Factors that are Perceived as Supporting or Hindering Active School Travel (AST): Go-Along Interviews with Primary School Children and their Parents

Juliane Schicketanz[a,b]*, Sigrun Kabisch[a], Péter Bagoly-Simó[b], Tobia Lakes[b,c]

[a] *Department of Urban and Environmental Sociology, Helmholtz Centre for Environmental Research (UFZ), Leipzig, Germany*

[b] *Department of Geography, Humboldt University of Berlin, Berlin, Germany*

[c] *IRI THESys, Humboldt-University of Berlin, Berlin, Germany*

* Correspondence: juliane@schicketanz.com

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Children's school journeys can provide a daily source of physical activity, social interaction, and independence. Many studies focus on quantitative analyses of factors influencing active school travel (AST) from an adult-centric perspective. This study analyses children's and adults' perspectives on school travel behaviour and route perceptions using qualitative walking interviews. We conducted 14 go-along interviews with primary school children and their parents along different routes to school in Leipzig, Germany. We transcribed the interviews, analysed the factors perceived to support or hinder AST and mapped the route perceptions. The results of our study provide detailed insights into individual, family and route environment related factors of AST. Perceived traffic safety along the routes was most relevant for all parents we interviewed. The other factors differed according to the mode of transport and accompaniment. Children who regularly walk to school report on numerous positively perceived places e.g. associated with social interaction, play, and hiding activities. Our findings suggest that enabling children to gain positive experiences along their routes might be a chance to increase active and independent school travel.

Keywords: active school travel, school journey, walking interview, qualitative GIS, health geography

1 Introduction

Active travel among children is decreasing (Rothman et al. 2018; Schmidt et al. 2017; Grize et al. 2010), even though several studies from developed countries have shown the benefits of active travel such as walking and cycling, i.e. higher general physical activity rates, better cardiorespiratory fitness, better mental health, and higher autonomy (Stark, Singleton, and Uhlmann 2019; Voss 2018; Ramanathan et al. 2014; Cooper et al. 2005). Since the journey to primary school is an everyday routine travel behaviour among children, which contributes to their daily physical activity, it is an attractive construct to analyse in research (Voss 2018).

Several studies from North America, Europe, Australia, and New Zealand have statistically shown that individual, family, environmental and school factors influence AST (Rodrigues, Padez,

and Machado-Rodrigues 2018; Davison, Werder, and Lawson 2008). This range of factors affecting health behaviour is described by the socio-ecological model (Sallis, Owen, and Fisher 2008). In order to analyse travel mode decisions and to increase children's AST the entire range of influencing factors needs to be considered.

Most studies on children's AST conduct standardised surveys, assess environmental measures and analyse the data quantitatively (Ikeda, Hinckson, et al. 2018; Wilson, Clark, and Gilliland 2018). Easily measurable and statistically significant factors are presented frequently: gender, distance to school, car ownership, safety, neighbourhood walkability and socio-demographic and -economic structure (Ikeda, Hinckson, et al. 2018). However, not every family characteristic such as the number of siblings has the same impact on each child (Schicketanz et al. 2022) and not everyone perceives the mere presence of green space positively (Dadvand, Gascon, and Markevych 2019). To understand the individual decision-making process of AST, it is crucial to consider the interrelation of factors as well as the environmental perception, which is also shown by the integrated model of environmental needs for children's active travel by Smith et al. 2020.

A body of international studies analyse AST from the perspective of adults (Ikeda, Hinckson, et al. 2018). Whereas parents and their perceptions as decision makers regarding children's travel are studied frequently (Lee et al. 2013; Tappe et al. 2013; Nevelsteen et al. 2012; Panter et al. 2010), children's perspectives on their route to school are less well researched (Egli et al. 2019; Wilson et al. 2019). Studies show that adults' and children's perceptions of their environment differ and that children often refer to places unnoticed by parents (Veitch et al. 2020; Alarasi, Martinez, and Amer 2015; Spilsbury, Korbin, and Coulton 2009; Rasmussen 2004). Thus, there is a research gap on the individual interplay of factors, that actually support or hinder active and independent school travel. It is crucial to apply child-centric and place-based methodologies

to investigate the environmental perceptions of children and their parents linked to their routes to school.

