Journal of Transport Geography 69 (2018) 129–137

Contents lists available at ScienceDirect

Journal of Transport Geography

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

Improving planning analysis and decision making: The development and application of a Walkability Planning Support System

Claire Boulange[a,*], Chris Pettit[b], Lucy Dubrelle Gunn[a], Billie Giles-Corti[a], Hannah Badland[a]

[a] RMIT University, Australia
[b] The University of New South Wales, Australia

ARTICLE INFO

Keywords:
Walkability
Planning Support System
Sketch-planning
Participatory workshop

ABSTRACT

Planning Support Systems are spatially enabled computer based analytical tools. They are designed to process spatial data and model *"what if"* scenarios in support of planning analyses. This paper presents how an existing land-use planning software was customised to create the Walkability Planning Support System. The paper describes the tool features including: (i) automated calculation of built environment variables; (ii) "sketch planning" functionality; and (iii) suite of indicators including a walkability indicator that estimates the probability that an adult would walk for transport. We discuss how the Walkability PSS enables urban planners to explore built environment scenarios and visualise their potential impacts on walkability. We present a suburban case study where we compare a baseline scenario with an alternative scenario developed with local planners that incorporated possible built environment interventions. Finally, we discuss potential applications for the tool and present how it could be refined along with recommended research directions.

1. Introduction

Given rapid urbanization rates worldwide (United Nations et al., 2015), many cities are growing and transforming, putting enormous pressure on urban planning and decision-making (Giles-Corti et al., 2016; Stevenson et al., 2016). Cities are made up of complex and simultaneously occurring systems e.g., transport; land-use; social, physical and digital infrastructure as well as energy and utilities. Planners need to understand and capture the collective effects of these systems when planning for healthy, sustainable development (Ainsworth and Macera, 2012; Allen, 2001). To facilitate this, data driven systems approaches can help planners appreciate how patterns and issues for cities (e.g., public health risks, green-house gas emissions) emerge from the interplay of complex systems (e.g., suburban urban form, location of employment, public transport systems). Data driven systems approaches can also help capture opportunities for improvement, for example in recognizing leverage points in the urban systems where interventions could lead to improved health and environmental sustainability outcomes (Diez Roux, 2011). Importantly the human interactions in these complex systems can be modelled and simulated. Given places are designed for people this is a critical consideration when planning future neighbourhoods and cities.

While it is established that regular participation in physical activity has positive impacts on individual physical and mental health and contributes to social cohesion (Van Dyck et al., 2015; World Health Organization and Calouste Gulbenkian Foundation, 2014), cities around the world face a dramatic increase in the rates of chronic disease, obesity and sedentary lifestyles. Over the last decade, there has been rapid growth in research into the built environment as an enabler or barrier to health and wellbeing. It appears that barriers to physical activity arise from the way cities are planned, designed, built or renewed and numerous studies have shown that city design influences walking behaviours (Heath et al., 2006; McCormack and Shiell, 2011; Ferdinand et al., 2012; Saelens and Handy, 2008; Saelens et al., 2012). Neighbourhoods are described as more "walkable" when they enable people to make walking their first transport mode of choice (Badland et al., 2013). Conversely, neighbourhoods that encourage motor vehicle dependency reduce opportunities for people to accumulate physically activity by way of active travel (Younger et al., 2008). Different design features influence different types of physical activity; key features found to be consistently associated with participation in transport-walking (Ainsworth and Macera, 2012), an active mode of transport, include: residential density, land use mix, street connectivity, proximity of destinations, presence of sidewalks, and access to public transport infrastructure (Adams et al., 2013). However, it is also understood that walkable environments arise from a combination of built environment

* Corresponding author at: Healthy Liveable Cities Group, Centre for Urban Research, RMIT University, Building 15, Level 3, 124 La Trobe Street, GPO Box 2476, Melbourne, VIC 3001, Australia.
E-mail address: claire.boulange@rmit.edu.au (C. Boulange).

https://doi.org/10.1016/j.jtrangeo.2018.04.017
Received 15 November 2017; Received in revised form 13 April 2018; Accepted 13 April 2018

attributes, typically described as a range of appropriate destinations easily accessible via connected street networks and supported by higher population densities (Christian et al., 2011; Frank et al., 2010; Grasser et al., 2013; Owen et al., 2007).

