



# School travel mode choice and the characteristics of the urban built environment: The case of Helsinki, Finland



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## ABSTRACT

As observed in several previous studies, the nature of the urban structure can affect children's mode of transportation to school. In this paper, we identify and investigate, in the Finnish context, the elements of the urban structure around homes and *en route* to school that promote children's ability to walk or cycle to school, using the conceptual domains proposed by Mitra (2013) to frame the work.

The associations discovered can, to a large extent however, be viewed as contrasting significantly with those identified in previous research, as an increase in the variables, essentially indicating urbanity, decreased the likelihood of the children walking or cycling to school. This is due to the existence of a well-functioning public transportation network in the Helsinki region. The associations were more significantly associated with the environment *en route* to school than with the environment around homes. This research improves our understanding of active school transportation behaviour in an environment that is already relatively supportive of active transportation and independent mobility by offering a well-functioning public transportation system.

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## 1. Introduction

Because of the growing obesity epidemic, the possibility that different environments could promote greater physical activity in children is a subject that has attracted increasing research interest (Ding and Gebel, 2012; van Loon and Frank, 2011; Ding et al., 2011; Pont et al. 2009). As such, activity on school journeys has become the focus of an increasing research effort (see reviews by Stewart et al., 2012; Stewart 2011; Wong et al., 2011; Davison et al., 2008; Sirard and Slater, 2008), as the journey to school is something that children need to cover on most days, and active school journeys can thus promote a significant opportunity for physical activity. To better understand the linkages between the environment and children's active school transportation (AST), a number of conceptual frameworks have been proposed (McMillan, 2005; Panter et al., 2008; Mitra, 2013; Sirard and Slater, 2008; Pont et al., 2011). We discuss a few of these in more detail below and suggest a way to empirically analyse the school journey travel mode choices of children and young people living within 1–3 km of their school, using the model proposed by Mitra (2013).

The earliest attempt to build a comprehensive child-specific framework of the built environment's impact on transport was

provided by McMillan (2005). In her framework the urban form was seen as having an indirect link to children's active transport, through the prism of parental perception and decision-making. The urban form clearly had an effect on parental perceptions of the neighbourhood through which the children had to travel and on parents' perceptions of traffic safety as well as on the transport options available to the household. Based on their perceptions, parents then decided whether their children could walk or cycle to school. Panter et al. (2008), however, were subsequently to criticise McMillan's framework for not incorporating the varied components of the environment that had been shown to influence parental decision making. In its place they suggested a conceptual framework composed of four domains of influence on children's active travel behaviour. These domains were the individual factors concerning the child, the physical environment, external factors (such as climate or policy), and the main moderating factors (age, gender, and distance). In this context, the diverse elements of the urban form were highlighted, focusing on relevant issues in relation to the creation of perceptions among both children and parents and their joint decision making processes, such as facilities, environmental factors related to personal and traffic safety, and route directness etc.

A further conceptual framework has been suggested by Mitra (2013). His critique of the framework proposed by Panter et al. is that the framework is not clear in explaining the behavioural

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processes that link the factors on these different levels of the ecological model to the choice of active transport modes. Trying to overcome this shortcoming, Mitra's framework is informed by research from three different research fields and multiple theoretical backgrounds where children's transportation has been in focus, namely, in transportation and urban planning studies, public health, and environmental psychology. Based on his review, Mitra builds a behavioural model of school transport (BMST) that is at its core a socio-ecological model, which looks at the associations between built environment and behaviour across multiple nested layers. In addition, the model also contextualises the intra-household interactions within the household activity-travel framework, and considers the perceived importance of an escorted trip, the mobility options available and the activity constraints on the family.

On the urban environment level, Mitra (2013) identifies five conceptual domains of relationship between the neighbourhood environment and school travel outcomes. These domains include the proximity to school, traffic and personal safety concerns, connectivity, comfort and attractiveness, and the possibility to maintain social capital on the school journey. Previously discovered evidence in respect of the environmental attributes associated with children's transport choices is then placed under these conceptual domains and discussed in detail by Mitra.

Of the frameworks described above, we find Mitra's (2013) framework the most thorough in its reasoning and portrayal of the hypothesised links between urban environment and transport options in respect of children's journeys to school. In this paper, we seek to highlight the elements of the urban structure that promote children's transport to school by foot or by bike, using the conceptual domains proposed by Mitra to frame the work. We also ask whether the correlates of walking and cycling differ. It has been suggested that the correlates for walking and cycling in terms of school journeys may be different (Kemperman and Timmermans, 2014; De Vries et al., 2010) and hence we treat walking and cycling to school as two distinct outcome variables rather than looking at active versus passive travel modes.