To close this gap, we conducted go-along interviews with children and their parents along their routes to their primary school according to their usual mode of transport. Since most of the interviews were conducted on foot, they are hereinafter referred as go-along interviews, even though three took place while driving. Through our go-along interviews we aim to gain detailed insights into which factors are individually important for the choice of travel mode and how those factors dominate and interrelate in the decision-making process (Kusenbach 2003; Mavoa et al. 2012). Linking children's and parental perceptions with their actual routes is particularly beneficial of go-along interviews and is often overlooked. Hence, in this study, we propose the combination of qualitative and quantitative measures involving a qualitative Geographic Information System (GIS) approach to answer the following research questions in this study:

- RQ1: Which factors are perceived to support and hinder AST?
- RQ2: How do children and their parents perceive the school travel routes?

Our manuscript is structured as follows: In the next section, we focus on previous research from different disciplines and review the existing knowledge about factors influencing children's AST as well as about the methods that have been used to study these factors in earlier work. We then present our empirical analysis in the following section: first, we introduce our go-along interviews with child-parent pairs along their routes to school. Further, we present factors of AST varying for different commuters. Finally, we present a spatially explicit visualisations of discussing children's and their parents diverging perspectives on their routes to school.

2 Theoretical background and previous research

The World Health Organisation (WHO 2013) calls for the design of "health-promoting environments" to strengthen children's health. This can address physical activity during free play, sports and active travel, i.e. walking, cycling or riding a scooter. This paper focusses on active school travel (AST) as a source of daily physical activity for all children attending a school. In the last 15 years, not only epidemiological studies, but also increasingly health geography and social science studies investigate AST. School travel takes place every day, can be assessed through standardised survey and analysed statistically. This has made AST a popular subject for quantitative research (Ikeda, Hinckson, et al. 2018; Wilson, Clark, and Gilliland 2018). However, it remains more of a statistical variable than a concept and does not consider all other facts of everyday mobilities, such as stationary activities, trips to leisure activities, visits or holidays (Christensen et al. 2011).

Well-researched correlating factors of AST are presented in several publications: The key factor of AST is the distance to school: the larger the distance, the less likely it is that a child will travel actively to school (Rodrigues, Padez, and Machado-Rodrigues 2018; Helbich et al. 2016; Larsen et al. 2009). On the individual and family level, the likelihood of AST increases with age and is higher among male children (Fyhri and Hjorthol 2009; Larsen et al. 2009). Families of children without siblings, not owning a car, and having actively travelling parents increases the likelihood of AST (Ikeda, Hinckson, et al. 2018; Wilson, Clark, and Gilliland 2018). In recent years, a growing number of studies has also accounted for environmental factors along routes to school: The likelihood of AST increases when streets are green and well connected, when the traffic volume is low and there are walking-friendly weather conditions (Sener, Lee, and Sidharthan 2018; Mah et al. 2017). Furthermore, actively commuting neighbours, densely populated and low-income

neighbourhoods are positively associated with active travel (Ikeda, Stewart, et al. 2018; Hsu and Saphores 2013). In general, route environment seems to have a stronger impact on travel mode than residential environment (Broberg and Sarjala 2015). The influence of school programs and recommendations regarding children's travel mode seems to be limited but effective when focusing on safety (Ikeda et al. 2020).

Few empirical studies on AST use qualitative approaches to address children's perceptions (Egli et al. 2019; Wilson et al. 2019; Walker et al. 2009). Methods vary between smartphone-based questionnaires combined with follow-up interviews (Walker et al. 2009), content analyses of open questions from surveys about liked and disliked aspects along school routes (Egli et al. 2019), and focus groups with participatory mapping (Wilson et al. 2019). These studies reveal the importance of individual perceptions of environmental conditions and safety, as well as highlighting active travel as an activity in its own right. A growing body of studies map environmental perceptions of children, such as the participatory mapping of physical activity spaces (Wridt 2010), the child-friendliness of the neighbourhood (Carroll et al. 2015), mapping children's neighbourhood perception and boundaries (Spilsbury, Korbin, and Coulton 2009), photo-story maps to assess children's sense of place (Martz, Powell, and Wee 2020) or GPS-tracking of neighbourhood perceptions (Loebach and Gilliland 2010). In summary, there is still a need of research on AST applying qualitative spatial methods to provide a deeper understanding of perceived factors influencing school travel mode and how they contribute to individual decisions (Wilkie et al. 2016).

