High-Density Ageing-Friendly Neighbourhoods: Multi-Sensorial Perspective

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Abstract

Multi-sensorial, emotional and symbolic interactions with space are critical to our experience, use and appreciation of built environments and profoundly shape our overall sense of well-being. However, our contemporary cities are often either sensory overwhelming or sensory deprived, while design practices keep embracing values of ocularcentrism and pragmatism. In result, cities keep generating stressful conditions and inequality, instead of becoming healing, empathetic, sensitive and inclusive environments for all. The aim of this paper is to discuss the role of sensory experience in planning and designing healthier neighbourhoods in high-density contexts for all ages, beyond passive and non-integrated provision of healthcare and eldercare facilities, universal design, hygiene and safety. Focusing on, subjective multisensorial experience, overall ambience and culture-specific clues, housing neighbourhoods are seen as supportive "devices" with capacities to build up residents' physical and mental ability levels, independence and social support, sense of dignity and self-esteem, at different stages of ageing, especially due to associated declines in sensory, motor and cognitive functions with ageing. This paper outlines the initial stage of research that aims to capture and evaluate multi-sensory qualities of residential neighbourhoods from the senior residents' perspective. It summaries methods and preliminary findings of the pilot study conducted in two Singaporean high-density neighbourhoods that employed ethnographic explorations, sensory mapping, surveys and walk-along interviews to capture and analyse both quantitative and qualitative, objective and subjective, sensory data and daily rhythms of housing environments from the perspective of elderly users.

Keywords: ageing-friendly neighbourhoods, multi-sensorial experience, sensory rhythms, high-density environment

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Introduction

Bodily multi-sensorial, emotional and symbolic interactions with space are critical to our experience, use and appreciation of built environments (Holl et al., 2006; Jelic, et al., 2016; Merleau-Ponty, 1962; Pérez-Gómez, 2006). Everyday exchanges with numerous stimuli in urban settings profoundly shape our overall sense of physical, mental and social well-being. In order to foster well-being positively, physical settings need to provide a balanced and moderate degree of positive stimulation (Berlyne, 1971). However, our contemporary cities are often either sensory overwhelming or sensory deprived (Erwine, 2014), and keep eroding our perceptual sphere (Zardini, 2005), while generating stress and inequality, instead of providing healing, empathetic, sensitive and inclusive conditions for all. Instead of evoking and facilitating the existential feelings and sensations, contemporary architecture has narrowed down the sensation to vision and normalised emotions to eliminate any extreme forms such as melancholy, happiness or ecstasy (Pallasmaa, 2002). The reasons may lie in the design practices historically embracing the values of ocularcentrism and pragmatism, hygiene and standardization, while neglecting the body and the senses, and their complex subjectivities (Degen 2008; Pallasmaa 1996). Such a rationalist, functionalist and modernist approach results in spaces that discourage close physical and social encounters and can be traced since the Renaissance and the Enlightenment (Degen & Rose, 2012; Illich, 2004).

On everyday basis, human beings are deeply engaged with many routine activities, such that they often forget about their bodies and what role they play in these activities. However, this does not mean that our bodies do not react. Instead of being passive receivers, our senses are rather active seeking mechanisms that are always involved simultaneously and interdependently (Gibson, 1986). Sight may indeed be the dominant sense, but it also inevitably depends on the other senses. According to Pallasmaa (1996), vision discloses what touch already knows and the tactile sense could be described as the "unconscious of vision."

Sensory declines are common with ageing, particularly the declines in motor functions, vision, hearing and odour identification (e.g., Dillion et al., 2010; Schacht & Hawkins, 2005; Swenor et al., 2013). Sensory impairments have also been associated with cognitive declines, and they both accelerate with ageing (e.g., Crews and Campbell, 2004; Schneider & Pichora-Fuller, 2000), However, while sensory declines can have detrimental effects on daily functioning, independence and wellbeing of the elderly adults, they are often under-recognised and undertreated (e.g., Berry et al., 2004; Cacchione, 2014; Chia et al., 2006; Crews & Campbell, 2004; Kiely et al., 2013; Kim et al., 2011; Kwon et al., 2015).

