Travel Behaviour and Society 16 (2019) 118–130

Contents lists available at ScienceDirect

Travel Behaviour and Society

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

Exploring children's school travel, psychological well-being, and travel-related attitudes: Evidence from primary and secondary school children in Vienna, Austria

Juliane Stark[a,*], Patrick A. Singleton[b], Tina Uhlmann[a]

[a] University of Natural Resources and Life Sciences, Department of Landscape, Spatial and Infrastructure Sciences, Institute for Transport Studies, Peter Jordan St. 82, 1190 Vienna, Austria

[b] Utah State University, Department of Civil and Environmental Engineering, 4110 Old Main Hill, Logan, UT 84322-4110, United States

ARTICLE INFO

Keywords:
Children
Mode choice
Attitudes
Psychological well-being
School travel

ABSTRACT

In line with global trends of declining physical activity and growing obesity, children's school travel nowadays is often characterized by being driven to school instead of walking and cycling. In order to counter these trends one needs to understand children's travel behavior and mobility needs. In that regard, one underexplored task is if and how transport modes relate to children's well-being. This study aims to evaluate the connections between children's subjective psychological well-being, mode use and attitudes. A sample of children from three primary and two secondary schools in the City of Vienna reported their mood and alertness on and after school trips along with travel mode use, preferences, and attitudes. The results showed that children's psychological well-being was related to the travel modes they used and their preferences and attitudes towards those modes. The association between mode use and PWB was positive for active travel but weak. Age differences were also apparent – younger children preferred active travel modes for school and leisure trips, while older children had more positive attitudes and stronger preferences for car use – foreshadowing potential travel behavior changes as children approach young adulthood and become more independent.

1. Introduction

Declining rates of physical activity are reported all over the world. Recent analyses across 168 countries show that the prevalence of insufficient physical activity has increased in high-income countries (Guthold et al., 2018). Members of young age groups especially get too little exercise. According to World Health Organization (WHO), 83% of pupils in Austria do not fulfil the recommendations on health-preserving physical activity for children and adolescents (Maier et al., 2017). This is in line with global estimates based on figures in 2010 indicating that 81% of adolescents (aged 11–17 years) do not meet the WHO recommendations on physical activity for health (WHO, 2018). With increasing age, the children become even less active (Ramelow et al., 2015; Riddoch et al., 2004): Young people aged 14–19 spend most of the day (70%) sitting and lying (Knechtsberger and Schwabl, 2016). Similar trends are also reflected in increasingly sedentary travel patterns: The share of walking trips of Austrian pupils decreased significantly from 35% to 25% between 1995 and 2014, while they are being driven by car more often (from 17% of their trips to 25%) (Tomschy et al., 2016). With these developments, it could be related that only 35% of Austrian young people report no physical complaints (Knechtsberger and Schwabl, 2016).

Low physical activity (PA) rates in connection with everyday mobility likely have negative consequences for children's psychological and social well-being in addition to their physical health, yet the mechanisms behind these relationships have not been sufficiently explored. Research on adults suggests that active mode travelers (those going by foot and bicycle) tend to be happier and more satisfied with their transportation situation (De Vos et al., 2013); although, this could be due in part to self-selection of these modes by more active people with positive attitudes (modal consonance) (De Vos, 2019). Results tend to be similarly positive for children and young adults (Waygood et al., 2017). As just one dimension of children's overall well-being and happiness, travel well-being likely influences children's overall life satisfaction (Waygood et al., 2018) and may even contribute towards attentiveness in school and educational performance (Westman et al., 2017). Thus, not only are positive experiences during a trip of interest, but also the association of active travel and children's emotions during

* Corresponding author.
E-mail address: juliane.stark@boku.ac.at (J. Stark).

https://doi.org/10.1016/j.tbs.2019.05.001
Received 28 November 2018; Received in revised form 1 May 2019; Accepted 2 May 2019
Available online 14 May 2019

the day. Evidence of such benefits from active travel may help to convince parents to promote active travel throughout childhood and early adulthood.

Beyond the impacts on children's health and well-being, life satisfaction, and cognitive performance, low levels of active travel during childhood may have important consequences for the formation of mode-specific attitudes and sustainable mode use later in the life course. This is consistent with a travel socialization perspective in which attitudes towards particular travel modes have social influences that originate during childhood (Baslington, 2008). Children reared in an environment where walking and bicycling to school are outside the norm may develop more negative attitudes towards active travel or at least be less likely to consider these modes for transportation purposes in the future. Through negative reinforcement and habit, such children may be more likely to adopt positive attitudes towards car use and seek out opportunities to drive when the option arises in young adulthood. Overall, the potential negative environmental consequences of an auto-oriented childhood may be large when viewed from the perspective of an entire life course. Yet, again, the complex relationships between travel attitudes, behaviors, and well-being – especially during the early life course – demand additional research for greater understanding.

The purpose of this paper is to explore these relationships between children's well-being and transport/travel attitudes and behaviors, a topic that is underdeveloped in research literature (Waygood et al., 2015, 2017). As we subsequently discuss in Section 2, these relationships are multifaceted, and – at present – there is insufficient evidence to ascertain directions of causality for children. Therefore, our exploratory study is based on the hypothesis that active travel on school trips and positive attitudes towards used travel modes are positively associated with indicators of children's well-being. We also wish to explore age (and gender) differences in these relationships.

In this paper, we analyze the results of in-class surveys with children from three primary and two secondary schools in the City of Vienna (Austria). Children reported their mood and alertness at the time of travelling to school as well as during an early class, their travel mode use and preferences, and their attitudes towards attributes of travel modes. In this way, the surveys allow us to explore children's travel-related subjective psychological well-being and, in addition, how these indicators of well-being are related to mode use. Furthermore, in this context, the interconnection to children's mode-specific attitudes is explored, a topic which has not yet been analyzed thoroughly. Two age groups were involved, allowing us to analyze differences in travel well-being and attitudes between children of different ages (8–9 vs. 12–13).

The paper is structured as follows: Section 2 contains a brief literature review on children's psychological well-being; their travel-related behaviors, preferences, and attitudes; and connections between these concepts. Section 3 presents details about the study's method, including the survey approach and questionnaire design. The results of the descriptive-explorative data analysis are presented in Section 4. In Section 5, the paper closes with an interpretation and discussion of key findings, study limitations, and opportunities for future work.

2. Background

2.1. Children's psychological well-being

Many studies exist in the field of (health related) quality of life of children and adolescents (e.g. Bullinger, 2009; Bullinger and Ravens-Sieberer, 1995; Drotar, 1998; Ravens-Sieberer, 2000). Although there are multiple definitions and theories of quality of life – which cannot be discussed here – our focus is on the narrower concept of well-being from a subjective perspective (Schumacher et al., 2003; Schwenkmezger, 1994): *psychological well-being* (PWB). This can also be considered the mental/emotional state component of quality of life (Patrick and Erickson, 1988) or the psychological domain of children's well-being (Pollard and Lee, 2003).

Psychological (or subjective) well-being broadly encompasses affective states (emotions, mood, happiness, etc.) as well as more cognitive elements (satisfaction, fulfillment, etc.) (Becker, 1994; Diener, 1984, 2000). In-line with multifold concepts of well-being and quality of life, many different methods and questionnaires exist for measuring the multidimensional concept of PWB, for example: WHOQOL (WHOQOL-Group, 1994), ILK Rating questionnaire (Mattejat et al., 1998), EuroQOL (Kind, 1996); EORTC-questionnaire (Aaronson et al., 1996), Rosenberg self-esteem scale (Rosenberg, 1965), positive and negative affect scale (PANAS) (Watson et al., 1988), and scale of positive and negative experience (SPANE) (Diener et al., 2010). Those scales were developed outside the transportation context. Recently, questionnaires to measure PWB associated with travel have appeared, including the Satisfaction with Travel Scale (STS) (e.g. Ettema et al., 2011), the Travel Mood Scale (TMS) (Glasgow et al., 2018), and other measures of travel affect (Singleton, 2017).

Despite this abundance of measurement tools for the adult population, there is no standard method to assess well-being in children (Pollard and Lee, 2003). Given the particularities of this age group – shorter attention spans, lower reading abilities, and challenges understanding complex concepts (Henerson et al., 1987) – studies seeking to quantify children's self-reported well-being often use a small number of visual scales, such as emotional faces or emoticons, to increase comprehension and make the task more enjoyable (Andrews and Whitey, 1976; Wydra, 2014). In this study, we use a similar visual method to measure children's self-reported current and recent mood (affective PWB). (For an alternative approach using age-appropriate words in a transportation context, see the STS-Children (STS-C) (Westman et al., 2017).)

PWB is more richly viewed not in isolation. Indeed, the psychological domain of children's well-being can also affect and be affected by other dimensions of well-being (Pollard and Lee, 2003; Waygood et al., 2017), including the physical (e.g., health/safety indicators), economic (e.g., household resources), cognitive (e.g., concentration in school and academic achievement), and social (e.g., relationships with others) domains. In the language of Waygood et al. (2017), our study explores travel-related "intrinsic" influences on children's PWB, those occurring during or because of travel. In the next two subsections, we summarize the limited literature on associations between children's PWB, travel mode use (and preferences), and travel-related attitudes.

