Children and sustainable mobility: small feet making smaller carbon footprints

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ABSTRACT

Whilst there is an extensive body of research on the social and environmental concerns associated with private car usage and the role of the built environment and urban form in sustainable travel, there is limited focus on children's active contribution to these trends, both as part of the problem with their carbon intensive travel patterns and as part of the solution with their capacity to be agents for a positive change. Private cars are heavily relied on by families with children that lead to a wide range of health and environmental issues. In the context of the 'pre-cognitive, habitual' theories of travel behaviour, these travel patterns are likely to be carried into their adulthood. Policy responses to tackle these issues (such as urban consolidation policies) do not generally make room for children in their deliberations. This article aims to explore the place of children in the trends and discourses related to car dependence and sustainable travel in Australian cities and calls for a greater attention to children's travel patterns for more effective policies and longer-lasting benefits.

Introduction

The intrinsic affiliation between urbanisation and the transport technologies including mass car production has been widely reported in the literature. The mobility afforded by mass production of cars and cheap oil resulted in the development of unprecedented urban sprawl across the world. For many years the construction of highways was endorsed as an automatic response to mobility issues such as traffic congestion and the demands of the ever spreading cities characterised by low density and segregated land uses. More recent attention has focused on the term 'sustainable travel' which is often used interchangeably with the terms 'sustainable transport' and 'active travel/transport'. The term encompasses the activities of walking, cycling and usage of public transport. Given the widening presence of 'scootering' and 'skating' particularly among children and young people, the definition of 'sustainable travel' can also be broadened to include these activities. However in the Australian context, the practice of highway building still dominates the current transport policies in major cities such as Sydney, Melbourne and Perth (Legacy, Curtis, and Scheurer 2017) and Adelaide (North–South Corridor Motorway, Government of South Australia 2017a).

Growing concern about the negative social and environmental impacts of car oriented mobility is increasingly challenging these practices. For example, road transport related carbon emissions (mainly from passenger motor vehicles) account for 10%–35% of total carbon emissions in countries such as US,

Canada, UK and Australia. A deliberate policy and practical change to move away from the construction of car oriented infrastructure to non-motorised infrastructure to support walking, cycling and public transport use has resulted in a substantial reduction in car usage and associated environmental issues in cities like Amsterdam and Copenhagen (Gehl 2013; Montgomery 2013; McLellan et al. 2014).

Much of the current literature on sustainable travel pays particular attention to the 'journey to work'. In the Australian context, this is particularly evident in the Australian Bureau of Statistics census data which codes residence and workplace for people in the paid workforce (ABS 2011). Apart from infrequent household surveys, children's travel patterns do not appear in these statistics.

In terms of individual research projects related to children's travel behaviours, a great deal of attention has been given to the health implications of reduced physical activity levels, such as obesity, diabetes and various cardiovascular diseases (Rahman, Cushing, and Jackson 2011; Epstein et al. 2012; Sallis et al. 2012; Villanueva et al. 2013; Giles-Corti et al. 2014). The methodology adopted in these studies has led to an increased consideration of children's health issues in relation to built environment design, but not to the underlying connection between the lifestyle of children and the demand they create for private car usage. While a few scholars have emphasised the link between child friendly cities and sustainable cities (Tranter and Pawson 2001; Malone and Tranter 2003; Tranter and

Sharpe 2008), the place of school aged children in the growing trends of private car usage and associated carbon emissions outcomes still remain under-researched. This paper aims to provide a deeper insight into the environmental issues associated with school aged children's current travel patterns to school and other activities by reviewing the literature and data available from Australia and overseas.

Defining child friendly cities

The term 'child friendly' has come to be used to refer to the UNICEF Child Friendly Cities Initiative that is the embodiment of the Convention on the Rights of the Child (CRC) that was developed in 1989. This definition states that a child friendly city is actively engaged in fulfilling the right of every young citizen to a wide range of rights, including their participatory rights in their communities as equal citizens, their rights to be safe and protected from harm and their rights to have environments supporting their needs to learn, play and be social (UNICEF 2013).