Therefore, embracing sensory qualities in strategic and sensitive ways becomes even more critical when designing for ageing population. Accordingly, enriching our understanding of the spatial, perceptual, emotional and social support needs of the "new elderly" is a prerequisite for designing better neighbourhoods and fully exploit their capacities to enable more meaningful and joyful "ageing in place" and "active ageing" and enhance the overall well-being of all ages. High-density conditions pose further challenges However, while the past two decades experienced "sensory revolution" in social sciences, ethnography, anthropology, human geography and cultural studies (Howes, 2006), the empirical studies in architectural and urban design disciplines focusing on multi-sensory approach to ageing-friendly and healthsupportive neighbourhood design are scarce.

Research Scope and Objectives

The overarching aim of this paper is to discuss the role of sensory experience in planning and designing healthier and elderly-friendly neighbourhoods. The premise is that the design of ageing-supportive environment needs to go beyond mere provision of healthcare and senior services, and the basic concerns for hygiene, safety and universal design. Subjective multi-sensorial experience, overall ambience and culture-specific clues are seen as important ingredients of neighbourhood design that is supportive to all stages of ageing. Challenging and building up physical and mental ability levels is critical independence, sense of dignity and self-esteem of the elderly, and together with functional and social support substantially contribute to overall quality of life and well-being. Accordingly, the main objectives of this paper are:

- To draw greater attention to multi-sensorial aspects of urban experience, design and well-being in reference to pressures of ageing population;
- To discuss the initial stage of on-going research that explored the ways capture, analyse and visualise both quantitative and qualitative, objective and subjective, multi-sensory data and daily rhythms of housing environments from the perspective of elderly residents;
- To summarise methods and preliminary findings of the pilot study conducted in two Singaporean high-density neighbourhoods.

At this initial stage of research, the primary concerns of this paper are methodological, pertinent to documentation, analysis and visualisation of sensory data. The preliminary results are discussed mainly as illustrations of the methodological explorations and outcomes and as indicators for the direction to be taken in the subsequent phases of research. Systematic investigations of sensescapes and the seniors' embodied experiences of their neighbourhoods are needed to enrich the knowledge of these largely neglected and less tangible aspects of everyday city life and their role in shaping the physical, mental and social wellbeing of senior urban dwellers.

Ageing Population, Multi-Sensory Experience and Ageing-Friendly Design

Ageing population trends. It has been predicted that the global population aged 60 years or over will grow from 12.5% in 2017 to 20% in 2050 (UN, 2017). Similarly, by 2050, the elderly population in Asia is expected to reach 23% on average. However, such predictions are even more alarming for Singapore, where by 2030 the population aged 65 or over is predicted to rise to 27%, and to 47% by 2050 (Tan, 2017). Such estimates are comparable to Japan, the eldest society in the world today.

Sensory and cognitive decline. According to a recent study (Correia et al., 2016) conducted in the United States among over 3,000 participants above 57 years old, 94% of senior adults have at least one sensory impairment. As estimated by the World Health Organisation (2010), about 285 million of people of all ages in the world and 30% of the world population aged 65 or above have some level of visual impairment. Loss of vision is associated with the higher risk of falls, injury, and depression, lower

performance in daily activities and dissatisfaction with social life (Crews & Campbell, 2004; Kwon et al., 2015). More than 40% of adults older than 65 experience some degree of hearing decline (Cruickshanks et al., 1998; Swenor et al., 2013). People with hearing impairment are more likely to have communication difficulties and poorer self-esteem, which often leads to withdrawal from social interaction and various psychosocial problems (Ham et al., 2007). About 24% of people aged above 70 (Kern et al., 2014) and 60% of those above 80 years old show problems with smell and odour identification (Murphy et al., 2002). Over 60% of adults older than 70 show taste deficits (Welge-Lüssen, 2009). Tactile impairment also prevails among the adults aged over 55 (Wickremaratchi & Llewelyn, 2006). Finally, almost 50% of the adults aged over 80 have some degree of motor impairment (Buchman & Bennett, 2011).