2.2. Children's PWB and mode use

A growing body of literature finds consistent associations between self-reported travel-related subjective/psychological well-being or satisfaction and specific travel modes, at least among adults. In general, walking and bicycling are rated more positively than car travel, which in turn is frequently rated more positively than travel by public transport (e.g., De Vos et al., 2013, 2016; Friman et al., 2013; Kemen, 2016; Martin et al., 2014; Smith, 2017; St-Louis et al., 2014; Singleton, 2018). (Such findings often persist even when controlling for travel time and personal characteristics.) These results make sense: traveling is an experiential activity (especially for a vehicle operator), and modes have intrinsic differences (public transport use requires sharing space with strangers[1]; walking and cycling occur outside and involve physical exertion).

For children, associations between travel mode and PWB appear to be similar in direction as for adults, but the relatively small number of studies means that "more effort is required to replicate findings" (Waygood et al., 2017, p. 37). In a recent integrative review, Waygood et al. (2017) found generally (but not categorically) positive associations between PWB and active modes (walking and cycling) – including

[1] This might be different for children who travel by public transport - as social interactions can be more important for children.

more positive experiences and lower stress from walking – and negative relations for travel by car.

Research articles published since that review find similar results that strengthen its findings. Primary school children in Hong Kong who walked were happier traveling home than those who used motorized modes (Leung and Loo, 2017). Similarly, primary school children in Quebec City rated bicycle and walking trips as better than car trips (Waygood and Cervesato, 2017). Ratings of PWB during the first school lesson of the day were also higher for children who used active modes and lower for public transport users than for car passengers among primary school students in Lower Austria (Stark et al., 2018). Among primary and secondary students in southwest Sweden, children who traveled to school by active modes or school bus had higher ratings of travel satisfaction and more positive moods in the morning than did children who traveled by car (although the differences for mood were not significant) (Westman et al., 2017). It seems that these consistent modal associations with PWB may persist throughout the life course.

2.3. Children's travel-related attitudes, modal preferences, and PWB

More so for children than for adults, mode use is not the same as mode choice: children's travel to school is strongly shaped by parental travel attitudes and behaviors, the built environment, and other complex institutional constraints including school and legal requirements (Mitra, 2013). Therefore, we cannot assume that the modes children use correspond to their own modal preferences. The scarce evidence that exists on this topic suggests that children's modal preferences may be shaped by fun or social factors (McDonald, 2005). Recent in-depth studies of children's travel suggest that they want to travel in ways that afford them independence (from adult supervision), exploration and informal play, and social engagement with their peers and the community (Babb et al., 2017; Depeau et al., 2017).

Children's modal preferences are likely directly shaped by their travel-related attitudes towards those modes; yet, again, research on children's travel attitudes is lacking. Several studies find connections between (especially parental but also students') travel-related attitudes and children's and teenagers' travel mode to school (e.g., Fitch et al., 2019; McDonald, 2012; Timperio et al., 2004; Thigpen, 2017). These findings are consistent with psychological attitude-behavior frameworks such as the theory of planned behavior (Ajzen, 1991).

Based on different frameworks relating attitudes to travel behaviors and well-being (e.g., De Vos and Witlox, 2017), the interaction of children's travel-related attitudes and preferences with their travel mode use is expected to influence children's PWB. If they are able to travel in ways they prefer, this consonance is expected to generate travel satisfaction and positive PWB; dissonance between children's modal preferences and uses is expected to generate lower levels of travel-related PWB (De Vos, 2018). Over time, cognitive dissonance theory (Festinger, 1957) anticipates that attitudes may evolve to better match behaviors, especially in situations such as where children's travel behaviors are constrained. In a study of teenagers in Stockholm, adolescents' attitudes towards car use and ownership were more positive for those in car-owning vs. car-free households (Sandqvist, 2002). Changes in travel attitudes as children age into adolescence and adulthood may also shape travel behaviors and PWB, yet longitudinal studies are rare. There is some evidence that adolescents have less positive attitudes towards car ownership than their parents (ibid.) and that younger generations (millennials) have less positive attitudes towards driver licensure (Thigpen, 2017).

2.4. Purpose of this study

The present study examines relations between children's mode use on school trips, attitudes and PWB. Given the complexity of these potential relationships and the relative lack of empirical evidence for children's travel, our study is exploratory in nature. Yet, it draws upon existing frameworks explaining relationships between adult travel behavior, well-being, and travel attitudes. In particular, De Vos and Witlox (2017) review literature on travel satisfaction – which is closely related to our focus, psychological well-being – and propose a conceptual framework (ibid., p. 369). The relevant parts of the conceptual framework suggest that both travel mode choice and travel-related attitudes influence trip satisfaction, which in turn affects satisfaction with the activity at the destination. Given that children and adolescents have less agency over their choices of travel modes, we would also include another element: consonance between mode use and modal preference. Consonance (dissonance) could have a positive (negative) link with travel well-being, either directly or indirectly by mediating the link with travel attitudes. Based on research on children's travel and well-being summarized above and on the De Vos and Witlox (2017) framework, we hypothesize that active travel on school trips and positive attitudes towards used travel modes are positively associated with indicators of children's well-being, and that these associations may be stronger for PWB of the journey to school than PWB when in class. We also expect that some of these relationships will be different for older and younger children, particularly around attitudes and preferences towards the car.

3. Methods

The study was part of an Austrian educational project (2016–2018) to foster cooperation between schools and research institutes, in order to interest children and adolescents in science and technology, research and development. Thus, the project was not primarily concerned with the relationships between travel behavior, PWB and attitudes; however, we collected some data during workshops in primary and secondary school children to assess their physical mobility preferences in general, attitudes towards travel modes and their subjective PWB related to school travel. The children's participation in the survey was secured by obtaining parents' written declarations of consent and information sheets. There was no case that parents did not gave permissions for their child's participation. All project activities took part in the presence of teachers and during lesson times while respecting break times to avoid limiting children's playtimes. The project activities were also supported by the relevant administrative school authorities as well as parents' associations and principals of the school involved.

3.1. Survey design and participants

As part of the introductory portion of the project, we conducted a mobility and attitude survey in November 2016 at five schools in the city of Vienna: three were primary schools, while the other two were secondary schools. The school locations were situated in the 21st district of Vienna, within a radius of about 6 km straight-line distance. Therefore, they were quite similar with regard to geographical setting and public transport supply: All of them had high quality tram and bus connections that fed the metro lines. One class per school took part in the surveys. At the time of the survey, the children of the primary schools were 8 to 9 years old (3rd grade), and the children in the secondary schools were 12 to 13 years old (7th grade) – the mean age was 9.9. In total, 129 children took part (44.2% female). Table 1 gives an overview of key figures of the surveys.

Each paper-and-pencil survey was carried out at the beginning of a workshop, which started in the first school lesson in the morning. The questionnaires were handed out in class. Children were asked to fill in the questionnaires and were made aware that their attendance is voluntary. It was also pointed out that this is no class test. Children were supervised while filling in the questionnaire by researchers and teachers. Although the children were quite used to fill in worksheets and were looking forward to filling in the questionnaire, we went through the questionnaire point for point conjointly. If some children turned out to need additional support, for example because of lower writing speed,

Table 1
Key figures of the surveys.

1	2	
Basic data …		
Period of data collection	November 2016	
Location	5 schools, City of Vienna	
Target groups	Primary school children	Secondary school children
N	83	46
Mean age	8.5	12.5
Survey design	Self-administered questionnaire with supervision, PAPI	
Content with regard to …		
… Mobility behavior	Frequency of mode choice (ST/LT), independent mobility (freedom of choice)	
… PWB	Subjective PWB (on the way, at time of reporting)	
… Attitudes	Attitudes related to travel modes, preferences (ST/LT)	
Other	Career aspiration, attitudes towards technical jobs, perception of the environment*	

Notes: * only sub-group (N = 26 secondary school children); PAPI – paper and pencil interview, PWB – psychological well-being, ST – school trip, LT – leisure trip.

sub-groups were formed with support by a researcher; this approach has proven very successful. This was only necessary for the primary school children. Considerable importance was attached to instructions on the scales used in the questionnaire. The self-completion questionnaire mainly dealt with the topics of travel behavior, mobility-related attitudes, the children's view of technical professions, and their ideas for the future. In the following, only relevant parts of the questionnaire are addressed.

3.2. Questionnaire

Teachers participated in the design process of the questionnaire to ensure its suitability for the two age groups in this study. We used pictograms of travel modes, emoticons and simple wording. In addition, examples were provided on how to mark the answers correctly. To assure comparability, the same questionnaire was used for both age groups.

Firstly, children stated the travel mode used for their way to school in the morning on the reporting date. Then, children reported their subjective well-being – actual and experienced while travelling – using a 5-point scale with mood icons following the approach from Westman et al. (2013). In doing so, children reported (i) their affective state[2] on their way to school this morning (t_1) [*very good mood, good mood, average, bad mood, very bad mood*] as well as (ii) their experienced alertness [*very chipper, chipper, average, tired, very tired*]. Then, children reported their current (in class) (t_2) subjective well-being using the same questions and icons. In contrast to Westman et al. (2013), we used very expressive mood icons and a keyword for each icon (Fig. 1) because, in a pre-test with a small group of children, children preferred to have one keyword per smiley instead of a lonely description of endpoints. They reported to look at the "text" or "text and icons", but not only at the icons. They also preferred to have a visual accentuation of the lines (instead of columns and lines).