To date, there has been less emphasis on examining these relationships in dynamic simulation environments to examine the impact of urban planning decisions on health outcomes (Diez Roux, 2011). Yet, in the last decade, there has been a rapid proliferation of both evidence on walkability and active transports modes - including transport-walking (Lowe et al., 2014) - greater availability of high quality and fine-grained spatial data, and on-going advancements in smart city related information technologies, such as PSSs (Geertman et al., 2015). Planning Support Systems (PSSs) are spatial data driven tools designed for measuring, mapping, or evaluating impacts arising from likely urban development scenarios (Geertman, 2002; Geertman and Stillwell, 2004). When developed using best practice evidence, they can be applied to meaningfully derive information and analyse data to support spatial planning practices (Geertman et al., 2013). PSSs are designed to support collaboration throughout the urban planning process with simple user interfaces that allow testing and evaluation of various urban design scenarios (Arciniegas and Janssen, 2012; Geertman and Stillwell, 2004; Geertman et al., 2013), and are commonly built using Geographical Information Systems (GIS), designed to collect, analyse and visualise spatial data. In addition to the GIS core functions, PSSs include tools specially designed for supporting urban and regional planning including demographic analysis tools and environmental modelling functions (Brail and Klosterman, 2001). They support sketch planning processes where maps and drawing tools are employed to visually represent planning schemes and potential plans (Geertman and Stillwell, 2003; Vonk and Ligtenberg, 2010). Many examples of PSSs in transport management (Biermann et al., 2015), scenario planning (Levy et al., 2015) or public engagement (Jutraz and Zupancic, 2015) can be found in the literature (Geertman et al., 2017). The evolution of PSSs is taking place simultaneously with the development of new spatial methods and software technologies (Geertman et al., 2017). Such developments allow PSSs to display greater capacity in terms of visualisation, e.g., visualisation of multi-dimensional data or three-dimensional scenes time (Geertman et al., 2017) and perform complex tasks including the computation of complex algorithms in short periods of time (Widjaja et al., 2015).

These conditions have motivated the development of a PSS capable of simulating changes in the built environment and measuring the impact these changes would have on transport walking behaviours. Such a PSS could support decision-makers and urban planners to: (a) measure the walkability of an area; (b) test potential impacts of future policies and planning scenarios by allowing users to create and manipulate a virtual representation of an urban precinct (Diez Roux, 2011); and (c) assess selected health impacts of planning decisions for the community. Hence, the aim of this study was to customise an existing GIS-based PSS tool to create a “Walkability” focused PSS tool, operational for modelling and evaluating the impact of planning decisions on transport-walking outcomes. This paper focuses on the tool development, further research into the usability of the Walkability PSS and its suitability in planning practice has been reported elsewhere (Boulange et al., 2017b).

2. Methods

2.1. Study area

To test the Walkability PSS a case study was conducted in collaboration with the Victorian Planning Authority (MPA) and the City of Hume Council, who were undertaking at the time this research a large urban renewal project in the suburb of Broadmeadows in metropolitan Melbourne. This was an opportunity to engage with practitioners and to apply the Walkability PSS to a real example. Broadmeadows is located 16 km north from the Melbourne Central Business District as presented in the local context plan in Fig. 1.

The City of Hume is a growing, urban fringe municipality with well-established urban areas in the southern section that is closer to the city, and rural areas in the north. It also includes Melbourne's principal

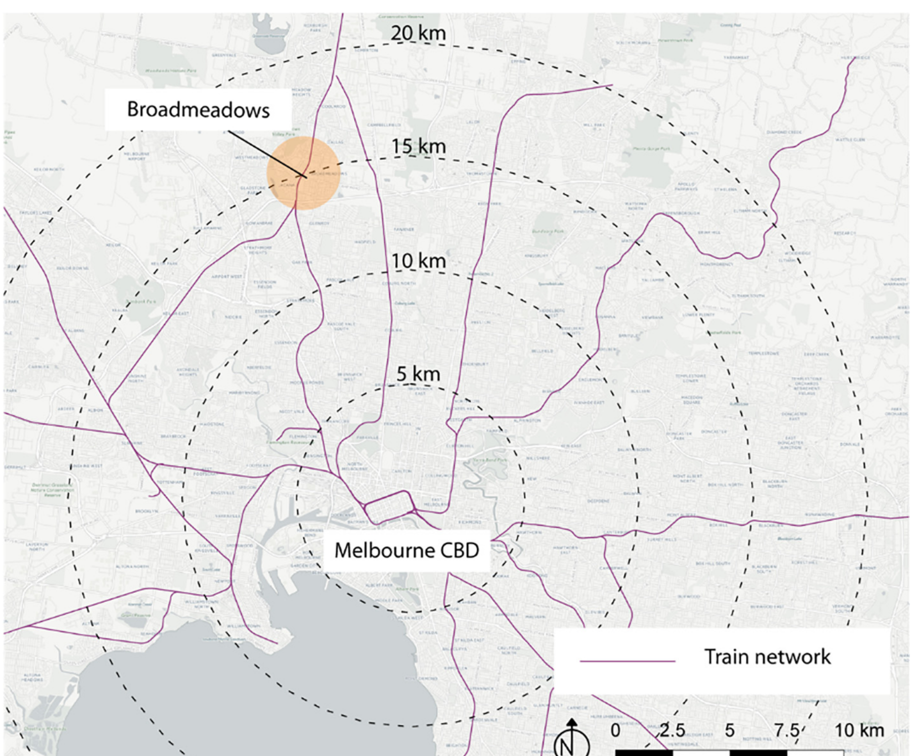

Fig. 1. Broadmeadows, local context plan.