Journal of Transport Geography 68 (2018) 31–41

Contents lists available at ScienceDirect

Journal of Transport Geography

journal homepage: www.elsevier.com/locate/jtrangeo

Exploring independent and active mobility in primary school children in Vienna

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ARTICLE INFO

Keywords:
Children
Travel behaviour
Independent mobility
Active mobility
Mobility licenses

ABSTRACT

Declining active and independent mobility in primary school children poses a threat to the development of the children's psycho-motoric and cognitive abilities. Increasing accompaniment of children, which is often carried out as car transportation, creates more motorized traffic, thus leading to lower likelihood of other children traveling independently and actively. Against this background, a two-step survey was conducted to analyse the active and independent mobility (AIM) of primary school children. In a first step, mobility licenses and mobility data were collected with the help of travel diaries including specific information on travel accompaniment. In the second step, in-depth interviews with parents were conducted. Although the data can only provide a snapshot of the independent mobility of primary school children, this study confirms that active and independent mobility is the result of a variety of factors. The results indicate that – besides trip distance and age –the type of school (all-day/half-day primary school) is likewise relevant. Based on the parents' assessments, significant sharing of trips takes place in case travel accompaniment is unnecessary. Depending on the parents' attitudes towards AIM, we identified three "profiles" (Promoters, Pragmatists and Protectors). Linking these profiles to indicators of AIM reveals that different attitudes manifest themselves in children's travel patterns. The results are limited as only two schools served as sources of data and it was not possible to decouple the parental profiles from children's ages. Overall, it can be concluded that there is potential for improved active and independent mobility in children. To be effective, future campaigns need to consider parental attitudes.

1. Introduction

Primary-school age, which refers to the ages of 6 to 10, constitutes a particularly important time for the development of the perception of dangers and spatial cognition in public space for children. At this age, decisions on mobility – which mode of transportation to choose and which route to take – are mainly made by children's parents. Parents' concerns regarding low traffic and social safety lead to higher frequency of accompanied travel which is often carried out as car transportation. In this process, more motorized traffic is created, leading to a lower probability of other children traveling independently (without supervision by adult chaperones) and actively (walking and cycling). Mobility characteristics on the part of primary school children have changed over the last decades. Trends of declining active and independent mobility (AIM) contribute negatively to overall child development and children's future mobility preferences. To work against this worrying development, it is of great importance to identify specific barriers imposed by parents in pursuit of fostering children's independent and active mobility.

This paper reports on a multi-level approach of data collection and analysis from two primary schools in Vienna, Austria. The overall objective was to gain insight into the travel behaviour of primary school children, in particular into the characteristics of AIM which can be linked to the parents' attitudes, since considerably less research exists from Austria compared to the number of studies in the U.S. and other European countries. The research is guided by the question of in what sense parental attitudes influence the extent of their children's independent and active mobility. In particular, this paper wants to contribute to research in this area by:

(1) Examining comparable trip characteristics, mobility licenses[1] and travel accompaniment for children in two Austrian primary schools

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[1] Mobility licenses refer to permission parents give to their children to conduct specific activities in the mobility context. Such licenses are used for example by Hillman et al. (1990) to operationalize children's independent mobility.

https://doi.org/10.1016/j.jtrangeo.2018.02.007
Received 19 January 2017; Received in revised form 7 February 2018; Accepted 20 February 2018
Available online 27 February 2018
0966-6923/

of different types and settings, based on trip diaries which were specifically designed to obtain in-depth information about independent mobility.
(2) Analysing parents' attitudes qualitatively by means of in-depth interviews in pursuit of better understanding of the background behind mobility decisions and linking these parental attitudes to their children's mobility licenses and other indicators of AIM.

The paper is structured as follows: Section 2 gives an overview of findings from existing studies in the field of the independent mobility of children. The survey approach and instruments are described in Section 3. This section also includes a presentation on the school settings and sample characteristics. The results are presented in Section 4, starting with an overview of indicators of children's active and independent mobility given consideration of the two school locations (Section 4.1). The results on parents' attitudes and their interrelation with their children's mobility behaviour are subsequently shown (Section 4.2). In the conclusion section (Section 5), the determinants of children's independent and active mobility are discussed and recommendations for future research are derived accordingly.

2. Literature review

An international study of the Policy Studies Institute on children's independent mobility throughout 16 countries (Austria did not take part) found that children's independent mobility varies widely (Shaw et al., 2015). Where comparable data are available, studies show that the independent mobility of school children has actually declined over time (e.g. Hillman et al., 1990; Shaw et al., 2013; Frauendienst and Redecker, 2011; Funk, 2008). Independent mobility is a complex phenomenon resulting from various influences. According to the behavioural model of school transportation (BMST) (Mitra, 2013), key factors are the physical environment, external influences such as the surrounding social-political context, but also child, parent (or guardian) and household characteristics. According to the conceptual framework of BMST, all of these factors directly or indirectly affect the child's travel patterns and show complex interconnections. What's more, independent mobility and mode choice affect each other, since car use leads inevitably to escorted travel. From a legal perspective, this is also the case for cycling up to the age of 12 or 10, respectively (after positive cycling proficiency test) in Austria. Meanwhile using public transport unaccompanied is allowed from the age of 6.

Although literature reviews show that studies in this field offer a variety of (partly inconsistent) findings which are not generalizable (Potoglou and Arslangulova, 2017), they are unanimous in their assessment that parents and their perception of the urban environment are a relevant factor for independent mobility (Shaw et al., 2015). This is obvious, as the mobility of children – especially at a young age – is to a large extent an outcome of choices made by parents. Parental concern about the danger caused by road traffic is specifically identified as a motivation for frequent shuttling by car (e.g. Limbourg, 2010; Funk and Fassmann, 2002; DiGuiseppi et al., 1998; Wittenberg et al., 1987; Waygood and Susilo, 2015; Wen et al., 2008). This connection reveals a vicious cycle. Parents' risk perception prevents them from granting active and independent mobility (AIM) to their children. As a consequence, motorized traffic then increases and leads to subsequent higher risk perception, also for parents of children who walk or cycle. In addition, household interactions such as parents' work travel patterns likewise play an important role (e.g. McDonald, 2008).

Parents however often do not take into account that these changes in children's mobility may result in a negative impact on the child's personal development (Hüttenmoser, 2004, 2006). Moreover, the experiences which children and youth gain on their trips hardly affect only their future travel behaviour (Limbourg et al., 2000; Hurrelmann, 1998; Moczek and Rambow, 2004). That is, less AIM influences a child's development of becoming a cognitively, physically and socially healthy human being (BMLFUW, 2005; Hillman, 2006). AIM is crucial for the development of psychomotor and cognitive abilities, such as spatial orientation, perception and estimation of distances, time and speed (Limbourg, 2006). Children with car-dependent lives can also suffer from a learning deficiency, a slower development of social behaviour, missing balance or spatial awareness (Zimmer, 2003; Limbourg, 2010). Schützhofer et al. (2015) state that a child with sufficient physical activity in his/her daily life will subsequently have well-trained balanced senses, and will thus be able to deal with critical situations when, for example, he/she is cycling on the road. Furthermore, a child with good motor skills can rely on a higher level of awareness of road traffic. Both may ultimately lead to a lower risk of children being injured in a traffic accident.