To get an impression of the children's general travel behavior, children also reported the frequency of travel mode use on school and leisure trips[3] [*(nearly) always, frequently, sometimes, (nearly) never*] for each given travel mode [*car passenger, bus/train, scooter, bicycle, walking*]. Further, their individual preferences of travel modes on school trips and leisure trips were surveyed. Their attitudes with regard to the given travel modes were assessed using a 4-point scale with smileys and a keyword. We included several different content-related dimensions of travel mode attitudes based on the assumption that overall attitudes towards travel modes are determined by subjective evaluations of attributes associated with the travel modes:

- Image [*really cool, good, average, uncool*],
- Health [*very healthy, healthy, unhealthy, very unhealthy*],
- Effects on the environment [*very environmentally friendly, environmentally friendly, environmentally unfriendly, very environmentally unfriendly*],
- Social aspects – possibility to converse with others [*very good, good, bad, very bad*], and
- Safety [*very safe, safe, unsafe, very unsafe*] without any further specifications with regard to traffic safety and personal security.

In that sense, we collected subjective evaluations only excluding the subjective belief-values (strength or importance of these associations), because respondents often intuitively assign high value in self-reports of belief-expectancies (see e.g., French and Hankins, 2003; Chan et al. 2015).

Further questions referred to the children's perception of the environment, their freedom on mode choice and not transport-related questions and are not described here. As outlined before, the survey described here was not the main topic of the project. Therefore, except for gender and age group, household characteristics and other determinants of mode choice are not included in the following analysis due to lack of data.

3.3. Data analysis

The data collected were analyzed using descriptive methods. Bivariate relationships between children's well-being, travel mode use, and related attitudes were used to examine the self-reported data. As it is also important to understand whether there are gender or age differences in everyday experiences, group comparisons between the two age groups and boys and girls were conducted. As the sample size is quite low for some of the analyzes and unbalanced for the two age groups, interpretations are always in regard to the project and the studied target group.

4. Results

The results of the descriptive-exploratory analyses of mode choice and preferences, psychological well-being, and travel-related attitudes are described in the following subsections.

4.1. Modal split and preferences

The first column in each section of Fig. 2 shows the modal split for trips to school (ST) on the reported date by age group ("ST used"). In the Figure, the sum of shares of active travel modes (walking, scooter, cycling) is provided on the top of each bar. Due to small sample sizes, we had to aggregate the use of scooter (1.6%), bicycle (0.8%) and walking (33.1%) into one category (active travel). The bicycle seems to be not important for school trips. In terms of leisure trips, the reported general frequency of mode use reveals that the bicycle is more relevant but still on low level (Table A-2). The low share of bicycle trips stems most probably from: (i) the time of the survey (November), (ii) the good supply of public transport at the school locations, and (iii) the high share of primary school children in the sample (in Austria, children are not allowed to go by bicycle on their own before the age of 12 or 9 if they pass a cycling exam).

Overall, the results reveal a high share of public transport (42.6%) on school trips, followed by the use of active travel modes (35.4%) and

[2] A distinction between "mood" and "emotion" is not made here. Following the definition that emotions are "specific states generated in reaction to certain events or appraisals" (Stuart and Biddle, 2008, p.166), our questions at t_1 may be more about emotions during travel, while our questions at t_2 may be more about mood at school. Both could be affected by travel.

[3] The analogous translation of the questions was "How often do you use the following travel modes on your school / leisure trips?".

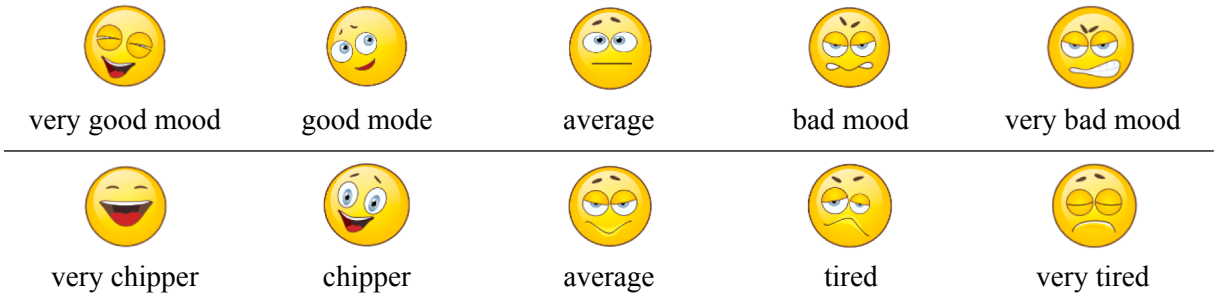

Fig. 1. Mood icons for affective state (top) and alertness (bottom).

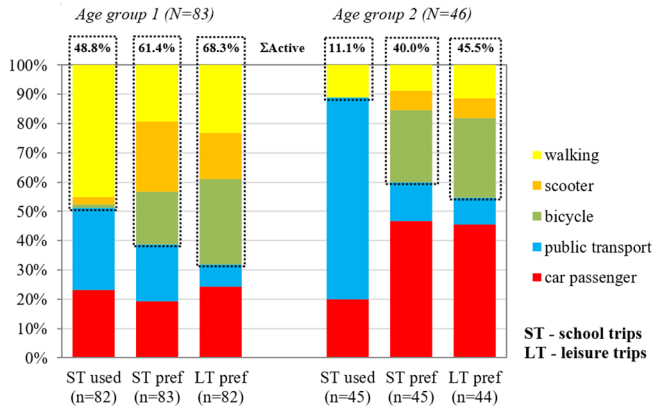

Fig. 2. Modal split based on (i) travel modes used on the reported day for the trip to school (ST used), (ii) travel modes preferred for school trips (ST pref) and (iii) for leisure trips (LT pref), dependent on age group (age group 1 – primary school children; age group 2 – secondary school children), absolute numbers see Table A-3.

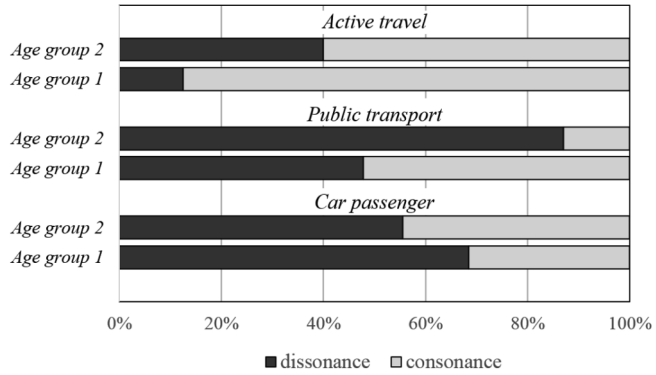

Fig. 3. Consonance and dissonance of mode use for school travel (actual versus preferred), by age group (age group 1 – primary school children; age group 2 – secondary school children).

car use as a passenger (22.0%). We also checked "today's travel mode use" against the reported general frequency of travel mode use on school trips and found high confirmation rates (75% to 100% under consideration of the answers "(nearly) always or frequent" use). This means that the self-reported mode choice seems to be plausible for the children's general school travel.

Whereas no significant differences in terms of gender or school site were found, age did matter: older children (age group 2) used public transport more often than younger children (age group 1) did – at the expense of active travel modes (mainly walking) ($\chi 2(2) = 23.166$, $p = 0.000$). Presumably, this is because secondary school children had longer average trip distances (2.1 km) than primary school children (1.5 km). The share of car use as a passenger is quite similar for the two age groups. In the sample, as expected, longer trip distances enhance car use. Although the share of active travel is not very high in age group 2 (11.1%), we did not exclude these children from the analysis. However, this should be considered in the interpretation of the results.

An analysis of children's modal *preferences* for school trips ("ST pref") and leisure trips ("LT pref") (the last two columns in each section in Fig. 2) showed that – independent from age – the share of active travel modes could be much higher than the actual modal split. For young children, the active travel mode share increases from 48.8% (used on school trips) up to 68.3% (preferred) on leisure trips; most of this shift comes at the expense of public transport. Older children would also prefer to travel actively (11.1% reported, 40.0–45.5% preferred) but also seem to have a high affinity for car use (~45%).

An individual-based analysis revealed 49.6% dissonance between reported and preferred travel modes on school trips if a "shift" within active travel modes (for example scooter used, bicycle preferred) is neglected. Dissonance was much lower among younger children (35.4%) than among older ones (75.6%). For both age groups, the highest rate of consonance is within the active travel modes (Fig. 3).

During the survey, it was evident that primary school children had difficulties to commit themselves to one preferred travel mode, particularly when it comes to leisure trips. It seemed that they kept their real decision making processes in sight. Thus, they often wanted to report their "first, second and third" favorite travel mode. This was also reflected in the data: It is notable that younger children wanted to switch within active travel modes (almost exclusively from walking to bicycle or from walking to scooter). This did not apply to the older ones whose desired modal shift on school trips primarily concerns public transport to car or to bicycle in case of dissonance.

4.2. Psychological well-being

The items of psychological well-being (PWB) were encoded by using higher values for better well-being: Thus, positive endpoints (very good mood/very chipper) refer to 5 and negative endpoints (very bad mood/very tired) to 1. Table 2 gives an overview of the subjective well-being

Table 2
Mean values of indicators of affective state and alertness, five-point scale (1 – very bad mood/very tired to 5 – very good mood/very chipper).

1 PWB	2 Time	3 All (N = 129)	4 Age group 1 (N = 83)	5 Age group 2 (N = 46)	6 p-value[1]
AF	t_1	3.82	3.96	3.54	0.016
AF	t_2	4.07	4.14	3.95	0.115
AL	t_1	3.18	3.40	2.77	0.014
AL	t_2	3.49	3.46	3.56	0.618

Note: AF – Affective state, AL – Alertness, t_1 – on the way to school, t_2 – time of reporting. Age group 1 – primary school children; age group 2 – secondary school children.

