Annals of Tourism Research

Measuring cruise passenger dispersal through technology

--Manuscript Draft--

Manuscript Number:	ATR-D-21-00591R2
Article Type:	Research Note
Section/Category:	Quantitative
Corresponding Author:	Anne Hardy University of Tasmania College of Arts Law and Education Hobart, Tasmania AUSTRALIA
First Author:	Anne Hardy
Order of Authors:	Anne Hardy
	Oscar Vorobjovas-Pinta
	Martha Wells
	Louise Grimmer
	Martin Grimmer

Title Page (with author details and affiliation)

MEASURING CRUISE PASSENGER DISPERSAL THROUGH TECHNOLOGY

*Anne Hardy *(corresponding author)*
School of Social Sciences
Private Bag 22
University of Tasmania
Hobart, Tasmania 7001
Australia
Phone: +61 6226 7687
Anne.Hardy@utas.edu.au

Oscar Vorobjovas-Pinta
School of Business and Law
270 Joondalup Drive
Joondalup Western Australia 6027
Australia
Phone: +61 8 6304 5540
Edith Cowan University
Australia
o.pinta@ecu.edu.au

Martha Wells
School of Social Sciences
Private Bag 22
University of Tasmania
Hobart, Tasmania 7001
Australia
Phone: +61 6226 7687
Martha.Wells@utas.edu.au

Louse Grimmer
College of Business and Economics
Private Bag 84
University of Tasmania
Hobart, Tasmania 7001
Australia
Phone: +61 6226 1587
Louise.Grimmer@utas.edu.au

Martin Grimmer
Office of the Provost
Private Bag 3
University of Tasmania
Hobart 7001
Australia
Phone: +61 6226 2824

Martin.Grimmer@utas.edu.au

Key words

Tourist Tracking

Dispersal

Technology

Tourism Tracer

Cruise ship passengers

Author bios:

Anne Hardy works at the University of Tasmania in Australia. She is interested in tourist behaviour, sustainable tourism and the use of technology to understand tourists behaviour.

Oscar Vorobjovas-Pinta works at Edith Cowan University. Oscar is interested in the sociology of tourism, the use of technology in tourism, social justice, and LGBTQI+ tourism.

Louise Grimmer us a 2021-22 Fulbright Scholar and Senior Fellow of the Institute of Place Management. She researches retail place marketing, small stores and retail resilience and revitalisation.

Martha Wells is a PhD candidate at the University of Tasmania. Her research interests are spatial analysis of tourism and gamifying tourism interventions.

Martin Grimmer is a Professor of Marketing. He specialises in consumer behaviour with a focus on green marketing and pro-environmental consumer behaviour, as well as retail marketing.

INTRODUCTION

Where do cruise ship passengers go once their cruise ends, and can we accurately measure their mobility? As cruise ships lie idle during the COVID-19 pandemic, debate continues over the relative worth of the cruise ship market. In addition to concerns about environmental impacts and employment practices of cruise companies (Higgins-Desbiolles 2020), questions about passenger dispersal, expenditure, and mobility (or lack thereof) remain highly topical.

Traditionally, data on cruise ship passengers' mobility has been generated by surveys, requiring passengers to recollect where they travelled during transit stops; a method prone to inaccuracy (Shoval et. el. 2011; Hardy et al. 2017). To overcome this limitation, researchers (see Shoval et al. 2020; Ferrante et al. 2018; Navarro-Ruiz, 2020; Domènech et al. 2020) have combined surveys with GPS (Global Positioning System) technology to track passenger dispersal during visits to transit destinations. De Cantis et al. (2016) found passengers dispersed only an average maximum distance of 3km from their arrival port during transit. Recently, onshore cruise activity has been conceptualised; Esteve- Pérez and Garcia-Sanchez (2015) defined specific geographical zones that passengers move within, Navarro-Ruiz (2020) defined nodes through which mobility and expenditure could be examined, and Domènech et al. (2020) explored characteristics of the built environment (e.g., restaurants, souvenir and fashion shops) that positively impact frequency of visitation and time spent.

