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Pedestrian access modelling with tree shade – won't someone think of the children…

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Abstract

Australia has one of the highest rates of skin cancer in the world and school children are amongst the most vulnerable to harmful UV exposure. Australia also has one of the world's highest levels of childhood obesity and much research has focused on encouraging active modes of transport to and from schools.

This research aims to answer the following questions: How do we balance the need for protecting school children from excessive UV exposure whilst encouraging active modes of transport? And, how can innovative strategic approaches to urban transformation increase the potential for school children to walk to school maximising exposure to sun, and hence vitamin D, in winter but minimising UV exposure in summer?

The method used for this study involves bringing together "PedCatch", a novel animated pedestrian catchment modelling tool that can exclude busy roads or intersections, with high polygon 3D proxy-object tree modelling, flexible 3D precinct modelling, and temporal solar impact analysis.

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The results of the study demonstrate that by using these tools, it is now possible to assess a school's walkable catchment given specified sun and shade parameter requirements, taking into account the time of year, the solar impact of street orientation, urban form, street tree size, spacing, species and location. The study also describes how the tools can be used to rapidly test potential impacts of urban interventions and modifications to street design such as increasing canopy coverage, adjusting street setbacks for future urban development.

This research has far-reaching implications for schools, school children and their parents, policy makers, planners and urban designers. The tools have the potential to contribute to the development of more walkable and accessible communities that minimise over exposure to the harsh Australian sun whilst encouraging an increase in children's level of physical activity.

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1. Introduction

Overweight and obesity is estimated to cost Australia over $55 billion in total every year [1] and has overtaken smoking as the country's leading cause of premature death and illness [2]. Physical inactivity is the fourth leading contributor to the burden of disease globally [3]. Increasing physical activity is a critical priority for the future of Australia and its citizens particularly its younger population which has seen the steady decline in active transport used by children to go to and from school and growing incidences of childhood obesity in recent decades [4–6]. Children walking to school is critical for an active and healthy community with not only health, but environmental and social benefits [7].

The likelihood of children walking to school regularly is much higher if children live in well-connected neighborhoods with good pedestrian accessibility or "Pedshed" ratings [7,8]. It follows that urban designers need to carefully consider school siting and street design in school neighborhoods to encourage children to walk to school [7–9].

In addition to proximity to school, it has been shown traffic volume and perceived safety significantly impact on the likelihood of children walking or cycling to school [7,10] with parents being concerned for children's safety due to traffic driving their children to school thus contributing further to the traffic, in a vicious circle.

Although it is important to encourage children to walk to and from to school, prolonged exposure of children to direct sunlight in summer can be problematic. Australia experiences summer temperatures that can exceed 40°C [11] and has one of the highest rates of skin cancer in the world [12] with over 440,000 Australians treated for skin