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Beyond Proximity: a child-friendliness index for local living policies in Australasian cities

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Abstract

The concept of local living is a central theme of Australian planning strategies aiming to create neighbourhoods where the daily destinations for work, study or shopping are within a 10 to 15 minute walk from home. As such, schools are commonly included as key community infrastructures within these Australian local living policies. This emphasis on schools as locally accessible destinations is a much-needed objective given the centrality of education for the majority of childhood and the large proportion of private car usage transporting children to schools in Australasian cities. Existing research has highlighted the complexities around travel behaviour in accessing schools, which includes factors that extend beyond their proximity. In recognition of the multifaceted changes required to address the dominance of private car use for families with children and the critical view of proximity being the primary focus of these policies, this paper discusses the use of more diverse metrics to assess the performance of neighbourhoods and school catchments in terms of accessibility for children. Through the development of a home and school-based child-friendliness index, which combines measures of the social and built environment associated with child-friendly sustainable mobility, a spatial analysis was conducted to assess the relationship between travel modes to and from school and child-friendliness. The findings demonstrated that car trips both to and from school were negatively associated with child-friendliness.

1. Introduction

The increased number of car trips taken by children and young people as passengers globally has been well documented. The associated decline in walking and public transport trips to school is most pronounced for the younger age groups living in developed countries (McMillan 2013), with car ownership rates noticeably higher in households with young children compared to other household types (Fyhri et al. 2011).

In the Australian context, the car-based mobilities of children in accessing daily destinations, including school have become normalised over the last couple of generations as part of contemporary lifestyles, with planning and transport discourses, policy, urban design, infrastructure and services failing to substantively address children's needs and rights to access non-car transport modes as part of their daily lives.

Although there are no nationwide datasets regarding the scale of private car usage to transport children to their daily destinations in Australian cities, individual studies and household surveys consistently report that the majority of children's trips to and from school occur via car. Figures suggest that car usage is most dominant when accessing primary school (The Royal Children's Hospital National Child Health Poll 2019; Garrard 2016). In contrast, active transport rates for

primary school trips only constitute around 25% of total trips, with walking the primary method (22%) (Garrard 2016). This compares to children's active transport rates of 98% in Japan, 87% in the Netherlands and 52% in the UK (Garrard 2016). In the context of the overall population of primary school-aged children in Australia (2,075,224 children at primary schools at the 2021 Census, ABS 2021), this translates to over 1.3 million children nationwide who are being driven in cars to access a primary school during school days. Tellingly, these trips are typically within walking (up to 1 km for 26% of families) and cycling (up to 5 km for 70% of families) distances from school (The Royal Children's Hospital National Child Health Poll 2019).

Existing research has recognised the importance of multifaceted approaches to more effectively reducing the reliance on cars, with various successful policies and programs such as walking buses, bike trains and active transport school programs facilitated by local governments. However, this policy and program development has been rather fragmented and has yet to be implemented on a wider scale. The capacity of such initiatives to create substantial change has also been hindered by the governance arrangements characterised by policy silos (Gilbert et al. 2018).

The current policy environment in Australia with the prevalence of local living policies provides a timely opportunity to reexamine the issues surrounding the dominance of the car in accessing schools given they are commonly included as key urban functions of Australian local living policies. The concept of the local school is also prevalent in public discourses, with schools often 'expected to be local' by communities (Brookfield 2017; p.51), despite the reality that they are not always accessed and utilised at a local level due to the many factors influencing families' decision-making processes when choosing schools (e.g. school type, curriculum offerings, socio-cultural or religious reasons) (Jackson 2019; Cucchiara & Horvat 2014). Besides, proximity to school does not directly translate into equitable access due to differences in school type (public versus private for instance), variability in the eligibility criteria for enrolments, nor is it based on the actual distances required to travel related to urban spatial structure.