As mentioned above, actual and representative studies on the independent mobility of children are lacking in Austria. In particular, no comparable studies exist on mobility licenses as conducted by Shaw et al. (2015) or Hillman et al. (1990). The nationwide household travel survey of 2013/2014 (Tomschy et al., 2016) includes an unweighted sample of 444 trips (one reporting day) on the part of 163 6-to-9 year-old children living in Vienna. Although the survey does not offer any information about accompaniment on trip level, key mobility figures can nevertheless be derived. Modal split data on school trips of Austrian primary school children were collected between 2013 and 2017 in the context of a consulting programme for educational institutions (Klimaaktiv homepage, 2017). As only those schools were involved which were interested in the mobility management program, the data might well be biased. In an individual study on children's mobility in 2000, data on parents were collected at nine primary schools in different Austrian provinces (three schools in Vienna, N = 220) (Sigl and Weber, 2002). The results show that children from Vienna are less mobile than children from small towns or rural areas. Most of them (80%) travel less than 1 km to their primary school. A high share of children is escorted by car due to the fact that parents judge the traffic situation to be too dangerous for independent travel. On trips to school, every second child is always accompanied. The results reveal that unsupervised play in the vicinity of the residential environment is not possible because play areas are difficult to access or displaced by car traffic. Although the study offers useful information about independent mobility, some aspects remain unclear from a methodological perspective, as the questionnaire has not been published. For example, how accompaniment is defined or how reasons for accompaniment are collected. No trip diaries were used; mobility licenses were not surveyed. Overall, comparability with the present study is therefore limited.

Further individual studies focus on children of kindergarten (e.g. Ausserer et al., 2010) or older age groups (e.g. Stark et al., 2014, 2015; Füssl et al., 2012).

This study explores characteristics of children's AIM in their everyday mobility and the attendant underlying reasons. In this context, children's behavioral characteristics are linked to parent's attitudes. Two primary schools in Vienna are used as an example. Although our two-step survey does not claim representativeness, the methodological approach and results presented in this paper are expected to be useful for transport researchers, urban planners, as well as municipal authorities when planning campaigns to strategically promote physical activity amongst this important target group.

3. Methods

3.1. Approach and survey instruments

We conducted a two-stage survey in two primary schools in the city of Vienna. To measure and examine characteristics of AIM, the first stage contained a paper-and-pencil survey investigating the children's mobility behaviour on two days (one weekday, one weekend day). In the second stage, parents were invited to take part in an in-depth face-

Table 1
Data sources.

Nr	Sections	Information[a]	Respondent(s)
Stage 1 – paper-and-pencil questionnaire			
1.1	Baseline questionnaire	Number of vehicles in household, socio-demographics, mobility licenses, mobility habits of parents and child	Parent
1.2	Travel diary	Trip information on two reporting days	Parent, children
1.3	Declaration of consent	Willingness to participate in face-to-face interview	Parent
Stage 2 – in-depth face-to-face interview			
2.1	Trip-specific questions	Reasons for accompaniment, mode choice	Parent, children
2.2	Quantitative indicators	Action radius, assessments	Parent
2.3	Discussion topics	Motives and habits, freedom of choice	Parent

[a] Excerpt.

to-face-interview which aimed at involving the one parent filling in the trip diary beforehand as well as the child. The survey documents were distributed in all school classes and collected again over the following weeks. All children were approached during the same survey period between mid of October and mid of November 2013. The following in-depth face-to-face interviews were conducted in early 2014. Table 1 gives an overview of all sections of the two-step survey which are described in the following.

The *paper-and-pencil survey* consisted of two questionnaires. The *baseline questionnaire* contained questions about the household in general (e.g. home address, number of adults and children in the household, age and gender of the child for which the trip diary was filled in). Data about the parents' occupation and the number of vehicles in the household were collected. Mobility licenses were enquired about using the approach by Hillman et al. (1990). In comparison to other studies (e.g. Kyttä et al., 2015), we only asked parents about the licenses, not the children. As only one reference weekday was covered in the trip diary, the general frequency of accompaniment on school trips (to and from school) was also collected. Further questions were asked to obtain information on mobility habits, i.e. the frequency of use of travel modes was examined for each parent and child. Furthermore, the child's frequency of bicycle use during his/her leisure time and to school during spring/summer time in good weather was asked in order to check for the possibility of seasonally-skewered bicycle use given in the trip diary. The last page contained the invitation for an in-depth interview. Whereas the baseline questionnaire could be filled in by the parents alone, the trip diary had to be completed together with the child.

We used a *travel diary* principally based on the KONTIV-format (Brög et al., 1983) to collect mobility data on the children. The questionnaire was adapted according to our research questions. In doing so, we collected the travel modes used in a given trip in the order of their usage (trip stages). Trip stages were used as the basic unit for gaining detailed information on duration, accompanying persons (supervisors, friends etc.) and the necessity for supervision.

The answers given by the written questionnaires provided the basis for the *in-depth face-to-face interviews* which were customized to the respondents' specific situations. As determinants of children's AIM are very complex, we tried to understand the principles behind existing mobility patterns. For that reason, we used a semi-structured questionnaire containing mainly open-ended questions. Based on the trips stated in the travel diary, trip-specific reasons for accompaniment and mode choice for each specific trip were collected in the introductory part. In this regard, we asked the child why he/she travelled together with another person(s) (supervisors, friends etc.) or why the child travelled alone in this specific situation. We also tried to find out what reasons caused the parents or the child to choose the travel mode(s) for the given trip.

Further guiding questions referred to children's allowances and the subjective perception of traffic and social safety. Parents' attitudes regarding AIM were investigated, as well as their viewpoint on their own responsibility to act as a role model by using active travel modes whenever possible (see Fig. 1). Additionally, some attitudinal indicators were collected quantitatively through closed-ended questions. This refers to indicators which were as independent as possible from one's own child's age or trip length. Parents reported their general attitudes with regard to social and traffic safety (for example per travel mode) or their attitude towards the most appropriate age for independent travel using five-point assessment scales. Discussions and quantitative indicators are used to point out disparities in parental attitudes.

Based on the information collected, we explored whether attitudinal differences - expressed in parental “profiles” - manifest themselves in children's travel patterns, particularly, in indicators of children's AIM. Fig. 1 gives an overview of the conceptual framework of the study.

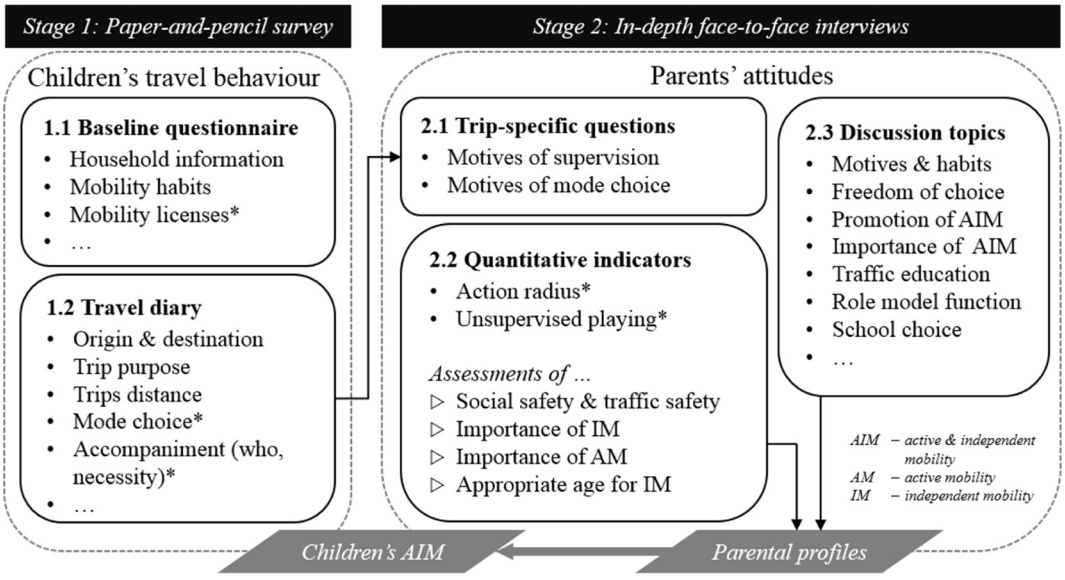


Fig. 1. Overview of the conceptual framework. *Indicators of children's AIM.