While researchers have explored the behaviour of *transit* passengers, data regarding the mobility of cruise ship passengers upon their *final* departure from a cruise ship is limited. This preliminary study seeks to overcome this gap by using technology to explore the mobility of domestic and international cruise ship passengers at the end of their cruise in Sydney, Australia. Sydney is an iconic cruise location; in 2018/2019 it attracted 553,985 domestic and 69,493 international passengers (Port Authority of New South Wales 2019). This study is part of research assessing the impact of factors such as demographic status, travel party size and repeat visitation on dispersal.

METHOD

This study uses Tourism Tracer app-based technology (Hardy 2020) which collects fine-grained GPS data and survey data on tourist mobility for multiple days at a time. Following their disembarkation from one of two terminals (White Bay or the international passenger terminal at Circular Quay), passengers were approached by recruiters and invited to participate in the study. Upon consent, recruiters assisted in downloading the Tourism Tracer app onto their mobile phones and enabling its tracking functionality. Participants' mobility was tracked for up to 28 days.

A convenience sampling methodology was used, from mid-January 2020 until 13 March 2020, three days before the Australian Government banned international entry of all cruise ships due to COVID-19. As large volumes of passengers exit the terminals, the total number of approaches made by the study's recruitment team was not recorded.

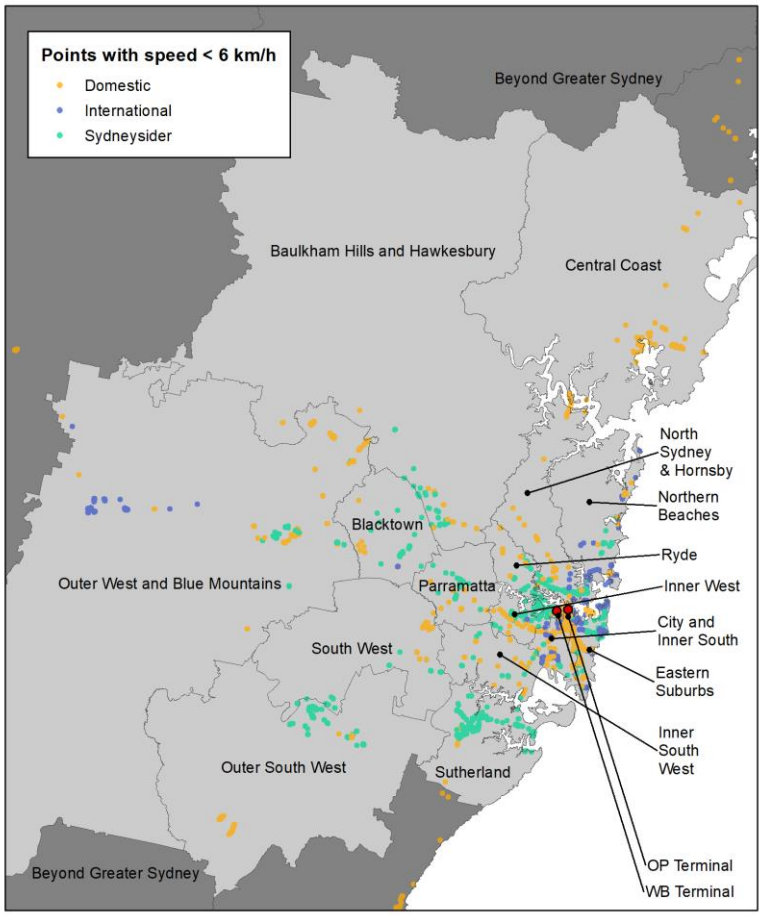
Data cleaning involved removing participant's 'tracks' if they had fewer than 10 GPS points, if the total tracking time was less than four hours, and/or if they had not answered the survey questions. This resulted in 75 usable downloads. Three groups of passengers were recruited: 'Sydneysiders' – passengers who lived in the Greater Sydney region (27%, n=20); 'Domestic passengers' – those who lived in Australia but outside the Greater Sydney region (57%, n=43), and 'International passengers' – passengers residing outside Australia (16%, n=12). International passengers provided data for the shortest length of time (median 21 hours) as

many of their tracks ended in the international airport terminal within 24 hours of arrival. Conversely, domestic (54 hours) and Sydneysiders (72 hours) allowed tracking for the full length of their tracking period.