2. Methods

As part of a broader research project, 296 surveys were completed by children aged 9 to 18 years, across 6 schools (3 primary, 2 secondary, 1 combined) in Adelaide, South Australia and 4 schools (2 primary, 1 secondary, 1 combined) in Melbourne, Victoria during 2017 and 2018. Out of the 296 children completing the questionnaire aged 9–18 years, 129 children were girls (43.6%) and 158 were boys (53.4%) with 9 unstated. Nearly three-quarters of the children were living in Melbourne (73%, n=217) compared to 27% living in Adelaide (n=79). 84 surveys were also completed by parents of children aged 9 to 18 years in the same schools. Schools were selected to represent local catchment areas (preferably with school zoning rules), diverse socio-economic characteristics and mixed residential density. This study was approved by the University of South Australia Ethics Committee and gained the required approval from educational authorities as well as approval from school principals and teachers.

2.1. Independent variables: Child-friendly built environment

Child friendliness is assessed through a child-friendliness index developed for the study, which incorporates the social and built environmental correlates of child-friendly sustainable transport within a 1000 m network area of the home and school of participant children. The Child Friendliness Index (CFI) was developed to allow the production of a composite score for each participant child's home-based and school-based buffer area. The index comprises 15 measures

from four broad themes: active and public transport infrastructure; traffic safety; proximity to local services and green spaces; and demographic diversity (Table 1). The CFI is used when comparing the use of different travel modes. The travel behaviour of each child in terms of the private car, active and public transport use is compared against the CFI.

Table 1: Spatial measures of child-friendly sustainable mobilities

Themes and Variables	Units of Measurement
AT and PT:	
Walkability index	Walkability Index ((connectivity, Land Use Mix, population density) on AURIN Portal
Connectivity (by bike lanes)	
PT stops	Count of PT stops (bus, tram, train)
TRAFFIC SAFETY:	
Crash data	Count of traffic crashes for each participant student's home-based bu
Traffic lights	Count of traffic lights
Traffic exposure	The ratio of high order roads (301, 302, 303, 304) to low order roads (305, 309, 400)
PROXIMITY TO LOCAL SERVICES AND GREEN SPACES:	
Schools	Count of schools, childcare centres, libraries, health services, local shops and green spaces.
Libraries	
Health services	
Childcare centres	
Green spaces (playgrounds, parks, community gardens, reserves)	
Retail at street level (eyes on the street)	The ratio of the total commercial area (e.g. commercial, mixed use, community facilities and activity centres) to the total area of the buffer area
DEMOGRAPHIC DIVERSITY:	
Housing density	The ratio of total number of dwellings to the total polygon area (hectare)
Housing mix (mix of different house types e.g. separate, semi-detached, flat/apartment, etc.)	The diversity index in the AURIN portal
Child population density	The ratio of total number of children aged 0–19 to the total population

2.2. Calculation of spatial unit for analysis: Network buffers

The spatial tools at the Australian Urban Research Infrastructure Network (AURIN) (2019) portal along with the QGIS software (version 3.8.0) were used to calculate the measures and develop a Child Friendliness Index for the 1000 m road network buffer around each school of participant children's homes, with 1000 m distance representing a generic 10 to 15-minute walk or 5-minute bicycle ride.

2.3. Development of a Child Friendliness Index

The Child Friendliness Index was calculated by summing the results for each measurement listed above both for the home-based and school-based buffers. The total score (1–10) for each measurement was summed for each buffer area ranging between 15 (lowest child friendliness) and 150 (highest child friendliness). The resulting child friendliness indices (home-based and school-based) were further classified into three equal groups to rescale the results from low, medium and high child-friendliness. These results were used when analysing the relationship between the travel mode reported by participant children and parents.

In the absence of an evidence base indicating the different levels of weighting or importance for each indicator used, an equal weighting approach was used. Equal weighting is a commonly used approach in indices due to the wide-ranging complexities of the development of weighted indices e.g. in the absence of a single, robust method that eliminates the bias from the process (Greco et al. 2019; Gomez-Limon et al. 2020).

