

Collection of Revealed Preference Mobility data of City Tourists – a Two-part Survey Design

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1 ABSTRACT

Before the global Covid-19 pandemic, city tourism had been experiencing remarkable growth. Between 2014 and 2019, the market share grew from 22 % to 30 % (IPK International, 2020, 2015). With increasing numbers of visitors and the fact that tourists often concentrate around certain areas of interest, cities are experiencing growing problems (Gao et al., 2021). Furthermore, tourism has a considerable impact on greenhouse gas emissions, especially due to the arrival and departure of tourists, but also as a result of intra-destination trips by car (Gühnemann et al., 2021). Thus far, tourism transport has rarely been considered in urban transportation planning. For example, cost-benefit analyses for infrastructure that affects visitors, like a tramway line to a major touristic hotspot, do not consider the travel demand of tourists because the required data and instruments are mostly lacking.

With this submission, we present the method and results of a two-part survey that we conducted in 2020 and 2021 to collect data on the travel behaviour of tourists in Kassel, Germany. The first part of the survey was held as a Computer-Assisted Personal Interview (CAPI) on weekends at several touristic hotspots in Kassel. Visitors were asked about sociodemographic information, their main reason for visiting Kassel, their modes of transport for the journey, the duration of their stay, as well as planned and visited tourist attractions in Kassel. Overnight visitors were furthermore asked about their place of accommodation. For the second part of the survey, we chose two behaviourally homogeneous groups: overnight guests who arrived by car and day trippers who also arrived by car. It has been shown that the means of transport for arrival have a major impact on the modal choice of intra-destination trips (Bieland et al., 2017). The respondents were contacted again by phone one or two days after the first interview. The second part of the survey is based on the prevalent travel-diary approach and was held as a Computer-Assisted Telephone Interview (CATI). We altered the survey design of travel diaries to collect data on activities rather than trips because these are easier for visitors to reproduce. We surveyed all activities a visitor undertook on the day he or she was interviewed by us for the first time. For each activity, information was gathered about the start and end time, the type of activity, the location, and the means of transport.

In total, we were able to interview 2,050 visitors during the first part and 397 visitors with 1,186 intra-destination activities during the second part. The travel behaviour varied heavily between day and overnight visitors. When only counting visitors who made on-site trips (excluding undirected travel), day visitors made 1.6 trips on average, whereas overnight visitors made 3.2 trips per person per day. The modal split shows distinct differences between day and overnight visitors too. Daily visitors have a much higher share of car usage whereas far fewer trips were made by walking.

Keywords: tourism transport, revealed preference data, survey design, travel behaviour, travel diary

2 INTRODUCTION

It is common practice for cities, administrative regions, and even countries to conduct travel surveys in order to generate data about the travel behaviour of their population. These data are crucial for strategic transportation planning (e.g. Sustainable Urban Mobility Plans (SUMP)) and are often a basis for travel demand models that enable future traffic and the impact of transport and land use measures to be predicted. Generally, travel surveys are addressed to the population of a certain area, for example a city and its surrounding districts. A sample of this population is contacted and asked to record their travel behaviour for a specific time period (often a particular day or week) with the help of a travel diary. The resulting data are often regarded as a reflection of the traffic situation in the examined area, but this is not generally true. Because the sampling focuses on the area's population, tourists are not included in surveys and their travel behaviour is, therefore, neglected. This has led to an increasing data gap with the remarkable growth of city tourism in the last few years.

Between 2014 and 2019, the market share of city trips in all journeys worldwide grew from 22 % to 30 % (IPK International, 2020, 2015). This data gap has the consequence that, for example, travel demand models are not able to forecast transport for infrastructure projects geared towards tourists, like a new tramway line to a major tourist attraction. The growing number of visitors coupled with the fact that tourism concentrates around certain areas of interest and time periods is leading to growing problems for cities (Gao et al., 2021). Furthermore, tourism has a considerable impact on greenhouse gas emissions, especially due to the arrival and departure of tourists (Gühnemann et al., 2021) but also as a result of intra-destination trips if they are made by car. In correspondence with the political and societal demand for a transformation of the transport and mobility sector, the necessity is growing for traffic planners to take tourism into consideration. An established instrument for strategic traffic planning are travel demand models. These models can forecast transport and evaluate the impact of measures on current and future traffic networks. They usually rely on structural and sociodemographic data of the model area and its inhabitants. The travel demand generated by visitors is rarely considered in these types of models resulting in the inability to evaluate the impact of measures that are geared towards tourists, like new public transportation lines to touristic hot spots. To develop, validate and calibrate such models, data on travel behaviour is crucial. Therefore, the need to gather data on travel behaviour of tourists, such as by surveys, is necessary.

