ABSTRACT: Over the next twenty years, the number of Australians over the age of 65 is expected to double. Current policy initiatives emphasise ‘ageing in place’ whereby older people are encouraged to remain in the community, rather than move into institutional care. It is argued that ageing in place benefits individual health, social cohesion and increasingly, links are being made to the form and sustainability of our urban environment. This cross-disciplinary paper is a result of collaboration between researchers in architecture, construction management and population health. The outcomes of a study, undertaken by the authors, that combined subjective and objective measures of two residential suburbs within Newcastle (NSW, Australia) are discussed in relation to the links between the health of the ageing population and urban form; a significant national and international issue that is now only beginning to be adequately addressed through research. The outcomes of the study show that there is a relationship between the visual character and urban form of a locality, and the quality of life of its residents. This relationship also exists at the scale of individual streets, and this is discussed from the perspective of the potential scenarios for the design of residential urban space for ‘ageing in place’.

Keywords: ageing in place, urban analysis, streetscape analysis

INTRODUCTION

Over the next twenty years, the number of Australians over the age of 65 is expected to double (ABS, 2009). Current policy initiatives emphasise ‘ageing in place’ whereby older people are encouraged to remain in the community, rather than move into institutional care (Hogan, 2004). It is argued that ageing in place benefits individual health, social cohesion and increasingly, links are being made to the form and sustainability of our urban environment (Kendig, 2000). To date, most of the research examining the impact of housing and neighbourhood on health has not been able to tease out the complex interaction between the place-based variables. Despite the widespread correlation between objective and subjective measures in quality of life surveys, built environment and urban sustainability surveys remain dominated by objective measures only (Porta, 2005). Where subjective built environment measures have been used in studies of neighbourhood satisfaction they have not been correlated with physical measures of the built environment (Landorf, 2008). While there is emerging evidence that characteristics of the built environment relate to health status, no comprehensive correlation has been made between built environment and health measures (Mohan, 2007).

1. AGEING IN PLACE AND THE BUILT ENVIRONMENT

1.1 Background

Urban sustainability strategies highlight the need to integrate economic, environmental and social concerns when planning future developments. This includes planning developments that are equitable and that will enable people to remain physically and socially active throughout their life cycle. With increasing evidence to suggest that health in later life is particularly sensitive to environmental characteristics, there is an urgent need to better understand the determinants of healthy ageing, and the environmental factors that support older people living independently in the community (Subramanian, 2006).

However, there is currently little evidence on which to base the development of policies, programs or advice to assist community ageing in place. We know little about the safety and access features of existing housing stock and the neighbourhoods in which older people live, or how the built environment influences health (Prohaska, 2006). The United Nations Research Agenda on Ageing for the 21st Century argues there is an urgent need for research into the impact of housing and neighbourhood on the health of older people (Geriatrics, 2008). The World Health Organisation Active Ageing Policy has emphasised safety and access characteristics as particularly important, observing that homes and neighbourhoods that are unsafe and that have multiple physical barriers to access and functionality are likely to limit physical and social participation and increase the risk of depression, and declining fitness and mobility in older people (WHO, 2002).
There is also little known about the impact of an ageing population on urban sustainability. While there is agreement about the general objective of sustainable development, practical strategies and universal benchmarks remain elusive. A recent study of over 100 built environment sustainability tools has highlighted the lack of consistency in assessment methodology, criteria and metrics (Landorf, 2008). Few of the tools were found to assess the two key sustainability principles, namely a long-term and holistic decision-making process and community participation in that process. Fewer still were found to assess the requirement for a balance across the economic, environmental and social dimensions of sustainability. Economic and environmental metrics were found to dominate the less tangible social issues, and assessment of the potentially disabling impact of the urban environment on older people was not evident in any of the tools (Landorf, 2008).