3.2. The setting

Two public schools were selected to cover different organisational types (half-day and all-day school) and different locations in the outskirts of the city of Vienna. Due to budget constraints, it was not possible to consider more than two schools for our survey.

School A is a standard, half-day primary school. It is located in the 19th district of Vienna and is surrounded by very dense settlement structures of multilevel residential constructions of a high residential quality from the pre-war era. Two tramway lines pass close to the school; the next bus stop is within 10 min walking distance. Children who use public transport for their school trips have to cross several streets in the process. Although there is a marked pedestrian crossing and a traffic-calmed street (30 km/h-zone) in front of the school building, high traffic volumes and a high demand for parking spaces in the vicinity of the school can be observed.
School B is an all-day primary school. This means that compulsory education and further courses take place throughout the day until at least 3:30 p.m.; childcare is provided until 5:30 p.m. Children from this school mainly reside in the 22nd district of Vienna with a lower population density compared to the 19th district (Fig. O-A 1). In the immediate surroundings of school B, there are tall office buildings of the post-war era to the west, as well as a suburb area to the east on the other side of the Old Danube. The school is situated directly at a six-lane city entrance road (Annual average daily traffic of 36,000 motor vehicles; Verkehrsplanung Käfer GmbH, 2010); this leads many parents to drop off their children on their way to work in Vienna's city centre. Due to the less central location, the level of motorization within the pick-up area of school B is generally higher compared to School A (Fig. O-A 2). To consider these aspects in the sample, we collected information on the vehicle ownership and the overall car use by the mother and father.

In summary, the two primary schools of different organisational types located in different areas in Vienna provide data which enable us to derive fundamental insight on different determinants of AIM, including parental decision-making patterns, although the sample is not large enough for extracting generalizations about the entire population.

3.3. The sample

In sum, 380 questionnaires were distributed. Table 2 shows a summary of sample characteristics. The response rate was much higher at School B (58% vs. 41%). This can be explained by the strong support of School B's principal who distributed an additional cover letter encouraging the parents' participation. In sum, 1,052 trips and 1,583 trip stages from 190 children (49% girls) were collected. The age distribution in School A (mean 7.5) and School B (mean 7.8) is almost identical with a slight surplus of the oldest age group in School B at the expense of the children aged 6. Those six children aged 10 were assigned to age group 9. In 37 cases of the 190 returned questionnaires, parents stated that they were willing to take part in a face-to-face interview. 12 of those parents were not able to actually take part in the interview, the main reasons for which being insufficient contact information, such as incorrect or partly illegible information of the telephone number or e-mail address and lack of response to contact. The net sample consisted of 25 parents – 40% were parents of a daughter. In 80% of the cases, children took part in the in-depth interview. Table 2 shows some household characteristics of the sample. There is a low rate of unemployed mothers at School B, since the working status is one precondition for being accepted into this all-day school. The average number of persons per household is similar, along with the vehicle ownership status.

Table 2
Sample characteristics.

	School A		School B	
Response				
Number of completed travel diaries	74		116	
Number of in-depth interviews	8		17	
Number of collected trips	445		607	
Number of collected trip stages	600		983	
Age distribution [%]				
6 years	27		17	
7 years	24		22	
8 years	25		28	
9 (10) years	21 (3)		30 (3)	
Working status of parents [%]	Mother	Father	Mother	Father
Not employed	40	5	25	5
Half-time employed	34	7	40	6
Fully employed	26	88	35	89
Adults (children) per household [-]	1.9 (2.2)		1.9 (1.9)	
Vehicles per household [-]				
Cars		1.1		1.1
Moped/motorbike		0.1		0.1
Bicycles or scooters		3.8		3.1
Child's bicycle ownership [%]		84		88

3.4. Analysis methods

The quantitative data of the baseline questionnaire and travel diary were recorded in a database. Data analysis was performed using IBM SPSS Version 21 software. For the aggregation of mode choice from stage to trip level, a usual fundamental definition of a hierarchical structure was used (BMVIT, 2011). Following the preliminary study design model by Mayring (2001), parental attitudes were analysed based on (i) qualitative content analysis using transcripts of the in-depth interviews and quantitative indicators, and by (ii) linking the results subsequently to the data on children's actual travel behaviour by means of bivariate analyses.

4. Results

4.1. Indicators of active and independent mobility (AIM)

4.1.1. Mode choice

The modal split strongly depends on the trip purpose and school site respectively its catchment area: children at School A demonstrated a higher share of walking trips (47.0%) at the expense of car use (24.4%) than school B (23.2% walking, 38.1% car passenger) (Table 3). One main reason for that is the shorter average trip distance in School A, which is 1.8 km for trips to school (School B: 2.7 km) and 5.5 km for other trips (School B: 7.6 km). Longer average trip distances cause more complex trips at School B: 29% of the children's local travels involve more than one trip stage (19% School A). A disaggregated analysis of the modal split based on trip stages -which depicts the share of active mobility in children's travel behaviour more accurately - shows that the share of pedestrian children in School B (44%) does not vary that widely from those of School A (55%) in contrast to the trip-based modal split. Because of the longer average trip distance, children of School B thus have a lower chance of trips featuring non-stop walking. The share of cycling is low at both sites which can also be attributed to the survey timing in autumn. However, 80% of the parents stated that their child never uses the bicycle on the way to school regardless of the weather or season. In leisure time, cycling is an option for joint family excursions

Table 3
Average trip distances and mode choice (ST – trips to school, OT – other trips).

	All (n = 1,041)			School A (n = 434)			School B (n = 607)		
	All	ST	OT	All	ST	OT	All	ST	OT
Trip distance [km]									
Overall	5.5	2.4	6.7	4.6	1.8	5.5	6.3	2.7	7.6
Weekday	2.9	2.4	3.4	2.8	1.8	2.9	4.0	2.7	3.9
Modal split [%]									
Car passenger	32.4	20.6	36.3	24.4	8.9	29.0	38.1	27.0	41.7
Public transport	29.5	32.4	29.2	24.9	22.2	26.9	32.8	38.0	31.0
Bicycle	5.0	4.3	5.3	3.7	3.3	4.0	5.9	4.9	6.3
Walking	33.1	42.7	29.2	47.0	65.6	40.1	23.2	30.1	21.0

(60%), but not in the urban area. Compared to the modal split of children based on the data of the Austrian household survey[2] (car use 36.3%, public transport 22.3%, bicycle 3.4%, walking 38.0%), our sample shows lower shares of car use in favour of public transport and bicycle use. This reflects the selection of our sample in the outskirts of Vienna.

Relating mode choice to trip purpose, a conspicuous fact stands out, namely, that children walk more on trips to school compared to trips with other destinations[3]. Overall, no significant dependencies on gender and age could be found. The finding on gender is in line with other studies (e.g. Potoglou and Arslangulova, 2017; Pojani and Boussauw, 2014; D'Haese et al., 2011). No relation of mode choice or age was confirmed by Sigl and Weber, 2002.