It is mainly the parents who decide and support their child's travel mode to school (Mah et al. 2017). Beside their traffic safety concerns, time scarcity or limited neighbourhood networks (Egli et al. 2018; Witten et al. 2013), their decisions are strongly dependent on their perception of their child. Being confident in children's abilities and observing good mood during the journey,

raises the probability of active independent school travel (Riazi et al. 2022; van den Berg et al. 2020). The other way around, independent and active school travel itself promotes higher levels of self-confidence (Riazi et al. 2022; Rutberg and Lindqvist 2019). Overall, children worry less regarding their environment than parents (Timperio et al. 2004) and they understand their environment as an invitation to play, climb and run (Egli et al. 2020). By actively learning how to travel to school, children develop a sense of place (Malone 2013). This might not only be part of the curriculum at primary school, but also a promising starting point strengthening children's spatial orientation and supporting AST.

To improve children's route environment by reaching out to decision makers (urban planners, schools, education authorities), it is important to link environmental perceptions along children's routes to certain points on the map. Collecting individual descriptions of similar places provides a broader picture of what determines children's mobility and what children are concerned about in their environment. Moreover, empirical studies on AST can contribute to the body of knowledge on concepts of how children perceive their environment and how this influences their behaviour in space: The sense of place concept describes a relationship between the feeling of belonging to a place and attributing individual meanings to places (Stedman 2008). In addition, the integrated model of environmental needs shows how the interrelated environmental factors effect AST (Smith et al. 2020). A circle of influence consisting of family and socio-spatial effects that influence the parental decision is outlined by Egli et al. (2018).

In light of this gap of knowledge, we aim to investigate which factors are perceived to support and hinder AST (RQ1) and how children and their parents see the school travel routes (RQ2). To do so, we analyse, visualise and discuss our go-along interviews with child-parent pairs along their routes to school.

3 Methods

The study was carried out with primary school children (age of 8-10 years) from February to July 2020 in Leipzig, Germany. Given that active travel increases with age (Fyhri and Hjorthol 2009), we selected an age group that is in the process of becoming independently mobile and therefore shows a high degree of variation in terms of accompanied and unaccompanied travel modes. By focusing on public schools, we exclude long routes to distant private schools and cover only routes that could be completed on foot or by bicycle.

Our previous study in Leipzig showed a positive association between AST and higher population density, shorter routes to school (closer to the city centre), and the traffic along routes (Schicketanz et al. 2022). Therefore, to cover heterogeneous route environments, sociodemographic and socioeconomic characteristics and travel modes, schools in three different neighbourhoods in Leipzig were chosen: one urban and densely populated neighbourhood (9432 inh./km²) with mainly Wilhelminian-style row houses, with a higher level of education (57% with university degree); one suburban, less densely populated neighbourhood (890 inh./km²) with mainly single-family housing and an average level of education (37% with university degree), and one suburban, densely populated (7919 inh./km²) large housing estate with lower educational level (17% with university degree) (Amt für Statistik und Wahlen 2020). Study participants were searched by distributing invitations in the third grade at one primary school per neighbourhood. The federal school authorities were informed but not further involved, as the interviews took place outside the school grounds. The interviews before the first wave of the pandemic were still conducted without any infection control measures, while the interviews after were conducted exclusively outdoors and at a distance to ensure the safety of the participants. Since no one from the latter neighbourhood responded, additional participants from different primary schools of the

same neighbourhood had to be recruited through door-to-door visits after the first pandemic-related school closures.

We conducted 14 go-along interviews while accompanying children along their routes to or from school, together with their parents (nine mothers, four fathers, one with both). The legally proven informed consent including data protection declaration was obtained in written form of at least one parent of each child (the information on the collection of personal data including purpose and legal basis (Art. 6, Para. 1 DSGVO) of the data processing, recipients of the data, duration of storage, information on data subject rights, right to revoke consent, right of appeal and the data protection declaration of consent). In addition, the children's willingness was requested verbally. Individual socio-demographic and -economic variables were only surveyed in relation to the travel mode during the interviews and but not in a standardised way. Go-along interviews mean that 'research subject and researcher are in motion in the field' (Hein, Evans, and Jones 2008, p. 1267). They are a specific kind of walking interviews, when the interviewee knows the route well and guides the interviewer (Kusenbach 2003). They make it possible to record various individual experiences of place and are particularly suitable for our interdisciplinary research, which links geographical, health and social science research, as go-along interviews combine physical activity analysis and environmental perception mapping (King and Woodroffe 2017; Kusenbach 2003). The strength of this method is that walking facilitates or promotes relaxed conversation and reduces the power imbalance between researcher and research subject (Kinney 2017).