It is estimated that the number of people with dementia globally will almost double by 2030 and triple by 2050 (Alzheimer's Disease International, 2014). Similar projections apply to Singapore, especially concerning population aged 65 years and above, yet with a growing number among younger adults.

Numerous studies proved the correlations between sensory, motor and cognitive functions with ageing (e.g., Crews & Campbell, 2004), including the risk of developing dementia (e.g., Lin et al., 2013; Pacala & Yueh, 2012; Panza et al. 2015), delirium (e.g., Inouye et al. 2014) and depression (e.g., Cacchione, 2011; Carabellese, et al., 1993; Ribeiro et al., 2015), among others. Moreover, the elderly with dual sensory impairment, which usually refers to both hearing and visual decline, are at a higher risk of cognitive impairment, depression and social and communicational problems than those with single sensory impairment (Caban et al., 2005; Schneider et al., 2011; Swenor et al., 2013).

Finally, sensory and cognitive declines have been proven to negatively affect almost all aspects of the seniors' daily living and the overall quality of life (Chia et al., 2006; Fischer et al., 2009; Renauld & Bédard 2013). Reduced physical activity and mobility, problems with navigation and spatial orientation (Cacchione, 2011; Haanes et al., 2014), increased risk of falls (e.g., Dillion et al., 2010; Lord & Dayhew, 2001) and difficulties in communication are some of the most common consequences of sensory and cognitive decline with ageing. Very often, such consequences further lead to lower confidence, independence and autonomy levels, decreased willingness to go out and withdrawal from the social participation (Andressen & Puggaard, 2008; Crews & Campbell, 2004; Haanes et al., 2014; Handler, 2014; Heine & Browning, 2004).

Ageing-friendly and health-supportive initiatives. Since its foundation in 1948, the World Health Organisation (WHO) has recognised the importance of interaction between physical, mental and social factors in determining health and well-being, which go beyond simply the existence and function of healthcare institutions. In 1970s and 1980s, the WHO launched a 'Health for All' movement, followed by the 'Healthy City' programme, to improve people's health globally by modifying the living conditions of physical environment and social and economic conditions of everyday life (Kenzer, 1999).

With the rising pressures of global population ageing, in the late 1990s, the WHO introduced "Active ageing" initiative to describe a "process of optimizing opportunities for health, participation and security in order to enhance quality of life as people age" (WHO, 2002, p. 12). Six groups of active ageing determinants were proposed, namely: physical environment, social, economic, health and social services, behavioural and personal determinants, with gender and culture as common modifiers. The aim of this global initiative was to support senior residents' autonomy, independence and health for as long as possible by building up their physical and mental abilities. The initiative also aimed to combat ageism and to promote social integration and empathy.

"Ageing in place" is another concept that refers to enabling adults to grow old in their own home, and within the familiar community and environment for as long as they can and with minimal disruptions to their lives and activities (Yap, 2014). In line with this concept, in 2007, the WHO released the "Global Age-Friendly Cities: A Guide", which outlined a framework for evaluating the "age-friendliness" of an urban environment, consisting of 8 criteria. They are: outdoor spaces and buildings, transportation, housing, social participation, respect and social inclusion, civic participation and employment, communication and information and community support and health services.

In the past few decades, Singapore has embraced all the above initiatives through better provision of affordable healthcare and eldercare and elderly-friendly housing, neighbourhood upgrading programmes to implement barrier-free and universal design principles, incentives for post-retirement employment, and promotion of active lifestyles, among other efforts. The prevailing focus was on 'ageing in place', as traditionally the main source of support for the elderly in Singapore is the family. About 85% of Singaporean elderly citizens live with at least one child. However, Singapore is also experiencing a rising trend of senior citizens living alone, whose number has tripled since 2000 (Tai, 2015). With limited access to care, the elderly living alone are more vulnerable to loneliness and psychological health issues. Elderly Singaporeans who live alone are 1.7 times more likely to die prematurely than those living with friends or family (Ng, et al., 2015). Both groups had similar health conditions and physical and social activity levels. Moreover, the study showed that the elderly men are almost three times more likely to die earlier if they live alone.