In the results, the influence of the school location becomes clearly visible: Children from School B have longer school trip distances resulting in higher shares of car use as a passenger. They also have longer non-school-related trip distances. The higher motorization in the catchment area of School B is not reflected in the number of motorized vehicles per household, but in the families' car use, which is much higher in families from School B than from School A (mother $F = 2.5$, df = 1, $p = 0.118$; father $F = 4.8$, df = 1, $p = 0.030$; child $F = 7.0$, df = 1, $p = 0.009$). A look at the parents' travel patterns revealed that parents from School A walk on longer distances significantly more often than from School B (mother $F = 31.7$, df = 1, $p = 0.000$; father $F = 16.5$, $p = 0.000$; child $F = 26.2$, df = 1, $p = 0.000$). This may result from the dense urban settlement structure of School A's catchment area. The children's modal split correlates strongly with their parents' mode choice. The correlation is stronger for the mother than for the father, with both correlations showing high significance across all modes (see Appendix Table A2). This is plausible, since – generally – a gender gap in childcare indeed exists (Scheiner, 2016). It should be emphasized that these results are based on general information reported by the parents, not on travel diaries.

4.1.2. Mobility licenses

Fig. 2 shows the mobility licenses by age which are collected within the baseline questionnaire. Significant differences emerge between the age groups ($F = 14.9$, df = 4, $p = 0.000$); mobility licenses increase with age. This corresponds to results of similar studies in Germany (Frauendienst and Redecker, 2011), Finland (Kyttä et al., 2015) and other countries (Shaw et al., 2015). Licenses for going out after dark, cycling on main roads alone and using buses alone are least prevalent. This result corresponds to the international study on children's independent mobility (Shaw et al., 2015).

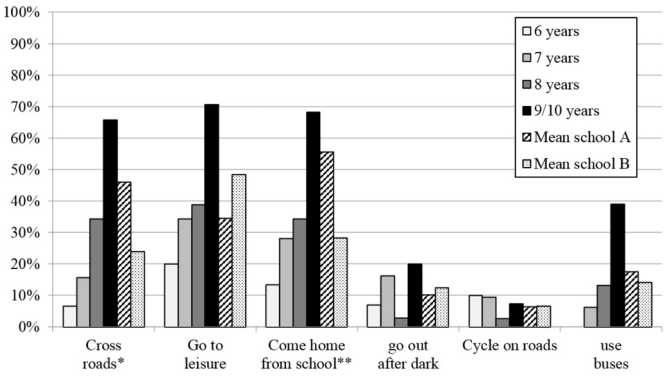


Fig. 2. Mobility licenses by age, reported by parents (n = 141), (*p < 0.01, **p < 0.001).

The mean scores of mobility licenses of the two school locations do not differ for the most part. However, a detailed look revealed that children of School A have a significantly higher license in crossing main roads alone ($F = 8.6$, df = 1, $p = 0.004$) and in traveling home from school alone ($F = 12.5$, df = 1, $p = 0.001$), although younger children are slightly overrepresented. We were also able to find out that children from School A tend to have higher licenses at a younger age. This may be due to the fact that trips from children of School A are generally shorter. However, the bivariate correlation of allowances and average trip distance at the individual level is not significant ($r_s = -0.18$, $p = 0.214$). There is a slight tendency indicating that the higher the allowances, the lower the frequency of accompaniment ($r_s = -0.25$, $p = 0.064$). This cannot be observed for children from School B, where no relationship between allowances and trip distance ($r_s = 0.09$, $p = 0.080$) or frequency of accompaniment ($r_s = -0.06$, $p = 0.207$) exists.

Apart from age, the working status of the parents seems to have an influence. That is, the mobility license score increases with the mother's employment rate (not employed, part-time, and full-time). This means that children of mothers employed full-time have higher allowances than children from unemployed mothers or mothers employed part-time. This effect only occurred for School A. A similar effect was reported by Kyttä et al. (2015) and seems to be plausible because children at half-day schools have to be more self-organized if parents are at work during the day. For children at all-day schools, it is not relevant if parents work the whole day or not. However, this effect does not occur in terms of the working status of the father. No significant connections to gender can be found.

As no earlier study in Austria on mobility licenses exists, only a comparison with other existing individual studies in an international context is possible. However, the different frameworks have to be considered. Whereas our study is conducted in a big city, the surveyed areas in UK and Germany comprised “a range of (…) geographies” (Shaw et al., 2015, p15). Five schools of different areas in England and Germany were chosen to provide a cross-sectional snapshot of the countries. However, the

[2] Own data analysis of unweighted trips of 6-to-9 year-old individuals, living in Vienna, first reference day. It should be noted that the sample size for this sub-sample is low (n = 444).

[3] Findings of previous studies (e.g. Yarlagadda and Srinivasan, 2008) show that mode choice by children can differ depending on the direction (home-to-school trips vs. school-to-home trips). Hence, in our study, school trips are defined as home- school relations.

samples used in all of these studies are limited in scope because they are non-random and not representative nationally. A comparison of the overall children's independent mobility level indicates that our sample falls into a moderate or lower independent mobility compared to other studies, especially for cycling on roads (Table A1). Particularly in the study of Kyttä et al. (2015), a higher level of independent mobility is evident (Shaw et al., 2015; Kyttä et al., 2015).

4.1.3. Accompaniment

The analysis of the travel diaries shows that 87% of all trip stages were accompanied by a guardian such as parents, grandparents, babysitters, etc. High frequency of accompaniment can be observed throughout all trip purposes and declines with children's age - from 96% (6 years) to 81% (9/10 years). No statistically significant correlation was observed between accompaniment and gender. This is contrary to the results of Sigl and Weber (2002) who state that girls are accompanied more often than boys on school trips (this result also includes non-guardians).

A comparison of school sites shows that children at School A travel more independently. The strong disparity can be observed, for example, in the case of school trips (Fig. 3): While every fifth child of School B is accompanied everyday on the way to school, no equivalent case could be observed in School A. Again, a reason for that is most likely the difference in trip distances. This correlation is confirmed by various studies in other countries (e.g. Scheiner, 2016; Zwerts et al., 2010; Fyhri and Hjorthol, 2009; Waygood and Susilo, 2015; Sigl and Weber, 2002). To be sure, the school type also plays a major role, especially for school-home relations. That is, for children at the all-day school, it is part of the daily routine to be picked up in the evening on their parents' way from work back home (despite presence of good public transport options).

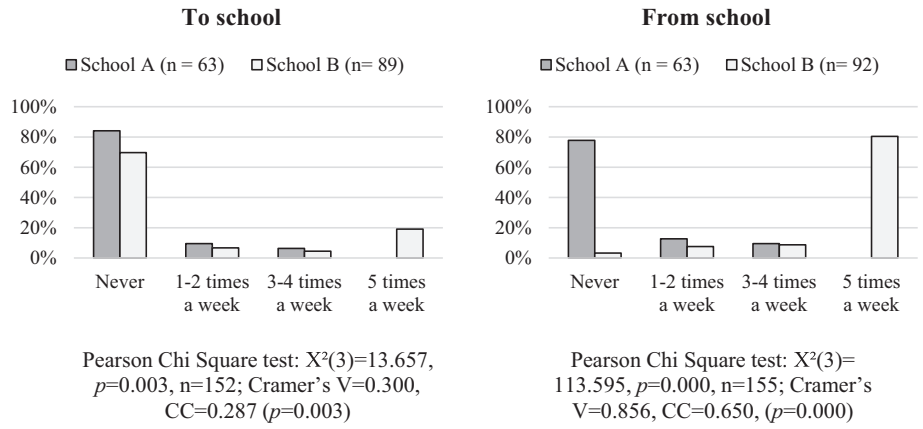
Parents from School A not only accompany children less frequently. They also consider escorting to be “unnecessary” more often. As stated in the travel diaries, an absolute necessity of accompaniment is stated by 31% for accompanied trip stages at School A compared to 59% at School B. These different assessments can be observed for accompanied school as well as for accompanied leisure trips. Again, it must be considered that mode choice and accompaniment are closely linked, although the perceived necessity of accompanying children can be attributed to car use for longer trip distances at School B. The fact that there are low correlations of the overall mobility license score and the share of accompanied trip stages supports the finding that parental permissions are only one of a range of factors leading to accompanied travel.

