Habitat International 49 (2015) 547–558

Contents lists available at ScienceDirect

Habitat International

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

Liveable streets in Hanoi: A principal component analysis

Peter Sanders [a], Mark Zuidgeest [b, c, *], Karst Geurs [d]

[a] Faculty of Geo-information Science and Earth Observation, University of Twente, The Netherlands
[b] Centre for Transport Studies, University of Cape Town, South Africa
[c] HealthBridge Foundation of Canada, Canada
[d] Centre for Transport Studies, University of Twente, The Netherlands

ARTICLE INFO

Article history:
Received 10 September 2014
Received in revised form
11 June 2015
Accepted 3 July 2015
Available online 17 July 2015

Keywords:
Liveable streets
Traffic hazard
Social interaction
Principal component analysis
Hanoi
Vietnam
Appleyard

ABSTRACT

Liveability along four streets in Hanoi, Vietnam is assessed. Hanoi is a rapidly growing metropolis characterised by high levels of personal motorized traffic. Two high traffic volume streets and two low traffic volume streets were studied using a mixed methods approach, combining the collection and analysis of quantitative and qualitative data on traffic volumes and liveability perceptions of its residents. The research methodology for this study revisits part of the well-known Liveable Streets study for San Francisco by Appleyard et al. (1981). A Principal Component Analysis (PCA) shows that residents on both low traffic volume streets experience less traffic hazard and stress, including noise and air pollution, than neighbouring high traffic volume streets. In line with Appleyard, the study shows that low traffic volume streets were rated more liveable than high traffic volume streets. In contrast to Appleyard, however, the study also shows that traffic volumes are not correlated with social interaction, feeling of privacy and sense of home, which is likely caused by the high levels of collectivism typical for Vietnam. Finally, the study indicates a strong residential neighbourhood type dissonance, where a mismatch exists between preferences for living in peaceful and quiet streets and the actual home location of residents.

1. Introduction

In Hanoi, the capital of Vietnam, the number of motorised vehicles, primarily motorcycles, grew by a factor 5 between 1990 and 2005. As a result, Hanoi suffers from congestion, pollution, noise, low levels of traffic safety, and a dominating, and increasing, presence of personal motorized vehicles on a very limited road space (Japan International Cooperation Agency [JICA], 2007). This likely affects the functioning of society in terms of quality-of-life, public health and the sense of well-being in the city (Geertman, 2010). However, there is little empirical evidence linking traffic volumes to residential quality of life in developing countries.

A well-known study on the effect of traffic on social interactions and perceptions on the street environment, housing and the community was conducted in the late 1960s by Donald Appleyard and his colleagues in San Francisco, USA, and reported in the book 'Livable Streets' by Appleyard, Gerson, and Lintell (1981). The authors measured the differences in liveability along three residential streets that vary in levels of traffic volume, but which are otherwise relatively similar. Their study illustrated that streets can be "scenes of conflict" between living and access, residents and travellers, street life and traffic safety. People living along busy roads can suffer from noise and air pollution and social interactions between residents may be affected. In the rest of the paper, we refer to the book as Appleyard's liveable streets study. Since then, several researchers have examined linkages between traffic flow and liveability in a developed world context (Smith, Nelischer, & Perkins, 1997; Fotel, 2006; Hart & Parkhurst, 2011; Power, 2012). This paper is, to the authors' knowledge, the first to examine Appleyard's framework in a developing country context. This is particularly of interest as many cities in developing countries are growing with accompanying high motorisation rates (Gakenheimer, 1999). The city of Hanoi is examined as a case study. Hanoi is a fast growing city in Vietnam, a middle-income country in South East Asia, with already very high levels of motorcycle ownership and use. Notably in *Habitat International*, Appleyard pleaded posthumously for the conservation of the many liveable streets and neighbourhoods seen in developing cities, hoping that these cities would learn from the mistakes of dealing with motorization in the western world

* Corresponding author. Centre for Transport Studies, University of Cape Town, South Africa. Tel.: +27 216504756.
E-mail address: mark.zuidgeest@uct.ac.za (M. Zuidgeest).

http://dx.doi.org/10.1016/j.habitatint.2015.07.001
0197-3975/

(Appleyard, 1983). Hart and Parkhurst (2011) also uttered a similar call for conservation in countries not having mass car ownership yet. In this paper we examine how residents perceive residential quality-of-life along four streets in present day Hanoi using a mixed methods approach, combining the collection and analysis of quantitative and qualitative data on traffic volumes and liveability perceptions of its residents.

The rest of the paper is structured as follows. Section 2 describes the literature on built environment and liveability and discusses Appleyard's liveable street study. Section 3 describes our case study in Hanoi and the research methodology, and Section 4 presents Principal Component Analysis as a statistical technique to derive representative clusters of liveability indicators and discusses the results of this clustering exercise. Section 5 accordingly presents a discussion and compares the case study results with Appleyard's study and its follow-up studies. In Section 6 the main conclusions are given.

