Australasian Transport Research Forum 2024 Proceedings
27-29 November, Melbourne, Australia
Publication website: https://australasiantransportresearchforum.org.au/

Exploring multimodal transport and activity spaces of older adults within transit-oriented urban environments in Sydney, Australia

Jialing Xie [1], Ian Woodcock [2]

[1] Sydney School of Architecture, Design and Planning, University of Sydney, Australia

Email for correspondence (presenting author): jxie0341@uni.sydney.edu.au

1 Introduction

Transport-related social exclusion among older people is an increasingly prevalent societal challenge. This is especially the case for those with declining physical abilities, who lack access to essential goods and services, and cannot maintain social connections or involvement in structured exercise and optimal physical activity (Franke et al. 2019; Preston and Rajé 2007; Ryan and Wretstrand 2019). Although private vehicles may offer the greatest flexibility, especially in car-centric Australian cities (Transport for NSW 2019; Parliament of Australia 2019), many older adults reduce or eliminate driving as physical ability declines or health issues arise that may lead to transport-related social exclusion (Musselwhite and Shergold 2013; O'Neill 2015; Ryan and Wretstrand 2019). While the mobility of older people and the importance of creating accessible mobility environments have been recognised as enhancing their quality of life, there is a lack of understanding of the motivations for, experiences of, and capacities for non-car-based travel among older adults. Researchers also agree that the conceptualisation and appreciation of activity spaces tailored to the everyday travel of older adults and their specific mobility demands, rather than the ageist associations of older people with illness in past research (as per Ravensbergen et al. 2022), remains underexplored. The key question here is: how do multimodal active and public transport, transfer facilities and related urban spaces enable and constrain the activity spaces of older adults when automobiles are not an available transportation option.

The concept of 'activity space' is increasingly used to understand the behaviours of older people across time and space, providing insights into individuals' relationships with their socio-spatial environments (Smith et al. 2019; Sturge et al. 2021). An activity space is defined as a space outside the home that includes locations both routinely and non-routinely visited, along with the corresponding travel routes that an individual interacts with over time (Golledge and Stimson 1997; Massey 2005; Sturge et al. 2021). However, research exploring travel behaviours over time and space related to transport utility in later life is limited, especially among older adults living in transit-oriented neighbourhoods, or among older adults dependent on non-car-based transport. Although previous researchers observed that the most frequent activities among older people include shopping, healthcare, entertainment, and leisure walks (Davis et al. 2011; Levin 2019; Ravensbergen et al. 2022), there has been little qualitative or quantitative research undertaken to examine how older adults organise their everyday lives through different forms of transport and how this affects their socio-spatial relationships.

Transit-oriented land use planning and urban design, integrated with active and public transport planning, aims to encourage people to rely less on cars and make more daily trips via active and public transport. We are seeking to understand how these mobility environments are experienced by older adults for accessing essential amenities and social participation (Boschmann and Brady 2013; Duncan et al. 2021; Musselwhite et al. 2015; Yang 2018). In the Australian context, Sydney's expansive (and expanding) network of Train, Metro and Light Rail stations plays a key role in the city's transit-focused urban planning strategies (Transport for NSW 2023a) while buses are important for local and broader mobility and overall network connectivity. This paper presents preliminary findings from a larger study focused on older

adults aged 65 and over, who are casual users of public spaces associated with suburban railway stations in Greater Metropolitan Sydney and explores the scale of older adults' activity spaces associated with multi-modal public transport and provides insights into how different transport options influence their use and experience of these activity spaces. Against the view that older people's lives become constrained without access to car-based mobility (and the promotion of driverless cars increasingly associated with it) we argue that effective multi-modal public transport services integrated with well-designed public spaces can support and maintain mobility among older individuals across the metropolitan area and enable them to lead active social lives across diverse scales of activity spaces.