A closer look at a subsample of 118 accompanied trips revealed three main categories of accompanied travel: (i) most of the trips were relevant to both children and parents (62%). This refers to trips with joint-trip purposes, e.g. visiting relatives. (ii) 24% of trips had destinations only necessary for the child. This means that accompanying persons conduct this trip for the sole purpose of escorting the children. For the remaining 14%, the trip was only relevant to the custodian. This refers to trips on which persons subjected to supervision are able to fulfil their obligatory supervision while handling, for example, shopping tasks. The latter category is also mentioned in the report of the “Mobility in Germany survey 2008” (infas and DLR, 2010). The authors state that 25% of trips of children aged 10 years or younger were made primarily because they had to accompany their parents due to the fact that they weren't allowed to stay at home alone.

To summarize, the results of the travel survey show that AIM potential is not being fully exploited. Children in the sample have a high share of car use, especially in terms of non-school-related trips. Their modal split strongly depends on the school site. That is, compared with children from School B, children from School A located in the pedestrian-friendly, densely built areas, walk much more also in their freetime. Accordingly, they are also accompanied less often in their travels and are allowed to go home on their own. These results can be attributed to their shorter trips, but also to the school type (half-day). Overall, however, children's mobility licenses mainly depend on age as accompaniment does, but not on trip distance. In addition to these influencing factors, it can be assumed that the children's observed behavioural patterns (AIM-indicators) are also an expression of parental attitudes which are explored in the following section.

4.2. Parental attitudes

In the introductory part of the parental in-depth face-to-face interviews, children's trips were discussed one by one regarding underlying circumstances. Three main “rational” motives on parental mode choice for their children emerged: (1) distance to destination, (2) compatibility with their own destinations and (3) time savings. These factors fully correspond to the reasons parents gave to McDonald and Aalborg (2009) when they were asked for the reasons behind their decision to drive their children to school by car. Concerning the need for accompaniment on their children's trips, parents reported that the main reason was (1) ‘traffic safety’ followed by the perceived (2) ‘lacking ability of children to travel independently’ and (3) ‘car use for comfort reasons’. Although these trip-specific reasons were reported consistently, and parents generally stated that (the promotion of) AIM is important, we found considerable variety in the specifics of weighing out the pros and cons attached to any particular local travel arrangement, as well as which way, to what extent, and on what basis parents engage in promoting AIM for their children. In the course of the discussions, “emotional” motives in the context of AIM likewise appear. The following key points can be summarized from the qualitative content analysis point of view. That is, in line with findings from



Pearson Chi Square test: $X^2(3)=13.657$, $p=0.003$, n=152; Cramer's V=0.300, CC=0.287 ($p=0.003$)

Pearson Chi Square test: $X^2(3)=113.595$, $p=0.000$, n=155; Cramer's V=0.856, CC=0.650, ($p=0.000$)

Fig. 3. General frequency of travel accompaniment per week on trips to school and from school.

literature, the individual perception of traffic and social safety of various travel modes play an important role in parents' argumentation. In this regard, parents differ in their mention of fear, supervision and control. In the discussions, some parents strongly emphasize the compatibility with their daily routines –whilst some of them less so. Their individual perception of AIM benefits for the child (e.g. in terms of health) turns out to be a factor when it comes to AIM-related decision making. It became clear that for some of the interviewees, one important aspect is the parents' self-image or, more precisely, how they define their role model function in this context and how they reflect on their responsibility to promote these issues. Based on the attitudinal differences, three profiles of parents emerged, which we named (i) Promoters, (ii) Pragmatists and (iii) Protectors ("P-types"). They are characterized as follows:

Promoters encourage their children to engage in independent mobility very early on; they try to practise AIM as often as possible. *"(…) if they [children] want to travel somewhere, you can support them by explaining the routes (…) or by ensuring that they travel in a group - if they [trips] are longer. There is no need to escort them."* With regard to walking and cycling, they often mention the benefit of the positive health impact. These parents try to be a role model, use the bicycle often for their everyday travel, and try to avoid car use. *"We go for a walk regularly, cycling, hiking, we make a lot [actively]." "I walk a lot with the kids (…) I attach great importance to that." "In my opinion, 'city children' do not walk enough. (…) Sometimes we directly walk home from the metro station [instead of using the bus]." "One must train the children even more [if there is a hazardous area]. This concerns parents with their role model function."* It is noticeable that they often make generalized statements ("parents should", "one should"), for example: "*One must give the matter [of promoting AIM] some thought." "One really can support them by training the routes." "Of course, parents have to play their part, this is very clear. What they [parents] do not exemplify, does not last."*

They describe walking and public transport as safe modes of travel in terms of social and traffic safety. Promoters see traffic and mobility education not primarily as a task of the school; they feel responsible for taking charge of it themselves. Some of them also point out that it is or must be feasible for parents to promote AIM independent of challenging everyday situations (e.g. time constraints). "*Sometimes I try to organise the daily routines in such a way that she can travel alone for the last part of the journey."* In this context, *Promoters* mention flexibility in working hours. They trust their children to be out on their own in the residential environment and foster their children's freedom of action and choice. In that sense, it seems to be important that their children learn to take responsibility on their trips from an early age, such as the following parents reported: *"I try to motivate her to walk on her own – on trips she knows well and where I trust her." "Sometimes, when I pick him up (…) I ask him if we should drive or walk." "We practice the trips until it really works." "I don't hold his hand, I try [to help him] that he finds his way by himself. [I] let his hand go step by step." "We taught her to go by scooter, bicycle (…); she can decide by herself." "[With regard to independent travel of children:] They need to have an immediate sense of achievement. Then the first step has been made."*

Meanwhile, *Pragmatists* particularly emphasize that they try to reconcile their own trip chains and the promotion of AIM for their children. They point out that making decisions on travel accompaniment and travel modes on their children's trips in an appropriate, functional and time-saving manner. They justify car use with time constraints, stress and a low compatibility of shuttling back and forth with the household duties. *"We have a lot of errands to run. We have to use the car for organisational and temporal reasons. We have to use it to enable active recreational programmes [for the child]. This sounds contradictory, in fact."* They often allow their children to travel independently to school or to leisure activities, but pick them up afterwards by car and take the children along on errands. They like to use non-motorized modes for joint weekend excursions. However, active mobility in daily travel only takes place under certain conditions. Their deliberate attempt to promote independent mobility often ends with a compromise. Pragmatists often describe inner conflicts: *"It is very difficult for me, since actually it [independent mobility] would be very important for me (…)."*

The third group, the *Protectors*, usually chooses the car for their own trips, and tend to have a negative attitude towards public transport. Their children are mainly escorted by car and have consequently little chance of experiencing independent mobility at the primary school age, demonstrated by the following example of one father: *"[…] it would never have happened that he [son] would have taken public transport [to ride to school]. Firstly, because he is not familiar with it since we never tried it out and [secondly] we [parents] ourselves only get around by car."* Another parent states: *"I do not yet promote [her] independent mobility, it is like that, that you even have to work actively against it, because she would like to do it on her own."* Their children's independent travel is seen as less important. Protectors emphasise traffic safety and comfort as reasons for escorting their children. They assess the social safety of walking and public transport to be rather low. It seems that they want to justify themselves in their respective decisions using "self-centred" statements. It also appears that they have the need to always feel fully in control: *"There [inside the car] he [son] has his child seat … he is strapped, there, I know, he is stored securely. There is always the chance that something might go wrong, however, inside the car – that is the safest."* Another parent states: *"I can't promote it [cycling], because, you know, there are crowds of people. That's dangerous."* In this context, parents also mention low confidence in their children's abilities to travel independently; a mother reported: *"I try to observe how they behave. I let them walk short trips by themselves (…) they are issued with mobile phones."* In contrast to *Promoters*, *Protectors* seem to be also very restrictive when letting children playing outdoors without supervision. Talking about their children's first experiences of traveling independently, a particularly conspicuous aspect is that *Protectors* mention a comparatively higher age, often starting at secondary school.