2. Liveability and the built environment

2.1. Liveability and liveable streets

Liveability is a concept closely related to people's wellbeing and is defined by Okulicz-Kozaryn (2013, p433) as the "standard of living or general well-being of a population in some area such as a city". The role of the built environment in liveability has been studied by many. The Economist Intelligence Unit (Economist, 2011), for example, describes how healthcare, education, urban design and open spaces have become influential cornerstones in creating liveable urban environments. Kochera, Straight, and Guterbock (2005) use such cornerstones to describe how liveable communities can be created as suitable environments for growing old, showing how the built environment can facilitate the setting of a community, which provides a social environment that engages residents in civic and social life and acts as an enabler of personal independence. In line with this, Power (2012) shows how low-density, sprawl housing and traffic may cause environmental damage. Melia, Parkhurst, and Barton (2011), on the contrary, discuss how urban intensification, e.g. compact city development, can also lead to worsening local environmental conditions, unless appropriate traffic restraint measures are taken. Recently, Scott, Dugundji, and Páez (2013) devoted a special issue of the *Journal of Transport Geography* to the question how transport systems impact on society, health, communities and well-being. Here, Wang and Lin (2013) show, for the case of Hong Kong, that built environment factors, such as population density, accessibility, public rental housing and self-containment, are strong determinants of social environments and social contacts.

Others have more specifically looked at how the built environment influences, and is influenced by traffic, mobility choices, accessibility, liveability and quality-of-life. Cervero (2002), for example, presents evidence that a compact, mixed-use, and walking-friendly environment influences mode choice in favour of non-motorized and public modes. In a more recent paper, Cervero (2013) discusses and demonstrates the importance of coordinating transport and urban development in a pro-poor manner to encourage welfare and prosperity in developing cities.

Appleyard's liveable street study was amongst the first to assess the use of streets in a systematic way, not only from a technical and economic view but also looking at the social and political dimensions. Their theoretical model of the 'Ecology of the street', displayed many possible relations between the street environment, residents and travellers. Five liveability indicators were identified in the San Francisco case study based on interviews along selected streets, i.e.: traffic hazard (i.e. the danger of traffic), stress, noise and air pollution, social interaction (i.e. the friendliness of the street and number of friends and acquaintances the people have), and environmental awareness (i.e. how well residents know their own street in terms of locations of trees, benches, details of buildings etc). The authors found all five liveability indicators to be inversely correlated with traffic volume. A well-known output from the study was an annotated image mapping, visualizing the level of social interaction along the three streets, showing that residents of the light traffic street on average have three times as many local friends and acquaintances compared to those residing along the heavy traffic streets. The study inspired many professionals in street design, traffic management and urban planning (Vasconcellos, 2004) and other researchers who applied his framework elsewhere. Koorey and Chesterman (2010) for example conducted a similar study in New Zealand, while Hart and Parkhurst (2011) summarize three studies in the US and describes one in Bristol in the UK, all of which conducted a similar data collection which confirmed that social interaction and environmental impacts deteriorate when traffic volumes increase (Patterson, Gutter, & McGovern, 1988, cited in Hart & Parkhurst, 2011; Bosselmann, Macdonald, and Kronemeyer, 1999; Transportation Alternatives, 2006). The Bristol case study also indicated that a high level of traffic is limiting the development of friendships more than it is preventing the formation of less socially-involved acquaintances.

Appleyard's liveable street study and the work that followed, however, are also known to have some shortcomings. A first logical shortcoming, as mentioned before, is that all studies took place in developed countries such as England, the United States and New Zealand, which may confound generalisation of the results to the whole world. Second, the studies controlled for dimensions of traffic, such as speed, composition and direction that can also influence street life, but not for personal and household characteristics and residential self-selection. Residential self-selection refers to the fact that households, depending on attitudinal and socio-economic characteristics, may choose their residential locations to a greater or lesser degree on the transport environment that the built environment offers (Mokhtarian & Cao, 2008). Literature on built environment and travel behaviour indeed shows that these are important factors to control for. Most studies that include residential self-selection find that, for example, built environment impacts are overestimated if self-selection is not controlled for, but the degree to which the impacts are overestimated differ strongly between studies (Mokhtarian & Cao, 2008; Cao, Mokhtarian, & Handy, 2009). Residential self-selection may also be relevant here; residents that care more than average about street life might go and live on light traffic streets to avoid the nuisances of heavy traffic and will thus be overrepresented in that part of the sample.

Some authors have looked at how to mitigate the negative effects of traffic on liveability and social cohesion, besides for example traffic calming. Bosselmann et al. (1999) studied the presence of tree-lined boulevards that physically separate local and through traffic and how these can improve liveability of residents. They conclude that boulevards are successful in mitigating the adverse impacts of heavy traffic. Residents of these boulevards are less aware of the traffic due to physical segregation from traffic with a line of trees and "value their street as a special place" (Bosselmann et al. 1999, p. 179). Berke and Conroy (2000) in turn describe how physical spaces that are adapted to the desired activities of inhabitants encourage community cohesion and sense of place, hence creating a more liveable built environment.

2.2. Transport and liveability in an urban developing country context

East and Southeast Asia, including Vietnam, are currently