Visitor surveys are an established instrument for gathering data on tourists' behaviour. It is common to survey the mode of arrival and departure, but rarely is intra-destination travel behaviour included. Some studies, like Gutiérrez and Miravet (2016), have included items to survey aggregated information, but, to our knowledge, besides our survey, only Bursa et al. (2022) did a comprehensive study that gathered the revealed preference data of tourists in three alpine-touristic regions in Austria. Their survey design shows a lot of similarities to ours, for example they likewise decided to modify the concept of travel diaries to ask respondents about all their activities.

In this paper, we present the methodology and results of a revealed preference visitor survey we conducted in Kassel, Germany. The survey work is part of the research project “transport demand modelling of same-day visitors and tourists in cities”, funded by the German Research Foundation (DFG), project number 409499825. The results of the survey were the basis for developing a modelling framework to integrate traffic generated by visitors into an urban travel demand model. We concentrated our surveying and modelling to common city tourists that either came as day or overnight visitors. Other visitor groups like business travellers can be added later to a modelling framework. Parts of the modelling work we did with the surveyed revealed preference data are described in Harz and Sommer (2022). There we present the methodology and results of choice models we estimated to analyse the mode choice behaviour of the interviewed tourists.

3 STUDY AREA

The city of Kassel with its 200,000 inhabitants is the regional centre of the north of the German federal state of Hesse. Due to its history as the former capital of the state of Hesse-Kassel, the city has a rich offering of parks and palaces, as well as a comprehensive number of museums. The most notable park is the Bergpark Wilhelmshöhe, one of the largest landscape parks in Europe. With its extensive water features, the Bergpark was granted World Heritage status by UNESCO in 2013, resulting in a distinct increase in the number of visitors. Additionally, every five years, Kassel hosts the Documenta, an exhibition of contemporary art that is one of the largest and most important worldwide. It lasts for 100 days and attracted nearly 900,000 visitors from all over the world in 2017. Due to its central location within Germany and its very good rail connections, Kassel is a very popular choice for conferences and business meetings, resulting in a very good hotel infrastructure. According to estimations by dwif (2020), there were 15.9 day visitors, 1.05 million overnight stays in accommodation like hotels or campsites, and 1.32 million overnight stays with friends or family in Kassel. We chose Kassel as the study area for our research because of our good local knowledge and access to local and regional data from the city and tourism authority. Kassel is representative of midsize major cities in Germany for urban tourism.

4 SURVEY WORK

4.1 Overall design

The visitor survey had the objective of generating (1) data about the socio-demographic and socio-economic structure of tourists, (2) information about their journey, and (3) revealed-preference travel and activity data during their time in Kassel. The target group of the survey was visitors to Kassel who were 18 years old or older and were not visiting the city for business purposes or an event. We decided to only interview visitors who were 18 years or older to avoid obtaining consent from parents. Business travelers and visitors of events were excluded because, as described, we wanted to concentrate our modelling framework to common city tourists for the time being and we assumed that these groups of visitors differ substantially in their travel behaviour.

This included all overnight visitors as well as day visitors who arrived from places that were more than 25 km away from downtown Kassel.

The survey was split timewise and methodically into two parts. In the first part, visitors were recruited for the survey and asked about their general personal and journey related information. The purpose of the second part of the survey was to survey all activities by a selected individual during the day he or she was interviewed for the first time, the so-called ‘activity chain’. The surveying of the revealed-preference activity data was conducted for two behaviourally homogeneous groups based on their type of visit (overnight or daytime) and the mode of transport for their journey (by car or public transport). It has been shown that the mode of transport for arrival has a major impact on the modal choice of intra-destination trips (Bieland et al., 2017). We decided to choose the two largest groups of day visitors arriving by car and overnight visitors arriving by car to maximise the number of surveyed trips. Visitors who belonged to one of these two groups were asked to participate in the second part of the survey. As an incentive, we gifted each participant of the second part of the survey a lottery ticket for the German TV lottery.

The survey was conducted in Kassel in two timeframes: one in September and October 2020; and the other in August and September 2021. During both timeframes, the infection numbers of COVID-19 were very low in Germany resulting in relatively normal domestic tourism.