2 Methodology

This study draws on preliminary data from in-depth and iterative interviews with participants aged 65 years or over, who frequent either of two case study spaces more than 2-3 times per week, and who spend more than 10 minutes in that space. Participants were recruited by direct approach in public spaces of each selected site. Site selection was based on data from Transport for NSW (2022, 2023b) and Open Street Map. The criteria included the number of older people ($\geqslant$60 years) living within 15-, 20-, and 30-minute active and public transport catchments of each site and the presence of mixed-use environments close to a variety of public transport facilities. The two sites drawn on for this paper are Arthur Whitling Park (Castle Hill Metro Station) and Strathfield Square (Strathfield Rail Station). This study uses iterative in-depth interviews with frequent users of these public spaces, and applies a time-geographic approach (Hagerstrand 1970). Space-time methods are valued for understanding dimensions of time and outdoor activities related to mobility in elderly populations (Clarke and Gallagher 2013; Frantál et al. 2020). Interviews occurred two or three times across a week, during participants' routine visits to the sites, to understand their daily activity mobility practices and experiences using public transport. Transcripts were coded for spatial content and translated into geographically accurate maps (Woodcock et al. 2011). The content of these interviews includes time points, durations, places, interactive behaviours, and facility utilisation, that enable understanding the environment of daily activity spaces and the nuances of individual spatial practices. Data coding reveals two broad themes from the interview structure: activity patterns and related space-time constraints. Notes were entered into NVivo 12 for analysis. Activity patterns of older adults were identified from both previous literature and the interviews to determine spatial activity patterns and important daily places. Additionally, spatial and time constraints related to their transit-oriented mobility were coded into initial categories. Axial coding was then performed to categorise interview transcripts line by line for drawing connections between each code, which led to the development of themes and sub-themes presented in the results section below. Ethics approval for this research was granted by the University of Sydney Human Research Ethics Committee (HREC) (Project no: 2023/587).

3 Main findings

3.1 Participant characteristics

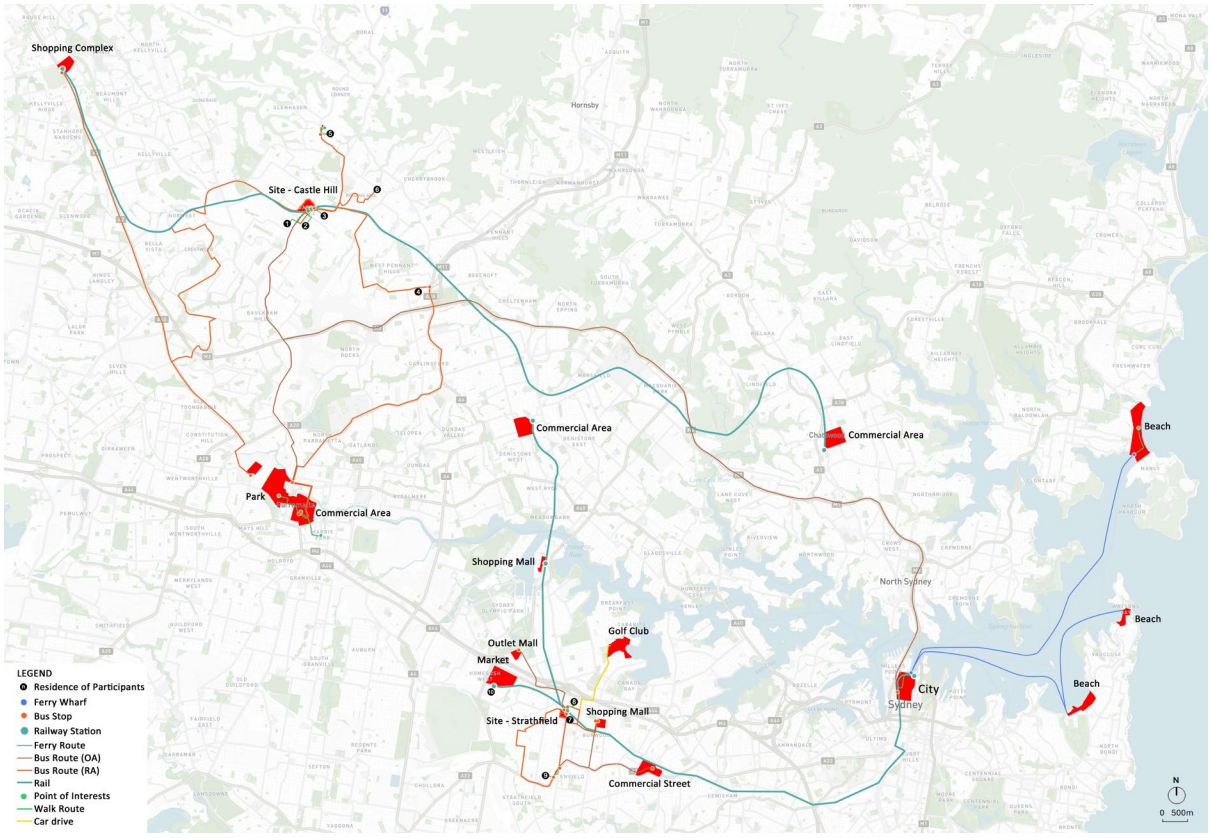
Of the 10 participants, four were interviewed at Strathfield Square (SS) and six at Arthur Whitling Park (AWP). 8 were aged over 75, with two aged between 70-75. Four participants were female and six were male. Five participants lived within walking distance of the site, and five lived within a ten to twenty-minute bus ride or train journey. All participants were able to walk independently. Five lived alone, while two were working post-retirement. Half of the participants reported visiting the space two to three times a week, the other half visited almost daily.

