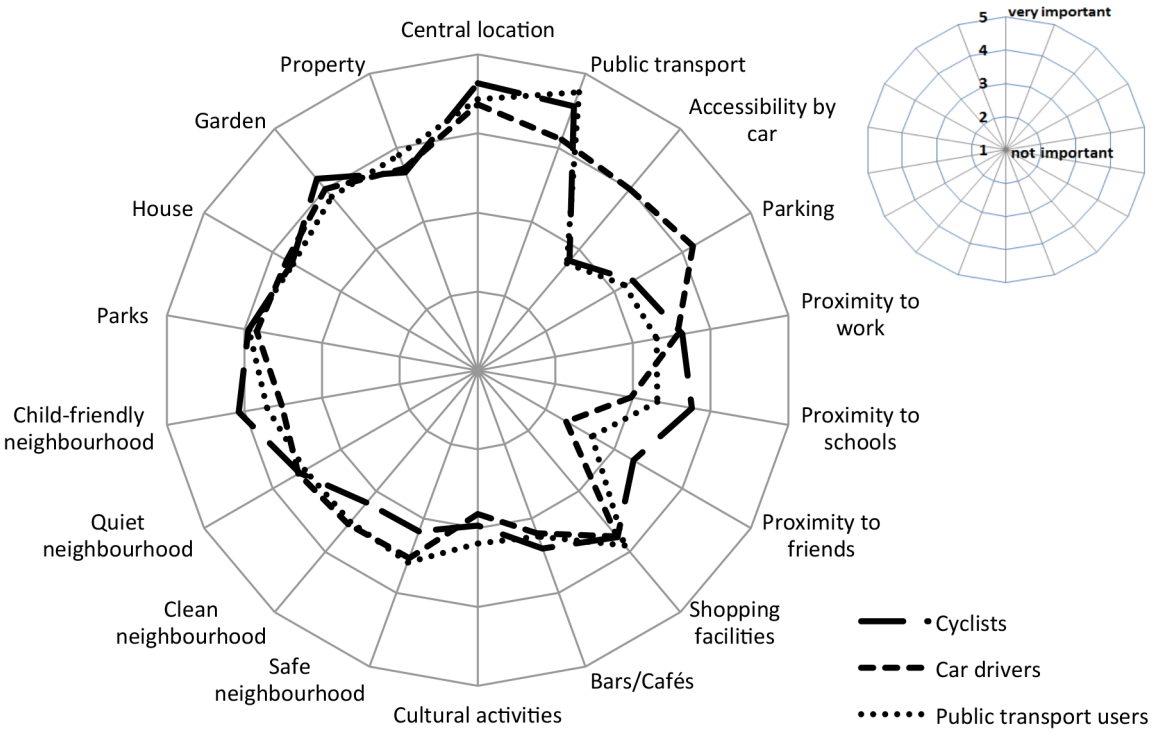

Figure 7. Importance of neighbourhood and housing characteristics among the residents. Source: authors' own analysis based on dataset 'Alter Schlachthof' (2012).

for urban planning to develop residential areas without private parking spaces that are suitable for families with sustainable travel behaviour.

Proximity to the work place was not a main driver for the three clusters to choose this kind of neighbourhood, however it was more important for *cyclists* and *car drivers* than for *public transport users*. Proximity to schools and friends are most important for *cyclists*, less important for *public transport users* and were negligible reasons for *car drivers*. Regarding a mix of uses, the residents of all three clusters mentioned that shopping facilities were important. Living in proximity to cafes, bars or cultural facilities was less important.

Preferences in terms of the living environment that are not connected to mobility-related issues show minor variations among the three clusters. The residents rated a safe, clean and quiet neighbourhood and the availability of parks as being important aspects when looking for a new residential location. A safe and clean neighbourhood was less important for the *cyclists* group compared to the other groups but a child-friendly neighbourhood in turn was more important for them.

Finally, aspects concerning the conditions of the apartment such as living in a house with a garden and acquiring ownership were important aspects for the respondents when looking for a new residential location. Having a garden is particularly important for the cluster of *cyclists*. These aspects tend to be more characteristic for suburban housing.

Overall, the high rating of rather suburban housing characteristics and urban land use structures show that the residents were explicitly looking for this kind of urban area where they can combine different housing and neighbourhood attributes. When it comes to mobility-related motives, differences between the three clusters emerge and this is where urban planning measures can be strengthened.

The influence of further urban planning measures

The residents were also asked about their attitudes towards driving and if they would change their travel behaviour if certain urban planning measures were implemented.

Different views were expressed on the need for driving (see Figure 8): While the majority of the *cyclists* and the *public transport users* stated that they don't need a car for their everyday activities, more than half of the *car drivers* agreed that they can't organize their everyday life without driving. This shows that even in an urban residential location with excellent public transport access and short distances to shops etc. the *car drivers* insist on a car. However, the following results indicate that further urban planning measures would at least slightly lead to more environmentally friendly travel behaviour.

