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Understanding tourists’ spatial behaviour: GPS tracking as an aid to sustainable destination management

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The spatial behaviour of tourists within cities is not well understood, partly because of the complexities of cities as spaces and partly because few studies have addressed this phenomenon. This paper reports on collaborative research studies, conducted in conjunction with destination-management agencies in the Australian cities of Sydney and Melbourne. The studies used Global Positioning System (GPS) tracking devices to find out how various kinds of tourists moved around each city, supplemented by semi-structured interviews with the tourists to help explain their movement patterns. A total of 154 participant groups took part. Each study sought to provide information to destination-management agencies to help them improve aspects of the visitor’s experience by improving wayfinding systems. Findings were analysed visually using a space syntax approach. Tourists walked between 10 and 35 km per day. Lack of knowledge of public transport systems and ticketing was a major constraint on public transport use. Melbourne’s street pattern and its free city circle tram were found more user-friendly than Sydney’s street pattern and public transport. The resulting visual maps provided destination managers with a valuable diagnostic tool; a range of new initiatives have been developed, including better conference visitor information, and training for information centre staff.

Keywords: sustainable; tourists; space; spatial behaviour; GPS tracking

Functions of a city

Tourism is one of many social and economic forces in most urban environments. It encompasses a sector that manages and markets a variety of products and experiences to people who have a wide range of motivations, preferences and cultural perspectives (Edwards, Griffin, & Hayllar, 2008). Tourists constitute a “transient population” using cities either as gateways to other destinations or as a home for ephemeral periods of time (Edwards et al., 2008). A number of factors have contributed to the growth of urban tourism: changing work/leisure patterns and supply-side changes such as long-weekend city travel; people taking more frequent but shorter holidays; a general increase in mobility; the emergence of low-cost airlines; and consumers’ desire for experiencing and seeing new things in situ (Dunne, Buckley, & Flanagan, 2010; European Commission, 2000).

Cities perform a range of functions that play an important role in providing visitors with satisfying and fulfilling experiences of the city as a tourist destination. Functions include facilitating feelings of being comfortable in an unfamiliar place; providing a relaxing atmosphere and items of interest; being a place where visitors can interact with the community and other tourists; being a place for “people watching” and allowing visitors to be themselves; being a place that can be explored and is easy to navigate to, in and around;

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having characteristics that set it apart from other places and contributes to the city’s overall sense of place; providing a sense of history and culture; allowing the visitor to see how the local community lives; and enabling connections to the city.

Tourists share spaces and places within the city with permanent residents who are going about their normal business of working, shopping, commuting, playing and undertaking an education, and in most of those places at most times of the year the tourists will be outnumbered. The presence of tourists may only be obvious in those areas of a city where there are iconic attractions, such as the Trevi Fountain in Rome or Buckingham Palace in London. Even then, many of the places within a city where tourists congregate in great numbers may also be significant places for local recreational and entertainment activities. Yet, tourism in major cities can pose some challenging and fairly distinctive problems. Some of an urban destination’s infrastructure and superstructure is designed to cope with and cater for tourists. However, tourism tends to be superimposed on a spatial system and infrastructure network that was not designed specifically to cater for it and tourism activity can be unevenly distributed (Gladstone & Fainstein, 2001), with some cities being more successful than others in fulfilling the functions ascribed to them. Understanding where tourists go within a city and how they negotiate their way from one point of interest to the next is not something discovered through subjective observation (Edwards, Dickson, Griffin, & Hayllar, 2010).

This study addresses this problem by using Global Positioning System (GPS) devices to track the paths of tourists within two Australian cities: Sydney and Melbourne. These cities are not only the nation’s most populous but are also its two most visited tourist destinations. Each city has a permanent population in excess of four million people. Sydney received a total of 7.9 million domestic visitors (Tourism Research Australia, 2012b) and a further 2.6 million international visitors (Tourism Research Australia, 2012a) in the year ended June 2012, while Melbourne received some seven million domestic visitors (Tourism Research Australia, 2012b) and 1.7 million international visitors (Tourism Research Australia, 2012a) over the same period. Even with those substantial numbers, tourism neither dominates nor overwhelms either city. In spite of Sydney accommodating a total of nearly 78 million visitor nights in the year ended June 2012, on an average night the ratio of permanent residents to visitors was approximately 20:1 (Tourism Research Australia, 2012a, 2012b).