3.2 Multiple transport modes and spatial practices of older adults

3.2.1 Activity space patterns

The study identifies two activity space patterns: routine and occasional. Spatial data reveals two clusters of participants based on distance: those living within walking distance (approximately 1 km) to the case study sites and those beyond. Data from iterative interviews provides further insights: activities within the small activity space often occurred 3-4 times a week ('routine'), while those in the larger space happen less frequently, around once or twice a month ('occasional'). Across the two sites, all participants' routine and occasional activities were often multipurpose as they reported more than one type of activity for each out-of-home journey. Routine activities, occurring in station precincts with an enclosed shopping centre, often included walking (e.g., the walk path at Arthur Whitling Park), sitting in public spaces, observing others, and engaging in direct or indirect social interactions. Figure 1 is a map of multiple transit modes, combining public transit (PT) with active transport (AT), that enable both routine and occasional activity spaces of participants recruited at the two sites. The larger activity spaces were characterised by traveling up to 36km for special events or leisure that occurs on an occasional basis. Other occasional activity spaces were visited only once or twice a month and activities were mainly related to visiting family or friends, as well as for leisure purposes, such as trips to the city centre (e.g., Sydney CBD area) and nature (e.g., beach or large park). Most participants travelled to these locations by bus, train or ferries using a gold senior Opal card (i.e. capped daily fare).

Figure 1: Multimodal transport-enabled activity spaces of participants



3.2.1.1 Transit-oriented urban environments facilitate everyday routines

Mixed-use development around rail-based transit stations, integrated with accessible public spaces and essential amenities, enabled older adults living both within walking distance and beyond to maintain routine activity spaces. This combination supported independence, socialisation, and exercise, contributing to the everyday quality of life for older generations. Participants living beyond walking distance noted that public transit services between home and essential amenities offered opportunities for out-of-home activities. However, older adults

living within a 15-minute walk of transit-oriented spaces, such as those near shopping centres, often established routine activity spaces on foot within their neighbourhood, relying less on available motorised transport like trains or buses. Health concerns frequently contributed to this lower inclination to travel longer distances. Public spaces associated with metro stations, such as the park above Castle Hill station with an underground link to the shopping centre, were frequently used by participants residing within 15-, 20- and 30-minute active or public transport catchments of these sites.