EXPLORING PASSENGER DISPERSAL

We investigated the impact of the arrival port on dispersal, and found no significant difference between the two at which participants were recruited. We then explored the impact of passengers' place of residence on dispersal throughout Greater Sydney and adjacent coastal and inland areas. International passengers were most represented in regions adjacent to Sydney Harbour where the terminals are located. Sydneysiders were more likely to head inland to the western suburban regions of Sydney (see Figure 1).

Figure 1: Dispersal by passenger residence



Following this initial analysis, we identified clusters of walking-speed or motionless points as 'stops' and we used them to calculate the cumulative time each passenger spent in a particular region. The average minutes per passenger type (Domestic, International, Sydneysider) was used for comparison (Table 1). The time and percentage distribution was found to differ significantly across the types ($x^2(4)=2684$, $p < 0.001$).

Table 1: Average time (in hh:mm) and percentage of passengers in each area classifications

Areas	Domestic		International		Sydneysiders	
Beyond Sydney and Central Coast	26:38	53%	0:00	0%	0:00	0%
City centre/Sydney Harbour adjacent	16:51	88%	9:41	100%	12:16	85%
Inland Sydney	4:41	81%	0:58	58%	16:05	90%

Dispersal metrics were used to explore passenger dispersal. Two dispersal metrics (i.e., SDE and Cumulative Distance – see Hardy et al. 2020) did not demonstrate significant variance between passenger types using Analysis of Variance (ANOVA). However, the Maximum Linear Distance (MLD) varied significantly by passenger type ($F(2,72) = 6.00$, $p < 0.01$). MLD measures the straight line from the passenger terminal to the GPS location point farthest from the terminal. Domestic passengers' MLD was found to be 142.94 km, whereas International and Sydneysiders were 26.53 km and 31.76 km respectively. Thus, Domestic passengers travelled significantly farther than International and Sydneysider passengers at the end of the cruise.

Detailed spatial data of state-wide land use (Department of Planning, Industry and Environment 2020) was then synchronised with the GPS stop data mentioned earlier, to provide a context for passenger behaviour. The detailed land-use classes were simplified to six broader relevant categories (Table 2). Two categories ('recreation, culture and nature' and 'commercial') were determined to be more likely to be tourism 'spaces'.

Table 2: Average number of stops in each land use classification for passenger's post-disembarkation