Based on their statements, nearly all of the parents could be assigned to one of the three groups. To verify this assignment and to cope with unclear cases, we considered quantitative information which was collected complementarily within the interviews. For example, parents' mode-specific attitudes with regards to traffic and social safety were considered (complete list of 14 indicators, see Table A3). For these attitudinal indicators, the scales were standardized to derive a final "P-score" reflecting the parents' tendency to promote a child's AIM (from 1 to 5). By our definition, a high P-score indicates rather promoting attitudes, whilst low scores indicate rather protective attitudes. Based on the individual P-scores, a final assignment of each parent was made (Table 4). As a result, in our sample, 9 parents belong to the group of *Promoters*, 9 to *Pragmatists*, and 7 to *Protectors*. All P-types can be observed at each school location. This suggests that the P-type is not solely a matter of the school location and respective residential location. Although the sample size is very low, we found the tendency that parents of older children are rather *Promoters*. Examining single age classes, however, indicates the existence of different P-types for same-aged children. In terms of trip distance, the influence is inconclusive. For school trip distances, longer trips seem to favour *Protectors*, yet this does not apply for the overall average trip distance. The absolute level of trip distance related to one P-type nevertheless varies between the schools.

In order to analyse the impact of parental attitudes on children's mobility behaviour, in a next step, data collected in the quantitative survey were linked to the results of the in-depth interviews. As a result, bivariate analyses were carried out depicting the following indicators describing the nature and extent of the child's independent and active travel behaviour: (i) overall mobility licence score, (ii) share of accompanied trip stages, (iii) share of walking, (iv) share of car use, (v) independent action radius at residential location[4] and (vi) average weekly duration of unsupervised outdoor playtime[4]. The scales of these

[4] Only collected in the in-depth interviews.

Table 4
Parental types (P-types), related P-scores in the sample and corresponding sample sizes and means (children's age, trip distance), N = 25

P-type	P-score (1 to 5)		Overall			School A			School B		
	Min	Max	n	Age	Dist[a]	n	Age	Dist[a]	n	Age	Dist[a]
Promoters	3.61	4.21	9	8.1	6.6 (1.2)	3	8.0	8.8 (0.6)	6	8.2	5.5 (1.6)
Pragmatists	3.02	3.60	9	7.4	5.7 (2.5)	3	7.7	7.5 (1.6)	6	7.3	4.8 (3.0)
Protectors	2.43	3.01	7	7.4	5.9 (4.3)	2	7.5	2.5 (2.9)	5	7.4	7.1 (5.0)

[a] Mean overall trip distance (mean school trip distance).

Table 5
Correlations between parents' P-score and AIM-indicators of children's actual travel behaviour (Spearman-Rho), N = 25.

	MobLic	Acc	Walk	Car	AR	Play	Age	$\bar{x}$ *dist*	$\bar{x}$ *dist_sch*
MobLic							0.655**	−0.284	−0.347
Acc	−0.138						−0.246	0.365	0.156
Walk	0.468*	−0.376					0.312	−0.258	−0.424*
Car	−0.434*	0.411*	−0.813**				−0.325	0.497*	0.365
AR	0.549*	−0.511*	0.482*	−0.544*			0.319	0.022	−0.503*
Play	0.057	−0.159	−0.034	−0.232	0.191		0.171	0.086	0.335
P-score	0.346	−0.348	0.166	−0.283	0.583**	0.066	0.407*	−0.088	−0.523*

Note: P-score – Parental type (higher P-scores reveal rather AIM-promoting attitudes) [-], MobLic - Mobility license, Acc - share of accompaniment [%], Walk - Share of walking [%], Car - Share of car use [%], AR - Action radius [km], Play - Playing outside unsupervised [hours], $\bar{x}$ dist – Average trip distance [km], $\bar{x}$ dist_sch – School trip distance [km].

* $p < 0.05$.

** $p < 0.01$; two-tailed.

AIM-indicators were standardized from 0 to 1. Table 5 shows the bivariate correlations between AIM-indicators and parents' P-score. The results indicate considerable trends that a higher P-score ("*Promoter*") goes along with a higher value in children's mobility licences, a larger independent action radius, longer independent outside playtime, higher shares of walking and lower shares of accompanied travel and car trip stages. According to Cohen (1992), the effects are mainly at a medium level (action radius on strong level), but not significant for the most part, which can be attributed to the small sample size.

Again, it should be noted that the variables' gradients can be affected by the child's age and trip distance (in terms of action radius, unsupervised playtime, in principal, only by age), which is confirmed by the correlation coefficients. What's more, older age could lead to more allowances on longer trips. However, as mentioned above, the existence of each P-type at both school sites suggests that trip length has no confounding effect. Although different P-types exist in single groups of same age, due to the small sample size, it was not possible to isolate the age effect (or to control for other socio-demographics).

5. Conclusions

Although our data can only provide a snapshot of independent mobility of primary school children in Vienna, the study confirms that children's active and independent mobility is the result of a variety of factors. The main influential variables as known from literature are also found in this study. That is, shorter trip distances and higher age have a beneficial impact on the independent mobility of primary school children. The differences in travel behaviour at our two school sites can be attributed to different urban environments; however, the organisational type of school likewise has an impact on travel patterns. At the all-day school, children had a higher share of escorted (school and non-school) trips and in case of escorted trips, a larger proportion of parents saw an urgent need for accompanied travel.

As expected, parental attitudes strongly influence the degree of AIM. Parents mention, amongst others things, traffic and social safety in relation to trip length as the reason for accompaniment. It came out clearly that the parents' effort to maximize the trip compatibility leads to lower rates of independent mobility. Since all parents stressed the importance of AIM, there seems to be a gap in effectively implementing this issue in everyday routines. This is in line with findings from Pooley et al. (2011) who found out that the use of active travel modes often does not fit into the everyday travel plans of family members unless they are very committed and organised. In light of parents' uncertainties about children's capabilities regarding independent mobility, it is important to provide information about a child's different stages of physical and cognitive development at the age of primary school. This also refers to information about substantial short- and long-term benefits of AIM on a child's development. As presented in this paper, there are trips where parents deliberately want to escort their children – for various reasons – and trips for which parents cannot neglect their obligatory supervision. Overall, the results reveal that there is a considerable potential for AIM. For a substantial share of escorted trips, parents admitted that accompanying was not necessary. Linking this assessment to mode choice, we found out that most of the unnecessarily accompanied trip stages are allocated to walking (54.2%), followed by public transport (28.0%) and car-passenger (17.8%). The main priority for AIM-promoting actions should be placed on escorted car trip stages, where supervision is actually not necessary (in our sample, this refers to 9.1% of all accompanied trip stages). In this context, parents should also be made aware of their children's wish to use active travel modes; furthermore, an increased focus on non-school trips should be ensured.