3.2.2 Space-time constraints on routine and occasional activity spaces

Both routine and occasional activities of older adults were influenced by several factors that can support and maintain their mobility and enable them to lead active social lives across a range of scales from the local neighbourhood to inter-suburban to metropolitan. Health and weather conditions were consistently mentioned as primary constraints. As participants aged, the influence of these factors, along with the distance between home and activity sites, became more pronounced. They engaged more frequently in routine activities at nearby out-of-home locations with enhanced active transport features, such as continuous footpaths and pedestrian-friendly designs. In contrast, longer distances and transit times reduced the frequency of multipurpose trips to larger activity spaces in other suburbs, such as visiting friends or taking leisure walks in larger parks. One participant expressed both a sense of independence and physical burden during such multipurpose trips. Nonetheless, a well-connected transit network, with stops near essential amenities, expanded the potential activity spaces for many participants. For example, one participant living within a 10-20-minute bus ride from the site, highlighted that factors like shaded bus stops and minimal street crossings were crucial in making their routine activities viable. Multiple transport modes with interchanges or transfers, also enabled longer-distance travel, particularly for older adults who no longer drove. Transport concessions further facilitated occasional activities by reducing some barriers. One participant described an occasional activity space requiring 36km of travel via multiple public transport modes across the Sydney Metropolitan area, challenging traditional 'cost of time' assumptions that favour car travel.

4 Discussion

This study provides insights into how transit-oriented urbanism facilitates the daily routines of older adults, especially those living beyond walking distance of station precincts, and enables both routine and occasional activities for those within walking range. The findings confirm that transit-oriented urban environments, connected with multiple transport modes and access to essential amenities, significantly enhance the diversity of older adults' activity spaces across city suburbs. A high-quality, multi-modal public transport network featuring multiple transport modes, convenient and safe transfers, and concession pricing, enables older people to maintain large-scale activity spaces akin to what car-based travel might offer, facilitating trips that might otherwise be restricted by car dependence.

The study also examined the time and spatial barriers faced by older adults within current transit options that affect older adults' use of active and public transport networks, offering important insights for designing transit systems and urban spaces that better accommodate their needs and promote active aging. Mapping the multiple scales and multimodal accessibility and integration of these spaces between land use and the transport system, provided valuable insights. This paper shifts the focus towards the diverse everyday travel experiences of the growing proportion of older people, examining how transit-focused urbanism can support or hinder the maintenance of activity spaces. It challenges the assumption that mobility in later life is inherently limited in car-dependent cities, showing that active and public transport alternatives can be viable for all generations.

However, this study has limitations, including the number of participants and study sites, which may not fully capture the daily mobility patterns of older adults in suburban Sydney. Activity space patterns are likely influenced by individual personality (e.g., introverted or extroverted), financial circumstances, or family commitments, affecting engagement with different spaces.

The reliance on self-reported data also limits the depth of understanding of daily spatial practices. A multi-method approach, combining in-depth case studies with time-geographical mapping, could further reveal the time-space constraints of older adults, highlighting the role of multimodal transport networks in shaping their movements within the city. Ongoing research extends beyond conventional transport research, which typically focuses on statistical cost-benefit analyses of changes in transport mode, distance travelled, and time taken (Bissell 2018), demonstrating that later life can involve more frequent movement and longer trips due to improved public and active mobility environments. This shift offers the potential to encourage active aging among older adults living in the city, contributing to the design of transit systems and urban spaces that better accommodate older adults and enhance the diversity of considerations necessary for transport planning and designing transfer points. It also calls for rethinking the dominance of car-centric planning across all generations in Australasia.

5 References

Bissell, D. (2018). *Transit Life: How Commuting Is Transforming Our Cities (1st ed.)*. Cambridge: The MIT Press.

Boschmann, E. E., & Brady, S. A. (2013). Travel behaviors, sustainable mobility, and transit-oriented developments: a travel counts analysis of older adults in the Denver, Colorado metropolitan area. *Journal of Transport Geography*, 33, 1-11.

Broome, K., McKenna, K., Fleming, J., & Worrall, L. (2009). Bus use and older people: A literature review applying the Person–Environment–Occupation model in macro practice. *Scandinavian Journal of Occupational Therapy*, 16(1), 3–12. https://doi.org/10.1080/11038120802326222

Clarke, P., & Gallagher, N. A. (2013). Optimizing Mobility in Later Life: The Role of the Urban Built Environment for Older Adults Aging in Place. *Journal of Urban Health*, 90(6), 997–1009.

Davis, M. G., Fox, K. R., Hillsdon, M., Coulson, J. C., Sharp, D. J., Stathi, A., & Thompson, J. L. (2011). Getting out and about in older adults: the nature of daily trips and their association with objectively assessed physical activity. *International Journal of Behavioral Nutrition and Physical Activity*, 8(1), 116.