Senses and enabling environments – **some aspects.** While the major health problems of the 19th century cities stem from overall poor hygiene, crowding and infectious diseases, the majority of physical and mental health issues in contemporary cities result from the sedentary lifestyle, exposure to stress and violence (Kearns et al., 2007; Perdue, 2003; WHO, 2002). Although widely assumed as negative, stress can also be understood as positive. 'Eustress' was first introduced by Hans Selye (1978) to define positive response to external stressors. Accordingly, the overall state of someone's health is defined by the degree to which an individual responds to a range of negative stressors positively.

It has been argued for a long time that well-designed and aesthetically pleasant spaces and features can hold attention, distract from stressful thoughts, trigger positive emotions, boost self-esteem and contribute to overall sense of well-being (Kolstad, 2001; Parker, 1990). The restorative effects of places on cognitive, emotional and physical functioning are well described and documented (e.g., Ulrich, 1991a, 1991b; Kaplan et al., 1989) and have led to framework concepts such as the 'biophilia hypothesis' (Wilson, 1984) and 'Attention Restoration Theory' (Kaplan et al., 1989). Ulrich's (1991a, 1991b) 'Theory of Supportive Healthcare Design' has proven that 'positive distractions' (such as nature, smiling and caring human faces, pet animals, music and culture) not only incite positive feelings but also have positive physiological manifestations in lower blood pressure and the lower production of stress hormones.

An increasing number of recent studies in neuroscience that focus on investigating the embodied experience of built environment and its impacts on emotions and wellbeing tend to confirm above (Eberhard, 2009; Jelic et al., 2016; Sternberg & Wilson, 2006). According to psycho-neuro-immunology, while negative emotions can create a misbalance of the immune system and further manifest as a physical disease, positive emotions can also have positive impact on people's overall physical and mental health. Instead of mediating,

A growing body of research suggests that various features of the physical environment are linked to physical and social activities in older adults and various health benefits (Frank & Engelke, 2005, Moudon & Lee, 2003). Studies have proven positive correlations between the everyday productive and leisure activities and the lowered risk of cognitive decline (Niti et al., 2008). Moreover, research has shown that fulfilling entertainment needs of the older people can support well-being and joyful living (Alm et al., 2009; Hossain et al., 2014).

Spending time outdoors has proven to have various physical, mental and social benefits for the elderly (Orr et al., 2016). However, the outdoor environment also pose challenges and 'dilemmas' for senior adults whose physical and social activity often depends on their 'embodied capacities' (Schwanen & Ziegler, 2011; Sugiyama & Thompson, 2007), which is one of the reasons why the older people do not spend enough time in the outdoors (Kono et al., 2004).

According to Weden et al. (2008), people's subjective perceptions of the neighbourhood qualities are the most strongly associated with their self-rated health level. Greater attention to sensorial qualities of housing neighbourhoods and subjective perception thus provides greater opportunities for designers to contribute to both physical and psychological well-being of the elderly adults.

Research Approach and Methodology

This study adopts the phenomenological approach to studying multi-sensory experience of the elderly users. Phenomenology articulates a process of constant interaction between all realms of sensory experience (detected by the eye, ear, nose, mouth, skin, tongue, skeleton and muscle) and cognition - the 'lifeworld' (the everyday world of lived experience), through which the emotional and meaningful experiences of an urban environment emerge (Merleau-Ponty, 1962; Dovey, 1999).