As we found considerable variety in the way, to what extent, and on the basis of which line of argumentation parents engage in promoting AIM of their children, it can be concluded that we need tailor-made concepts for promoting independent mobility: *Promoters* no longer need to be convinced, whereas there is a high need to address the group of sceptical *Protectors*. The vicious cycle of road traffic volume and perceived traffic safety must be addressed, as well as the importance of practical training of road use as an important prerequisite for child development. "Pragmatists" can presumably be persuaded with practical measures addressing parental time constraints, such as group walking. We see the need for further studies to validate and sharpen our parental "profiles" (for example by inclusion of socio-demographics) which we derived from qualitative data. Due to the low sample size, we were not able to decouple different attitudes from age. It would also be interesting to gain data about the children's wish to travel unsupervised.

As there are numerous superimposed effects, the cause-effect relationships between parents' travel patterns and attitudes, urban environment, school type and children's AIM, these relationships should be explored with a larger data sample in Austria. A trip-stage based diary – which proved to be effective in our survey for in-depth data collection – should be collected for the whole household, including objective trip specific alternatives for mode choice and reasons for accompaniment. This would allow analysing trip chains in more detail. The results confirm that mobility licenses bring added value in research on children's independent mobility: the share of accompanied trip stages alone cannot give a complete picture of the complex topic on the AIM of children, since the correlation with the mobility license score is low. The parental attitudes towards independent mobility can be described more comprehensively by means of mobility licenses since children's trips are often accompanied unnecessarily.

It would also be interesting to link the children's mobility data to information on their daily physical activity. Although we cannot conclude that children at the all-day school have lower activity levels, we assume that the high share of shuttling by car in their everyday mobility shapes their attitudes on travel modes and therein their future mode choice. It is worth noting that the development of a child-friendly urban environment presupposes improvements in infrastructure for walking and cycling and organisational measures (e.g. temporal car-free zones around schools) to make these travel modes more competitive and acceptable to parents. At the same time, policies also in other fields should be pursued. This involves, for example, policies to foster flexible working hours and small catchment areas of schools.

Acknowledgements

We would like to express our appreciation for the school principals, the Vienna Schools Council as well as the parents' association of each school. We also thank parents and children for participation.

Appendix A. Appendix

Table A1
Mobility license scores of different studies on primary school children's independent mobility (only parents' answers).

Study	Kyttä et al., 2015[a]	Shaw et al., 2013	Shaw et al., 2013	Own study
Year of data collection	2010	2010	2010	2013
Age group	8–10	7–11[b]		6-10
n (parents/schools)	140/N/A	353/5	281/5	190/2
Setting description	Inner city, Small town, Rural settings (Finland)	Inner City, suburban, Edge of large town, Free-standing market town, Rural village (UK)	Inner City, suburban, Edge of large town, Free-standing market town (Germany)	Outskirts of big city (area with enclosed construction of high residential quality and area with large-size housing complexes) (Austria)
Mobility licenses				
Cross roads	N/A	36%	66%	33%
Go to leisure	82%	7–33%[c]	27–85%[c]	43%
Come home from school	71%	25%	76%	39%
Go out after dark	36%	2%	7%	12%
Cycle on roads	N/A	60%	76%	7%
Use buses	N/A	5%	25%	16%

Note: N/A-not available.

[a] For this table results for school children living in the inner city are used.

[b] For this table only results from primary school children are used.

[c] The range displayed is "due to the way the question was asked in 2010, with some parents reporting that their children 'travelled alone' and others reporting that it 'varies' (…)" (Shaw et al., 2013, p. 24).

Table A2
Spearman's correlation of parents' and child's general frequency of use of travel modes.

	Mother			Father		
	r_S	p	n	r_S	p	n
Car	0.733	0.000	133	0.564	0.000	129
Public transport	0.580	0.000	147	0.261	0.003	128
Bicycle	0.723	0.000	135	0.596	0.000	120
Walking	0.765	0.000	144	0.567	0.000	125

Table A3
Assessment indicators on parental attitudes and transformation to P-score.

Assessment indicators	Travel mode[a]	Min score [1]	Max score [5]
Traffic safety	Walking, bicycle, pt	Not safe at all	Very safe
Traffic safety	Car	Very safe	Not safe at all
Social safety	Walking, bicycle, pt	Not safe at all	Very safe
Social safety	Car	Very safe	Not safe at all
Appropriate age for independent mobility	–	10+ years	6 years
Traffic safety as factor for school choice	–	Not important	Very important
Traffic safety of residential area	–	Not safe at all	Very safe
Social safety of residential area	–	Not safe at all	Very safe
Importance of child's independent mobility	–	Not important	Very important
Importance of child's active mobility	–	Not important	Very important

[a] pt-public transport.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jtrangeo.2018.02.007.

References

Ausserer, K., Röhsner, U., Risser, R., 2010. Zufussgehen beginnt im Kindesalter - Wege vom und zum Kindergarten, final report of the project GEMMA: Wege zum Kindergarten.

Brög, W., Meyburg, A.H., Wermuth, M.J., 1983. Development of survey instruments suitable for non home activity patterns. Transp. Res. Rec. 944, 1–12.

Bundesministerium für Land- und Forstwirtschaft, Umwelt- und Wasserwirtschaft (BMLFUW), 2005. Gesunde Umwelt für unsere Kinder. WHO Kinder-Umwelt-Gesundheits-Aktionsplan für Europa und Initiativen in Österreich, Vienna.

Bundesministerium für Verkehr, Innovation und Technologie (BMVIT), 2011. Handbuch für Mobilitätserhebungen KOMOD - Konzeptstudie Mobilitätsdaten Österreichs.

Cohen, J., 1992. A power primer. Psychol. Bull. 112, 155–159.

D'Haese, S., De Meester, F., De Bourdeaudhuij, I., Deforche, B., Cardon, G., 2011. Criterion distances and environmental correlates of active commuting to school in children. Int. J. Behav. Nutr. Phys. Act. 8, 88. http://dx.doi.org/10.1186/1479-5868-8-88.

DiGuiseppi, C., Roberts, I., Li, L., Allen, D., 1998. Determinants of car travel on daily journeys to school: cross sectional survey of primary school children. BMJ 316, 1426–1428.

Frauendienst, B., Redecker, A.P., 2011. Die Veränderung der selbstständigen Mobilität von Kindern zwischen 1990 und 2010. Zeitschrift für Verkehrssicherheit 57 (4), 187–190.

Funk, W., 2008. Mobilität von Kindern und Jugendlichen. Langfristige Trends der Änderung ihres Verkehrsverhaltens. Materialien aus dem Institut für empirische Soziologie an der Friedrich-Alexander-Universität Erlangen-Nürnberg: Vol. 05/2008. IfeS, Nürnberg.

Funk, W., Fassmann, H., 2002. Beteiligung, Verhalten und Sicherheit von Kindern und Jugendlichen im Straßenverkehr. In: Bericht der Bundesanstalt für Straßenwesen, Heft M 138. Gladbach, Bergisch.

Füssl, E., Oberlader, M., Risser, A., Seisser, O., Risser, R., 2012. Jugendliche: Lebensqualität, Verkehr & Mobilität. Final Report for FWF project P 23194-G17. http://www.factum.at/content/news-reader/items/teenagers-quality-of-life-traffic-mobility-134.html?file=tl_files/pressedownload/European%20Night%20without%20Accidents%202011/Folder_Quality%20of%20life_Teenagers.pdf, Accessed date: 11 October 2017.

Fyhri, A., Hjorthol, R., 2009. Children's independent mobility to school, friends and leisure activities. J. Transp. Geogr. 17 (5), 377–384. http://dx.doi.org/10.1016/j.jtrangeo.2008.10.010.

Hillman, M., 2006. Children's rights and Adults' wrongs. Child. Geogr. 4. http://dx.doi.org/10.1080/14733280600577418.

Hillman, M., Adams, J., Whitelegg, J., 1990. One False Move … A Study of Children's Independent Mobility. Institute for Policy Studies, London.

Hurrelmann, K., 1998. Einführung in die Sozialisationstheorie. Beltz, Weinheim and Basel.

Hüttenmoser, M., 2004. Ohne gesunde Umwelt, keine gesunde Entwicklung. Referat an der Fachtagung des SMV, Luzern.

Hüttenmoser, M., 2006. Auf der anderen Seite der Straße ist alles grau. Zum Stellenwert der Primärerfahrungen von Kindern im Aussenraum. Werkspuren 1 (2006), 12–19.

Institut für angewandte Sozialwissenschaft GmbH (Infas), Deutsches Zentrum für Luft- und Raumfahrt e.V (DLR), 2010. Mobilität in Deutschland 2008. Final report. Bonn – Berlin.

Klimaaktiv homepage, 2017. Gesunde und glückliche Kinder durch aktiven Schulweg. Homepage on behalf of the Federal Ministry for Agriculture and Forestry, Environment and Water. https://www.klimaaktiv.at/mobilitaet/mobilitaetsmanagem/bildung/Gesunde-und-gl-ckliche-Kinder-durch-aktiven-Schulweg.html, Accessed date: 11 October 2017.

Kyttä, M., Hirvonen, J., Rudner, J., Pirjola, I., Laatikainen, T., 2015. The last free-range children? Children's independent mobility in Finland in the 1990s and 2010s. J. Transp. Geogr. 47, 1–12.

Limbourg, M., 2006. Mobilität im Kindesalter. https://www.uni-due.de/~qpd402/alt/texte.ml/pdf/Mobilitaet_im_Kindesalter_06.pdf (page visited 12.01.2017).

Limbourg, M., 2010. Prävention in NRW: Kinder unterwegs im Straßenverkehr. In: Unfallkasse Nordrhein-Westfalen, 2. Edition, Düsseldorf.

Limbourg, M., Flade, A., Schönharting, J., 2000. Mobilität im Kindes- und Jugendalter [in German]. Leske und Budrich, Opladen.

Mayring, P., 2001. Combination and integration of qualitative and quantitative analysis. Forum 2 (1). http://dx.doi.org/10.17169/fqs-2.1.967.

McDonald, N.C., 2008. Household interactions and children's school travel: the effect of parental work patterns on walking and biking to school. J.Transp. Geogr. 16 (5), 324–331. http://dx.doi.org/10.1016/j.jtrangeo.2008.01.002.

McDonald, N.C., Aalborg, A.E., 2009. Why parents drive children to school: implications for safe routes to school programs. J. Am. Plan. Assoc. 75, 331–342.

Mitra, R., 2013. Independent mobility and mode choice for school transportation: a review and framework for future research. Transp. Rev. 33 (1), 21–43. http://dx.doi.org/10.1080/01441647.2012.743490.

Moczek, N., Rambow, R., 2004. Mobilitätserfahrungen von Drei- bis Sechsjährigen in

Stadt und Zwischenstadt. In: Dalkmann, H., Lanzendorf, M., Scheiner, J. (Eds.), 2004. Studien zur Mobilitäts- und Verkehrsforschung – Verkehrsgenese – Entstehung von Verkehr sowie Potenziale und Grenzen der Gestaltung einer nachhaltigen Mobilität. Band 5. Mannheim, pp. 149–164.

Pojani, D., Boussauw, K., 2014. Keep the children walking: active school travel in Tirana, Albania. J. Transp. Geogr. 38, 55–65. http://dx.doi.org/10.1016/j.jtrangeo.2014.05.012.

Pooley, C.G., Horton, D., Scheldeman, G., Tight, M., Jones, T., Chisholm, A., Harwatt, H., Jopson, A., 2011. Household decision-making for everyday travel: a case study of walking and cycling in Lancaster (UK). J. Transp. Geogr. 19 (6), 1601–1607. http://dx.doi.org/10.1016/j.jtrangeo.2011.03.010.

Potoglou, D., Arslangulova, B., 2017. Factors influencing active travel to primary and secondary schools in Wales. Transp. Plan. Technol. 40 (1), 80–99.

Scheiner, J., 2016. School trips in Germany: gendered escorting practices. Transp. Res. A 94, 76–92. http://dx.doi.org/10.1016/j.tra.2016.09.008.

Schützhofer, B., Rauch, J., Knessl, G., Uhr, A., 2015. Neue Ansätze in der verkehrspsychologischen Verkehrssicherheitsarbeit im Kindesalter. Zeitschrift für Verkehrssicherheit 4 (2015), 235–246.

Shaw, B., Watson, B., Frauendienst, B., Redecker, A., Jones, T., Hillman, M., 2013. Children's independent mobility: a comparative study in England and Germany (1971–2010). Policy Studies Institute, London.

Shaw, B., Bicket, M., Elliott, B., Fagan-Watson, B., Mocca, E., Hillman, M., 2015. Children's independent mobility: an international comparison and recommendations for action. Policy Studies Institute, London (ISBN 9780853740148).

Sigl, U., Weber, K., 2002. Hurra, wir sind mobil: Mobilitätsverhalten von 5- bis 10-jährigen Kindern in Wien. Kuratorium für Schutz und Sicherheit, Niederösterreich und im Burgenland.

Stark, J., Bartana, I., Fritz, A., Hössinger, R., Berger, W.J., 2014. Abschlussbericht Unterwegs. Final Report of research project Unterwegs.

Stark, J., Bartana, I., Fritz, A., 2015. Examining mobility behaviour among youth - a progress report. Transp. Res. Proc. 11, 481–491.

Tomschy, R., Herry, M., Sammer, G., Klementschitz, R., Riegler, S., Follmer, R., Gruschwitz, D., Josef, F., Gensasz, S., Kirnbauer, R., Spiegel, T., 2016. Österreich unterwegs 2013/2014. Ergebnisbericht zur österreichweiten Mobilitätserhebung Österreich unterwegs 2013/2014. In: On behalf of: BMVIT, ASFINAG, ÖBB Infrastructure AG, Provincial government of Burgenland, Lower Austria, Styria, Tyrol. Bundesministerium für Verkehr, Innovation und Technologie, Vienna.

Verkehrsplanung Käfer GmbH, 2010. Traffic Counting Vienna 2010 – Final Report. On behalf of Municipal Department 18, City of Vienna.

Waygood, E.O.D., Susilo, Y.O., 2015. Walking to school in Scotland: do perceptions of neighbourhood quality matter? IATSS Res. 38 (2), 125–129.

Wen, L.M., Fry, D., Rissel, C., Dirkis, H., Balafas, A., Merom, D., 2008. Factors associated with children being driven to school: implications for walk to school programs. Health Educ. Res. 23 (2), 325–334. http://dx.doi.org/10.1093/her/cym043.

Wittenberg, R., Wintergerst, I., Passenberger, J., Büschges, B., 1987. Straßenverkehrsbeteiligung von Kindern und Jugendlichen. Bericht der Bundesanstalt für Straßenwesen, Bergisch Gladbach.

Yarlagadda, A.K., Srinivasan, S., 2008. Modeling children's school travel mode and parental escort decisions. Transportation 35, 201–218.

Zimmer, R., 2003. Zu wenig Bewegung – zu viel Gewicht. In: Deutsche Liga für das Kind. Frühe Kindheit, Berlin, pp. 15–17.

Zwerts, E., Allaert, G., Janssens, D., Wets, G., Witlox, F., 2010. How children view their travel behaviour: a case study from Flanders (Belgium). J. Transp. Geogr. 18 (6), 702–710. http://dx.doi.org/10.1016/j.jtrangeo.2009.10.002.