To date, most of the research examining the impact of housing and neighbourhood on health has not been able to tease out the complex interaction between variables. Firstly, most studies have only examined single aspects of the built environment or health. For example, studies have examined whether specific aspects of housing are associated with falls and accidents (Mackenzie, 2003) or whether neighbourhood characteristics affect physical activity.9 Secondly, despite the widespread correlation between objective and subjective measures in quality of life surveys, built environment and urban sustainability surveys remain dominated by objective measures only (Porta, 2005). Where subjective built environment measures have been used in studies of neighbourhood satisfaction they have not been correlated with physical measures of the built environment (Landorf, 2008). Thirdly, while there is emerging evidence that characteristics of the built environment relate to health status, no comprehensive correlation has been made between built environment and health measures (Moha, 2003; Parkes, 2002). Finally, little is known about the relationship between neighbourhood choice and built environment characteristics, or how the physical characteristics of a neighbourhood might be evaluated and compared (Porta, 2005).

The few studies that have undertaken a more multidimensional examination of the urban environment and health in older people have supported the complexity of these relationships. Recent work by Bowling (Bowling, 2007) in the UK found that community dwelling people aged 65 and over who lived in affluent areas, and had high perceived access to facilities and neighbourhood satisfaction, had higher levels of social activity, regardless of individual demographic and socio-economic characteristics (Bowling, 2007). The ENABLE-AGE project, which examined the relationships between objective and perceived housing and instrumental activities of daily living (IADL) and subjective well-being among people aged 75-89 years living alone, in five European countries, found that both objective and perceived aspects of housing were related to well being, and environmental factors were related to both negative health events and positive health-related outcomes (Oswald, 2007).

1.2 Regulating a cohesive streetscape

The recent development of greenfield sites for suburban development with design guidelines affecting the physical appearance of dwellings appears to show that there is a market for visually cohesive streetscapes (Alexander, 2003; Lensworth Wallarah Peninsula, 2004). In preliminary design stages the architectural quality of a building in relation to its context might be discussed in terms of its response to the existing character of the street. However, those verbal descriptions will eventually become “physical materials in physical space” (Stamps III, 2003:453). Planning guidelines that require both “excessive similarity and excessive dissimilarity are not tautological but rather express the hypothesis that pleasure is an inverted-U function of similarity” (Stamps III, 2003:455).

Craglia (2004) reflects on the importance of the “reinvention of tradition as one of the strategies to enhance visibility” based on the market driven by the “urban tourist” as opposed to the more traditional resident. These sometimes conflicting requirements of the city draw a distinction between the modernist tendency to regulate space based on zoning and the post-modern approach where “fragmentation, urban mosaics and the colourfulness of cultural difference” (Craglia, 2004:p52) are encouraged. Craglia argues that this “recognition of differences has resulted in a cultural shift in urban studies with the city analysed as a work of art, a representation, and a text, that take different meanings for the various actors in it” (Craglia, 2004:52). Urban planning ideas originally proposed by Sitte, Lynch, Jacobs and Alexander (Alexander, 1977; Jacobs, 1961; Lynch, 1960; Sitte, 1945) are now being discussed from a commercial point of view (Craglia, 2004).

2. METHODS FOR VISUALLY ASSESSING STREETSCAPE CHARACTER

Establishing the existing visual character of a streetscape involves a two-step process. The first might be considered as an observation of the patterns of interrelationship between elements, a process that by its description should suit a photographic study. The second stage involves deciding the importance of particular patterns in relation to others (Alexander, 2003; DIPNR, 2004; VicD.I., 2001). It is this stage of the process where an individual’s interpretation of what appears to be important may provide different analytical outcomes. The emphasis that each Local Government Authority (LGA) places on the importance of visual character will change, as will the meanings that each individual reads into a given scene. For buildings to be approved, planning authorities must assess these qualitative aspects of existing urban areas such that decisions can be made about proposed changes. It is this first objective stage of analysis that is of importance within this paper, particularly the question of how the visual properties of a dwelling within a streetscape might be interpreted.
Fisher-Gewirtzman (2003a) observes that while density measures might be relevant to planning at the scale of the city or region, they are of little use when considering the degree of enclosure or openness within a particular urban space. She reflects that understanding the relationship between the built form of the street and surrounding urban space is fundamental, “appropriate thorough work is needed to develop sharper evaluation, control methods, and predictive tools, conditioned to the human perception of space.” (Fisher-Gewirtzman 2003a:577).