Of particular importance for the methodological considerations in this paper are the recent studies that focused on various approaches of capturing, measuring, evaluating, analysing and visualising sensory qualities of urban environments and subjective multi-sensory experiences (e.g., Adams et al., 2007; Degen, 2008; Degen & Rose,

2012; Naghizade & Ostadi, 2014; Pink, 2008; Rogerson & Rice, 2009). 'Sensory sliders' by Malnar and Vodvarka (2004) and sensory notation system by Lucas and Romice (2008) provide useful means for capturing subjective multi-sensory responses in an intuitive yet systematic and comparable manner, supplemented by a robust sensory vocabulary matrix. Based on socio-sensory perception and ethnographic approach, as well as in reference to Henri Lefebvre's (2004) 'rhythmanalysis', Palipane (2011) developed a multimodal mapping technique for documenting sensory experience and guide place-making practices beyond the predominant focus on visual and spatial experience.

Upon a comprehensive literature review of theories and research methods pertinent to multi-sensorial experience, health-supportive and elderly-friendly environment, the pilot stage of this study employed a combination of quantitative and qualitative methods, including ethnographic research and on-site observation, spatial mapping, surveys and walk-along interviews. The following methods and the preliminary research outcomes are discussed in this paper:

- Visual ethnography exercises;
- Sensory and activity rhythm analysis;
- Socio-perceptual surveys; and
- Walk-along interviews.

Sites – Case Studies. This research was conducted in two typical public housing neighbourhoods in Singapore, namely Clementi and Bukit Panjang neighbourhoods. More than 80% of Singaporeans live in similar neighbourhoods, which are built and operated by the Housing Development Board (HDB), and thus often referred to as "HDB neighbourhoods". Clementi neighbourhood (Figure 1) comprises two developments, one from the late 1970s and the other one built in 2013. The newer development comprises high-rise tower blocks and an elevated public space platform with various public amenities, while the older precinct consists of typical lower-rise housing slab blocks. Bukit Panjang neighbourhood (Figure 2) was built in late 1980s and resembles the older Clementi precinct.



Figure 1: Clementi neighbourhood – new precinct (left) and old precinct (right).



Figure 2: Bukit Panjang neighbourhood.

Visual ethnography exercises

The initial stage of research was facilitated through two workshops with thirty students from architecture, urban design and urban planning graduate and post-graduate programmes, as part of an elective course "City and Senses: Multi-sensory Approach to Urbanism" offered at the Department of Architecture, School of Design and Environment, National University of Singapore. The workshops primarily focused on Clementi neighbourhood and involved visual ethnography journey exercises and notations of sensory experience and body movement.

Photo-Journeys. Two photo-journeys through Clementi neighbourhood were conducted, first to capture the very first encounter with space, and the second to document sensory properties of space and student researchers' subjective multisensory experience. Photo-journeys revisited the 'serial vision' technique (Cullen, 1971), as well as the situationists' and psychogeographers' concepts of 'dérive' (Debord, 1994) and 'flâneur' (Benjamin, 1999), which both require dropping usual motives for movement and action and some level of estrangement, in other words letting one's self to be led by the environment. Before looking into perception of the elderly residents, it was crucial for the student researchers to familiarise themselves with the environment and start from their own subjective experience. Both photojourneys were envisioned as quick encounters with space, each lasting for about 20 minutes. In the first journey, teams of 3-5 students were asked to be led by the space and take 10 photos of anything they wanted, while carefully marking the path taken and the points where the photographs were made. At the end of the journey, to reflect on and verbally explain his/her experience, each student described all taken photographs using 3 keywords of his/her choice. The second journey was less spontaneous and more guided, during which students took the same path again and made another series of 10 photos, but this time documenting key sensory qualities of the neighbourhood, followed by keywords.

As synthesis, team members compiled and compared their individual photo and sensory documentations (Figure 3), which created a starting point for more in-depth discussion about perception and subjectivity as well as methods and challenges of sensory documentation and analysis.