More shopping facilities within the neighbourhood, for example, would partially increase trips on foot or by bike: a share of 7 % of the *cyclists*, 16 % of the *car drivers* and 12 % of the *public transport users* agreed that they would walk/cycle more often to the supermarket if there were more shopping facilities in the neighbourhood. This share is not very high, because the majority of the *cyclists* and the *public transport users* already leave the car at home for shopping: about 90 % of both the *cyclists* and the *public transport users* do their grocery shopping on foot or by bike. In contrast, almost half of the *car drivers* use the car for shopping trips. Taking a closer look at those residents, the results indicate that they would not substantially change their travel behaviour if more shopping facilities were located in the neighbourhood: all of them stated that they are (very) satisfied

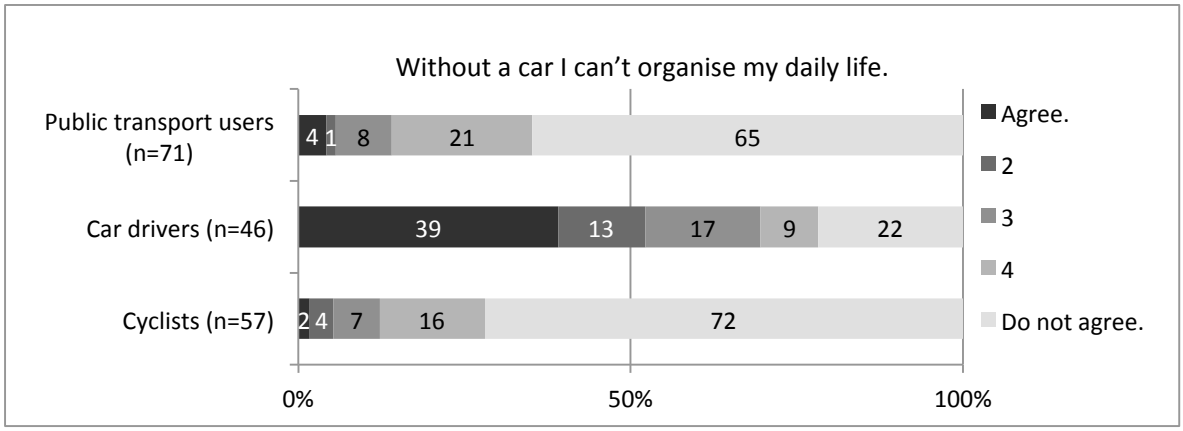

Figure 8. Attitude towards driving. Source: authors' own analysis based on dataset 'Alter Schlachthof' (2012).

with the shopping facilities on offer and only one fifth would leave the car at home if there were more shopping facilities.

A reduction of private parking spaces could lead to slightly lower shares of car use: 10 % of the *cyclists*, 16 % of the *car drivers* and 12 % of the *public transport users* who own a car would leave their car at home more often if they did not have the opportunity to park it in front of the house on their private parking space (for example, to avoid searching for a public parking space).

Would the residents use public transport more often if the stops were reached faster? The results indicate that about 90 % of each group is (very) satisfied with the accessibility of public transport, however, a small share of residents would change their travel behaviour and go by public transport more often if the stops were closer. 18 % of the *cyclists*, 12 % of the *car drivers* and 18 % of the *public transport users* would use public transport more often in this case.

Conclusion

Alter Schlachthof is no unique case. In Germany and other European countries, neighbourhoods like this are emerging and have to be adapted to the needs and demands of the new residents by ensuring sustainable mobility at the same time. The results of this study show that new living concepts in the inner city combining suburban housing types with urban amenities have positive effects in terms of daily mobility. Being far more accessible than the residences in suburban areas, they can help in reducing emissions and energy consumption due to motorised private transport. Residents can satisfy their desire for a house with a garden and live in a central location with good public transport access. Mostly families are attracted by this combination of urban and suburban characteristics of the living environment. They are highly educated, employed and dispose of a high income. This is translated into high car ownership rates: the car ownership rate per household doubles the one in the inner city of Berlin (Jarass/Heinrichs 2014:148). However, most of the time, the residents leave their car at home and go for more than half of their trips by foot or by bike. This mismatch between owning and using a car shows that the potential for sustainable land use and travel behaviour is not fully exploited. Urban planning missed out on creating alternative mobility concepts, such as Car-sharing systems, in order to reduce the number of cars and reduce the surface dedicated to parking spaces.