When evaluating the effect of changes to the streetscape – for example, changes to the façade of a dwelling – Alexander (Alexander, 2003) suggests that the analysis be undertaken at different scales and include views of the locality or “neighbourhood”, views within the street (the “character precinct”) and views from the front of “adjacent properties”. At the scale of the “neighbourhood”, elements such as the topography, street pattern, vistas and the prevailing character of the urban space are also to be examined. The “character precinct” is conceived as a fundamental unit of streetscape character as it attempts to find “those properties that have a strong visual relationship to each other within a street or other urban space” (Alexander, 2003:17). Elements to be examined at this scale include street fixtures and furniture, patterns of lot widths, outline, composition and any symmetries of the built form, extent of light and shade within the built form and on the ground. At the scale of the adjacent properties, elements to be examined include the built form (including solid and void), horizontality and verticality of the elements within the façade, the intricacies of line within the street façade and colour and texture of the materials.

Ellefsen (1991) states that planning authorities have a need for specific and objective information about the character of dwellings and their settings when they undertake studies of the local environment. Similarly, Lillis and Pourmorianian ( 2001) have found that techniques currently used for streetscape analysis do not establish the basic information required by planning authorities and community groups for informed decision-making about changes to the streetscape. In response, they proposed a “toolkit” that relied on a checklist of commonly found elements within the streetscape. An individual would use the checklist to record the visual aspects of the street, but how this information would be used by a designer to develop a new design is difficult to understand. As Stamps (Stamps III, 2003) reflects, those verbal and notated descriptions will eventually become ‘physical materials in physical space’. So while this information might enable the development of a database of elements within the streetscape, by not visually recording the information within the street (using photography), the database would retain a subjectivity based on the expertise of the assessor, while the checklist could never be so comprehensive as to actually record the varied and intricate relationship between elements within the streetscape (Tucker, 2005b).

A photograph only records a two dimensional frame of a part of the streetscape, but it has the benefit of recording the complex relationships of visual elements in a detailed way (Tucker, 2004). Whatever forms are within the visual frame aside from the front view of the dwelling – such as street-trees, parked vehicles, landscaped areas –need to be recorded as part of the visual complexity of the street view (Alexander, 2003; DIPNR, 2004). Without using photography it is difficult, cumbersome and intrusive to describe the visual nature of an element in sufficient detail for it to actually be useful. For instance, the size of a window might be described in a statement, but its detail, as a unit and placement within the wall, its relation to other elements, material qualities and degree of weathering, which all affect the visual field, are best recorded using photography.

Aside from issues purely concerned with visual character, visualizing the form and materials of the built environment might inform urban sustainability issues such as space and energy consumption. Fisher-Gewirtzman (2003a) adds that “quantitative parameters” such as the penetration of natural light, wind intensity and density measurements need to be related to other physical and psychological “qualitative parameters” such as texture, privacy, colour, and style. While qualitative measures are open to interpretation by the individual, planning authorities need to assess these aspects of existing urban areas, so that decisions can be made about proposed changes. Because these qualities are difficult to measure they can be overlooked, resulting in changes that disassociate residents from their “place-based communities” (Hull IV, 1993). In cases where the character of a street or locality requires improvement, the challenge is to identify the physical attributes of the preferred character, while developing the broader infrastructure and amenity within the locality (Townsend, 2001; Tucker, 2007, 2004).