Figure 3: Photo-journey documentation and comparison – Clementi neighbourhood (Courtesy of Fu Chong and Xu Xuan)

The second workshop focused on investigating the capacities of sensory notation charts developed by Lucas and Romice (2010) to capture the predominant sensory experiences of the same neighbourhood in a systematic and comparable manner and potentially guide design interventions (Figure 4).



Figure 4: Sensory documentation and comparison – Clementi neighbourhood (Courtesy of Felice Chap, Fu Chong, Xu Xuan and Yu Qi).

Sensory and activity rhythm analysis

In addition to visual ethnography and multi-sensory mapping, on-site observations were conducted in both neighbourhoods to document and analyse quantitative spatio-sensory data and residents' activity patterns. Observations were conducted at specific

points in the neighbourhood carefully selected based on preliminary desktop analysis of land uses and amenities in the neighbourhood, followed by the validation on site to insure that the key spots of activities are covered.

Quantitative spatio-sensory data. The sources and intensity of various sensory clues (visual, aural, tactile, smell and taste, and kinaesthetic experience) were documented using a personal multifunctional environment meter to objectively record the sound level [dB], light [lux], relative humidity [%RH] and air temperature [deg C]. Such quantitative data were supplemented by the 'subjective' information gathered using "sensory scales" or "sensory charts", to identify the levels of intensity and comfort/pleasantness of particular sensory stimuli at each point of observation. Measurements were done at 3-4 time intervals to capture the changes of sensory and ambiental qualities at different times of the day, as well as during one weekday and 1 weekend – sensory rhythms (Figure 5).



Figure 5: Sensory rhythms – Clementi neighbourhood: grey – vision; red – touch; violet – sound; yellow – smell; dark green - taste (Courtesy of Kuldeep Rabha, Mehnaj Tabassum, Li Jinyi and Nandita Nayak).

Gathering residents' activity data. A 'snap-shot' method and 'tracing' were adopted from Gehl and Svarre (2013) to observe and document transitory and stationary activities occurring in the neighbourhood (Figure 6). For a short period of time (5-10mins) the researchers counted the number of people passing by or performing

stationary activities (e.g., seating, playing, exercising, etc.) at each point of observation. Age, gender and ethnicity of public space users were also noted down, wherever possible. In addition, certain number of residents were followed to get the sense where people go.



Figure 6: Activity patterns – Clementi neighbourhood: red – dominant pedestrian paths; blue – number of passers-by; yellow – number of people engaged in stationary activities (Courtesy of Ge Fan Li, Naitik Parekh, Nurzhanat Kenenov, Phuah Lin and Ulrich Chia)

Sensory and activity rhythms. As a form of synthesis, the relationships between daily activities and sensory qualities of particular spots in the neighbourhood were further explored. Analysis and graphical representation were inspired by Henri Lefebre's 'rhythmanalysis' (2004), including also timeline and journey diagrams, mental mapping, and photo-collages, among other techniques.

Senior residents' activity patterns. Specific focus was given to where the elderly residents go and gather. Findings showed that spots the most frequently occupied by the elderly users are foodcourts and wet markets, which are also sensory the richest places in the neighbourhood (Figure 7).



Figure 7: Gathering spots – Bukit Panjang neighbourhood (Source: by authors)

Both visual ethnography and sensory and activity rhythm analyses proved to be fruitful means not only for refining methodological research directions but also for distilling critical issues pertinent to ageing-friendly neighbourhood design and informing certain design measures. Key topics that arose from these exploratory exercises include: walkability and wayfinding in reference to legibility, accessibility, physical ability and memory, quality and integration of public amenities, multigenerational interaction and social support, inclusive vs. exclusive environment in reference to universal design and ageism, place identity and emotional landscapes. Role-playing and actively engaging the elderly residents were additional means for indepth analysis of these themes.

Socio-perceptual surveys

With reference to preliminary findings from the initial phases of research, the next ongoing stage of research involves socio-sensory perception surveys conducted to gain deeper insights into elderly resident's perception, satisfaction and utilisation of particular spaces in their neighbourhoods.