Parent and child were interviewed while walking or driving depending on the usual travel mode to or from school. A semi-structured interview guideline was used to investigate the decision-making process regarding travel mode and the route itself (Tab. 1). The guideline contained child specific questions in order to receive individual answers, knowing that with parent's presence

child's answers tend to be more similar to those of the parents (Havermans, Vanassche, and Matthijs 2015; Müller 2019). By asking openly how the decision-making process for the school travel went, the parents were able to report freely about the influences. There are factors that fundamentally concern all parents, but which have little or no explicit influence on the way to school such as time constraints and traffic safety concerns. Children in particular feel more motivated to tell their story when asked open questions (Brubacher et al. 2019), which were also triggered by environmental elements along the routes.

Tab. 1 Interview guideline

	Parent/Child	***Question***
RQ 1	child	*How do you usually travel to school and are there any exceptions? When and why?* *If you could decide on your own, how would you travel to school?*
	parent	*When did you first think about how your child should travel to school and how did you decide?*
RQ 2	parent and child	*What do (don't) you like along your route to school?* *What do you wish for your future school journeys?*
	child	*What do you do while you're travelling to and from school?* *Do you have any funny/bad stories about your school journeys?*
	parent	*Is the route to school generally suitable for walking? Do you recommend any detours? Why?* *What is the effect of your own daily travel and the behaviour of family members and your child's friends?*

The walk or drive was tracked using GPS. The children were equipped with a smartphone and asked to take photographs of places that were important to them. This photovoice technique was primarily chosen to stimulate discussion and critical dialogue about certain places along the routes (Dennis et al. 2009; Wang and Burris 1997). The photographs also serve to illustrate the

results and children's eye level. For each route to school we have a data set comprising a recorded interview with GPS tracks and geocoded photographs, similar to the mixed data plots about neighbourhood walks produced by Kreher et al. (2019).

Interviews were anonymised, transcribed and then coded and analysed according to the research questions following the summarizing qualitative content analysis approach of Mayring (2010). For the first research question, we inductively coded and categorised all travel mode related interview segments. The categories were further summarised and grouped according to the levels known from the social-ecological model: individual, family, environmental and school-related. The categories provide a detailed and at the same time comparable picture of AST supporting and hindering factors. We did not aim for category saturation, due to our relatively small sample size and because we missed certain travel modes (door-to-door car driver and cyclists). Interestingly, the distribution of the perceived factors of AST (RQ1) varied not only for the mode of transport but also for the type of accompaniment. Therefore, the interviews were sorted: children regularly walking alone, children walking together with other children, children walking accompanied by parents, and children brought by car or using public transport accompanied by parents.

Participants were constantly asked to describe their route during the interview to answer RQ2 (Tab. 1). All descriptions of places were coded and sorted into 'children's perceptions' and 'parents' perceptions' and evaluated whether the places were described positively or negatively. All non-judgemental descriptions were coded as neutral. The content analysis was conducted with the original German transcripts and only for this paper, the codes and selected quotes were translated into English and proofread by a professional translator.

A qualitative GIS approach was used to map the interview data and photographs. We imported the GPS tracks and the photographs in QGIS (version 3.10.2), then linked them to the

interview codes and selected quotes using time stamps (Fig. 1). Our data interpretation mainly focuses on interview quotes, codes, and actual routes to school. Photographs and further data on environmental features such as road networks and buildings were added for visualisation purposes. Our qualitative GIS approach made it possible to localise and compare the spatial perceptions of children and parents.

Fig. 1 Workflow

Our study was undertaken according to the rules of the data protection representative of the Helmholtz Centre for Environmental Research who is independently reviewing the ethics proposals of research undertaken at the Helmholtz Centre for Environmental Research. The project design was presented in an early phase of the project and the process of data acquisition, storage, analysis and visualisation was pursued in line with the data protection representative's requirements. This addresses particularly the informed consent form of the participants before data assessment and the data management. In terms of data management, we secured the storage of the data on access-restricted and secure drives at the Helmholtz Centre, the anonymization of the data following the assessment (interviews, GPS tracks, photos) and deleting the contact data as well as photographs of faces immediately after the interview was conducted.

To avoid the possibility of identifying the place of residence the GPS tracks were each shortened by at least 100 m before the place of residence in order not to allow any conclusions to be drawn about the actual place of residence. Moreover, if secret routes were taken, they were only displayed if they were visible to all in public space. Finally, only data that is available to the public anyway, was displayed in the maps, e.g. the location of the schools. All these measures were approved by the data protection representative.