3. ANALYSIS OF THE URBAN INDICATORS: NEIGHBOURHOOD

3.1 Selecting the neighbourhoods for the study
Two localities within Newcastle, NSW were selected for an analysis of their urban environments; Merewether Heights which is located 4km south west of Newcastle centre and The Junction 2km south west of the centre, both are 1km from the coast. These localities were selected because of their proximity to each other but their potentially contrasting urban fabrics might show where differences exist in health related outcomes. The Junction neighbourhood is on the fringe of the inner city of Newcastle (836 buildings), has a shopping centre and shopping streets, has some housing stock that is 100 years old and geographically flat. Merewether Heights neighbourhood (532 buildings) in contrast is more typically a ‘suburb’ with more obvious boundaries provided by its hill location, most housing stock is no more than 50 years old and the street layout is more circular than gridded. These differences have meant that the way individual houses meet the street and describe the space of the street are visually different (Tucker, 2007).
3.2 Overview of the analysis of the urban environment within the selected neighbourhoods

A method developed by Porta & Renne (2005) to objectively measure urban environments using a series of indicators was used to provide a framework for the study. While the method established by Porta & Renne is based around urban fabric indicators developed by the Western Australian Ministry for Planning, the principles are similar to those established by Newcastle City Council (NCC, 2009) and broadly recognised within other Australian cities as versions of ‘New Urbanism’. These principles promote walkability connectivity within a neighbourhood, a mix of uses and housing types while maintaining a traditional neighbourhood structure (Calthorpe, 2001). The strategy developed by Newcastle City Council is called ‘Newcastle Urbanism’ and the control plan that effects development within the city and surrounding suburbs states that ‘streets are the primary public places for access and exchange between people, and should be made safe, friendly, attractive and efficient’ (NCC, 2009:p7).

Analysis of the built environment used established methods that analyse the urban form in terms of its amenity: accessibility, permeability and walkability, with a range of formal characteristics that measure the complexity, continuity and transparency of the visual environment of the streetscape. Whether the amenity of a residential locality can be sustained or modified to provide a more sustainable urban pattern for an ageing population is becoming an important issue, particularly for cities that have a significant proportion of its population within surrounding suburbs. While the visual character of streets within a city plays an important role in creating a sense of place and community for its citizens (Lynch, 1960), the amount of perceived complexity or visual diversity within a streetscape is an important variable that influences whether or not a person might find the environment appealing (Berlyne, 1974; Imamoglu, 2000; Rapoport, 1990; Stamps III, 2003).

4. ANALYSIS OF THE URBAN INDICATORS: NEIGHBOURHOOD

4.1 Mapping accessibility

The mapping of a walkable zone within a neighbourhood enables an assessment of the interconnectedness and accessibility of the street network for pedestrians. Within each of the neighbourhoods a circle with a 400m radius was drawn, representing a 5 minute walk from the centre of the suburb. Within The Junction; the layout of streets is based on a rectangular grid providing a high degree of interconnectedness between locations. Within Merewether Heights: The layout of streets is based on a series of connected streets that are terraced down the slope. There are 6 cul de sacs within the area that limit the accessibility between locations. Some streets have a significant slope that may effect accessibility.

4.2 Land use diversity

This indicator measures the diversity of land uses within the neighbourhood. A higher value may increase consumer choice, and provide amenity for residents within walking distance. Traditional developments typically have a higher level of land use diversity than conventional developments (Porta, 2005). The Junction has a much higher land use diversity compared with Merewether Heights. Where Merewether Heights has virtually no other land use apart from housing, and with most house blocks of a similar size, The Junction has a variety of land uses including schools, churches, parks, large retail outlets and finer grain shopping streets. This diversity of use is reflected within the regulated land zoning within The Junction.

4.3 Natural surveillance from within the street

Oscar Newman famously argued that boundaries contribute to defensible space and can be either real or symbolic. Whether the boundary is a high wall or the change in surface texture, they both serve to indicate a transition from public to private space “where one’s presence requires justification” (Newman, 1972 p63). Furthermore, Jan Gehl observes that conversations in streets occur more frequently when a yard is delineated by a boundary such as a low wall (Gehl, 1996:p192). These boundaries create resting places which Gehl states are important for enabling people to stay longer in the semi-private area in front of their house and thereby increasing the possibility for interaction with passers by. This activity on the street is an important factor in making places liveable because “people come where people are” (Gehl, 1996:p27). Gehl also observes that these characteristics are more likely to keep people in a public realm for longer periods. These areas might be what Alexander calls “positive spaces” (Alexander, 2002:p173). This concept could also be applied to the façade of a building. A positive space or shape is one which surrounds another shape or space and is able to be considered as a shape or space in its own right. The whole composition is then considered so “there is not a single place which is leftover” (Alexander, 2002:p176). According to Alexander, a void can unify the structure of a composition by providing a focal point for surrounding details and elements (Alexander, 2002:p222). The porch of a bungalow could be read as a unifying void for the façade of a house. The uniform shade enabled by this space can create a place for the eye to rest, and contrasts with the higher levels of visual information in the rest of the façade.