At this point, a total of 154 residents in Bukit Panjang neighbourhood participated in the surveys, 84% of whom live in the area longer than 20 years (Table 1). The following analysis focuses on elderly participants only. The sample included three main categories of the elderly based on their physical ability and health condition, namely: the 'young-old' (65-74 years old) – physically and mentally fit, the 'old' (75-82 years old) – largely independent or semi-independent and semi-mobile, with some need for support from care institutions and the 'oldest-old' (82 years old and older) – dependent, with very limited mobility and highest need for medical care (Chan, 2001). Finally, the analysis also includes the so-called 'oldish' category, described by Bozovic-Stamenovic (2013) as bordering generation of "becoming old", comprising adults 50-64 years old who are mobile and active, yet with new aspirations that are largely neglected in Singaporean neighbourhood design.

Table 1: Survey participants profile – Bukit Panjang neighbourhood

AGE	Valid Sample
Adults (21-49)	21
'Oldish' (50-64)	55
Young-Old (65-74)	49
Old (75-82)	26
Oldest-Old (83 & Above)	3
Total	154

Sensory impairment and health condition. According to preliminary findings, 56% of participants reported one or more sensory impairment, among which poor vision dominates, followed by poor hearing and walking difficulties (Table 2). 18% of the participants reported poor or fairly good health condition (Table 3).

Table 2. Sensory impairment – Bukit Panjang neighbourhood

SENSORY IMPAIRMENT	Valid Sample	%
Poor vision	28	47%
Poor hearing	15	25%
Poor smell detection	1	2%
Walking difficulties	13	22%
Cognitive difficulties	0	0%
Others	2	3%

HEALTH CONDITION	Valid Sample	%
Poor	3	2%
Could be better	24	16%
Good	77	50%
Very good	30	20%
Excellent	19	12%

Table 3: Self-reported health condition – Bukit Panjang neighbourhood

Daily routine. The majority of Bukit Panjang elderly residents reported that they go out relatively frequently (Figure 8), mainly engaged in shopping, eating, meeting friends, commuting and exercising (Figure 9). However, 15% of the elderly residents go out less than once a week and 4% only few time every months.



Figure 8: How often do you go out of your home into your neighbourhood?



Figure 9: What activities do you most frequently perform within your neighbourhood (as part of your daily routine)?

Table 4: Do you agree with the following statements related to your sensory experience?

Statement	Strongly disagree	Somewh at disagree	Neither agree or disagree	Somewh at agree	Strong ly agree
This neighbourhood is overall aesthetically appealing.	0%	2%	18%	64%	16%
This neighbourhood offers good variety of areas with distinguishable ambients.	1%	3%	24%	61%	11%

Neighbourhood shows obvious signs and/or features pertinent to different cultures.	2%	5%	27%	53%	13%
This neighbourhood is often too crowded.	3%	27%	37%	26%	6%
Spaces around my home are generally clean and tidy.	3%	6%	13%	62%	17%
I often find spaces around my home smelly.	15%	38%	31%	13%	3%
I often find spaces around my home quite noisy.	15%	35%	25%	21%	4%
I feel overwhelmed and bombarded in this neighbourhood on everyday basis.	13%	42%	28%	15%	1%

The most frequented places on regular daily bases are markets and foodcourts, while the most liked areas in the neighbourhood are parks and community organisations. The most disliked areas in the neighbourhood are those near rubbish chutes, voiddecks (empty spaces underneath housing blocks) and obstructed pathways (by vehicles). In respect to sensory experience, residents find their neighbourhood clean, aesthetically appealing, with good variety of ambiances. However, a substantial number of participants expressed that their neighbourhood is often too crowded, smelly and noisy, and that they feel overwhelmed by the overall amount of environmental stimuli near their homes (Table 4).

Regarding their walking experience, residents tend to prefer sheltered pathways surrounded by greenery, but tend to avoid by rubbish chutes, messy areas and dark places. Among critical barriers to enjoyable walking experience are numerous obstacles, slippery floor, lack of companionship and fear of getting lost in the neighbourhood (Table 5).