The go-along interviews showed varying modes of transport and group compositions. Seven children reported daily walking, four children walked during the interview but are also regularly brought by car (e.g. in the morning or by the other parent), two are brought by car partly and walk one part of the route and one child uses public transport. One large and four small walking groups were interviewed. Eight children reported that they usually walk without their parents. Nevertheless, parents were asked to be present in all interviews in order to gain their input. In this study, the go-along interviews lasted 26 minutes on average. The mean route length to school was 1200 metres (range: 200-2300 metres).

4 Results

4.1 Factors perceived as supporting or hindering AST

Our primary aim was to better understand the factors that are perceived to support or hinder AST. For the individual travel mode choice, we found that the factors from the individual to the school level vary in terms of frequency and importance for the four identified groups (Fig. 2).

Fig. 2 Frequency with which factors perceived as supporting or hindering AST were mentioned in the interviews

Interestingly, traffic safety concerns were the most commonly mentioned factor regardless the chosen travel mode. All interviewees observed certain traffic situations as generally unsafe but describe different impacts on travel mode choice and behaviour. For example, larger intersections without any kind of pedestrian crossing were described as an unpassable barrier (3P car) and as a reason to take a detour and to accompany the child (9P walk accompanied) or as a manageable obstacle (5C walking group). Others criticised traffic lights, e.g. when turning cars were allowed

to cross children's routes or when pedestrian green phase was too short (7P walking unaccompanied). Even though it was mostly busy streets and big crossings that were mentioned, some interviewees described small crossings as problematic, where parked cars limit visibility.

> There are so many crossings, where cars park (…) and therefore children, with their body size, are not able to get an overview of the traffic situation (11P walking group)

The condition of the footpaths or streets was also a frequent theme among the interviewees, who described issues such as cobbled streets that are unsuitable for cycling or narrow footpaths that make it impossible to walk side by side (4P walking unaccompanied, 5C walking group).

In all three interviews with *children regularly walking alone*, it is noticeable that parents still mentioned safety concerns. One parent described confusing traffic light intersections (7P walking unaccompanied). Another parent of a child who usually walks alone considered the early morning darkness as a reason for bringing their child by car.

> If he doesn't go to the early morning school care, then there are more children on the way and it's usually a bit brighter, so that's different, but otherwise at half past six I take him by car (4P walking unaccompanied)

Nonetheless, in our interviews the route to school was perceived as overall manageable and the safety concerns have only little influence on the decision to let a child walk to school independently. Although the children in our first group mainly walk alone, they have the opportunity to meet other children by chance along the route. That was highlighted as a major factor supporting AST.

> There are many children who walk from this neighbourhood to school. That is very pleasant, being able to send him to school alone (4P walking unaccompanied)

Walking groups mostly consist of children who live close to one another or children who live along the same school route. In three cases, parents arranged for the children to walk together in the mornings (1 walking group; 5 walking group, 11 walking group). Two groups were formed regularly but spontaneously on the way back from school (8 walking group, 12 walking group). In interviews with walking groups, children's individual wishes were more often described as relevant for independent active travel than in interviews with children walking alone.

> We asked them whether they want to try out walking without parents, and then we just observed from afar, if they arrived at school (11P walking group)

The groups of children walking together most frequently mentioned shared positive experiences, such as places where breaks were made and shortcuts were taken. Places were mainly described by the children using the term 'we', which shows that places are bound with group experiences.

> Our friend lives around here and sometimes we ring a random doorbell and run away (8C walking group)

> Here is the secret path (…) some girls always took this route, and then we followed them and discovered that we can go this way, too (11C walking group)

It is worth noting that there were several discrepancies on route choice between parents and children walking unaccompanied and that the parents expressed tolerance in this regard (4 walking unaccompanied, 8 walking group). In contrast, accompanying parents highlighted the importance of always walking the same route so that children can be tracked (10 walking accompanied).

In interviews with *accompanied walking children*, children and parents mentioned that they do not feel ready yet to walk alone.

> My daughter is very dreamy. When she walks together with friends and talks, they are distracted and don't pay attention anymore (9P walking accompanied)

> I'm afraid to walk alone because we just recently moved to the city (10C walking accompanied)

However, parents would like their children to travel unaccompanied and have long-term plans to gradually train their children to walk to school independently (10P walking accompanied).

In our study, the group of *car and public transport users* combined a non-active mode with walking. The parents took their children to school by car, park between 300 and 500 metres away from the school and walked the final part of the journey, because they enjoyed being physically active and did not want to contribute to the heavy traffic around the school (2P car).

Parental mobility behaviour and time efficiency were the main reasons for car use. If the parent prefers driving to work or is used to travelling by tram, it influences their children's travel mode.