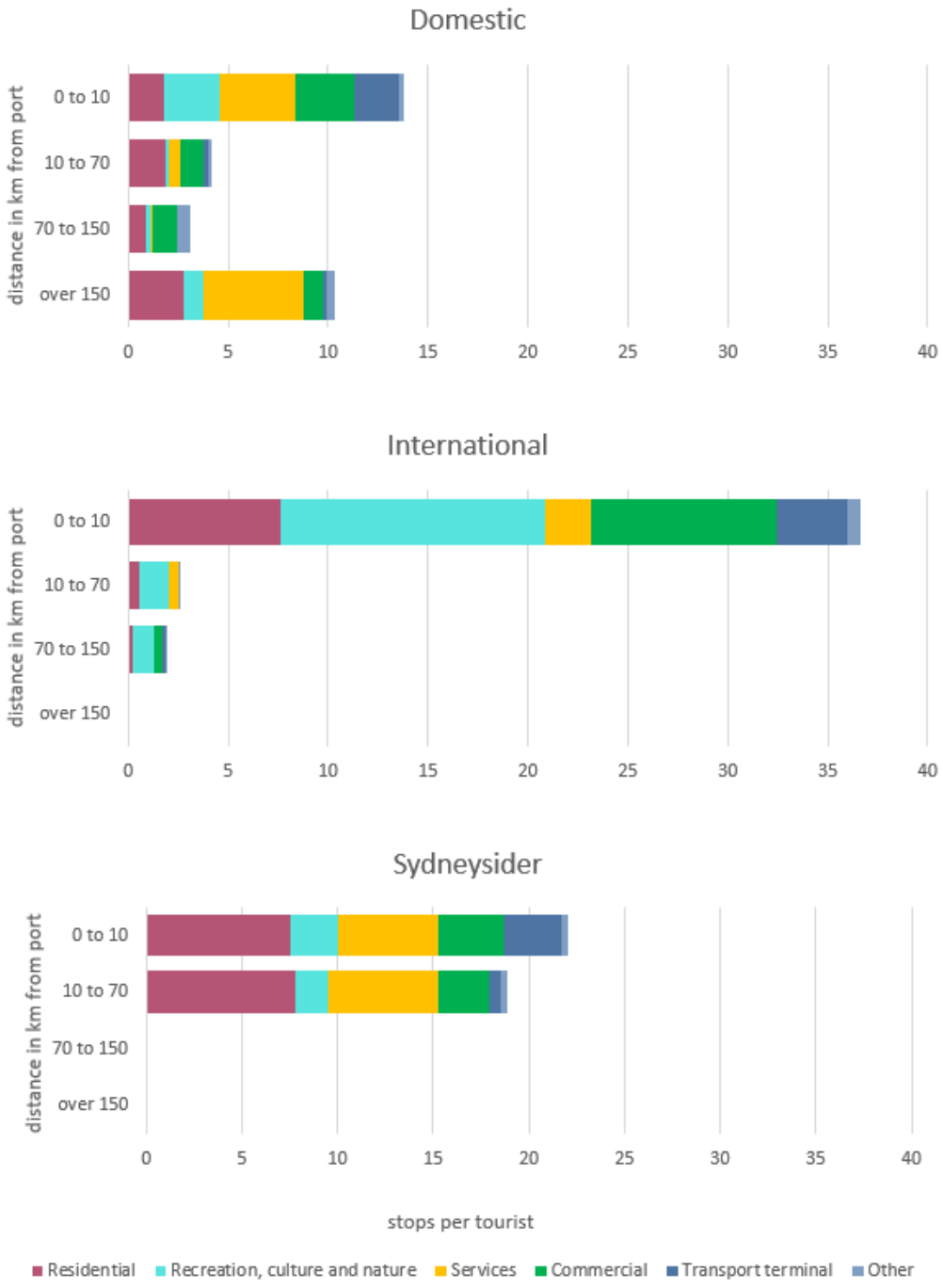
Land Use	Domestic	International	Sydneysiders
Recreation, culture and nature	4.1	15.8	4.2
Commercial	6.3	9.6	6.1
Residential	7.4	8.4	15.3
Services	9.4	2.8	11.1
Transport terminal	2.8	3.8	3.6
Other	1.4	0.8	0.8
sum:	31.4	41.2	41.0

Domestic, International and Sydneysider passengers differed significantly in their stops across land use classifications ($\chi^2(10) = 320.73$, $p < 0.001$). International passengers behaved as tourists at a much higher rate than either Australian cohort; they had a higher number of stops in recreational, cultural and natural areas (15.8), and in commercial areas (9.6). Domestic and Sydneysider passengers had similar and far fewer stops in these land use types. Sydneysiders recorded the most stops in residential areas (15.3) and service buildings (i.e., schools, government buildings etc) (11.1), which suggests they returned home. Domestic passengers also had a high average stop count in service buildings (9.4), but a lower rate of stops in residential areas than International passengers (7.4 compared with 8.4).