In these circumstances, tourists do not necessarily stand out from the urban crowd, and they must negotiate their way around an unfamiliar place where the spatial fabric and infrastructure were not designed with their needs as paramount. GPS tracking offers a precise means of determining how tourists move around a city, including the routes they select, the places they spend time in and the modes of transport they choose. It represents a potential tool for collecting data which urban destination managers can use to examine and evaluate aspects of a tourist’s experience in a city and thereby identify ways to improve that experience. The tool, therefore, presents destination-management agencies with the opportunity to manage tourism within a city in a more sustainable fashion.

**Sustainable urban tourism**

Defining sustainable tourism in an urban context can be problematic due to the complex relationships of politics, economics, sociology, behaviour and environment embedded in the urban context (Adhya, Plowright, & Stevens, 2010; Hillier, 2009). The World Tourism Organization (WTO) indicates that it considers the impacts of tourism in three dimensions: ecological, socio-cultural and economic (United Nations Environment Program [UNEP] & World Tourism Organization [WTO], 2005). In relation to the economic dimension, the
goal of sustainable tourism is expressed as being to “ensure viable, long-term economic operations, providing socio-economic benefits to all stakeholders that are fairly distributed, including stable employment and income-earning opportunities and social services to host communities, and contributing to poverty alleviation” (UNEP & WTO, 2005, p. 11). Underpinning this definition is the concept that tourist expenditure should be distributed equitably within a destination. Distribution is affected primarily by the dispersal of tourists throughout a city, as patterns of spending will be influenced by patterns of movement (Liburd & Edwards, 2010). Hence, in the context of sustainable development, an objective of urban destination managers may be to encourage the wide dispersal of tourists throughout a city.

The WTO further recognises that “sustainable tourism should also maintain a high level of tourist satisfaction and ensure a meaningful experience to the tourists” (UNEP & WTO, 2005, p. 11). A meaningful experience is considered as more than merely seeing the sights; it is about relating to the cultural, built and natural environment in such a way that a tourist heightens their emotional, physical, intellectual and even spiritual senses (O’Dell, 2007; Stickdorn & Frischhut, 2012). In several studies of tourist experiences in London, Maitland and Newman (2004) and Maitland (2006) reported on the desire of some tourists to get beyond the obvious tourist core of the city and to glimpse the real life of London in fringe areas around the centre. However, tourists can be frustrated in this desire by the limitations of information, directional signage and public transport or a physical environment and connectivity of spaces that do not invite a broader exploration of a city. Increasing public transport use is a key aspect of making city tourism accessible and more sustainable, yet it presents the urban destination with a particular dilemma. Public transport can move people to greater parts of a destination facilitating the dispersal of tourism expenditure and in doing so lead to wider benefits for the destination. However, public transport can simultaneously result in impacts such as traffic congestion, noise, accidents, greenhouse gas emissions, resource depletion and other environmental problems (Becken, 2006).

Any factors that can inhibit a tourist’s ability to enjoy and experience a city may thus work against the goal of sustainable tourism. Ashworth and Page have observed that tourists visiting a city are selective and “make use of only a very small portion of all that the city has on offer” (2011, p. 8). The extent to which this selectivity is deliberate or enforced is, however, a moot point. According to Montgomery (2005), connectedness is achieved in cities that allow maximum scope for activity for people of all ages and backgrounds, is organised so that cities’ form and functions are easily understood, and provides access to resources, services and information when needed. Examining how tourists move around a city and in particular the factors that constrain that movement may well be fundamental to devising ways to enhance their quality of experience within the city. Ultimately, this can impact on economic sustainability as it affects the viability of businesses that cater to tourist demands. Experiences that satisfy the aspirations of tourists may, in the longer term, generate repeat visits and positive word of mouth.

None of this is to suggest that catering to tourists’ needs is a paramount consideration when it comes to the sustainable development and management of major cities. Rather, it is an acknowledgment that one of a city’s functions as a tourist destination may be that it addresses the issues discussed above to enable it to perform more sustainably. The sustainable management of urban destinations has been conceptualised as concerned with developing tourism that is equitably distributed and viable in the long term for both residents and tourists (Hinch, 1996; Jamieson, 2006). This requires balancing the functional elements of developing facilities, maintaining or enhancing the quality of the built and natural environment and ensuring an adequate level of infrastructure. It also means balancing the interests of tourists and the tourism industry with those of the host community, which necessitates a combination of policy, planning, design, management and marketing and communication
activities aimed at improving experiences for the tourists; improved economic and social benefits for the host community; minimising negative outcomes; and improved functioning of activities within the urban environment (Edwards et al., 2008). Achieving this balance is fundamental to the success of businesses within a destination, and it requires an understanding of how tourists move through and explore the spaces within the city.

**New methods of spatial research**

Over the past nine years, the rapid advancement and availability of small, cheap and reliable tracking devices drawing on GPS technology is assisting researchers to develop new methods of spatial research. GPS offers several advantages over traditional tracking methods, as it allows the precise and continuous tracking of individuals and provides spatially rich data, including velocity and timing information (O’Connor, Zerger, & Itami, 2005), making it possible to accurately track the paths tourists take and to provide greater understanding of their socio-spatial behaviour (Asakura & Iryo, 2007). Importantly, the overall accuracy and detail of the trails recorded by GPS exceeds the feedback that can be gathered through travel diaries or post-travel surveys (Edwards, Dickson, Griffin, & Hayllar, 2010). For these reasons there has been a flurry of simultaneous activity over the past few years in studies that examine tourists’ spatial movements. The aim of these studies in using GPS is to visualise the visitor’s navigation of a city’s system. GPS tracking has been used to observe people in an open-air museum in the city of Akko and in Old Jaffa in Israel (Shoval & Isaacson, 2006, 2007).

Shoval (2008), as a result of tracking tourists in the historic town of Akko (Israel), was able to identify areas of congestion and underutilisation, highlighting inefficiencies in economic and social resources. Kempermann, Chang-Hyeon, and Timmermans (2004) recorded significant differences between first-time tourists and repeat tourists to a theme park. New visitors tried to attend as many attractions as possible, whereas repeat visitors were more selective and focused. van der Spek (2008) carried out a series of pedestrian-tracking studies on visitors to three European cities: Norwich (United Kingdom), Rouen (France) and Koblenz (Germany). He concluded that the study provided good insights into the behaviour of visitors such as walking distance, duration, familiarity, and that visitors to each city behaved in different ways. Similarly, Modsching, Kramer, Gretzel, and ten Hagen (2006) captured the spatial behaviour of tourists in the inner city of Görlitz (Germany), concluding that the data from tracking technologies can be an important input to planning processes and can evaluate the implementation of measures such as specific marketing campaigns, by comparing pre-implementation data with data captured after a measure is introduced. McKercher, Shoval, Ng, and Birenboim (2012) used GPS to compare visitor behaviour patterns of first-time and repeat visitors to Hong Kong. Overall they found that first-time visitors tended to sample the destination, wandering throughout the city, often by foot, while repeat visitors concentrated their activities in fewer places and disproportionately in shopping or dining districts. Fennell (1996) argued that the infrastructural capacity of a region will influence how tourists spread themselves out. He suggested that tourists are impacted by aspects of an urban destination’s spatial arrangement, such as streetscapes, visual access, signage and landmarks, which can enhance or inhibit the ability of people to move around.

**Tourism and the spatial arrangement of cities**

The urban form is represented by geographically discrete precincts within a spatial configuration through which the visitor will move, unaware of any administrative or political boundaries. During the tourist’s visit, destination managers and businesses hope that the
visitor will make choices which lead them to take full advantage of what the city has to offer and thereby distribute tourism’s benefits broadly (Crouch & Ritchie, 1999). From a public-policy perspective, effective wayfinding systems can help spread visitor expenditure more broadly throughout the city. An effective wayfinding system can assist tourists in such tasks as determining their location within a setting; determining their destination; developing a plan to take them from their location to their destination, including identifying places of interest en route; and reducing frustration and wasted time. The effect is to lead to more satisfactory experiences for tourists. Wayfinding is movement through spaces which requires continuous involvement in reading, interpreting and representing space decision-based behaviour (e.g. turn right, go up, look for information) in response to an environment (e.g. buildings, streets, intersections, stairs, billboards, shops, lighting).

Thus, planning the urban environment requires assumptions about how tourists will respond to characteristics of the environment as they formulate and enact their itinerary. Hillier (2005) poses the following question: when cities exist and function as physical wholes, how do cities work to relate physical patterning to the economic, social and cognitive life of people who experience it a little at a time? This is a highly pertinent question to apply to tourists, whose experience of a city is limited both temporally and spatially. Hayllar and Griffin (2009) argued that in most urban destinations tourist visitation tends to be spatially concentrated in definable tourist precincts rather than dispersed throughout a city. They also categorised tourist visitation into three types: explorers, browsers and samplers. Explorers are those tourists who want to find their own way and discover in-depth a city’s inner complexities and qualities. Browsers are more content to stay within the confines of main precinct areas and to follow known tourist routes. Samplers are more concerned with specific attractions rather than with experiencing a place in a holistic sense. The typology suggests that tourists’ spatial patterns would be influenced by a wide range of variables, including motivations, interests, comfort, mood, personal circumstances, previous experience of a place and ability to read the environment. The typology reflects how tourists choose to experience an urban destination at a particular point in time, depending on the prevailing circumstances, rather than being a categorisation attached to the person. Essentially, the typology describes different forms of behaviour, which the same person could exhibit in different circumstances.

Another approach which can help to explain different modes of behaviour in urban tourist destinations is space syntax. Space syntax, understood as the system of spatial relations (Hillier & Hanson, 1984), considers how people organise and arrange the space in which they find themselves. Space syntax addresses “space as relatedness, and as it is, and might be, created by buildings and cities, and as it is experienced by the people who use them” (Hillier, 2005, p. 4). Hillier (2005) argues that space syntax makes people’s relationship to space more explicit; it allows an understanding of ways in which human beings actually organise and arrange real space. Syntactic depth occurs as a result of a space’s integration or segregation. That is, the degree to which people must pass through other spaces to go from each space to others will be high or low according to whether there is deep or shallow syntactic depth (Hillier, 2005). An example of a segregated space would be a garden only accessible by one entrance. An example of an integrated space would be a park with multiple entrances that allows for transition from all sides.

Boerwinkel (1995) suggests that visitor movements are influenced by two types of spatial order: successive arrangement and simultaneous arrangement. A diagrammatic representation of successive and simultaneous arrangement is depicted in Figure 1. The former (A) represents spatial systems in which there is a step-by-step uncovering of particular spaces to the visitor in terms of both sight and movement. This type of spatial
order is characterised by a spatial system that is localised and concentrated, with a tendency to generate fragmented integration cores that only represent parts of the system. Essentially, there are few and dispersed lively spaces resulting in people becoming stuck in a core and finding it difficult to penetrate all parts of the system. Gospodini (2001) argues that this type of arrangement controls and confines tourists’ choices in terms of sights and movement. Successive arrangement corresponds to systems characterised by high syntactic depth, meaning they are segregated (Hillier, 2005).

Simultaneous arrangement (B) acknowledges the inter-relations between many spaces that make up the spatial layout of a city as a whole (Hillier, 2005). Simultaneous arrangement provides a range and variety of choices, in both sight and movement, which are relatively extended and include many parts of the spatial system. The spatial order presents as a sequence of lively spaces connected to each other, enabling the visitor to cover all the different parts. Simultaneous arrangement encourages the tourist to freely move from one space to another within the system, facilitating exploration and “by-chance-encounters” (Gospodini, 2001). Simultaneous arrangement corresponds to spatial systems that are shallow in syntactic depth, meaning they are integrated (Hillier, 2005).

Because space syntax considers the networks of space, which in this instance is the street network, Hillier (2005) argues it provides a common ground between the real space of the city and people’s experience of it. The streets and buildings make the space but the space is what people perceive, feel and navigate through. Space syntax is an approach that allows for viewing the street network in a new and original way, enabling the discovery of how cities are structured spatially, how they work and how they grow and change (Hillier, 2005). The street network links the aggregations of buildings into a single system, and it

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### Figure 1. Basic spatial patterns of successive and simultaneous arrangement (Gospodini, 2001, p. 930).

<table>
<thead>
<tr>
<th>Spatial Patterns</th>
<th>In terms of diversity and individualisation</th>
<th>In terms of space syntax</th>
<th>In terms of the tourists quest</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A</strong> Successive arrangement</td>
<td>Space controls and confines the visitors choices in terms of sights and movement</td>
<td>Spatial systems with high syntactic depth and usually generating fragmented integration core that do not penetrate all parts of the system.</td>
<td>LESS ATTRACTIVE</td>
</tr>
<tr>
<td></td>
<td>In any particular space the visitor has many choices in terms of sight and movement</td>
<td>Spatial systems shallow in syntactic depth generating extended integration cores that cover all different parts of the system.</td>
<td>MORE ATTRACTIVE</td>
</tr>
<tr>
<td><strong>B</strong> Simultaneous arrangement</td>
<td></td>
<td></td>
<td>1. Offering many and different choices in experiencing space</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2. A sequence of lively spaces connected to each other (important for public open spaces)</td>
</tr>
</tbody>
</table>

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is what people navigate when they walk or drive in a city. The position of a street in an overall grid will influence flows and patterns of movement. The main streets lined with shops and services are an easily accessible attraction and will be busier than side or back streets. However, cities are large areas made up of many precincts, all of which are vying for economic and social attention, with each precinct hoping to attract visitation from both locals and tourists. When these precincts are more legible and integrated, as in simultaneous arrangement, people are more easily able to move from one space or precinct to another (Bafna, 2003).

As the primary shaper of people’s patterns of movement, a street network is visualised by users through a variety of media such as street maps and online satellite images (Hillier, 2005). Physicality does not disregard elements such as atmosphere and openness, but the individual’s positioning within, gaze upon, and openness to the city and style of urban form will influence how the destination as a whole is perceived by the visitor (Edwards et al., 2008). For example, the spaces within the street network will encourage the co-presence or co-absence of people signalling to the visitor whether the city is sociable, pleasurable and safe (Hillier, 2005, 2007). In an examination of visitor movement patterns in a museum, Hillier (2005) developed a visual model which demonstrated that people were using the space structure of the museum, rather than the attractive pull of the exhibits, to guide them around the gallery. Hillier went on to demonstrate how the model could be used to create new designs to restructure visitor flows. Space syntax may be a useful approach for examining the visual data that are collected through GPS.

**Research method**

This paper applies the space syntax approach to examine visitor spatial data collected in the cities of Sydney and Melbourne through the use of GPS devices. The Sydney study was conducted in conjunction with Destination New South Wales (DNSW), the state government agency responsible for tourism marketing, focusing on a general research question: “What is the general behaviour of tourists in Sydney?” The Melbourne study was multi-faceted and included two industry partners, each of which had more specific research questions. As well as wanting to understand general tourist behaviour, the City of Melbourne wanted to know whether their visitor information centres (VICs) influenced tourists’ patterns of movement. Hence some tourists were instructed to visit one of these centres at the start of the day to see if this resulted in different behaviours. Another partner, the Melbourne Convention and Exhibition Centre (MCEC), specifically wanted to track the movements of conference delegates who took time out from a conference during the course of a day. The first study was conducted in Sydney between 2007 and 2008. The second study was conducted in Melbourne in 2010.

Sydney is the site of earliest European settlement in Australia and contains the key tourist icons of Australia, the Opera House and the Harbour Bridge. Sydney’s central business district (CBD) is a densely urbanised location that extends southwards for about three kilometres from the Harbour Bridge to Central Station. On the east side it is bounded by a chain of parkland that extends from Hyde Park through the Domain and Royal Botanic Gardens leading to Farm Cove on the harbour. The western side is bounded by Darling Harbour, a popular leisure and nightlife precinct. George Street serves as the CBD’s spine and main north-south thoroughfare.

From 1901 until Canberra was built in the late 1920s, Melbourne was the federal capital of Australia. Melbourne is Victorian in architectural character. The Melbourne CBD district is laid out in a uniform grid pattern and is large in comparison to other Australian cities,
but not as dense in high rise as Sydney. The streets are distinctly wide: most accommodate a central tram line. Melbourne is distinctive for its labyrinth of connecting laneways and arcades that provides an “other world” experience of intimate spaces and serves as home to an extensive variety of bars, cafes and retail outlets.

The overall intent of the two studies was to build a picture of the spatial patterns of how tourists navigate the urban environment and the routes they take. Participants included both domestic and international tourists. A tourist was defined as a visitor to the city, from outside their usual home and work environment and staying at least one night. The two studies employed similar methods. To build a more complete picture, the GPS tracking was complemented by post-visit interviews and participant questionnaires. The interviews allowed participants to explain their routes and various spatial decisions taken during the course of the day.

**Tracking tools**

The studies employed two different GPS tracking devices: Garmin Forerunner 305 and Holux Loggers. Each device records time, speed, distance, position, altitude and direction. The Garmin 305 is a watch-style device worn on the wrist while the Holux Logger, which resembles a roll of camera film, was worn around the neck. Both devices were compatible with a free downloadable programme, SportTracks, which incorporates a number of features that were helpful for interpreting the data, recording debriefing notes and providing storage. In a small trial of the devices it was found that they collected comparable data.

**Participant recruitment and venues**

International and domestic leisure tourists were recruited from accommodation venues in Sydney and Melbourne. Venue choice was moderated by its geographic dispersal in the city and ability to offer distinct starting points for tourists’ engagement with the city. The selection of venues was also largely dictated by the willingness of accommodation managers to permit the researchers to recruit participants on their premises. While considerable time was devoted to attempts at obtaining permission from a range of accommodation types and locations within each city, managers of accommodation establishments above a budget level (i.e. 3, 4 and 5 star hotels) were not willing to allow their premises to be used for the study.

Other considerations included a high occupancy rate at the time of the study (to ensure a sizable pool of potential participants), appropriate spaces in which to both recruit and interview participants (privacy, adequate seating and space for equipment) and technical requirements such as access to wireless Internet. The weather during each data-collection period in Sydney and Melbourne was favourable.

A total of 40 participant groups were recruited in Sydney. More participant groups were captured in Melbourne because the supporting organisation requested a three-stage study. Stage 1 used the same method as Sydney. In stage 2, the researchers were directed to instruct participants to visit one of the City of Melbourne’s VICs before going about their normal day’s activities. Stages 1 and 2 were conducted over a seven-day period in late April and early May 2010. Forty participant groups were recruited in stage 1 and 42 participant groups were recruited in stage 2, realising a total of 82 useable trails. In stage 3, participants were delegates who were taking time out from attending a conference at the destination. It was conducted over a three-day period in early May 2010 and 32 delegates were recruited, resulting in 26 useable trails.
Administration

In both studies information letters were distributed in each recruitment venue on the evening prior to the day of data collection. Guests were advised of the study, its objectives and their requirements, and the availability of an incentive (a shopping voucher) for participation. Active recruitment was then undertaken the following morning. Participants were asked to wear or carry a GPS device that would record their location, time, speed, distance and direction over the course of a day. The devices were set by the research team before the departure of participants, who were advised to go about their day as they normally would and to “forget” they were carrying the device. Each group was tracked only once.

Upon their return to their accommodation at the end of the day, each participant group was debriefed using a semi-structured interview format. As part of this process they completed a questionnaire which was designed to capture demographic information along with their purpose for visiting, the activities they engaged in, mode/s of transport used and any barriers they may have encountered during the day. During the debriefing process data collected from the GPS devices were downloaded into the SportTracks programme. From here the data were exported into Google Earth and overlaid onto a map of the location, thus providing an immediate representation of the participant’s trail. The accuracy of the trail was reviewed with the participant and notes were taken of any wayfinding or mobility difficulties, the participant’s reasons for choosing routes and sites, and their activities of interest.

Analysis

The software supporting the GPS devices enabled the overlaying of trails onto Google Earth. The technology provided clear evidence of the path taken, speed travelled and time of day. A visual examination of the trails was undertaken both individually and collectively on one map, showing individual trails and the intensity of activity along particular paths. Reviewing the trails with the participant was important for confirming the accuracy of the trails and whilst the paths are not perfect straight lines, in every instance they represented the routes taken and the direction of travel. Indeed, reviewing the trails with participants assisted in “jogging” their memories on aspects of their visit. The pace at which participants travelled was recorded by the devices. This was assessed by the trails’ linearity: straight lines indicated that transport was used and the pace or speed is given as an output of the SportTracks programme.

Findings

The spatial patterns in each city highlight areas of substantial intense use while contiguous areas of potential interest remained “underutilised”, and the significance of iconic attractions and places as shapers of spatial activity is highlighted. Common to the Sydney and Melbourne studies is the preparedness of tourists to walk between 10 and 35 kilometres a day. Walking the city affords tourists the opportunity to become connected. However, there were some significant differences in the general patterns and range of movement, the modes of transport used and the ease with which tourists felt they could find their way around the two cities. The key findings from each city are reported separately below.

Common issues of concern raised by tourists in both Sydney and Melbourne focused on transport, maps, signage and information regarding attractions and general services. An efficient transport system enables people to move from A to B; however, it was found that visitors will walk up to 35 kilometres a day and are more interested in exploring the
fine grain of the city and finding "somewhere else" to go. A legible wayfinding system can facilitate this connection with the fine grain. Amongst the key constraints that tourists reported as limiting the range of their exploration of a city were their knowledge of the public transport network and ticketing system, and the quality of a city's wayfinding system. In particular, confusion over how and where to purchase a ticket discouraged tourists from using the bus system in Sydney and, on occasions, the tram system in Melbourne.

**Sydney**

In Sydney, 47% of participants were male, and 54% of all participants had visited Sydney before. A large proportion was travelling with one other person (48%) or alone (26%); 72% were international tourists. Most used walking as their major form of transport (63%), with 77% also incorporating other forms of transport such as train, ferry and bus during the day on which they were tracked. Their main purposes for visiting Sydney were sightseeing (37%) or for a holiday (37%).

Tourists’ spatial behaviour in Sydney is based on the city core or “spine” (Figure 2). The concentration of participants’ trails suggests that Sydney has a linear spatial order, which is referred to as successive arrangement: a spatial system that generates fragmented integration with disjointed parts and limited choices for experiencing space, resulting in people becoming stuck in a core and finding it difficult to penetrate all parts of the system (Boerwinkel, 1995). Navigating their way through Sydney, participants found elements such as signage, the challenges of public transport and ticketing created difficulties for mobility and wayfinding, including the location of key cultural attractions. Connectivity points which afford access beyond the city core are few.

![Sydney Trails](image)

Figure 2. Sydney trails.
Figure 2 clearly shows spaces of co-presence and co-absence demonstrating a spatial system that is facilitating repetitive movements. In addition to the main thoroughfares of George Street and Elizabeth Street, other areas of co-presence are Circular Quay, Darling Harbour, Chinatown, The Rocks, Hyde Park and the Botanical Gardens. There is a high degree of repetitiveness, with participants returning to the same places and using the same routes throughout the day. The majority of people were “on foot” so they were looking for things to do between visits to attractions and sites. Therefore, while respondents had specific attractions in mind and the trails were somewhat process oriented, they would explore places between sites. However, once tourists found a path from A to B they tended to retrace their steps during the day. For example, the Opera House was an initial focus, but visitors would explore their same path there and back, taking images of local architecture as they went. Transport and wayfinding in Sydney were at times compared unfavourably to European cities such as London. Participants said that wayfinding was difficult and they would like more signage that would indicate how to find places of interest, activities and things to do.

In Figure 3 the movement patterns are represented by coloured lines indicating the most heavily used streets (red) through to the lesser used streets and areas (pink). These lines clearly show only a few spaces integrated to the city: the precincts of Circular Quay, Darling Harbour, Chinatown, The Rocks, Hyde Park and the Botanical Gardens. Co-presence for these spaces is higher than in others.

**Melbourne**

In stage 1, 63% were female and for 65% of all respondents it was their first visit to Melbourne. Seventy-six per cent were international tourists. For 51%, walking was their major form of transport. The tram system was used by 75%. Participants in stage 2 were equally divided between females and males: 88% were international visitors. For 54% of participants it was their first visit to Melbourne and walking was the major form of transport for 98%. Only 52% used the tram system. In stage 3, 74% were female, 67% were international tourists and 47% were first-time visitors: 63% used the tram system. Participants in stage 3 indicated that they liked to walk around the city as it was a way in which to get “fresh air” and to “stretch their legs”.

In Melbourne activity was particularly focused on the CBD (Figure 4), demonstrating a matrix pattern. Participants clearly felt comfortable moving about and exploring the city centre fairly thoroughly. For the central area at least, Melbourne emerged as an easy city for the visitor to explore, offering rewarding experiences en route as well as at focal attractions.

Melbourne’s laneways, free City Circle Tram (CCT) and free tourist shuttle bus provided an integrated system for participants to make their way around the city, with the CCT very popular as a means of orientating themselves. The CCT contributes to Melbourne’s wayfinding system by offering tourists another opportunity for reading and interpreting the city. As a result, they could link back and side streets with the main streets and move more easily from one space or precinct to another. The city offers diversity of experiences, sights, attractions and activities and the integrated system enabled tourists to cover all the different parts. The city has a focus on creative art and enlivening small places (micro spaces) which may also be facilitating “by-chance-encounters” for tourists, enabling them to make their way from one space to another within the system. Overall, tourists’ dominant patterns of use in Melbourne represent a simultaneous arrangement in which its spatial order shapes movement, facilitating a pattern which maximises co-presence.
The precincts of Victoria Markets to the North, Kings Domain to the South, Fitzroy Gardens to the East and Docklands to the West are spaces that act as extensions of the core, offering further opportunities for connectivity, exploration and co-presence. There is also evidence that certain streets to the north-east of the central city grid are organically developing as places of interest for tourists. During the debriefing sessions participants stated that they visited these places because they were told by other tourists that these places offered interesting things to see.

A visit to one of Melbourne’s VICs resulted in a slightly stronger concentration of more linear movements: up and down two main streets of Melbourne – Swanston and Elizabeth Streets. The patterns do not fully reflect the impact of the VICs; many participants had planned their activities prior to setting out. However, participants indicated that they intended to undertake some of the activities recommended by the VICs on subsequent days. Given the city-centric activities recommended to the study participants by visitor services staff, it could be assumed that the dense spatial patterns exhibited by visitors in stage 1 would be largely repeated.
Figure 4. Melbourne trails, stage 1 – grey; stage 2 – white.

Figure 5. Conference delegates.
The third stage of the Melbourne study focused on conference delegates taking time out. Time out is seen by conference delegates as an opportunity to gain some relief from a heavy conference schedule, see some of the city, meet friends and colleagues and to go shopping. In general the CCT has a big influence on the movement patterns of conference delegates along Flinders, Spring and La Trobe Streets and to Docklands (Figure 5).

Time is clearly at a premium for this group of visitors and the CCT facilitates quick and easy exploration of the city centre. Southbank, along with Collins and Lonsdale Streets to the west of Swanston Street, was also fairly heavily used. Understandably, in a shortened time span co-presence is limited, particularly if tourists are unaware of what is achievable in a short period of time. Participants across the three stages indicated that signage with respect to trams, maps and information regarding attractions and general services could be improved.

Conclusion

Both DNSW and the City of Melbourne aim to develop tourism sustainably, including dispersing the benefits of tourist visitation more widely. The findings from both studies have informed subsequent efforts to improve visitor information services and wayfinding in each city. In Melbourne, for example, it became apparent that there was an opportunity to develop themed trips of only a couple of hours’ duration to assist convention delegates to maximise their short time spans, and increase occasions for expenditure; the MCEC now includes a range of such suggested itineraries in their delegate information packs. Most recently the study informed the planning process associated with the redevelopment of Darling Harbour, one of Sydney’s major tourism precincts, managed by another government agency, Infrastructure NSW. The maps were used to make a visual assessment of the integration/segregation of the precinct with the aim of improving the site’s intelligibility and connectivity.

The visual maps that were generated from these studies are also being used by DNSW and the City of Melbourne as a design tool for improving their wayfinding systems. The slight tightening of spatial dispersal which occurred in stage 2 indicated a need to modify the training of VIC staff and volunteers to ensure they were better equipped to assist visitors to explore the city and surrounding precincts. The lack of spatial dispersal by tourists to Sydney alerted both DNSW and the City of Sydney to the need for a clearer and more consistent wayfinding system that would assist visitors and the community to efficiently find their way to destinations and explore the city more widely.

The resulting visual maps provided extensive insights for destination-management agencies on visitors’ spatial use of the city, indicating spaces of high use and co-presence as well as co-absence. Similar to other studies (Asakura & Iryo, 2007; McKercher et al., 2012; O’Connor, Zerger, & Itami, 2005; Shoval, 2008; Modsching et al., 2006; van der Spek, 2008), this research found that the use of a visual research method can serve as a diagnostic tool that can identify problems with specific services such as transport and visitor information. Space syntax proved useful for understanding the integration and connectivity of the street network within the spatial layout of the city as a whole for tourists. De-briefing interviews with tourists were also important in explaining the trails and subsequently pointing to problems and issues that might require corrective management action.

The method used in these studies is, however, labour-intensive and the number of trails that can be gathered is limited by the number of GPS devices available and the overall research budget. It also relies on the cooperation of accommodation and other venues, where tourists can be recruited and debriefed. Future research could attempt to overcome these problems through the use of mobile phone applications developed specifically to collect
location and other relevant information about visitor movements on a more extensive scale. The methods employed here could also be used to model scenarios for predicting how spatial interventions (signage, ticketing, road closures, location of services) may affect spatial behaviour and be adjusted to realise sustainable goals.

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References