[1] Asymp. significance (2-tailed), sign. level 0.05 sign. level Bonferroni corrected 0.025; Mann-Whitney-*U* test,

showing average positive levels in terms of affective state (AF) and average assessments in terms of alertness (AL). According to the children's self-reports, PWB-levels were rated higher at the moment of completion of the questionnaire (t_2) than earlier on the way to school (t_1). As outlined in chapter 3.2 the affective state as well as alertness were surveyed for two points in time.

We tested for differences in gender and age group using Mann-Whitney-U-tests and a Bonferroni-corrected significance level based on $\alpha_{corr} = 0.1/m$ where m is the number of null hypotheses. Whereas no relationship with regard to gender was found, the two age groups showed differences: Overall, younger children (age group 1) felt significantly better on their way to school than the older ones (age group 2) ($U = 1{,}252.500, z = -2.398, p = .016 < \alpha_{corr} = 0.025$ for affective state; $U = 1{,}336.5$, $z = -2.450$, $p = .014 < \alpha_{corr} = 0.025$ for alertness). However, the effect size for both variables corresponds to a weak effect ($r = 0.22$) according to Cohen (1992). There also seems to be a weak association of consonance vs. dissonance of mode use with PWB: In case of consonance (travel mode used on the school trips corresponds to the preferred travel mode), children had a significantly higher well-being ($U = 1{,}568.000$, $z = -2.039$, $p = .041 < \alpha_{corr} = 0.025$, $r = 0.18$), particularly for feelings of alertness ($U = 1{,}469.500$, $z = -2.440$, $p = .015 < \alpha_{corr} = 0.025$, $r = 0.22$). No association with home-to-school distances could be found.

4.3. Travel modes used on school trips and children's well-being

Next, we related PWB-assessments to the travel mode children used in the morning (Table A-1). Although, in general, active travelers in the morning had higher assessments of subjective PWB than those who traveled by car, no significant modal differences could be verified.

Correlations among indicators of affective state and alertness at different times (on the way to school vs. at the time of reporting) are displayed in Table A-2 (columns 4–6). PWB indicators regarding the school trip were moderately correlated with the same indicators measured during class. Being in a good mood does not, however, automatically mean that children feel attentive and awake. Although there is a tendency of a coherence between active travel and well-being – especially when children were on their way to school – the tests did not reveal any significant correlation.

Test of gender differences show a medium association: girls were significant happier $p < 0.05$ on their way (AF_{t1}) than boys when they travelled by car (Mann-Whitney-U test: $U = 48.500$, $p = .038$, $r = 0.41$) (Table A-4); based on Bonferroni correction of the significance level ($\alpha_{corr} = 0.025$), the result is insignificant. No significant differences with regard to affective state or alertness were observed in terms of gender, age group or consonance. Sample sizes are, however, low. These findings contrast with results from Westman et al. (2013) in Sweden who found that girls who travelled by car reported a lower degree of activation during travel than boys; this did not refer to valence.

4.4. Travel-related attitudes and well-being

Attitudes towards travel modes may have an influence on the perception of well-being on the way to school.[4] They may trigger emotions associated with travelling. From our point of view, a positive attitude towards a travel mode could also be the consequence of positive evaluated travel experiences (over time) expressed in high levels of PWB (reverse relationships). However, one could also argue that our indicators of well-being and attitudes are very similar. Nevertheless, we understand that they can mutually influence each other, and that attitudes towards objects or events refer to more stable subjective evaluations than current mental states like emotions do (Scherer, 2005). Although the distinction between the two PWB-indicators and attitudes towards travel modes is somewhat fuzzy, we analyzed their interaction.

In a first step, a descriptive analysis was conducted for children's attitudes towards different travel modes. From the results it emerged that they assessed walking as a very healthy, environmentally friendly mode which offers good possibilities for conversation. Overall, bicycling/scooter also ranked high on environmental friendliness and health but slightly lower on conversation. Travel by car scored higher than other modes in terms of image, but car and public transport had low ratings for health and the environment. Taking the mean of all five attitudes and comparing across modes (Table A-4), walking was rated highest, followed by bicycle/scooter, car, and public transport. Younger children rated cycling, scooter and public transport higher than older ones. However, significant differences can only be found for scooter (Mann-Whitney-*U*-Test: $U = 1{,}371.000$, $z = -2.659$, $p = .008 < \alpha_{corr} = 0.025$). Some gender differences were found based on analyses of the whole sample: males rated cycling and walking higher (Mann-Whitney-U-Test for cycling: $U = 1452.000$, $p = .006 < \alpha_{corr} = 0.025$; effect size $r = 0.24$; Walking: $U = 1535.500$, $p = .019$; effect size $r = 0.21$). The effect sizes, however, can be considered rather low for both cases (Cohen, 1992).

We found significant age group differences in individual mode-specific attitudes (Fig. 4, Table A-2). Bicycles and scooters were less-frequently seen as "cool" or "good for conversation" by older children as compared to younger children. Older children also rated cars and public transport modes much more critically than younger children on the health and environment dimensions. Bicycling and walking were perceived as slightly healthier and more environmentally friendly (respectively) among older children.

In a second step, the average scores over all travel-related attitude dimensions – segmented by travel mode – were put in relation to the indicators of well-being. We formed two groups of children: those who travelled by car as a passenger in the morning at the reporting date, and those who travelled actively (on foot or by bicycle/scooter). In the results regarding car passengers (Table A-6), the Spearman correlation between affective state on the way (t_1) and attitude towards car was 0.37, $p = .050$ (t_2: $r_S = 0.37$, $p = .061$); the relationship with attitude toward public transport was also significant and positive. No significant positive association between alertness and car-attitude was found. In terms of active travel (mainly walking) (Table A-7), the bivariate correlation between affective state on the way (t_1) and attitudes towards walking was significant and positive ($r_S = 0.36$, $p = .018$; for t_2: $r_S = 0.15$, $p = .331$). This correlation increases if only children are selected who are consistent within chosen and preferred travel mode ($r_S = 0.40$, $p = .013$; for t_2: $r_S = 0.20$, $p = .252$). Positive correlations towards arousal $r_S = 0.27$ and 0.26 (t_1 and t_2) were also found, but these were marginally outside the level of significance. Consonance did not matter in this case.

It should be noted, when the detailed attitudinal dimensions towards walking were considered in relation to well-being (results not shown), the "coolness" of walking showed highly significant positive correlations with PWB indicators, in particular with alertness. Children rating the social component of walking highly were in a better mood but not more alert. Of course, due to a small sample size these results should be interpreted with caution.

5. Summary and discussion

In this study, we explored a relatively uncharted field of research about the relationships between children's psychological well-being, travel behavior (mode use and preferences), and mode-specific attitudes. In general, our results confirmed the hypothesized positive associations – based on the framework from De Vos and Witlox (2017) –

[4] Of course, especially, as children do not have the same degree of freedom to choose travel modes compared with adults, their attitudes are highly influenced by their parents, teachers or other reference persons. For older children, peer-group influences become more and more important (Bastian, 2010).

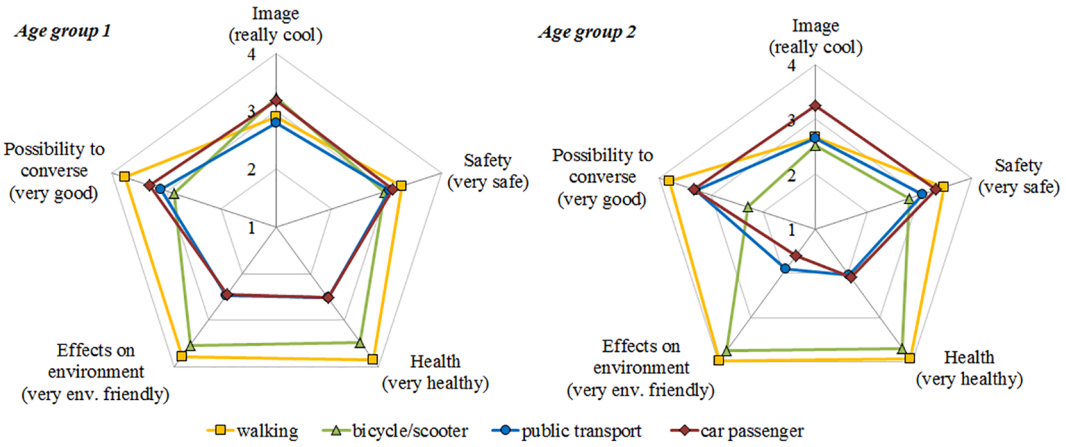

Fig. 4. Children's travel-related attitudes by age group, N = 129.

between active travel and PWB and between travel attitudes and PWB. We also examined gender and age differences amidst these relationships and tried to explore the impact of dissonance/consonance of mode use and preference. Our descriptive-exploratory analyses relied upon self-report questionnaires administered to over 100 primary and secondary school children in the City of Vienna. Psychological well-being for the trip to school and while in class were measured using five-point scales with facial mood icons asking about mood (overall affective state) and alertness, while mode-specific attitudes along five dimensions were measured using four-point scales. As we summarize and interpret in the following paragraphs, our study generated relevant findings that offer contributions to research in several areas, including understanding travel-related influences on children's psychological well-being and reasons for evolving travel mode preferences and attitudes as children age towards adulthood.

This study supports our hypothesis of a relationship between travel mode and well-being among children. As expected, active mode users had slightly more positive moods during the trip to school and when in class, but the difference was not statistically significant. Taken alongside previous evidence in the literature (e.g., Leung and Loo, 2017; Stark et al., 2018; Waygood et al., 2017; Westman et al., 2017), these results suggest that travel might affect children's well-being and that physically-active travel may help to generate more positive affect, although perhaps modestly so. Given a larger sample size, our study may have had the power to make the relationships we found more statistically significant.