Mapping the ability for a streetscape to promote a better natural street surveillance. Streets that are poorly designed with respect to this indicator contain blank walls, high fences, parking lots or the backs of commercial buildings. On the whole both localities have good natural surveillance with the predominance of houses facing each other in Merewether Heights probably having better surveillance than The Junction. Where natural surveillance is explored in finer detail within the streetscape images, there are particular locations where vegetation or slope do restrict views.

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4.4 Permeability (street connectivity)

The type and number of intersections affects the movement by users within a neighbourhood. Street networks that offer both, physical and visual directness of movement to a destination allow greater permeability. T-junctions and culdesacs reduce permeability while 4 way intersections and smaller block sizes enhance it. Both neighbourhoods were analysed using the method outlined in Porta Renne with The Junction (49) having a much greater value for permeability, almost 3 times that of Merewether Heights (17).

5. ANALYSIS OF THE URBAN INDICATORS: STREETSCAPE

5.1 Overview of the streetscape analysis

Using Google Earth streetscape images, around 500 images in total from each neighbourhood were analysed using methods outlined in Porta Renne, providing much finer grain information about the form and texture of the built environment. Table 1 below shows the analysis of these images for The Junction, grouped into the streets they were taken. This information can then be grouped to give a snapshot of the entire neighbourhood, shown in Table 2, and when this information is compared with the same information from Merewether Heights some differences were observed. The amount of sky visible from within the street (Sky Exposure) was slightly greater than within The Junction, Façade Continuity was greater in The Junction by a factor of around 35%, Softness of the street (Transparency and Translucency) was similar between the neighbourhoods. The Social Width Rating, the ability of a street to promote human interaction, was similar between the neighbourhoods. There are a number of factors affecting Visual Complexity however their average shows that The Junction was more visually complex by a factor around 20%. Sedibility was slightly higher in The Junction as were Visual Detractors (twice the value for Merewether Heights).

Overall, the analysis of the urban indicators at the scale of the neighbourhood does show differences that can be related to health outcomes, however when the indicators are viewed at the scale of the street (Table1), the values can vary significantly within the neeighbourhood. Even accounting for the differences in the number of images analysed within each of the streets, relating residents health outcomes with the streets they live may also provide a useful analysis of how the form and visual qualities of the built environment might inform the ability for a locality to promote ageing in place. There is still much analytical work to be done to see the extent of correlations that might exist, however some of this preliminary work is discussed in the next section.

Table 1: Streetscape image analysis using Porta Renne method for The Junction – maximum and minimum values for each street are highlighted for each urban indicator.
Table 2: Streetscape image analysis using Porta Renne method for The Junction and Merewether Heights

<table>
<thead>
<tr>
<th>Merewether Heights</th>
<th>202</th>
<th>19.2</th>
<th>1.1</th>
<th>0.8</th>
<th>6.7</th>
<th>3.7</th>
<th>2.9</th>
<th>1.4</th>
<th>1.6</th>
<th>1.3</th>
<th>1.5</th>
<th>1.4</th>
<th>2.3</th>
<th>1.2</th>
<th>0.0</th>
<th>0.2</th>
<th>1.3</th>
<th>0.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Junction</td>
<td>288</td>
<td>20</td>
<td>1.5</td>
<td>1.4</td>
<td>5.6</td>
<td>3.5</td>
<td>3.1</td>
<td>1.9</td>
<td>2.1</td>
<td>1.4</td>
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<td>0.2</td>
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<td>1.1</td>
</tr>
</tbody>
</table>