Somewhat unusually, we only include subjects living within distances between one and three kilometres from their school. Increasing distance has consistently been shown to decrease the propensity of journeys taken actively (e.g. Su et al., 2013; Pont et al., 2009; Yeung et al., 2008). In the pupils studied from the Helsinki region, inactive modes of transport were almost non-existent (2.8% modal share) on journeys shorter than one kilometre, while previous research shows notably lower shares of active transport in students living close to school. In the US, the share of walking was 48% for those living within 1 mile of their school (McDonald, 2008); while another study reported 32% walking, 14% cycling, and 54% using car or bus as their primary transport mode within the same distance (Schlossberg et al., 2006). In Australia, 23% of students living within 0.75 km of their school had no active commuting trips in a week (Merom et al., 2006). Meanwhile, a Dutch study found the share of inactive trips within 1 km of school to be 10% (Aarts et al., 2012). With regression analysis, the point is to explain the variance in the outcome variable (i.e. using inactive modes vs. walking or cycling) by the variance of the independent variables (i.e. the structure of the built environment). To be able to explain the variance in school journey transport modes, we need to concentrate on those trips where it is not only distance but also the environment that affects the mode chosen.

This article is, we believe, the first to operationalise Mitra's framework. We use, where available, variables related to the urban environment already utilised in earlier research and create new ways of operationalising the domains that have not previously been studied in detail. In their framework, Panter et al. (2008)

recommended that the built environment relating to the neighbourhood, destination, and route environment should be considered. Research that has empirically studied the destination (i.e. school) environment and facilities has however shown no significant associations with children's active travel behaviour (Panter et al., 2010; Mitra et al., 2010). Thus we concentrate instead on analysing the urban environments of homes and school journeys in correlation with the transport modes of children and young people and leave the destination environment out of our analysis.

Finally, this study adds to the discussion on the associations between the built environment and AST by exploring this general theme in the Finnish context. Thus far, this field of research has largely been dominated by research from the US, Canada, Australia and the UK with occasional examples from other European countries such as Netherlands (e.g. Aarts et al., 2012; Kemperman and Timmermans, 2014).

## 2. Material and methods

Recent developments in GIS (Geographic Information Systems) and especially in public participation GIS (PPGIS) have created new opportunities for the use of location-based methodologies. The softGIS methodology is one example of a PPGIS method that enables the collection of large datasets of residents' experiential knowledge concerning various environments (Kyttä and Kahila, 2011). The main benefit of utilising location-based surveys in data collection concerning daily mobility and environmental experiences is the geographical dimension the data maintains. Based on the coordinates, the experiential knowledge gathered from residents can be simultaneously analysed with register-based GIS data, which provides new, location-based research possibilities (Kahila and Kyttä, 2009).

The data relating to this study was collected via a softGIS survey for children, where the respondents used the Internet interface to mark their home and daily routes to school, and to answer questionnaires concerning school journeys, perceived health and wellbeing as well as background details. The method has been tested in previous research among both children (Kyttä et al., 2012; Broberg et al., 2013) and adults. The user interface included a set of questionnaire pages where conventional survey question and mapping pages alternated (see Fig. 1)<sup>1</sup>. Additionally, the respondents were asked to mark places that were functionally, emotionally or socially meaningful, and to describe how accessible these places were, in terms of independent mobility and active transport. This article concentrates on children's school journeys, while the data relating to meaningful places will be reported elsewhere.

### 2.1. Subjects and communities

This article studies the school journeys of two select age groups in a small but rapidly growing metropolitan area, the capital region of Finland. The research data was collected in 16 comprehensive schools (in total 22 5th grade classes and 38 8th grade classes) during the autumn and early winter of 2011. The schools and their surrounding residential areas included represent different urban structures ranging from the inner city urban core to surrounding suburbs, and fringe areas dominated by single-family housing.

<sup>1</sup> See <http://www.softgis.fi/children>. Similar datasets were gathered in Finland, Australia and Japan. For ease of understanding, in Fig. 1 the Australian version of the questionnaire is depicted instead of the one in Finnish.

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