We also found evidence that children's travel-related attitudes and modal preferences are also connected to their sensations of well-being, particularly for children's moods on the way to school. (Similar but less significant tendencies were observed for children's post-travel, in-class affective state.) Car users' overall attitudes towards the car (and public transport) were positively associated with mood on the way to school; similarly, overall attitudes towards walking for active mode users (who mostly walked to school) were also positively associated with affective states for the school trip. In this regard, (consonant) children who used their preferred travel mode had an even stronger relationship between walking attitudes and affective state. Looking at walking attitudes and PWB in more detail, alertness was positively associated with image ("coolness"), while mood was positively associated with the ability to converse. Also, younger children had more positive affective states and were more alert than older children on the way to school, but there were no age differences for PWB indicators when measured in class. This result could potentially be explained by a greater attitude-behavior gap for older children: they were less likely to have used their preferred mode to school. The cognitive dissonance (Festinger, 1957) between preferred and used travel mode may have led to reduced well-being (De Vos, 2018). Overall, it appears that travel mode attitudes (and gaps between modal preferences and use) are positively (and negatively) associated with the well-being of children, as anticipated. However, as these are correlational data, results should be interpreted very cautiously; no detailed conclusions can be drawn about the causality between these variables.

By surveying and comparing children at two stages in their pre-adult life course (younger children in primary school (3rd grade, ages 8–9) vs. older children in secondary school (7th grade, ages 12–13), we were able to highlight important changes in modal preferences that could foreshadow travel behaviors during young adulthood. Compared to younger children, there was much greater (nearly double) interest in the car and a much smaller (less than half) interest in the scooter and a slightly smaller interest in walking for older children; preferences for bicycling and the small preference for public transport stayed roughly the same. This corresponds to findings from Flade and Limbourg (1997), who state that children's orientation towards the car seems to intensify with ongoing age. These age differences in modal preferences show an increasing affinity for car use as children age towards adulthood. As children gain life experience and move into adolescence, there seems to be a growing interest in perhaps more comfortable and serious "adult" modes like the car and a declining interest in more fun "child-like" modes such as the scooter and walking. Once given more autonomy over their own mode choices, the future young adults in our study may abandon more healthy and sustainable mode choices (walking, public transport) for cars.

Although for many children mode use may not be much of a "choice" – and is perhaps more a reflection of parental and institutional preferences and constraints – a comparison between the modes used and the modes preferred to be used for school trips suggests a widening gap as children age. If all children in our study could travel by their preferred modes, then there would be more bicycle use among younger and older children. (These preferences are in line with other studies on this age group (e.g., Zwerts et al., 2010)). This discrepancy could reflect constraints imposed by the longer trips to secondary school locations; however, on average trips are not that much longer (0.6 km or 40%) than for primary school and still within a reasonable bicycling distance (2.1 km), which suggests that other barriers to bicycling (e.g., infrastructure, ability to converse, image) are at play. Also, we have already discussed how this increased travel mode dissonance could be a cause of reduced levels of PWB for older children. According to Festinger's (1957) cognitive dissonance theory, one way that people try to reduce the discomfort (low PWB) resulting from a discrepancy between an attitude and a related behavior is by changing the attitude to fit the behavior. Thus, an inability to bicycle may lead (over time) to more negative attitudes towards bicycling, which was the case for two of the attitude dimensions in our study.

Our investigation into travel-related attitudes towards specific

modes reveals potential explanations for these shifting modal preferences as children grow older. Overall, attitudes towards active modes (walking, then bicycle/scooter) were more positive than for car and especially than for public transport. In particular, younger children rated cycling, scooter and public transport more positive. A deeper look into the mode-specific attitude dimensions revealed the following significant age differences: Specifically, older children viewed the bicycle and scooter as being not as "cool" nor as good for conversation as did younger children. Whereas the image of all modes were rated roughly equal among younger children, the car stood out as the most "cool" mode among older children. (This parallels the trend of increasing modal preference for car use with higher age.) Perhaps this increasing affinity for the car reflects a growing concern for image and social status as children age, or perhaps older children are seeking validation of their maturity in forms of mobility that are only attainable at a later life stage. At the same time, older children demonstrated a significantly improved ability to understand the health and environmental impacts of different travel modes, rating bicycling and walking slightly higher and both public transport and especially cars as much lower on these attributes. With greater knowledge and experience, older children appear to be more aware of the negative health and environmental impacts of motor vehicle travel.

Overall, our results paint a picture in which children's psychological well-being is associated with the travel modes they use, their attitudes towards those modes, and the interaction of modal attitudes and usage. Any discrepancies between the modes children want to and can use could also lead to the formation of more negative mode-specific attitudes, potentially affecting future mode use. However, these relationships are complex and directions of effect may not be clear (De Vos, 2019). Due to the small sample and cross-sectional nature of our study, we are unable to definitively conclude about directions of causality between children's psychological well-being, their travel-related attitudes, and their travel mode preferences and behaviors. Our results should be interpreted cautiously and in relation to other research on these topics.

Nevertheless, our study's findings inform policies aimed at increasing children's physical activity and use of sustainable modes as they age into young adulthood. Overall, results suggest that the preteen/early-teen years are a formative period for the development of pro-car preferences and attitudes among children and young adults. While these trends are somewhat discouraging for sustainable travel, they also highlight opportunities for interventions. Even among older children, some attitudes towards and preferences for bicycling remain high, but constraints limit children's ability to cycle to school. Comprehensive bicycle promotion programs and efforts (Pucher and Buehler, 2008) in primary school could unlock the latent demand for cycling, helping to increase bicycle mode shares to school, maintain attitudes towards bicycling, and create a culture in which cycling to school is normal and bicycle social norms are supported into young adulthood and even beyond. (However, such efforts may have to make bicycling seem "cool" to older children without appearing to explicitly do so.) Another opportunity is to take advantage of older children's increased knowledge of the health and environmental consequences of various modes. Perhaps strategies designed to appeal to some children's and young adults' desires to help other people and improve the world could generate stronger intrinsic motivations for walking and bicycling, which are more effective at sustaining behavior changes than extrinsic motivations (Ryan and Deci, 2000). These strategies are consistent with a travel socialization perspective in which travel mode attitudes (such as towards the car) originate in childhood and can be addressed through social influences (Baslington, 2008).

5.1. Limitations and future work

There are some limitations of our study. First, most children did not use the bicycle, which would presumably be more "activating" than walking and therefore could lead to higher levels of well-being. Second, the study presented here focused on school trips only. Westman et al. (2013) found that children's experience of every-day travel varies depending on where they are going; experiences during the school journey tend elicit a lower degree of valence and alertness. Third, from a methodological point of view, it should be noted that the PWB assessments are partly based on retrospective reports, so there is a chance of memory distortion; although, the questionnaires were filled in the morning shortly after arriving at school. Fourth, our PWB indicators captured just a few dimensions of well-being (mood and alertness); additional dimensions (Friman et al., 2018) may have been able to paint a fuller picture of the various influences on children's well-being. Fifth, we would have preferred to use mobility and activity data in connection with well-being of the children based on one-day or multi-day travel diaries. Due to response burdens and a different focus of the embedding project, these surveys were not possible. Sixth, further variables with regard to the built environment, household characteristics (e.g. availability of vehicles), psychosocial factors such as parental concerns, and interrelations between parents' travel mode to work and parents' attitudes towards different travel modes were not included in the analysis due to a lack of data, although they may have an impact on the use of active travel modes (e.g., Deka, 2013; De Vos et al., 2013; Flade, 1994; Kalwitzki, 1994; Lopes et al., 2014; Stark et al., 2018). Seventh, our study utilized a relatively small sample of convenience in which the study of relationships between travel mode use, preference, and attitudes was not the primary focus. Research designed specifically for this purpose may be able to obtain a larger (and more balanced in terms of group size) sample, potentially increasing the power to detect significant associations and group differences. A larger sample size may also facilitate a more complex multivariate analysis – rather than the two- and three-way associations analyzed herein – that can account for multiple influences simultaneously. This would also allow drawing more general conclusions about the target groups.

The aspect of travel-related psychological well-being of children appears to be underrepresented within the larger context of research on benefits of active travel, especially given how widely this topic is studied elsewhere. Given the limitations of our current study expressed above, further research would help to direct how to integrate considerations of well-being into travel behavior and transportation planning models as well as in the evaluation of transport projects. As mentioned, our design did not allow for inferences of causality. Therefore, the bidirectional relationships between attitudes and PWB (and behavior and PWB) should be analyzed based on representative datasets to derive an overall conceptual framework. It would also be useful to gain a better understanding of the demarcation of attitudes and well-being. When it comes to convincing adults of the benefits of active mobility, it would be interesting to examine effects beyond PWB, including the cognitive educational performance of children. More practically, qualitative research on the efficacy of faces scales for (different dimensions of) children's well-being and the subjective interpretation of questions in this field would be very helpful for the design of future survey instruments. Also, further research with a larger heterogeneous sample – that should include non-school trips – may provide more information on gender and age-related impacts. Finally, longitudinal research following students as they progress through childhood and become young adults (and beyond) would be valuable for validating the causal frameworks posited by this and other articles.

It is hoped that the present analyses will also encourage researchers to find new pathways to understand the interrelations among travel behaviors, travel-related attitudes, and psychological well-being in children and young adults. In this context, a cooperation between different disciplines – e.g. mobility, psychology, and health – might be advantageous.