The term 'child friendly' embodies a multitude of concepts. More importantly these concepts are not limited to having access to basic services or protection from violence and abuse but nevertheless include the characteristics that are preconditions for children's lives beyond basic living requirements. More pertinently to children in the Global North who have basic needs, including safety, 'child friendly' implies the conditions that need to exist to enhance children's health and wellbeing, now and into their futures. Though there is a perceived degree of simplicity in the notions such as 'walk safely in the streets on their own' or 'meet friends and play', the current conditions of Australian cities and contemporary lifestyles of children do not support these seemingly simple goals, which cannot be taken for granted in the absence of conscious design and policy measures.

The multidimensional nature of child friendliness has been exemplified by few scholars. In the findings of the UNESCO initiated project *Growing Up in an Urbanising World*, Chawla (2002) lists both the positive and negative indicators for 'child based environmental quality'. In relation to neighbourhood environment, 'safety and free movement', 'peer gathering places', 'varied activity settings' and 'safe green spaces' are listed as positive indicators. On the contrary, 'heavy traffic', 'lack of gathering places' and 'lack of varied activity settings' indicate low environmental quality for children (Chawla 2002, 229). Chatterjee (2005) also argued that child friendly places require a 'diverse range of physical and social settings from the immediate environment of the child to citywide locations'.

A recent report by the global planning, architecture and engineering firm ARUP also affirms the importance of an integrated approach to child friendliness

(Wright et al. 2017). For example, the traditional role of streets for moving traffic has been challenged in the German city of Freiburg, with the recognition of their importance as multifunctional public places for children (31).

Children's private car usage

The increased number of car trips taken by children and young people as passengers globally has been highlighted by McMillan (2013) and Fyhri et al. (2011). The decrease in walking and public transport trips to school were most pronounced for the younger age groups across developed countries (McMillan 2013) while the car ownership rates were noticeably higher in households with young children compared to other household types (Fyhri et al. 2011). Australian statistics reveal that transport is the third largest source for greenhouse gas emissions in Australia after electricity and stationary energy (Pink 2010). Though the share of transport sector for emissions of 13% is smaller than for other developed countries (20%–30% for North America and up to 20% for Western Europe) (IPCC 2014) the historical data reveals a sharp increase of 52% between 1990 and 2015 (Australian Government 2015b). In addition, these datasets disclose that passenger cars are the largest transport source for these emissions.

The statistics in relation to purpose of car trips in Sydney indicate a significant share and growth in the 'to serve passengers' segment of these car trips, more significantly for the age group of 5–19 years. For example, between 1991 and 2001, the annual percentage increase in the number of car passenger trips by the age groups of 5–14 and 15–19 years were significantly higher than the actual population growth in these groups (for the age group of 5–14, over 3% annual growth in children's car trips as passengers compared to a decline in the total population of this age group, for the age group of 15–19 over 4% increase in children's car trips as passengers compared to 1% increase in the total population of this age group) (NSW Government 2005).

More recent travel survey data across Sydney displayed a substantial increase in education related car trips compared to work related trips. For example, between 2001 and 2011, the highest increase in car tips were in the social/recreation and education/childcare trips (each by 17%). For the same period, both work related business trips and personal business trips decreased (by 17% and 16% respectively) (New South Wales Government 2013).

In addition, further studies revealed that 71% of 0–14 year old children's trips are in cars, mainly occurring for education and childcare related transportation (Garrard 2009; Whitzman and Mizrachi 2012). In terms of the kilometres travelled, 87% of the total kilometres

travelled were as car passengers (Garrard 2009). Some of these increases in children's car trips are attributed to the increase in the distance travelled for these services due to the closure of local schools and families not necessarily choosing the closest schools (Sharpe and Tranter 2010; Garrard 2011), however for the majority of Australian children particularly for primary education, the distance to school is relatively short (within feasible distances for walking up to 1 km and cycling up to 5 km) (Ridgewell, Sipe, and Buchanan 2005; Garrard 2009; Sharpe and Tranter 2010).