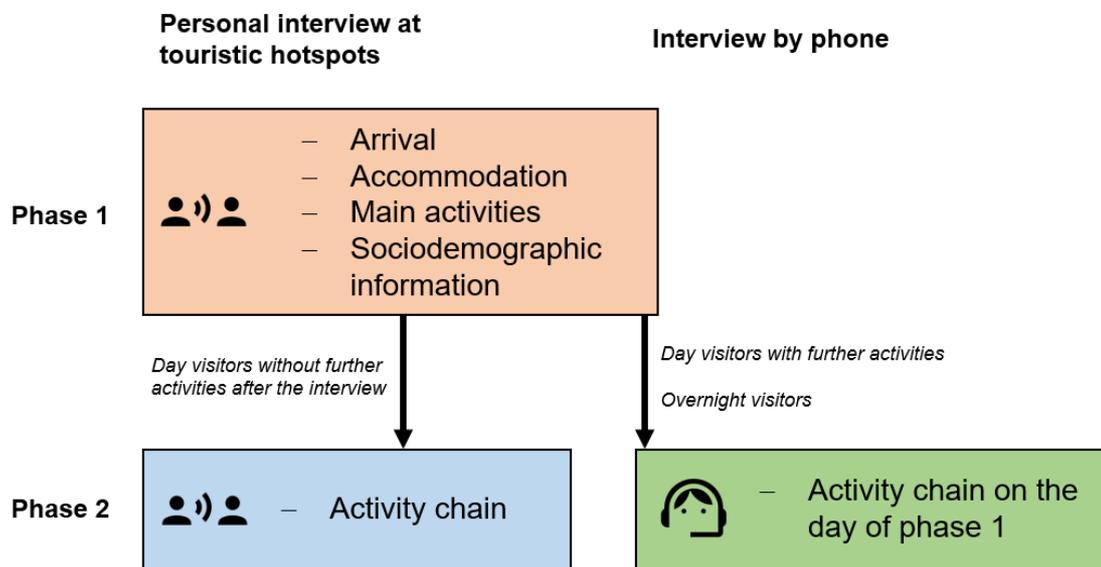


Figure 1: Overview of the different phases of the survey

4.2 Part 1: Visitor survey

The first part of the survey was held on ten weekends (five in 2020 and five in 2021) as a computer-assisted personal interview (CAPI) on tablet computers.

In contrast to conventional travel surveys, the population size is unknown, and the sample cannot, therefore, be drawn from an existing directory. Furthermore, there is no possibility of contacting tourists before they arrive in Kassel. Many surveys use an approach whereby tourists are contacted at hotels and interviewed

either using pen and paper or with the aid of a tablet computer. Unfortunately, this approach only works when interviewing overnight visitors staying at a hotel. Overnight visitors staying at different types of accommodation and day visitors cannot be contacted in this way. Furthermore, this approach is linked with a great amount of effort to get hotels to cooperate and participate in the survey. Even though this type of approach is a complete census, by experience, the return rate of completed surveys is rather low.

We chose another common approach, namely, to contact visitors randomly at places that are attractive to tourists and frequently visited by them. Of course, with this approach, screening is needed to differentiate locals from visitors. Because the probability that a visitor is chosen for an interview is limited by the places chosen, surveys that use this type of contact approach are not strictly seen as random sampling. This means that the data produced is not representative of all visitors to Kassel and a certain bias is expected. The interviewers were trained to choose interviewees randomly. In practice, this meant that, due to the ongoing inflow of visitors, the interviewers approached the next arriving visitor after a successful interview or unsuccessful interview approach. Limiting the population to visitors to the touristic hotspots on the given days and times, we nonetheless regard the sampling as mostly random due to the randomness of the inflow of visitors. Where visitors travelled in a group, one member of the group was chosen or decided to give the interview himself or herself.

The questionnaire consisted of four parts:

- Screening questions to filter out locals, business travellers, and visitors of an event
- Questions about the socio-demographic and socio-economic status of visitors
- Questions about the journey, e.g. mode for arrival and departure, and length of stay
- Citing of touristic sights visited or planned to be visited

Additionally, overnight visitors were asked about the type and location of their accommodation. Because the survey was conducted during the COVID-19 pandemic, we included questions regarding whether the pandemic had any influence on visitors' choice of accommodation and mode of arrival. While there was no clear indication that COVID-19 influenced the choice of accommodation, 8.4 % of visitors who arrived by car stated that they would have taken public transport if COVID-19 had not existed.

2,050 visitors were interviewed in the first part of the survey. They consisted of 760 same-day and 1,290 overnight visitors.

4.3 Part 2: Activity survey

The purpose of the second part of the survey was to record all activities by a selected individual during the day he or she was interviewed for the first time. This was carried out in two ways. Most visitors were contacted again by telephone one or two days after they had completed the first part of the survey and then interviewed again using a computer-assisted telephone interview (CATI). In this way, the interviewees were able to reproduce all the activities of their vacation day.

Like Bursa et al. (2022), we used the concept of travel diaries as a basis to survey the activities of visitors. Travel diaries are the most prevalent approach to gather data on everyday travel behaviour and are used widely by many administrative regions, like cities or countries. Prominent examples are the surveys "Mobility in Germany (MiD)" (Follmer and Gruschwitz, 2019) and the Dutch travel survey OViN (Centraal Bureau voor de Statistiek, 2018).