The distance from the port to each stop was calculated and an average stop distance was found for each land use classification (Figure 2) along with the number of stops per band of

dispersal, from close to Sydney Harbour (0 to 10 km) to beyond Greater Sydney (over 150 km from port) (Figure 2). The distances of the bands were created to reflect clusters in stops from the data. Sydneysiders consistently stopped most frequently in residential and service locations and did not travel more than 70 km from port, suggesting they did not behave as tourists once they disembarked. International tourists continued to focus on recreation, culture and nature in all dispersal bands, but were unlikely to visit locations more than 10 km from the port. Domestic passenger stops were focussed on recreation and commerce close to the port, with more stops in residential and service locations in farther bands.

Figure 2: Stops by distance from port and land use type, for different passenger types



DISCUSSION

This preliminary research contributes to existing advancements in cruise ship passenger dispersal. Previous research by Navarro-Ruiz et al. (2020) argued that amongst transiting cruise ship passengers, travel beyond major tourism nodes is infrequent. This research suggests that post-cruise mobility of international visitors aligns with this behaviour, *but* not for domestic cruise ship passengers; 53% of domestic passengers were found to travel beyond the Sydney and Central Coast regions, while Sydneysiders were likely to return to their homes.

This research also builds upon Domènech et al. (2020) by detailing nuances in preferences; international tourists focussed on recreation, culture and location, regardless of their location, whereas domestic passengers tended to stop in recreation and commercial locations close to the port but preferred residential and service locations in farther dispersed zones.

Methodologically, our research demonstrates that land use classification data, when paired with GPS data, is useful for classifying large mobility data sets. However, the dataset in this study used potentially outdated satellite photography from 2013-2017, and general land use may not accurately predict behaviour; a visit to a recreational site could be a leisure activity or a place of employment.

For tourism policy makers, this study highlights the dispersal of domestic passengers and the challenges that regional tourism organisations face in encouraging dispersal amongst international tourists. Our data suggests international and domestic disembarking passengers present different challenges for tourism-facing businesses; international passengers may need more incentive to disperse, while domestic passengers need more incentive to stay engaged with tourism and leisure once they disperse farther into the regions.

This study is limited by the small number of usable GPS tracks and surveys. Future research should increase the sample size to further develop an analytical model of post-cruise dispersal and expenditure, across different land use types.

Research is also needed to build upon the work of Casado-Diaz et al. (2021) and explore whether post-trip expenditure aligns with their findings on passenger expenditure. This research could also assess the types of products and services that attract passengers at the completion of a cruise. Such data will provide valuable insights for the post-COVID-19 tourism industry.

REFERENCES

Casado-Díaz, C., Navarro-Ruiz, S., Nicolau, N. and Ivars-Baidal, J. (2021). Expanding our understanding of cruise visitors' expenditure at destinations: The role of spatial patterns, onshore visit choice and cruise category. *Tourism Management, 83*: 104199.

De Cantis, S., Ferrante, M., Kahani, A. and Shoval, N. (2016). Cruise passengers' behavior at the destination: Investigation using GPS technology. *Tourism Management, 52*: 133-150.

Department of Planning, Industry and Environment (2020). New South Wales Land use 2017 v1.2 shapefile, from: https://datasets.seed.nsw.gov.au/dataset/nsw-landuse-2017-v1p2-f0ed accessed 25/3/2021.

Domènech, A., Gutiérrez, A., and Clavé, S.A. (2020). Built environment and urban cruise tourists' moblity. *Annals of Tourism Research, 81*: 102889.

Esteve-Pérez, J.A., and García-Sánchez, A. (2015). Cruise market: Stakeholders and the role of ports and tourist hinterlands. *Maritime Economics & Logistics, 17*(3): 371-388.

Ferrante, M., De Cantis, S., and Shoval, N. (2018). A general framework for collecting and analysing the tracking data of cruise passengers at the destination. *Current Issues in Tourism*, *21*(12): 1426-1451.

Hardy, A. (2020). *Tracking Tourists: Movement and Mobility*. Oxford: Goodfellow Publishers.