Two important implications that emerge from this research are the direct carbon emission outcomes due to the significant increase in the number of car trips and the long term implications in the form of loss of opportunities for school aged children to physically engage with their local environments that leads to a loss of spatial awareness due to the large amount of travel time spent in cars. Indeed, it is argued that children's sense of place and environmental awareness which are essential for environmentally sustainable lifestyles are diminishing (Tranter and Pawson 2001; Sutton and Kemp 2002; Mitchell, Kearns, and Collins 2007).

Children play a critical role in sustainable mobility not only due to their current car dependent lifestyles but their unique capacity for being 'change agents' (Heft and Chawla 2006, 2007, 2009; Sharpe and Tranter 2010; Malone 2013, 2015) for their own travel needs as well as for their household travel choices as a whole and 'indicator species' (Enrique Penalosa quoted in Tranter and Sharpe 2012) in achieving sustainable neighbourhoods now and in securing the changes needed for a sustainable future. These implications and children's critical role in sustainable mobility will be further discussed in the following section.

Children's pivotal role in sustainable mobility

The importance of 'habitual learning' (O'Brien et al. 2000; Tranter and Pawson 2001) in earlier ages has been stressed in some studies and also by the United Nations. For example, in its 'children on the front line' document (2015, 76), UNICEF stated that 'sustainable thinking from a young age onwards is more likely to have a lasting effect than trying to modify already ingrained habits later in life'. Similarly the 'habitual' nature of travel behaviours and the difficulty surrounding overcoming this path dependency is widely acknowledged (Tranter and Pawson 2001; Schwanen, Banister, and Anable 2012; Thynell and Wolmar 2014; Chatterton et al. 2015) which once again emphasises the importance of early intervention in the context of travel behaviour.

Undoubtedly, school aged children and families will continue to gain knowledge of environmental issues and of their own carbon footprints through the environmental education within school curriculums and general ease of access to data through internet and media which could play an important role in the formation of environmentally sustainable lifestyles. However as Chawla (1992) stated, increased environmental knowledge does not translate to deepened feelings for environment and that 'place attachment' has a critical role in creating 'enduring effects' (even after childhood ends) and 'active interest' in environment (73, 83). Similarly, other scholars have emphasised the importance of 'learning through environmental interaction' and 'learning by doing' for sustainable travel habits compared to formal curriculum activities for environmental learning (Malone and Tranter 2005; Schwanen, Banister, and Anable 2012; Chatterton et al. 2015).

For any educational activity for sustainability to translate into behaviour change and practice on a daily life, it is critical to complement them with other strategies. For effective promotion of active travel, there is a need to combine a range of infrastructure and non-infrastructure projects. Davison, Werder, and Lawson (2008) highlighted the important role educational community programs played in successful outcomes of safe routes to school projects in the US. Similarly McDonald and Aalborg (2009) emphasised that infrastructure alone is not sufficient for successful active travel policies and educating and encouraging families and children is essential to achieve behavioural change. In countries such as Denmark, Holland and Germany, the active travel education is provided beyond formal curriculum and supported with extensive practical training, which results in daily practice for children and wider communities (Schwanen, Banister, and Anable 2012; Faherty and Morrissey 2014).

In terms of the importance of education for behavioural change, O'Brien (2001, 2003) highlighted the effectiveness of communicating with parents on the negative impacts of cars on their children such as traffic related injuries, children's greater susceptibility to air pollution, loss of opportunities for play, physical activity and social interaction. Social, mental and emotional issues associated with the loss of play opportunities in their local environments were further examined by other researchers. For example, Gray (2013) and Tranter (2016) reported that this phenomenon was associated with the prevalence of mental disorders, loss of essential life skills such as sense of belonging, confidence, creativity, negotiation and getting along with others due to highly organised lifestyles of today's children.

Recent trends of car dependency

It has been well documented that private car use is significantly correlated with urban sprawl and urban design as an impediment to sustainability on many

levels (Girardet 1999, 2010; Newman and Kenworthy 1999, 2006; NewUrbanism.org 2010). Recently, the term 'peak car use' has been used to refer to a growing phenomenon of decreasing car ownership and use, particularly among young people (aged 16 years to mid-twenties) across the world (Newman and Kenworthy 2011; Kuhnimhof et al. 2012).

Some scholars have challenged these counter-trend claims on the grounds that it is unknown whether the young people's reduced car use is maintained when they grow older (Goodwin and Van Dender 2013; Frändberg and Vilhelmson 2014). It has been argued that a wide range of factors need to be considered to be able to fully explain this theory. These factors include the gendered differences in these trends (for example young women's car ownership rates have been catching up with those for men in Europe) and the overall 'postponement of adulthood' such as studying longer, participating in the workforce later and earning less therefore delaying car ownership (Delbosc and Currie 2013; Frändberg and Vilhelmson 2014; Garikapati et al. 2016).

Delbosc and Currie (2013) examined possible causes for this trend and found the evidence for delaying or forgoing was unclear for most countries. Out of all the evidence available, they stated that only changes in 'life stage milestones' and 'household living arrangements' had clear links with this trend indicating a delay in getting a driving licence (286). They also repeated the importance of integration of land use and transport system to facilitate any behaviour change towards getting a driver's licence.

Delbosc (2016) examined single year cohorts year by year (i.e. from the time they are 16 until they reach mid 20s). The official data for both the United States and Victoria, Australia confirmed that the decline in the proportion of 18 year olds with a driver's licence was not apparent when they reached their mid 20s. She concluded that the life stage related delays such as studying longer, gaining a full time job and becoming a parent later were consistent with the delays in licensing. More importantly, she emphasised the unique opportunities associated with each year without a car for young people in relation to sustained behaviour change for sustainable travel patterns. Namely, that if this window of opportunity is missed, the travel habits are hard to break, particularly after transitioning to parenthood. This concern is in line with other scholars emphasising the increased car reliance among families with children (Fyhri et al. 2011; McMillan 2013). Delbosc (2016) believed that these opportunities could be best seised through the creation of environments where the land use and transport systems are integrated to make active travel a viable option.

There are a number of reasons for high rates of private car usage amongst families with children. Children's daily lives and needs are affected by the general trends in household socio-economic status and type of school (public versus private) (Chillón et al. 2009), car ownership rates, increased female employment rates, increased access to mobile phone which reduces the amount of time in advance for the planning of daily activities (Fyhri et al. 2011). Taken together, these socio-economic factors contribute to children's reduced independent mobility and reliance on 'parental taxis'. Moreover, this highlights the importance of child friendly neighbourhoods to successfully attend to children's mobility needs, regardless of the availability of parental assistance. A recent Australian study by Ghekiere et al. (2016) explored the moderating role of parental accompaniment on the relationship between children's active travel and neighbourhood. Though the findings indicated a limited moderation, they further supported the importance of neighbourhood environments being conducive to walking and cycling for school aged children regardless they are accompanied by adults or not.

Reducing car use related carbon emissions – policy responses and trends

Overall, the research investigating factors associated with car dependence has focused on two intervention areas including urban form (particularly in the context of urban consolidation) and technology aiming to improve fuel efficiency. This section will examine these two policy responses and trends and the consideration given to children in these deliberations.

Urban consolidation policies to tackle car dependence

Higher density, mixed use developments are increasingly being promoted and delivered as a new form of living in Australian cities in an attempt to minimise sprawl and to transform car dependent low density neighbourhoods into more walkable, connected and sustainable communities (New South Wales Government 2014; Government of South Australia 2017b; Victoria State Government 2017). A review of Australian metropolitan strategies towards sustainable cities indicate that high density, mixed land use near transport corridors and nodes seem to be treated as the core ingredients of these sustainable developments. However there is a general tendency to ignore potential occupancy by households with children, through not regulating unit mix or minimum unit size and neglecting to plan for social infrastructure such as childcare centres, playgrounds and primary schools (Randolph 2006; Woolcock, Gleeson, and Randolph 2010; Whitzman and Mizrachi 2012; Reid, Lloyd, and O'Brien 2017). On the other hand, it has been argued that the affordability of higher density housing compared to other housing types is an important reason for higher density to be

Table 1. Australia's best-selling cars, August 2017.

The Toyota Hilux	4287
The Ford Ranger	3588
Toyota Corolla	2948
Hyundai Tucson	2206
Mazda 3	2163

Source: Federal Chamber of Automotive Industries (FCAI) 2017.

family friendly and that families with children need to be recognised as a sub-market (Easthope and Tice 2011).

Technological fix to the carbon emission outcomes of private car use

The long term trends reveal that technological advancements which improve fuel efficiency are somewhat offset by increases in power, weight and the popularity of four wheel drive (4WD) vehicles (Australian Government 2015a). The recent car sales statistics (Table 1) reveal that the Toyota Hilux remains the best-selling vehicle in Australia followed by the Ford Ranger (FCAI 2017).

In addition, the longevity of the Australian light car fleet at around 10.1 years (ABS 2015) suggests that relying on improvements in motor vehicle fuel efficiencies to reduce carbon emissions will require a long lead time, and replacing outdated inefficient motor vehicles will be challenging in a difficult economic climate for many Australians. The data in relation to the factors considered when purchasing a vehicle also shows that the purchase price was the most common factor (53%) followed by fuel economy and running costs (41%). For example, in 2008 only 1% of car sales in Australia were 'green cars' (emissions not exceeding 120 g/km of CO_2) compared to 11% in the UK, and the environmental impact/exhaust emissions were considered by only 4% of Australian buyers (Pink 2010). Correspondingly, the Australian car market recently saw the withdrawal of hybrid and electric cars by major companies such as Toyota, Holden, Nissan and BMW due to the lack of demand from buyers and lack of policy interest by the government (CarAdvice 2017; Fairfax Network 2017). For example, the senior management at BMW publicly criticised the Turnbull Government for not encouraging the supply of low emission vehicles through taxing regimes (Motoring 2017).

Conclusion

The social, economic and environmental pressure on our cities and mobility demands will continue to grow along with fast paced urbanisation. Because of this, the environmental issues of sprawl, car dependency and corollary social issues are likely to remain as the focus of urban research in the coming decades. Due to the pressing environmental problems facing our planet, we need a radical change in our cities to facilitate sustainable mobility. Replacing private car usage with active travel requires a concerted approach. In this, we argue there is no better place than school aged children's daily lives to originate this change.

This includes modifying urban environments and orchestrating a behavioural change from a young age through increased opportunities for these more environmentally sustainable modes such as walking, cycling and public transport. Due to the significant number of car trips among families with children, the abatement potential from child centred sustainable travel policy and plans is likely to be substantial. Though the technological improvements in the vehicle fleet are promising, the fast growth in the popularity of 4WDs and SUVs amongst Australians, particularly households with children (Raimond 2005) indicates a slow progress in reducing the transport related carbon emissions.

In the long term any reductions achieved through technology are likely to be undermined by the 'child blind' policy responses such as urban consolidation policies to tackle car dependence. As such, in order to provide a foundation for sustainable travel behaviours, it is essential to create precincts where children can safely explore and use their local environments on a daily basis and develop environmental awareness now and into the future that is critical for a sustained carbon emission reduction.

Policies aiming to create a wider range of meaningful environments supported by various educational programs are needed to address the complex mobility needs of families with school aged children in order to achieve sustainable mobility. In this, the approach to child friendly places should not be fragmented or be reduced to the provision of prescriptive play spaces. Rather it should be through an integrated approach aiming to provide a full range of child friendly streets and public places (Wright et al. 2017) which generate opportunities for sustainable modes of transport and play for children (O'Brien 2003; Tranter 2016). Recognising the symbiotic relationship between the goals of child friendly cities and sustainable cities (Malone 2001, 2007, 2015; Tranter and Pawson 2001) will provide an important basis for effective and equitable sustainable mobility policies. Australian planning and mobility policies have much to gain from a greater attention to children's mobility needs and rights and their distinguished capacity to arrest these critical trends.

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