> We tried walking but we didn't stick with it, because, I don't know, maybe it was convenience or missing children from our neighbourhood (…) and the younger sibling has to be brought to the kindergarten (3P car)

All non-active travellers described the distance to school (1400, 1800, 2300 m) as too long to walk. However, perceptions on route length and duration differed. Generally, most walkers evaluated their routes as not very long and in one interview a child even enjoyed daydreaming while covering the longer distance to school (12 walking group).

The health benefits of active travel were rarely described in the interviews and might not have an immediate impact on travel mode decisions. Noticeably, only parents of non-active travelling children who walked part of their journey mentioned enjoying being physically active

during the walking part of their school journey (2P car). Some children walking in groups valued the opportunity to talk with friends or take a mental break from school.

> C1: The path, where it is very narrow, should be wider so that we can better talk to each other.
> C3: Yes, and that we can walk next to each other (1C walking group)

> I have more time to fantasise, because at home my mum gets on my nerves when I monologue or sing or do anything else. On the way to school I can just fantasise, do whatever is going on in my imagination and nobody listens to me anyway (12C walking group)

Interestingly, the factors perceived as influencing school travel mode were weighted differently in individual decisions. For example, one parent perceived an unprotected crossing as an unpassable barrier (3P car) and another parent as a reason for walking with his child (9P walking accompanied). Another example is the varying impact of siblings on travel mode: In one family an older sibling led to early independent travel of the younger one (8 walking group), while other siblings sometimes walk together without parents (7 walking unaccompanied). Much older siblings did not seem to impact travel behaviour (2 car) and in one case a younger sibling led to car use because the kindergarten was close to the primary school and the trip was chained (3 car).

In another case, one parent preferred to accompany their child, due to a fear of strangers and alcoholics along the route (13 walking accompanied). In the same neighbourhood another parent frequently described the perceived stranger danger but did not consider it to be a barrier to sending their child to school unaccompanied.

> I don't let her walk alone except to and from school (…) we live in a social hotspot (…) there are many strange people (14P walking unaccompanied)

The latter family moved very close to the school, so that they could oversee the school route from

their balcony. This fact underlines the importance of school routes for family's everyday life.

4.2 School route perception

Our findings of how routes are perceived by children and parents show that children generally described more places connected with positive emotions ('it's cool there', 'I like it', 'it's fun'). Walking unaccompanied children mentioned almost four times as many places during the interviews then those who were accompanied by their parents (65:17 places). Walking groups in particular reported a lot on places along their route in connection with common experiences.

During the interviews, parents described about three times more negatively perceived places than positive ones (47:15 places). Unsafe crossings, places with chaotic traffic situations or areas where stranger danger is expected were the most frequently mentioned places. In particular, parents accompanying their children expressed many worries regarding their route to school; the barriers they perceive were used to justify why their children are not allowed to walk alone.

The descriptions of the places differed greatly depending on the travel mode of the interviewee and whether or not they were accompanied. In Fig. 3 we mapped GPS tracks and photographs, categorised perception codes, and selected translated and geolocated quotes. In Interview 1 numerous places were described by the children with spatial deviations between the described place and their current location (e.g. explaining in the beginning of the walk which places they like, but taking photographs and describing them in more detail at the actual location). The children encouraged each other to tell stories and share their experiences about their common route. In Interview 2 the descriptions varied although the route was partly the same. Along the first 500 metres, when the child walks, the parent described some negative traffic-related perceptions, such as narrow footpaths and traffic chaos around the school. Close to the car park a longer break was taken where the child became active, climbed on trees and went to a small stream. This is one

of the very few occasions, in which the natural environment plays a particularly important role along the route to school. During the car trip, only a few places were described. In general, the child was not a very active interview partner and limited himself to agreeing with his parents' opinion.

Fig. 3 Go-along interviews, left: 1 walking group, right: 2 car (road network and places of residence within a radius of 100m removed for anonymity)

5 Discussion

5.1 Discussion of applied methods

Go-along interviews have several benefits regarding our travel mode and space-related research questions, but also some limitations. The go-along interviews enabled us to gain new insights into children's perceptions of places along their routes to school, since interviewing 'on site' stimulates statements about the surroundings (Evans and Jones 2011). The method approaches interviewees as local and technical experts and offers children different ways of expressing their perceptions. Children who are used to walking independently behaved more confidently and were more lively participants in the go-along interviews than children who are regularly accompanied. Some interview settings, such as a high number of participants in some walking groups or brief driving interviews with no opportunities to stop and take photos, complicated the interview situation. The presence of parents makes it more difficult for some children to speak openly. From previous studies we know, that children tend to report 'appropriate' behaviour and confirm the parental view, which occurred in our interviews with regularly accompanied travellers, too (De Leeuw, Borgers, and Smits 2004; Müller 2019). Ensuring children's right to active participate in the research process on the one hand and the greatest possible protection of the data on the other is

a great challenge (Carroll et al. 2022). At the same time, interviewing both, children and parents, allows for comparing the environmental perceptions of both groups.

Nevertheless, we have to admit that our study mainly attracted participants interested in active mobility and research. None of our participants drove by car from door to door. Moreover, no cyclist took part in our study due to the complex survey method for the child. Children living with disabilities and their view on the school journey are underrepresented not only in our study (Ross and Buliung 2018): One sibling with a visual impairment wished for traffic lights with acoustic signals or vibration (7C walking independent) and a child with a concentration disorder seemed to have difficulties in learning to walk unaccompanied.

> Until recently, he always held on to the stroller and relied more on me. Now he has to find out for himself where the route to school is located, where to walk, where to pay attention (6P public transport)

In future research, the diversity of individuals such as children living with disabilities could be given more attention by designing flexible and adaptive method designs, e.g. relying on perceptions through all senses or interrupting the journey for interviewing while standing or sitting (Carroll et al. 2018)

The place-based approach of go-along interviews enables innovative ways of visualising and analysing qualitative interview data. We propose linking data spatially in maps to better understand the relationships between mentioned places, subjective descriptions, codes, and actual locations. Our approach can contribute to the field of qualitative GIS, where maps of qualitative data are enriched with quantitative data (Wilson et al. 2019; Hasanzadeh, Broberg, and Kyttä 2017; Alarasi, Martinez, and Amer 2015; Mennis, Mason, and Cao 2013). Qualitative GIS can not only inform neighbourhood-based health promotion and urban planning to identify a need for local

improvement (Kahila-Tani et al. 2016). It also treats children's perceptions, memories and concerns as important as features of the natural and built environment. Developing a qualitative GIS for collecting qualitative and quantitative data, analyses and presentation opens up opportunities for public participation in particular for less visible groups such as children. It can serve for further research questions, e.g. on migration, tourism or environmental education. For studying activity spaces of older children having map-reading skills, a public participatory GIS approach (PPGIS) would be appropriate, to analyse a larger number of participants and to cover a larger area on a web-based basis (Hasanzadeh 2022; Kyttä, Broberg, and Kahila 2012).

5.2 Factors perceived to support and hinder AST

Revisiting our first research question our findings show that the choice of mode is not only a choice between active or non-active school travel, as previous studies suggest (Helbich et al. 2016; Easton and Ferrari 2015; Lee et al. 2013). Non-active modes are combined with active modes, and the mode varies on the way to and from school or under certain circumstances, such as bad weather conditions. Travel group composition is also dynamic depending on the way to or from school, the timetable at school or spontaneous decisions. This diversity of mobility patterns has to be taken into account in future studies (Mikkelsen and Christensen 2009).

Our study confirms the importance of distance to school as a key factor for mode choice (Ikeda, Stewart, et al. 2018; Rodrigues, Padez, and Machado-Rodrigues 2018). The routes in our study vary between 200 and 2300 metres and relatively long distances are covered by car or public transport (1400, 1800 and 2300 metres). However, longer distances are also travelled actively (e.g. 1400, 1500 and 1700 metres). The majority of walking participants describe their routes as adequate for walking. All interviewees attend public schools and school district delineation should lead to walkable distances.

Our study highlights the varying importance of factors for travel mode choice and accompaniment. Besides distance, other factors seem to strongly influence children's school journeys include parental safety concerns, siblings, trip chains, and children's preferences. Some factors only slightly influence the decision, e.g. footpath conditions or the weight of school materials. The differences in how particular factors and their relevance are perceived highlights the importance of our qualitative approach. Although having no siblings is considered to support AST (Wilson, Clark, and Gilliland 2018), our study shows a certain differentiation with regard to the age of the sibling and which educational institution they attend. Furthermore, parents act as gatekeepers and decision makers with regard to children's school travel (Mah et al. 2017; Egli et al. 2018). Their perceptions about safe routes and what makes a capable child are crucial for allowing their children to walk unaccompanied. But parent's convenience also influence their decision (Egli et al. 2018). Children might only be asked about their preferences and wishes if the parents are generally in favour of their children's independent mobility. Therefore, interventions for primary school aged children should always include their parents.