Acknowledgements

The study was carried out within the framework of an educational project (Talents Regional programme, FFG 854243) and was funded by the Austrian Ministry for Transport, Innovation and Technology. We thank all schools for the fruitful cooperation.

Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Appendix

Tables A-1–A-9

Table A-1
Mean values of indicators of affective state and alertness on the reporting day, by travel mode.

1 PWB	2 Time	3 car (N = 26–28)	4 public transport (N = 51–53)	5 active (N = 42–44)
AF	t_1	3.78	3.71	3.95
AF	t_2	2.82	3.13	3.43
AL	t_1	4.23	3.98	4.07
AL	t_2	3.29	3.65	3.41

Note: AF – Affective state, AL – Alertness, t_1 – on the way to school, t_2 – time of reporting.

Table A-2
Means, standard deviations, and correlation coefficients (Spearmans rho) of PWB indicators and relation of PWB indicators and travel mode used (Cramér's V), N = 127.

1 PWB	2 M	3 SD	4 AF_{t1}	5 AF_{t2}	6 AL_{t1}	7 TM	8 p-value[1]
AF_{t1}	3.82	1.15				0.227	0.125
AF_{t2}	4.07	0.89	0.61			0.188	0.381
AL_{t1}	3.18	1.38	0.37	0.27		0.210	0.201
AL_{t2}	3.49	1.22	0.37	0.48	0.69	0.248	0.057

Note: AF – Affective state, AL – Alertness, t_1 – on the way to school, t_2 – time of reporting, TM – travel mode on way to school.
[1] Approximate. Significance.

Table A-3
General frequency of mode use on school trips (ST) / leisure trips (LT) in [%], by age group.

1 Mode/Age group	2 (nearly) always ST/LT	3 Frequent ST/LT	4 Sometimes ST/LT	5 (nearly) never ST/LT
Car				
1 (N = 80)	26.3/41.5	5.0/13.4	23.8/15.9	45.0/29.3
2 (N = 45)	8.7/33.3	11.1/33.3	22.2/26.7	57.8/6.7
Public transport				
1 (N = 82)	30.5/20.3	2.4/10.1	11.0/34.2	56.1/35.4
2 (N = 45)	68.9/13.3	13.3/37.8	6.7/35.6	11.1/13.3
Bicycle				
1 (N = 77)	0.0/12.8	1.3/11.5	9.1/26.9	89.6/48.7
2 (N = 45)	4.4/6.7	2.2/17.8	17.8/33.3	75.6/42.2
Scooter				
1 (N = 78)	10.3/17.7	3.8/7.6	14.1/29.1	71.8/45.6
2 (N = 45)	0.0/4.4	0.0/4.4	11.1/22.2	88.9/68.9
Walking				
1 (N = 81)	48.1/37.0	1.2/14.8	23.5/28.4	27.2/19.8
2 (N = 45)	17.8/17.8	8.9/48.9	20.0/20.0	53.3/13.3

Note: Age group 1 – primary school children (N = 83); age group 2 – secondary school children (N = 46).

Table A-4
Frequencies of mode choice, by gender and age group.

1	2		3	
Travel mode	Age group 1 (N = 83)		Age group 2 (N = 46)	
	Female	Male	Female	Male
ST used	32	50	23	22
Car	8	11	6	3
Public transport	9	14	13	18
Bicycle	1	0	0	0
Scooter	0	2	0	0
Walking	14	23	4	1
ST preferred	33	50	23	22
Car	8	8	11	10
Public transport	5	11	5	1
Bicycle	9	6	3	8
Scooter	7	13	2	1
Walking	4	12	2	2
LT preferred	32	50	22	22
Car	11	9	10	10
Public transport	1	5	3	1
Bicycle	11	13	5	7
Scooter	4	9	3	0
Walking	5	14	1	4

Note: ST – school trips, LT – leisure trips; Age group 1 – primary school children; age group 2 – secondary school children.

Table A-5
Means of PWB indicators by gender and travel mode.

1 PWB	2 Time	3 Car (female/male)	4 p-value[1]	5 Pt (female/male)	6 p-value[1]	7 Active (female/male)	8 p-value[1]
AF	t_1	4.214/3.308	0.038	3.895/3.594	0.434	4.167/3.808	0.333
AF	t_2	4.462/4.000	0.223	4.191/3.844	0.263	4.158/4.000	0.526
AL	t_1	3.000/2.643	0.482	3.000/3.219	0.558	3.263/3.560	0.490
AL	t_2	3.357/3.214	0.667	3.737/3.594	0.663	3.278/3.500	0.532

Note: AF – Affective state, AL – Alertness, t_1 – on the way to school, t_2 – time of reporting.
[1] Asymp. significance (2-tailed), sign. level 0.05, sign. level Bonferroni corrected 0.025; Mann-Whitney-*U* test.

Table A-6
Means of five attitudes, by travel mode, gender, and age group.

1	2	3	4	5	6
	car	public transport	walking	bicycle	scooter
All (N = 128)	2.85	2.72	3.53	3.19	3.10
Gender					
Female (N = 56)	2.87	2.81	3.46	3.03	3.00
Male (N = 72)	2.83	2.65	3.59	3.31	3.17
Age group					
1 (N = 83)	2.92	2.79	3.51	3.23	3.19
2 (N = 45)	2.72	2.59	3.57	3.10	2.92

Note: Age group 1 – primary school children; age group 2 – secondary school children.

Table A-7
Mann-Whitney U tests of travel-related attitudes by age group (only significant results displayed).

1 Variable	2 Age group	3 N	4 Mean rank	5 Sum of ranks	6 Mann-Whitney U	7 Z	8 Asymp. Sig. (2-tailed)
Image - bicycle	1	81	57.17	4630.50	1309.500	−2.662	0.008
	2	44	73.74	3244.50			
	total	125					
Image - scooter	1	81	52.28	4234.50	913.500	−4.820	0.000
	2	45	83.70	3766.50			
	total	126					
Health - car	1	82	58.98	4836.50	1433.500	−2.193	0.028
	2	45	73.14	3291.50			
	total	127					
Health - PT	1	83	58.71	4873.00	1387.000	−2.539	0.011
	2	45	75.18	3383.00			
	total	128					
Health - bicycle	1	83	68.30	5669.00	1552.000	−2.018	0.044
	2	45	57.49	2587.00			
	total	128					
Environment - car	1	82	54.70	4485.00	1082.000	−4.059	0.000
	2	45	80.96	3643.00			
	total	127					
Environment - PT	1	82	56.78	4656.00	1253.000	−3.223	0.001
	2	45	77.16	3472.00			
	total	127					
Environment - walking	1	82	66.82	5479.50	1613.500	−2.219	0.026
	2	45	58.86	2648.50			
	total	127					
Conversation - bicycle	1	81	56.31	4561.00	1240.000	−3.081	0.002
	2	45	76.44	3440.00			
	total	126					
Conversation -scooter	1	83	58.16	4827.00	1341.000	−2.731	0.006
	2	45	76.20	3429.00			
	total	128					

Note: Age group 1 – primary school children; age group 2 – secondary school children.

Table A-8
Bivariate correlations between PWB indicators and mean modal attitudes for children who travelled to school by car (N = 26–28).

1 PWB	2 Time	3 Att-Car	4 Att-Pt	5 Att-Bic	6 Att-Sco	7 Att-Wal
AF	t_1	0.370*	0.457*	−0.307	−0.234	−0.292
AF	t_2	0.373	0.377	−0.174	−0.047	−0.039
AL	t_1	0.184	0.285	−0.056	−0.112	−0.166
AL	t_2	0.088	0.142	−0.211	−0.098	−0.199

Note: AF – Affective state, AL – Alertness, t_1 – on the way to school, t_2 – time of reporting, Att – attitude towards travel mode (car as a passenger, public transport, bicycle, scooter, walking).

* Correlation (Spearman's rho) is significant at the 0.05 level (2-tailed).

Table A-9
Bivariate correlations between PWB indicators and mean modal attitudes for children who traveled to school actively (walk, bicycle, scooter) (N = 41–44).

1 PWB	2 Time	3 Att-Car	4 Att-Pt	5 Att-Bic	6 Att-Sco	7 Att-Wal
AF	t_1	0.064	0.113	−0.001	0.161	0.355*
AF	t_2	−0.150	0.122	−0.057	0.068	0.154
AL	t_1	0.091	0.164	−0.139	0.005	0.265
AL	t_2	−0.014	0.153	−0.132	0.001	0.263

Note: AF – Affective state, AL – Alertness, t_1 – on the way to school, t_2 – time of reporting, Att – attitude towards travel mode (car as a passenger, public transport, bicycle, scooter, walking).

* . Correlation (Spearman's rho) is significant at the 0.05 level (2-tailed).

References

Aaronson, N.K., Cull, A.M., Kaasa, S., Sprangers, M.A.G., 1996. The European Organization for Research and Treatment of Cancer (EORTC) modular approach to quality of life assessment in oncology: An update. In: Spilker, B. (Ed.), Quality of life and Pharmaeconomics in Clinical Trials. Lippincott-Raven, Philadelphia, pp. 179–190.

Ajzen, I., 1991. The theory of planned behavior. Organ. Behav. Hum. Decis. Process. 50 (2), 179–211. https://doi.org/10.1016/0749-5978(91)90020-T.

Andrews, F.M., Withey, S.B., 1976. Social Indicators of Well-being. Americans Perceptions of Life Quality. Plenum, New York.

Babb, C., Olaru, D., Curtis, C., Robertson, D., 2017. Children's active travel, local activity spaces and wellbeing: a case study in Perth, WA. Travel Behav.Soc. 9, 81–94. https://doi.org/10.1016/j.tbs.2017.06.002.