However, we decided to survey activities instead of trips because we expected that visitors were better able to reproduce them. This meant that only the structure of a trip diary needed to be changed by surveying the trip information by means of the prior and following activity. Arrival and departure were regarded as activities. Because we assumed that visitors are often unable to tell us the exact address of activities, we asked them to state a point of interest instead. For example, the location of a restaurant could be stated as "Italian restaurant near the city hall". For each activity, we asked for the following information:

- Type of activity (trip purpose)
- Location of the activity (trip destination)
- Mode of transport to reach the activity

- Start and end time

Some activities were not suitable to be surveyed in that way. This affected, on the one hand, activities that solely comprise moving in itself, like taking a walk. Mokhtarian and Salomon (2001) summarise this kind of trip and many others, including horse-back riding, cycling, etc., under the term ‘undirected travel’. In addition, we noticed that it is difficult to survey multiple activities conducted in a confined space, like shopping in a shopping street. In a strict sense, every shop visited would count as a new activity. We decided to condense multiples of the same kind of activity during the survey into one. These kinds of activities as well as undirected travel are summarised as so-called ‘spatial activities’ for our survey. Spatial activities differ from point activities by the fact that they have a start and end point that can either be different or the same. An example of a daily activity chain is depicted in figure 2.

As a certain non-response is expected, we decided to increase the response rate by preponing part two and conducting it right after part one of the survey for day visitors who responded that they would not participate in any more activities after the current one. In this case, the interview was carried out like the first part of the survey as a CAPI.

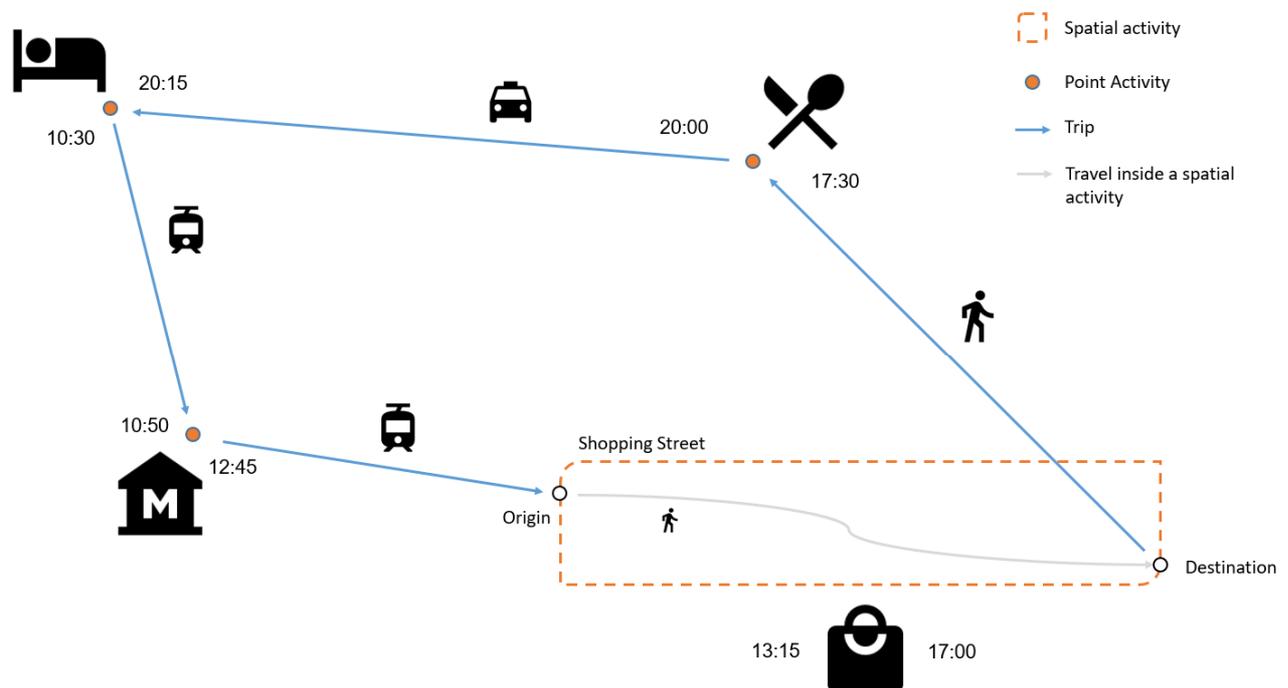


Figure 2: Example of a complex daily trip chain of a visitor with point and spatial activities

4.4 Data preparation and enhancement

The survey results needed comprehensive data preparation for further analysis. The filter logics created inside the survey software enabled inputting non-plausible information to be avoided in many cases during the interview. Nevertheless, some datasets had to be corrected manually, mostly because some interviewees stated that they were staying for more than one day and later stated that their hotel was clearly outside the Kassel region. These visitors were manually converted to day guests.