2.4. Dependent variable: Children's mobilities

The responses in the children's surveys for the weekly travel modes were rescaled and recoded individually for active transport and public transport at 0 = never, 1 = once a week, 2 = 2-3 times a week, 3 = most days and 4 = every day. In addition, parents were asked to indicate how their children travel to and from school on a typical week (for each mode from never to 5 times).

The responses for parking and walking more than 500 metres were later combined with the travelling by car option. For the data analysis purpose, the responses were recoded for the four different types of travel mode individually (car, public transport, walking, cycling/scootering/skateboarding) at 0 = never, 1 = once a week, 2 = twice a week, 3 = three times a week, 4 = four times a week and 5 = five times a week.

3. Results

In order to identify if there was a statistically significant relationship between private car usage as reported by children and child-friendliness, Spearman's rank order correlation (rho) analyses were conducted between the CFI and other continuous dependent variables, using SPSS 21.0. The level of significance was set at a p-value of 0.05. As a result of this type of bivariate test, the value of the correlation coefficient (r) can range from -1.00 to 1.00. This value indicates the strength of the relationship between each paired group.

The dependent variables on the travel modes (on the day of data collection and the weekly frequency) both from the student and parent surveys were tested against both the home-based and school-based CFI.

Individually, all dependent variables in relation to active and public transport to and from school were significantly ($p<0.05$) associated with the CFI for the buffer area around each child's home. A small, positive correlation was found between the child reported weekly frequency of active transport and public transport trips both to and from school and child-friendliness ($p<0.05$). The association between the weekly travel mode to school and child friendliness was stronger than other variables ($rho=0.294$, $n=284$, $p<0.05$).

Similarly, there was a moderate to a small negative correlation between the parent reported weekly frequency of car trips to school ($rho=-0.306$, $n=82$, $p<0.05$) and car trips from schools ($rho=-0.277$, $n=82$, $p<0.05$) and child-friendliness of the immediate neighbourhood. These results indicated that the number of car trips to and from school increased when the child-friendliness score of the neighbourhood decreased. In terms of the non-car-based travel modes

to and from school as reported by parents, only walking trips to school showed a significant positive association with child-friendliness in the immediate neighbourhood, rho=0.224, n=79, $p<0.05$.

When Spearman's rho analysis was repeated for the relationship between the weekly frequency of different travel modes reported by children and parents individually and school-based child-friendliness, there was a medium strength, significant positive correlation between the use of public transport to school (rho=0.314, n=292, $p<0.05$) and from school (rho=0.351, n=290, $p<0.05$) as reported by children and child-friendliness of the buffer area around participant child's school.

For the parent reported weekly frequency of different travel modes and their relationship with the school-based child-friendliness, more travel modes were found to have significant associations with school-based child-friendliness.

4. Summary and Conclusion

The Child Friendliness Index in this study combines measures of the social and built environment which are associated with child-friendly, sustainable mobility. Complementing other indices such as the school walkability index developed by Giles-Corti et al. 2011 and by Christiansen et al. 2014, which are associated with increased rates of active transport, the index captures additional factors, including various demographic variables, cycling and public transport accessibility, which all influence children's everyday mobilities. The index can be expanded to include additional factors such as the cleanliness of public places, sweeping schedules for specific areas (Gilbert et al. 2022), and active frontage data to indicate the provision of soft edges that promote further foot traffic and increased passive surveillance. Such additions would acknowledge and address the fine-grain fabric of the built environment

The results from the spatial analysis demonstrated that children's travel modes to and from school vary depending on the degree of child-friendliness in their home-based and school-based local environments. The results revealed higher car usage and lower non-car usage for children living or attending a school in an area with a relatively lower level of child-friendliness.

The use of composite indices such as the child-friendliness index described here represents a shift from stand-alone objective-based guidelines (e.g. proximity) to a set of minimum standard-based guidelines. It offers an alternative technique to assess the performance of neighbourhoods and school catchments from the point of view of accessibility for children.

The index can also be applied to the catchments of other daily destinations for children as well as those within local living policies, such as venues for extra-curricular activities, in supporting the idea that it is critical to develop clear and precise policies aiming to create a wider range of environments within the reach of sustainable transport.

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