Baslington, H., 2008. Travel socialization: a social theory of travel mode behavior. Int. J. Sustainable Transp. 2, 91–114. https://doi.org/10.1080/15568310601187193.

Bastian, T., 2010. Mobilitätsbezogene Einstellungen beim Übergang vom Kindes- ins

Jugendlichenalter. Querschnittliche Altersvergleiche bei 14- bis 16-Jährigen. [Mobility-related attitudes in the transition phase of childhood to adolescents. Cross-sectional age comparisons of 14 to 16-years old individuals.]. VS Verlag für Sozialwissenschaften, Wiesbaden.
Becker, P., 1994. Theoretische Grundlagen. [Theoretical principles.]. In: Abele, A., Becker, P. (Eds.), Wohlbefinden: Theorie - Empirie – Diagnostik [Well-being: Theory, empiricism, diagnosis.], second ed. Juventa, Weinheim, pp. 13–49.
Bullinger, M., 2009. Well-being in children and adolescents - The state of the art in research and conceptual background. Zeitschrift für Gesundheitspsychologie 17 (2), 50–55. https://doi.org/10.1026/0943-8149.17.2.50.
Bullinger, M., Ravens-Sieberer, U., 1995. Grundlagen, Methoden und Anwendungsgebiete der Lebensqualitätsforschung bei Kindern. [Basics, methods and areas of application of research on quality of life of children.]. Praxis der Kinderpsychologie und Kinderpsychiatrie 44, 391–398.
Chan, D.K.C., Hardcastle, S., Dimmock, J.A., Lentillon-Kaestner, V., Donovan, R.J., Burgin, M., Hagger, M.S., 2015. Modal salient belief and social cognitive variables of anti-doping behaviors in sport: Examining an extended model of the theory of planned behavior. Psychol. Sport Exercise 16, 164–174. https://doi.org/10.1016/j.psychsport.2014.03.002.
Cohen, J., 1992. A power primer. Psychol. Bull. 112, 155–159.
De Vos, J., 2018. Do people travel with their preferred travel mode? Analysing the extent of travel mode dissonance and its effect on travel satisfaction. Transp. Res. Part A: Policy Pract. 117, 261–274. https://doi.org/10.1016/j.tra.2018.08.034.
De Vos, J., 2019. Satisfaction-induced travel behaviour. Transp. Res. Part F: Traffic Psychol. Behav. 63, 12–21. https://doi.org/10.1016/j.trf.2019.03.001.
De Vos, J., Witlox, F., 2017. Travel satisfaction revisited: on the pivotal role of travel satisfaction in conceptualising a travel behaviour process. Transp. Res. Part A: Policy Pract. 106, 364–373. https://doi.org/10.1016/j.tra.2017.10.009.
De Vos, J., Schwanen, T., Van Acker, V., Witlox, F., 2013. Travel and subjective well-being: a focus on findings, methods and future research needs. Transport Rev. 33 (4), 421–442. https://doi.org/10.1080/01441647.2013.815665.
De Vos, J., Mokhtarian, P.L., Schwanen, T., Van Acker, V., Witlox, F., 2016. Travel mode choice and travel satisfaction: bridging the gap between decision utility and experienced utility. Transportation 43, 771–796. https://doi.org/10.1007/s11116-015-9619-9.
Deka, D., 2013. An explanation of the relationship between adults' work trip mode and children's school trip mode through the Heckman approach. J. Transp. Geogr. 31, 54–63. https://doi.org/10.1016/j.jtrangeo.2013.05.005.
Depeau, S., Chardonnel, S., André-Poyaud, I., Lepetit, A., Francis, J., Quesseveur, E., Jérôme, G., Théodora, A., Charles-Antoine, C., 2017. Routines and informal situations in children's daily lives. Travel Behav. Soc. 9, 70–80. https://doi.org/10.1016/j.tbs.2017.06.003.
Diener, E., 1984. Subjective well-being. Psychol. Bull. 95 (3), 542–575.
Diener, E., 2000. Subjective well-being: the science of happiness and a proposal for a national index. Am. Psychol. 55 (1), 34–43. https://doi.org/10.1037//0003-066x.55.1.34.
Diener, E., Wirtz, D., Tov, W., Kim-Prieto, C., Choi, D.-W., Oishi, S., Diener-Biswar, R., 2010. New well-being measures: short scales to assess flourishing and positive and negative feelings. Soc. Indic. Res. 97 (2), 143–156.
Drotar, D. (Ed.), 1998. Measuring Health-related Quality of Life in Children and Adolescents: Implications for Research and Practice. Erlbaum, Mahwah, NJ.
Ettema, D., Gärling, T., Eriksson, L., Friman, M., Olsson, L.E., Fujii, S., 2011. Satisfaction with travel and subjective well-being: Development and test of a measurement tool. Transp. Res. Part F: Traffic Psychol. Behav. 14 (3), 167–175. https://doi.org/10.1016/j.trf.2010.11.002.
Festinger, L., 1957. Theory of Cognitive Dissonance. Stanford University Press, Stanford, CA.
Fitch, D.T., Rhemtulla, M., Handy, S.L., 2019. The relation of the road environment and bicycling attitudes to usual travel mode to school in teenagers. Transportation Research Part A 35–53. https://doi.org/10.1016/j.tra.2018.06.013.
Flade, A., 1994. Der Straßenverkehr aus der Sicht von Schulkindern. [Road traffic from children's viewpoint.]. In: Flade, A. (Ed.), Mobilitätsverhalten. Bedingungen und Veränderungsmöglichkeiten aus umweltpsychologischer Sicht, [Travel behavior. Framework and Possibilities of Change from the Perspective of Environmental Psychology.]. PsychologieVerlagsUnion, Weinheim, pp. 185–194.
Flade, A., Limbourg, M., 1997. Das Hineinwachsen in die motorisierte Gesellschaft. [Growing into the motorized society.] Retrieved from Essen und Darmstadt: https://www.uni-due.de/~qpd402/alt/texte.ml/FladeLimb.html. (19 Nov. 2018).
French, D.P., Hankins, M., 2003. The expectancy-value muddle in the theory of planned behaviour and some proposed solutions. Br. J. Health Psychol. 8 (7), 37–55. https://doi.org/10.1348/135910703762879192.
Friman, M., Fujii, S., Ettema, D., Gärling, T., Olsson, L.E., 2013. Psychometric analysis of the satisfaction with travel scale. Transp. Res. Part A: Policy Pract. 48, 132–145. https://doi.org/10.1016/j.tra.2012.10.012.
Friman, M., Westman, J., Olsson, L.E., 2018. Children's life satisfaction and satisfaction with school travel. Child Indic. Res. 1–14. https://doi.org/10.1007/s12187-018-9584-x.
Glasgow, T.E., Geller, E.S., Le, H.T.K., Hankey, S., 2018. Travel mood scale: development and validation of a survey to measure mood during transportation. Transp. Res. Part F: Traffic Psychol. Behav. 59, 318–329. https://doi.org/10.1016/j.trf.2018.09.014.
Guthold, R., Stevens, G.A., Riley, L.M., Bull, P.F.C., 2018. Worldwide trends in insufficient physical activity from 2001 to 2016: a pooled analysis of 358 population-based surveys with 1.9 million participants. The Lancet. Global Health 6 (10), e1077–e1086. https://doi.org/10.1016/S2214-109X(18)30357-7.
Henerson, M.E., Morris, L.L., Fitz, C.T., 1987. How to measure attitudes. Sage Publications, Newsbury Park, CA.
Kalwitzki, K.-P., 1994. Mobilitätsverhalten: Bedingungen und Veränderungen. [Mobility behavior: circumstances and changes.]. Verkehrszeichen 4, 12–18.
Kemen, J., 2016. Mobilität und Gesundheit. Einfluss der Verkehrsmittelnutzung auf die Gesundheit Berufstätiger. [Mobility and health. Impact of mode use on employees' health.]. Springer Spektrum, Wiesbaden.
Kind, P., 1996. The EuroQOL instrument: An index of health-related quality of life. In: Spilker, B. (Ed.), Quality of life and Pharmaeconomics in Clinical Trials. Lippin-cott-Raven, Philadelphia.
Knechtsberger, A., Schwabl, T., 2016. Jugend-Trend-Monitor 2016. Vienna: marketagent.com - Digitale Markt- und Meinungsforschung. [Digital market and opinion research]. Presentation from 14.04.2016. Retrieved from: www.businessart.at/images/doku/jugend_trendmonitor_april_2016.pdf (15 Nov. 2018).
Leung, K.Y.K., Loo, B.P.Y., 2017. Association of children's mobility and wellbeing: a case study in Hong Kong. Travel Behav. Soc. 9, 95–104. https://doi.org/10.1016/j.tbs.2017.07.004.
Lopes, F., Cordovil, R., Neto, C., 2014. Children's independent mobility in Portugal: effects of urbanization degree and motorized modes of travel. J. Transp. Geogr. 41, 210–219. https://doi.org/10.1016/j.jtrangeo.2014.10.002.
Maier, G., Friedrich T., Felder-Puig, R., 2017. HBSC Factsheet 01 - Das Bewegungsverhalten österreichischer Schülerinnen und Schüler: HBSC Ergebnisse 2014. [HBSC Factsheet 01 – Physical activity behaviour of Austrian pupils: HBSC results 2014.] Federal Ministry for Health and Women (Ed.), Retrieved from: https://www.bmgf.gv.at/home/Gesundheit/Kinder_und_Jugendgesundheit/Schulgesundheit/Gesundheit_und_Gesundheitsverhalten_oesterreichischer_SchuelerInnen (11 Nov. 2018).
Martin, A., Goryakin, Y., Suhrcke, M., 2014. Does active commuting improve psychological wellbeing? Longitudinal evidence from eighteen waves of the British Household Panel Survey. Prev. Med. 69, 296–303. https://doi.org/10.1016/j.vpmed.2014.08.023.
Mattejat, F., Jungmann, J., Meusers, M., Moik, C., Schaff, C., Schmidt, M.-H., Scholz, M., Remschmidt, H., 1998. Das Inventar zur Erfassung der Lebensqualität bei Kindern und Jugendlichen (ILK) - Eine Pilotstudie. [Inventory for assessment of quality of life in children and adolescents – a pilot study.]. Zeitschrift für Kinder- und Jugendpsychiatrie 26, 174–182.
McDonald, N.C., 2012. Children and cycling. In: Pucher, J., Buehler, R. (Eds.), City Cycling. MIT Press, Cambridge, MA, pp. 235–255.
McDonald, N.C., 2005. Children's travel: Patterns and influences (doctoral dissertation). University of California, Berkeley, CA. Retrieved from: https://escholarship.org/uc/item/51c9m01c (15 Nov. 2018).
Mitra, R., 2013. Independent mobility and mode choice for school transportation: a review and framework for future research. Transp. Rev. 33, 21–43. https://doi.org/10.1080/01441647.2012.743490.
Patrick, D.L., Erickson, P., 1988. Assessing health-related quality of life for clinical decision-making. In: Walker, S., Rosser, R.M. (Eds.), Quality of life: Assessment and application. MTP Press, Lancaster.
Pollard, E., Lee, P., 2003. Child well-being: a systematic review of the literature. Soc. Indic. Res. 61 (1), 59–78. https://doi.org/10.1023/A:1021284215801.
Pucher, J., Buehler, R., 2008. Making cycling irresistible: lessons from the Netherlands, Denmark, and Germany. Transp. Rev. 28, 495–528. https://doi.org/10.1080/01441640701806612.
Ramelow, D., Teutsch, F., Hofmann, F., Felder-Puig, R., 2015. Gesundheit und Gesundheitsverhalten von österreichischen Schülern und Schülerinnen - Ergebnisse des WHO-HBSC-Survey 2014. [Health and health behavior of Austrian pupils – results of the WHO-HBSC-Survey 2014.], Vienna. Retrieved from: http://www.bmgf.gv.at/cms/home/attachments/9/7/0/CH1444/CMS1427118828092/gesundheit_und_gesundheitsverhalten_oester_schuelerinnen_who-hbsc-survey_2014.pdf (04 Sept. 2017).
Ravens-Sieberer, U., 2000. Lebensqualitätsansätze in der Pädiatrie. In: Ravens-Sieberer, U., Cieza, A. (Eds.), Lebensqualität und Gesundheitsökonomie in der Medizin. Konzepte – Methoden – Anwendungen. [Quality of life and health economics in medicine. Concepts – methods – applications.]. Ecomed, Landsberg, pp. 277–292.
Riddoch, C.J., Andersen, L.B., Wedderkopp, N., Harro, M., Klasson-Heggebo, L., Sardinha, L.B., Cooper, A.R., Ekelund, U., 2004. Physical activity levels and patterns of 9- and 15-yr-old European children. Med. Sci. Sports Exercise 36 (1), 86–92. https://doi.org/10.1249/01.MSS.0000106174.43932.92.
Rosenberg, M., 1965. Society and the Adolescent Self-Image. Princeton University Press, Princeton, NJ.
Ryan, R.M., Deci, E.L., 2000. Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. doi: 10.1037110003-066X.55.1.68. Am. Psychol. 55, 68–78.
Sandqvist, K., 2002. How does a family car matter? Leisure, travel & attitudes of adolescents in inner city Stockholm. World Transp. Policy Pract. 8, 11–18.
Scherer, K.R., 2005. What are emotions? And how can they be measured? Soc. Sci. Inf. 44 (4), 695–729. https://doi.org/10.1177/0539018405058216.
Schumacher, J., Klaiberg, A., Brähler, E., 2003. Diagnostik von Lebensqualität Und Wohlbefinden - Eine Einführung. [Diagnosis of life quality and well-being – an introduction.]. In: Schumacher, J., Klaiberg, A., Brähler, E. (Eds.), Diagnostische Verfahren zu Lebensqualität und Wohlbefinden. [Diagnostic methods on life quality and well-being.]. Hogrefe, Göttingen, pp. 1–18.
Schwenkmezger, P., 1994. Persönlichkeit und Wohlbefinden. [Personality and well-being.]. In: Abele, A., Becker, P. (Eds.), Wohlbefinden: Theorie - Empirie – Diagnostik [Well-being: Theory, empiricism, diagnosis.], second ed. Juventa, Weinheim, pp. 119–138.
Singleton, P.A., 2017. Exploring the positive utility of travel and mode choice. doctoral dissertation. Portland State University, Portland, OR doi: 10.15760/etd.5664.
Singleton, P.A., 2018. Walking (and cycling) to well-being: Modal and other determinants