The most time-consuming part was the geolocation of all location information. As described, we asked visitors for points of interest instead of exact addresses. To geolocate this information, we manually allocated spatial coordinates and information about the accuracy to each dataset. The accuracy information was necessary because we were not able to reproduce all of the coordinates on an address level. For more vague location information, like a street or neighbourhood, we allocated coordinates, but lowered the level for the accuracy variable.

For further analysis, the surveyed activity data were transformed into trips and trip chains. Due to the popularity of the Bergpark, a great number of walking trips was made within the park or within the immediate vicinity. We assume that a large share of these trips is part of the visit and, therefore, the trip itself is the activity. This can be compared to for example zoological gardens or outdoor museum where trips

inside the vicinity are not regarded as part of the travel behaviour but rather part of the visit and the activity itself. The Bergpark can be entered from all directions free of charge what makes distinguishing trips to the park from trips inside the park more difficult compared to definite attractions with fixed entry points.

As the park is only accessible on foot, there is no mode choice process for the trips described. We, therefore, decided to exclude these trips from parts of our analysis.

5 RESULTS

In the following, we present the results from the visitor and activity survey. Social demographics, economics, and journey-related analysis (5.1 and 5.2) relate to adult visitors (18 years or older). The analysis of travel behaviour, activity, and trip chains (5.3 and 5.4) involve adult visitors who arrived in Kassel by car and, therefore, have a car available for their intra-destination travel.

5.1 Social demographics and economics

Visitors interviewed were in 59.5 % of cases female with no noteworthy difference between day and overnight visitors. We cannot rule out that this might have to do with the fact that in travel groups female visitors are more likely to speak with our mostly female interviewers. The median age of (adult) visitors is 46.2 years with no distinct difference between day and overnight visitors.

The large majority of visitors with no noteworthy difference between day and overnight visitors were employees (72 %), pensioners (13.8 %), or students (8 %). Because we did our interviews on weekends, it could be expected that employees form the highest share of visitors. On weekdays, their share would have been lower (BMW, 2014). The level of education showed no large differences: 52.6 % of visitors had the highest level of German school education (Abitur) and 26.3 % the certificate of secondary education (Mittlere Reife).

Due to the ongoing Covid-19 pandemic, 96.6 % of visitors came from Germany. In 2021, the share of foreign visitors was 1.5 percentage points higher than in 2020. The largest group of foreigners in both years was the Dutch (1.6 % of all visitors). Regarding the origin of visitors from Germany, it is noteworthy that day visitors come from places nearer to Kassel than overnight visitors. For example, 28.5 % of day visitors come from Hesse, the state where Kassel is located, whereas only 14.8 % of overnight visitors do.

Households of day visitors tend to be slightly larger on average with 43.2 % of households having three persons more in comparison to 35.8 % of overnight visitors. 10.3 % of visitors had no cars in their household and 49.5 % had two or more. There was no significant difference in car ownership between day and overnight visitors. Comparing the net household income, one can observe small differences between the income groups with slightly more day visitors in the lower income groups (39.7 %), meaning less than 3,000 Euro per month, compared to overnight visitors (35.8 %).

5.2 Journey-related information

Visitors divided into 37.1 % who visited Kassel for only one day and 62.9 % who stayed overnight. For 62.4 % of visitors, the main reason for visiting Kassel was a city trip or cultural journey. Interestingly, there are distinct differences between day guests (75.5 %) and overnight guests (54.7 %). The second most stated reason was to visit friends or family with 26.4 % of all visitors. Again, this differs between day guests who only visited someone in 15.4 % of cases whereas overnight visitors stated that this was the reason for their journey in 32.8 % of cases. Other reasons, like shopping or a spa treatment, represented only less than 5 % of cases each. In 48.8 % of cases, visitors travelled in a group of two. While 71.6 % of overnight guests travelled alone or in a group, the group sizes of day guests were on average bigger with only 57.4 % of people travelling alone or in a group of two. Travel groups of day guests also consisted more often of children (22.8 % of cases) in comparison to overnight visitors (11.2 %).

The predominant mode for arriving in Kassel was the car (see fig. 3). Overnight visitors more often chose the train for their arrival (20.4 %) compared to day visitors (14 %). Furthermore, in total, 4.5 % of overnight visitors arrived by motorhome. Other modes of transport, e.g. bicycle or long-distance bus, only accounted for 1.5 % of all journeys.