Statement	Strongly disagree	Somewh at disagree	Neither agree or disagree	Somewh at agree	Strong ly agree
There are many obstacles to walk around this neighbourhood.	6%	40%	23%	27%	3%
Floors in this neighbourhood are slippery when it rains and I feel unsafe to walk.	8%	38%	23%	29%	3%
I hesitate to go out if there is no one accompanying or helping me.	19%	50%	16%	13%	2%
Sometimes, I can't find my way in this neighbourhood.	24%	48%	16%	10%	1%
Nature makes walking through this neighbourhood more enjoyable.	1%	3%	11%	60%	25%
I avoid passing by rubbish chutes, messy areas and dark places.	4%	32%	16%	31%	16%

Table 5: Do you agree with the following statements related to your walking experience?

I always prefer walking on sheltered	0%	30/2	12%	18%	350/2
pathways.	0/0	5/0	12/0	40/0	5570

Overall, vast majority of participants are satisfied with their lives and amenities available in their neighbourhood, including the opportunities for different generations to socialize. They find their neighbourhood well-designed for the elderly users (Table 6).

Table 6: Do you agree with the following statements related to your overall experience in this neighbourhood?

Statement	Strongly disagree	Somewh at disagree	Neither agree or disagree	Somewh at agree	Strong ly agree
Amenities in this neighbourhood provide well for my daily routine needs.	0%	0%	11%	67%	21%
There are plenty of opportunities for different generations (e.g. children and elderly) to meet.	1%	8%	18%	60%	13%
This neighbourhood is overall well- designed for the elderly users.	0%	4%	13%	68%	14%
I feel happy living in this neighbourhood.	0%	0%	6%	52%	42%

These preliminary snap-shot findings confirmed some of the issues identified in the initial stages of this research. However, they are only indicative and in in-depth analysis and data triangulation will be done upon full data collection.

Walk-along interviews

Parallel to socio-perceptual surveys, walk-along interviews (60-90mins long) are also being conducted with the residents in the neighbourhood to gather qualitative data about their sensory perception, narratives and emotional experience of the neighbourhood spaces. So far, 26 walk-along interviews were conducted in Bukit Panjang neighbourhood. This exercise includes spontaneous short walk from the resident's home to any place in the neighbourhood of his/her interest, followed by an in-depth interview. During the walk, eye-tracking glasses are used to identify critical environmental clues that catch participants' attention and shape their behavior, spatial orientation and movement (Figure 10). These first-hand recordings are supported by the researchers discreetly 'shadowing' the participants (walking a short distance behind) and noting key points in their journey, such as sudden shifts in head/eyes and body postures, change in pace, use of supporting features, such as railings, furniture, etc.



no big reason lah. It's harder for me to climb down the stairs instead of going up."

cooler to walk."

Figure 10: An example of preliminary walk-along interview documentation

Instead of Conclusion

Discussing the initial stages of an on-going study, this paper outlined different explorations of documenting, analysing and visualising multi-sensory experience in general, and from the perspective of elderly users in particular, as well as described the process of development of the methods for the future study. Visual ethnography employed in this study differs from the classical observational approach in that it allows subjects' active bodily engagements in research while capturing the profound 'unspoken' knowledge through the eves of the subjects, as also suggested in works by Pink (2007) and Bloch (1998). While incapable of recording touch, taste, smell or emotion, photo- and eye-tracking walk-along journeys showed to be fruitful mechanisms for capturing and articulating the subjective multi-sensorial and emotional encounters with the neighbourhood places in an active participatory and embodied manner. Sensory rhythm analysis also proved to be very fertile and it will remain the key means of synthesis and data triangulation. Systematic and in-depth consideration of multi-sensory experience is an alternative yet relevant and needed approach to informing meaningful, empathetic and context-specific design of ageingfriendly and healthful neighbourhoods.

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