of subjective well-being during the commute. Travel Behav. Soc. 1–13. https://doi.org/10.1016/j.tbs.2018.02.005.
Smith, O., 2017. Commute well-being differences by mode: evidence from Portland, Oregon, USA. J. Transp. Health 4, 246–254. https://doi.org/10.1016/j.jth.2016.08.005.
Stark, J., Meschik, M., Singleton, P.A., Schützhofer, B., 2018. Active school travel, attitudes and psychological well-being of children. Transp. Res. Part F 56, 453–465. https://doi.org/10.1016/j.trf.2018.05.007.
St-Louis, E., Manaugh, K., van Lierop, D., El-Geneidy, A., 2014. The happy commuter: a comparison of commuter satisfaction across modes. Transp. Res. Part F 26, 160–170.
Stuart, J.H., Biddle, N.M., 2008. Psychology of Physical Activity: Determinants. Well-Being and Interventions, Abingdon, Oxon, Routledge.
Thigpen, C.G., 2017. The reciprocal relationship between children and young adults' travel behavior and their travel attitudes, skills, and norms. doctoral dissertation. University of California, Davis, CA.
Timperio, A., Crawford, D., Telford, A., Salmon, J., 2004. Perceptions about the local neighborhood and walking and cycling among children. Preventative Med. 38, 39–47. https://doi.org/10.1016/j.ypmed.2003.09.026.
Tomschy, R., Herry, M., Sammer, G., Klementschitz, R., Riegler, S., Follmer, R., Gruschwitz, D., Josef, F., Gensasz, S., Kirnbauer, R., 2016. Österreich unterwegs 2013/2014. Ergebnisbericht zur österreichweiten Mobilitätserhebung. [Final report of national household travel survey in Austria.]. Federal Ministry for Transport, Innovation and Technology, Vienna.
Watson, D., Clark, L.A., Tellegen, A., 1988. Development and validation of brief measures of positive and negative affects: the PANAS scales. J. Pers. Soc. Psychol. 54 (6), 1063–1070.
Waygood, O., Cervesato, A., 2017. Transport and child well-being: case study of Quebec City. J. Transp. Health 5, S98. https://doi.org/10.1016/j.jth.2017.05.256.
Waygood, E., Friman, M., Olsson, L., Taniguichi, A., 2015. A111 transport and child well-being. J. Transp. Health 2 (2), S62–S63. https://doi.org/10.1016/j.jth.2015.04.599.
Waygood, E.O.D., Friman, M., Olsson, L.E., Taniguchi, A., 2017. Transport and child well-being: an integrative review. Travel Behav. Soc. 9, 32–49. https://doi.org/10.1016/j.tbs.2017.04.005.
Waygood, E.O.D., Friman, M., Taniguchi, A., Olsson, L.E., 2018. Children's life satisfaction and travel satisfaction: evidence from Canada, Japan, and Sweden. in press. Travel Behav. Soc. https://doi.org/10.1016/j.tbs.2018.04.004.
Westman, J., Johansson, M., Olsson, L.E., Mårtensson, F., Friman, M., 2013. Children's affective experience of every-day travel. J. Transp. Geogr. 29, 95–102. https://doi.org/10.1016/j.jtrangeo.2013.01.003.
Westman, J., Olsson, L., Gärling, T., Friman, M., 2017. Children's travel to school: satisfaction, current mood, and cognitive performance. Transportation 44 (6), 1365–1382. https://doi.org/10.1007/s11116-016-9705-7.
WHO, 2018. Global action plan on physical activity 2018–2030: More active people for a healthier world, ISBN 978-92-4-151418-7.
WHOQOL-Group, 1994. The development of the World Health Organization quality of life assessment instrument: The WHOQOL. In: Orley, J., Kuyken, W. (Eds.), Quality of Life Assessment: INTERNATIONAL Perspectives. Springer, Berlin, pp. 41–57.
Wydra, G., 2014. Der Fragebogen zum allgemeinen habituellen Wohlbefinden (FAHW und FAHW-12) - Entwicklung und Evaluation eines mehrdimensionalen Fragebogens. [The questionnaire for the general and habitual well-being – development and evaluation of a multi-dimensional questionnaire.] Institute of Sports Science, University of Saarland. Saarbrücken. Retrieved from: https://docplayer.org/23870286-Der-fragebogen-zum-allgemeinen-habituellen-wohlbefinden-fahw-und-fahw-12.html (19 Nov 2018).
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. https://doi.org/10.1016/j.jtrangeo.2009.10.002.