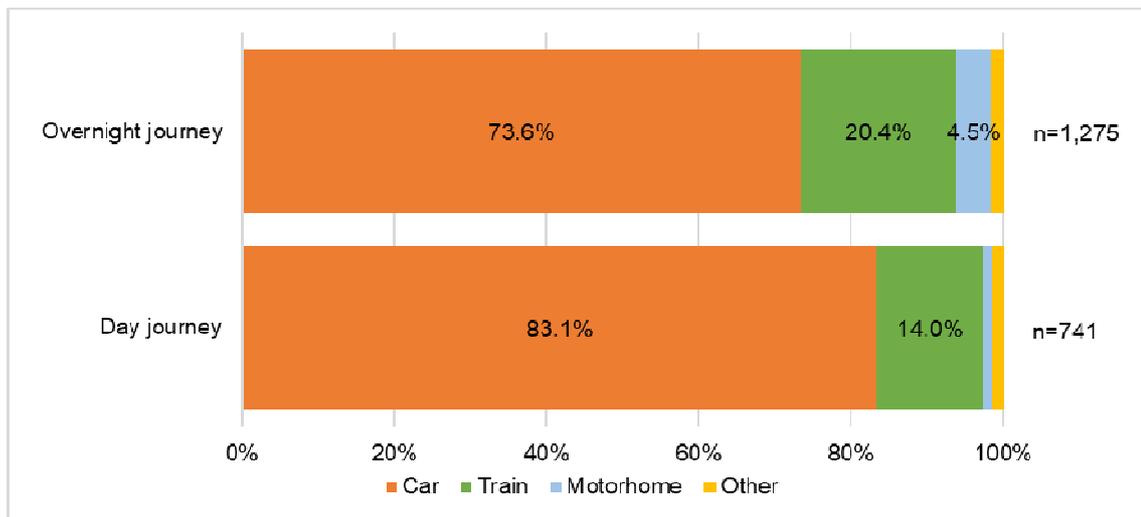


Figure 3: Modal split of trips for arriving and departing Kassel

Interestingly, 24.1 % of day visitors stated their day trip was not from their home, but from another holiday location. These are, for example, visitors who take a holiday of several days at a nearby location, like Lake Edersee, and do day trips into the surrounding area, for example Kassel. Overnight visitors predominantly stayed in hotels or guesthouses (56.7 %) and with friends or family (24.1 %). Other types of accommodation were holiday homes (6.2 %), camping sites (6.3 %), and a clinic (4.4 %). While AirBNB plays a big role in the accommodation market of many major cities, only 2.3 % of visitors to Kassel rented a room or an apartment with AirBNB. The durations of stay are rather short. 23.7 % of visitors stay for only one night and 46.5 % for two nights. This indicated that most visits are typically short holidays over the weekend.

5.3 Travel behaviour

Travel behaviour varied heavily between day and overnight visitors who arrived at Kassel by car. Some visitors only made undirected travel during their stay. We excluded these people and got a dataset of 129 trips from 82 day visitors and 476 trips from 151 overnight visitors. When only counting visitors who made on-site trips (excluding undirected travel), day visitors made on average 1.6 trips, whereas overnight visitors made 3.2 trips per person per day. The modal split shows distinct differences between day and overnight visitors too (see fig. 4). Day visitors had a much higher share of car usage (75.2 %), whereas far fewer trips were made by walking (15.5 %) compared to overnight visitors (33.6 %).

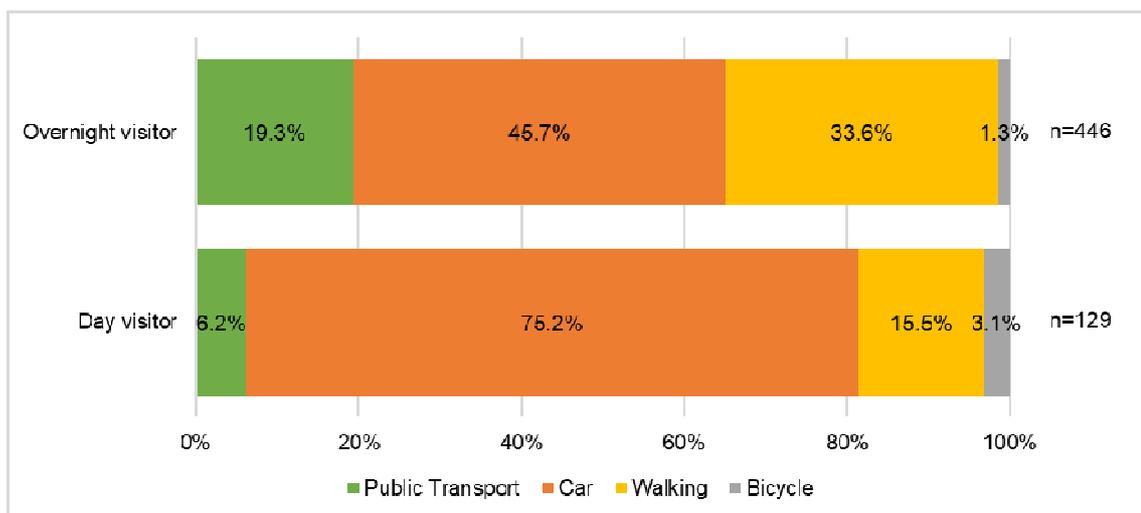


Figure 4: Modal split of intra-destination trips

5.4 Trip and activity chains

Activity chains and trip chains often describe similar circumstances, but from a different point of view. Esztergár-Kiss et al. (2017) define activity chains as chains that “contain all regular [...] and non-regular [...] activities of a traveller”, mostly between leaving and returning home. Trip chains extend the concept by

regarding the trips in between the activities and the chosen modes of transport. Because we are only interested in tourists' activities and trips at the destination, we also define that activity as trip chains starting and ending at the place of accommodation or upon arrival or departure. This leads to the special case where day tourists who only undertake one activity do not perform any intra-destination travel and, therefore, no trip chain is attributed to these activity chains. In our case, 59.4 % of all activity chains by day visitors consisted of only one activity, in most cases the Bergpark. As described, the Bergpark is the main tourist attraction in Kassel that presents visitors with a variety of different activities inside the park area leading to longer durations of visits. Because of the special nature of the Bergpark, we decided to consider it in activity chains as a separate type of activity. Single-trip chains are another anomaly that can occur when either day visitors only undertake two activities or overnight visitors undertake one activity on the day of arrival or departure.

We distinguished between the following activities:

- B: Visiting the Bergpark
- T: Other touristic activity
- V: Visiting friends or family
- R: Restaurant or other gastronomical facility
- S: Shopping or private errands
- A: Arrival
- D: Departure
- H: Stay at hotel or other type of accommodation

In Table 1, we summarise the five most common activity chains for day and overnight visitors. In the case of multiple visits to attractions inside the Bergpark in a row, we combined these into one activity. It can clearly be recognised that the activity chains of overnight visitors are far more diverse than those of day trippers. We observed 49 different chains performed by day trippers in comparison to 93 different chains by overnight visitors. For both, visiting the Bergpark as the only activity of the day is the most common activity chain, but, while this accounts for 15.5 % of overnight visitors, 52.8 % of day visitors arrive in Kassel, visit the Bergpark, and leave again without any other activity. This means that these visitors did not generate any intra-destination trip chain in Kassel. Their travel behaviour consisted only of arrival and departure.

Day visitors		Overnight visitors	
Activity Chain	Frequency	Activity Chain	Frequency
ABD	121 (52.8 %)	HBH	26 (15.5 %)
ATD	15 (6.6 %)	HBRH	11 (6.5 %)
ASBD	8 (3.5 %)	HBSH	8 (4.8 %)
ABRD	7 (3.1 %)	HBD	6 (3.6 %)
ABTD	7 (3.1 %)	HTH	6 (3.6 %)
Total:	229	Total:	168

Table 1: Frequency of the five most common activity chains for day and overnight visitors.

When analysing trip chains, i.e. the whole sequence of trips between the place of accommodation and arrival or departure respectively, 312 chains with 101 day visitors and 212 overnight visitors were surveyed. To analyse the trip chains, we did not exclude trips that consisted of undirected travel. The complexity, i.e. the number of trips the chain comprises, varied distinctly between day and overnight visitors (see fig. 5). The average number of trips in a trip chain amounted to only 1.6 for day visitors whereas overnight visitors undertook on average 3.0 trips per trip chain. It is noteworthy that 62.2 % of all day visitor trip chains consisted of only one intra-destination trip.

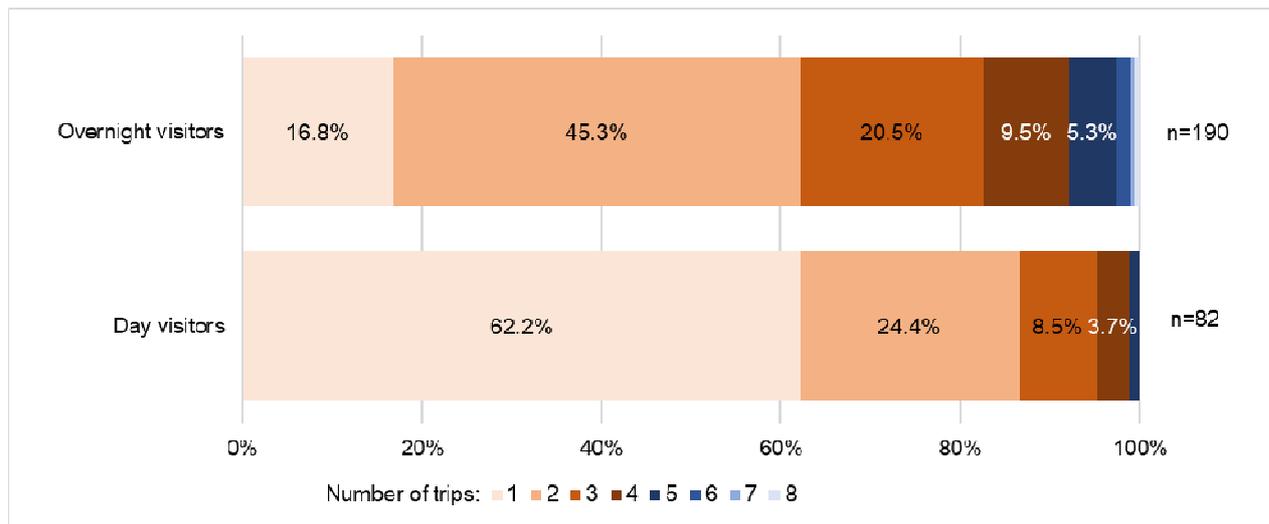


Figure 5: Complexity of day and overnight visitors' trip chains

Trip chains can be unimodal if all trips in the chain are made using the same mode of transport or they can be multimodal if more than one mode of transport is used (Schneider et al., 2021). In our case, 85 % of day and 78.3 % of overnight visitors' trip chains were unimodal (see fig. 6). Day visitors chose solely to drive by car for 76.3 % of their trip chains; public transport or walking played a minor role. In contrast, only 38.2 % of overnight visitors' trip chains were made solely by driving a car. 29.6 % of trip chains were made by walking only with an additional 9.9 % of multimodal trip chains combining walking and car driving. Furthermore, 22.3 % of trip chains involved using public transport. All in all, day visitors tended to prefer using the car for their intra-destination trip chains whereas overnight visitors were more open to choosing other modes of transport even though both groups arrived at Kassel by car.

Figure 6: Distribution of unimodal and multimodal trip chains of day and overnight visitors

6 DISCUSSION AND CONCLUSION

In this article, we have illustrated a survey method for gathering the travel behaviour data of tourists for their arrival and departure travel as well as their intra-destination travel. The two-part design proved useful to recruit short-term travellers including day visitors. The results show distinct differences in travel behaviour between day and overnight visitors. Both day and overnight visitors with car availability prefer to arrive in Kassel by car, but overnight visitors are a bit more likely to arrive by public transport or by motorhome. The activity and trip chains of day visitors are in the majority much simpler compared to overnight visitors. Many day visitors visit just one attraction, mainly the Bergpark, and leave again, resulting in no intra-destination traffic. It seems that day visitors are much more unlikely to change from the mode of transportation they arrived with for their trips at the destination. In contrast, overnight visitors have a much higher willingness to leave their car at their accommodation and travel by public transport and on foot. All visitors tend to prefer not changing their mode of transport during a trip chain.

The method of the survey and, therefore, also the results of course have certain limitations. The method of recruiting people at places of touristic relevance meant that tourists who did not visit these attractions did not have any opportunity to be included in the survey. Of course, it would have been possible to have extended the number of places to interview people, but this would have increased the cost, especially as the ratio of visitors to residents would have worsened. Alternative approaches, like recruiting visitors at hotels, on the other hand, would have neglected day visitors.

To survey travel behaviour using activity diaries proved to be a useful instrument, but it is linked with certain limitations. We experienced that it proved difficult for interviewees to remember exact time and location information. The start and end time of activities were so often implausible that we decided not to include relevant analysis for travel time and activity durations in this paper. It proved helpful for interviewees to state points of interest for location information, but it drastically increased the effort to process the data and still meant that records did not have exact location information. This proved to be especially challenging

when we estimated mode choice models based on travel times using these data. Separating activities into point and spatial activities was, in theory, a good method to identify undirected travel and sequences of the same activity but proved to be challenging to record both for interviewees as well as interviewers.

To improve data quality, a mixed approach combining location data generated by mobile phones with a phone-based survey that lets users correct data, like mode of transport and type of activity, as well as answer questions about sociodemographic and mobility related information might be promising. Mobile applications, like “TravelVu”, that was tested by Hubrich et al. (2020) in the city of Dresden, Germany already offer these capabilities. Of course, in comparison with our survey, recruiting participants is more complicated and costly, resulting in a lower sample size. On the other hand, the issues with activity diaries described would be less of a problem with an app-based solution. Exact location and time information, in particular, as well as the possibility to better identify undirected travel would be a big advantage of such a surveying method.

We conclude that further research regarding the travel behaviour of tourists is clearly needed. With the study by Bursa et al. (2022) on alpine tourists and ours on city tourists, including day visitors, there are two initial studies that have gathered revealed-preference travel data. As we concentrated on tourists who arrived by car, in-depth research regarding visitors who chose public transport would be welcome.

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