Table 2: Streetscape image analysis using Porta Renne method for The Junction and Merewether Heights

6. SELF REPORTED SURVEY RESULTS AND OBSERVED URBAN INDICATORS

6.1 Response rates with the self reported survey
An indication of the quality of life of residents within each locality was gained through a survey (letter box drop) that established demographic and health data together with perceptions of their living environment.
Only residents older than 55 were eligible to complete the survey with 80 people (47% response rate) responding from The Junction and 72 (38% response rate) from Merewether Heights.
There were many more respondents living alone, with higher levels of widowed and divorced people from The Junction. From Merewether Heights, there were more men and more partnered respondents, more people living with their spouse/partner, more people aged 75 years and older and less people aged 55-64 years. The same proportion of people in each locality felt that their health was either excellent or very good (58% at each site), and rates of common conditions and symptoms were similar and at levels expected for this population group. However, there were some differences. Arthritis, hypertension, diabetes and osteoporosis were more prevalent for respondents from The Junction, while asthma and cervical or prostate cancer were more common for Merewether Heights.

6.2 Walkability and quality of life
There were some significant differences between neighbourhoods in terms of perceived walkability. The Junction is perceived as more “walkable” with far better “access to shops”, obtaining none of the low scores received by Merewether Heights. Merewether Heights was perceived as a safer neighbourhood, but less safe to walk around, with traffic hazards and physical barriers, and hilliness. For The Junction, there were moderate correlations between access to shops and physical / social function; between walking safety and physical function; and between socializing while walking and mental health. For Merewether Heights, there were moderate correlations between perception of traffic hazards and physical function and general health; between hilliness and general health; between physical barriers and general health; and between neighbourhood satisfaction and social functioning.

6.3 Observed environment versus walkability
Table 3 provides detail of the significant correlations between perceived walkability and observed environment. There were different aspects of walkability related to different aspects of the observed environment for each site. There was no concordance in relationships across sites, and in fact the detractors average had opposite correlations for each site (ie, positive for site 1, that is social interaction increases with detractors, and decreases in relation to the detractors average in site 2).

6.4 Urban indicators compared to self reported health data
Correlations between observational and self reported data were done by street. As seen in Table 3, there were many significant associations between the observed built environment and quality of life indicators. However the correlations between urban indicators and health outcomes were different for each neighbourhood. The only correlations that existed between the neighbourhoods was for role emotional and number of buildings / softness: transparency. Otherwise there was no concordance in correlations.
Table 3: Observed environment and quality of life

7. FURTHER WORK

7.1 Extending the current study

The present study will be extended to incorporate the analysis of urban areas nearby to The Junction with an additional mapping; to study the potential for these areas to accommodate secondary small houses. The reason for this is to understand the capacity for these areas to support ageing in place in a sustainable way, and in direct response to recent changes to NSW planning policy that is facilitating the addition of a secondary dwelling to residential land that otherwise was only able to support the existing single dwelling (NSW Government, 2010).

7.2 Ageing in place

More analysis of the data accumulated by the study needs to be undertaken and this will progressively begin to determine the streetscape and urban elements that influence sustainable healthy ageing within cities. The work completed so far has shown that this relationship is complex and may hold correlations that were not expected. While collecting data at the scale of the neighbourhood may be important for determining ageing in place strategies for a city or region, it is at the scale of the street that urban amenity and health outcome might be better understood and correlated. The selection of The Junction for this study is interesting because the neighbourhood lies in an area outside the city centre but not so far out to truly be called a suburb, is flat, well connected to shopping and buses, and with land values that are relatively low. These ‘nearly urban’ areas within cities may be ideal for ageing in place and we are looking to undertake further work in other such areas. This research project is significant because it addresses an under-researched link between two significant and current issues of national and international relevance, namely an ageing population and urban sustainability, and represents a unique collaboration between researchers in the built environment and population health.

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