Duncan, M., Torres, Y. V., Gladwin, K., Horner, M., & Wood, B. (2021). Transit-oriented development for older adults: A survey of current practices among transit agencies and local governments in the US. *Journal of Transport and Land Use*, 14(1), 255–276.

FRANKE, T., SIMS-GOULD, J., CHAUDHURY, H., WINTERS, M., & MCKAY, H. (2019). 'It makes your life worthwhile. It gives you a purpose in living': mobility experiences among active older adults with low income. *Ageing and Society*, 39(8), 1639–1666.

Frantál, B., Klapka, P., & Nováková, E. (2020). When home becomes a cage: Daily activities, space-time constraints, isolation and the loneliness of older adults in urban environments. *Moravian Geographical Reports*, 28(4), 322-337.

Golledge, R. G., & Stimson, R. J. (1997). *Spatial behavior : a geographic perspective*. New York: Guilford Press.

Hagerstrand, T. (1970). What about people in regional science. *Regional Science Association Papers*, 24(1), 7–21.

Kim, S., & Ulfarsson, G. F. (2004). Travel Mode Choice of the Elderly: Effects of Personal, Household, Neighborhood, and Trip Characteristics. *Transportation Research Record*, 1894(1), 117-126.

Levin, L. (2019). How May Public Transport Influence the Practice of Everyday Life among Younger and Older People and How May Their Practices Influence Public Transport? *Social Sciences*, 8(3), 96.

Lin, D., & Cui, J. (2021). Transport and Mobility Needs for an Ageing Society from a Policy Perspective: Review and Implications. *International Journal of Environmental Research and Public Health*, 18(22), 11802-.

Massey, D. (2005). *For space*. Sage Publications.

Musselwhite, C. B. A., & Shergold, I. (2013). Examining the process of driving cessation in later life. *European Journal of Ageing*, 10(2), 89–100.

Musselwhite, C., Holland, C., & Walker, I. (2015). The role of transport and mobility in the health of older people. *Journal of Transport and Health*, 2, 1–4.

O'Neill, D. (2015). Transport, driving and ageing. *Reviews in Clinical Gerontology*, 25(2), 147–158.

Parliament of Australia. (2019). Communications and Transport Infrastructure Budget Review. Parliament of Australia.

Preston, J., & Rajé, F. (2007). Accessibility, mobility and transport-related social exclusion. *Journal of Transport Geography*, 15(3), 151–160.

Ravensbergen, L., Van Liefferinge, M., Isabella, J., Merrina, Z., & El-Geneidy, A. (2022). Accessibility by public transport for older adults: A systematic review. *Journal of Transport Geography*, 103, 103408.

Ryan, J., & Wretstrand, A. (2019). What's mode got to do with it? Exploring the links between public transport and car access and opportunities for everyday activities among older people. *Travel Behaviour and Society*, 14, 107-118.

Smith, L., Foley, L., & Panter, J. (2019). Activity spaces in studies of the environment and physical activity: A review and synthesis of implications for causality. *Health & place*, 58, 102113.

Sturge, J., Klaassens, M., Lager, D., Weitkamp, G., Vegter, D., & Meijering, L. (2021). Using the concept of activity space to understand the social health of older adults living with memory problems and dementia at home. *Soc Sci Med*, 288, 113208.

Transport for NSW. (2019). Older Persons Transport and Mobility Plan 2018–2022.

Transport for NSW. (2022). Train Station Entries and Exits Data.

Transport for NSW. (2023a). Sydney Trains Annual Report 2021 2022 Volume 1.

Transport for NSW. (2023b). Public Transport - Location Facilities and Operators.

Woodcock, I., Wollan, S. and Dovey, K. (2011) 'Mapping Neighbourhood Fields of Care', in Conference Paper, State of Australian Cities National Conference. 5th State of Australian Cities National Conference, 29 November–2 December 2011, Melbourne, Australia.

Yang, L. (2018). Modeling the mobility choices of older people in a transit-oriented city: Policy insights. *Habitat International*, 76, 10-18.