Furthermore, the results show that residents' mobility-related requirements differ regarding different types of mobility. Three types of mobility were found: one group of residents mainly uses the bike for everyday activities, one cluster drives for most of the trips and another group of residents typically goes by public transport. It was found that the central location, good access of public transport and proximity to shopping facilities are of particular interest for the groups of *cyclists* and *public transport users*. In contrast, accessibility by car and parking facilities were very important for *car drivers* in the context of residential relocation. On the one hand, this finding emphasises the effect of residential self-selection: people self-select themselves in the context of relocation, in order to translate their mobility preferences into their actual travel behaviour. On the other hand, it clarifies that the provision of private parking facilities is not obligatory to attract cyclists and public transport users to this type of new urban area.

When it comes to the implementation of further urban planning measures, the results indicate that simple measures, such as providing less private parking spaces, ensuring a fine mix of uses and proximity to public transport can – at least to a small extent – further promote non-motorised and public transport modes and therefore reduce emissions due to motorised private transport in urban areas.

Overall, this kind of housing concept is good news for energy efficient urban planning: the combination of suburban housing types and an urban setting has the potential to keep families with sustainable travel behaviour in the inner-city areas. Nevertheless, there is still scope for the implementation of further urban and transport planning measures to promote sustainable mobility.

References

Arndt, W.-H., Zimmermann, F., 2012, Mobilitätsverhalten in Deutschland. Aufbereitung und Auswertung von Mobilitätskennwerten. Difu-Impulse. Deutsches Institut für Urbanisitik, Berlin.

Backhaus, K., Erichson, B., Plinke, W., Weiber, R., 2008, Multivariate Analysemethoden. Springer, Berlin.

Beige, S., 2008, Long-term and mid-term mobility decisions during the life course. Dissertation, Zürich.

Buehler, R., 2011, Determinants of transport mode choice: a comparison of Germany and the USA. Journal of Transport Geography 19, 644–657.

Buzar, S., Ogden, P., Hall, R., Haase, A., Kabisch S., Steinführer, A., 2007, Splintering Urban Populations: Emergent Landscapes of Reurbanisation in Four European Cities. Urban Studies 44 (4), 651–677.

Cao, X., Xu, Z., Fan, Y., 2010, Exploring the connections among residential location, self-selection, and driving: Propensity score matching with multiple treatments. Transportation Research Part A (44), 797–805.

Doucet, B., 2010, Rich Cities with Poor People. Waterfront regeneration in the Netherlands and Scotland, PhD Dissertation. Koninklijk Nederlands Aardrijkskundig Genootschap Faculteit Geowetenschappen Universiteit, Utrecht.

Flade, A., 2006, Wohnen psychologisch betrachtet. Huber Verlag, Bern.

Foletta, N., Field S., 2011, Europe's Vibrant New Low Car(bon) Communities. Institute for Transportation and Development Policy, New York.

Haase, A., Kabisch, S., Steinführer, A., Bouzarovski, S., Hall, R., Ogden, P., 2010, Emergent Spaces of Reurbanization. Exploring the Demographic Dimension of Inner-City Residential Change in a European Setting. Population, Space and Place 16 (5). 443–463.

Jarass, J., Heinrichs, D., 2014, New urban living and mobility. Transportation Research Procedia (1). 142–153.

Naess, P., 2003, Urban Structures and Travel Behaviour. Experiences from Empirical Research in Norway and Denmark. European Journal of Transport and Infrastructure Research 3 (2), 155–178.

Naess, P., 2011, 'New urbanism' or metropolitan-level centralization? A comparison of the influences of metropolitan-level and neighborhood-level urban form characteristics on travel behavior. The Journal of Transport and Land Use 4 (1), 25–44.

Osterhage, F., 2011, Renaissance of Cities? An Empirical Analysis of the Population Development in German City Regions 1999-2009. Proceedings REAL CORP 2011 Tagungsband, 18–20 May 2011, Essen. URL: http://www.corp.at/archive/CORP2011_137.pdf

Rohrmann, B., 1993: Entscheidungsprozesse bei der Wohnungswahl. In: Harloff, Hans-Joachim (Ed.), Psychologie des Wohnungs- und Siedlungsbaus. Verlag für angewandte Psychologie. Göttingen, Stuttgart. 139–148.

Scheiner, J., 2007, Mobility Biographies: Elements of a biographical Theory of Travel Demand. Erdkunde (61). 161–173.

Schwanen, T., Mokhtarian, P., 2005, What affects commute mode choice: neighborhood physical structure or preferences toward neighborhoods? Journal of Transport Geography 13, 83–99.

Senatsverwaltung für Stadtentwicklung, 2007, Städtebaulicher Entwicklungsbereich Alter Schlachthof, Berlin.

Thomas, C., Schweizer, T., 2003, Zugang zum öffentlichen Verkehr: Der Fussverkehr als "First and Last Mile". In: Strasse und Verkehr Nr. 10. 16–19.

Van Wee, B., 2009, Self-Selection: A key to a better understanding of location choices, travel behaviour and transport externalities? Transport Reviews 29 (3), 279–292.