In contrast to previous studies (Ikeda et al. 2020; Smith, Ikeda, Hawley, Mavoa, Hosking, Egli, Zhao, Mackay, Donnellan, Amann, et al. 2020), in our interviews the impact of school factors, such as school route recommendations and school policy, was estimated to be low. Only a few parents reported that they took official recommendations into consideration when choosing their child's route; instead, they tended to follow their intuition. School policy is not seen by the parents as a powerful tool for supporting AST. Nevertheless, the majority of interviewed parents criticised the hazardous traffic situations around schools, particularly in the morning hours, and would like to see improvements carried out by public authorities e.g. through road closures set up by the police.

With regard to our second research question about how children perceive their school travel routes compared to their parents, certain differences could be detected, as was also shown in a previous study (Spilsbury, Korbin, and Coulton 2009). Children tend to describe their surrounding in a more positive manner, whereas parents used the interview situation to express more concerns about the route environment. These concerns caused by negative perceptions of the route environment seem to dominate decisions on mode choice more than objective measures of the built environment (McMillan 2007). Additionally, we found not only diverging perceptions between children who walk and those who are brought by car (Fusco et al. 2012; Ünlü and Çakir 2002), but also differing perspectives between accompanied and unaccompanied children.

When looking at the route descriptions provided during the interviews, another phenomenon that becomes apparent is that certain places were described repeatedly, e.g. at the beginning of the interview, before arriving at that specific place and upon arrival at the actual place, or in more than one interview. Those places can be framed as 'journey landmarks' (Fusco et al. 2012). They dominate the perception of the route and vary from aspects of the traffic environment to places where positive memories were created. These places might be a starting point for creating school routes that are perceived as pedestrian-friendly and enjoyable and which promote AST.

The positive effects of active and independent school travel, such as being physically active, enjoying talking to friends or relaxing between school and home, are well known (Egli et al. 2020; Witten et al. 2013), but are rarely mentioned explicitly in our interviews. Nevertheless, places where children take a short break at a bakery, jump over a stream, slide on frozen puddles or take a secret shortcut are frequently mentioned, particularly by children who walk together. This might represent an opportunity to promote active and independent travel as a way of supporting shared positive experiences among children at places along their route, rather than emphasising the health

benefits of active travel. Even when parental safety concerns are a major barrier, parents could organise accompanied walking groups or motivate their children while walking with them to experience their route to school as an activity in its own right and not just a transit space. One prominent intervention to support children's active travel are walking school busses, where children join an organised walking group along a particular route often accompanied by a parent (Heelan et al. 2009; Kearns, Collins, and Neuwelt 2003). However, it could become more widespread in Germany. In line with a previous study, we see great potential for children's enthusiasm about active travel to overcome parental hesitation (Rutberg and Lindqvist 2019). Supporting children's independent active travel would also prevent estrangement from the environment among children who are brought by car and connect children with the diversity of our society (Witten, Kearns, and Carroll 2015; Fusco et al. 2012; Miller 2005).

6 Conclusion

In our study we found that each family's travel mode choice was influenced by a unique interplay of factors. We have shown that some factors reinforce each other (e.g. stranger danger, limited confidence in children's abilities) and others compensate for each other (accompaniment by other children and road safety concerns). To develop targeted interventions, existing conceptual models (Smith et al. 2020; Egli et al. 2018) could be adopted for different travel mode and accompaniment types.

Unaccompanied walking children and in particular children walking in groups have the ability to observe numerous features of their route environment. Those mostly positive perceptions of their routes should be seen as a chance to support AST. Encouraging children to become local experts of their routes to school, e.g. with child-led neighbourhood walks or school projects in which children present their own daily routes, might have a long-term effect on their travel

behaviour. Parents more frequently expressed their concerns and described places that are perceived as dangerous, chaotic or in need of improvement. Parents do not seem to focus on the general health benefits of AST. Therefore, local authorities and schools could improve their communication by more effectively addressing other benefits such as children's independence and self-confidence and the value of developing local knowledge and orientation skills. Such measures should be used to link formal learning at school with informal learning outside the classroom. Connecting everyday experiences to classroom activities could enhance geographical literacy at an early age.

Our results demonstrated differences between parents' and children's perceptions of their routes as well as between accompanied and independently travelling children. Therefore, we recommend designing studies that include children's and parents' perspectives on activity spaces that recognise the diversity of travel modes and types of accompaniment. Conducting go-along interviews along the routes of interest captures not only children's and parents' spatial knowledge and memories but is also a helpful tool to inform urban planning and health promotion.

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