Hardy, A., Birenboim, A., and Wells, M. (2020). Using geoinformatics to assess passenger dispersal at the state level. *Annals of Tourism Research, 82*: 102903.

Hardy, A., Hyslop, S., Booth, K., Robards, B., Aryal, J., Gretzel, U., and Eccleston, R.E. (2017). Tracking passengers' travel with smartphone-based GPS technology: a methodological discussion. *Journal of Information Technology & Tourism, 17*(3): 255-274.

Higgins-Desbiolles, F. (2020). Socialising tourism for social and ecological justice after COVID-19. *Tourism Geographies, 22*(3): 610-623.

Navarro-Ruiz, S., Casado-Díaz, C., and Ivars-Baidal, J. (2020). Modelling the intra-destination behaviour of cruise visitors based on a three-dimensional approach. *Journal of Destination Marketing & Management, 18*: 100470.

Port Authority of New South Wales (2019). Sydney cruise ship study: Insights into passenger and crew behaviour, attitudes, perception and satisfaction. Port Authority of New South Wales, Sydney.

Shoval, N., Kahani, A., De Canits, S., and Ferrante, M. (2020). Impact of incentives on tourist activity in space-time. *Annals of Tourism Research, 80*: 102846.

Shoval, N., McKercher, B., Ng, E., and Birenboim, A. (2011). Hotel location and tourism activity in cities. *Annals of Tourism Research, 38*(4): 1594–1612.

Statement of Contribution

- Anne Hardy oversaw all aspects of the paper - including the theory, methods and the discussions
- Martha Wells did the GIS analysis and synced with the survey data
- Martin Grimmer designed the recruitment strategy and statistical analysis, so helped write the methods section along with parts of the results
- Oscar Vorobjovas- Pinta co-designed the field work, so contributed to the section on recruitment, plus theoretical aspects of the paper
- Louise Grimmer co designed the survey and then contributed to the discussion in the paper

Acknowledgements

The authors thank the Port Authority of New South Wales for funding this study.

Video Hardy

Click here to access/download

Video

Cruise disperal Hardy.mp4

Annals of Tourism Research

Submission checklist for **Research Notes**

(double blind reviewed)

SUBMISSION FILES

Done?	
☒	TITLE PAGE – title no longer than 56 characters, all in upper case
☒	TITLE PAGE – all author names with full affiliation details (inc postal address and email)
☒	TITLE PAGE – corresponding author clearly indicated including telephone and fax numbers (with country and area code).
☒	TITLE PAGE – up to 6 keywords
☒	TITLE PAGE – author bio(s) including name(s), affiliation, brief statement about research interest(s) of the author(s). Maximum 75 words in total (not per author).
☒	MANUSCRIPT – maximum 2000 words (incl. references, tables and figures)
☒	MANUSCRIPT – does not reveal author(s) identity
☒	MANUSCRIPT – tables and figures embedded within the manuscript
☒	HIGHLIGHTS – between 3 and 5 bullet points, each with a maximum of 85 characters inc spaces

FORMATTING

Done?	
☒	No acronyms are used (except universally recognised terms e.g. UNWTO, GDP)
☒	Page numbers appear on the manuscript file in the bottom left hand side
☒	Single line spacing: Left justified, with ragged edge on the right-hand side
☒	Spelling is in American or English spelling (not a combination of both)
☒	Paragraphs are no more than around 15 lines long, (between 125 and 200 words)

OPTIONAL

Done?	
[□]	Optional COVER LETTER
[□]	Optional and highly recommended GRAPHICAL ABSTRACT
[□]	Optional ACKNOWLEDGEMENTS
[□]	Optional FUNDING SOURCES
[□]	Optional DECLARATION OF INTEREST
[□]	Optional ARTWORK
[□]	Optional TABLES and FIGURES – preferably these are embedded in the text
[□]	Optional RESEARCH DATA

Declaration of interests

☒ The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

☐The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: