

Mapping perceptions of topophilia and topophobia using a mobile app: A tale of two cities

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Abstract

This study evaluates positive (topophilic) and negative (topophobic) perceptions of places using participatory mapping methods. Current research on mapping perceptions of urban environments relies heavily on retrospective self-reports from citizens. These methods are often susceptible to recall bias and do not capture granular information about urban environments. Places are dynamic, and peoples' perceptions of them vary by time and space. To address these gaps in methods, we collected data from individuals living in two cities, Olomouc, Czech Republic and Brisbane, Australia. GIS was used to analyse a combined total of 634 momentary assessments from Olomouc, and 318 assessments from Brisbane. Our findings suggest that this approach can yield accurate and reliable data about perceptions of topophobia and topophilia in the two cities as well as enable researchers to clearly define hotspots and hot times related to individual activity spaces.

Keywords: Perception, Participatory Mapping, Mobile Application, EMA, Topophilia, Topophobia, Olomouc (Czech Republic), Brisbane (Australia)

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1. Introduction

"It was the best of times, it was the worst of times..."
 Charles Dickens (A Tale of Two Cities)

Geographical space, encompassing a diverse range of environments and their attributes, is strongly connected with emotion (Mody et al., 2009). Whether we intend to or not, there are always competing emotions, whether positive or negative, that people associate with cities and specific places within them. Behavioural geography focuses not only on the connections between space and emotion but, more precisely, on the way people perceive space. Like the dichotomy in Dickens' *The Tale of Two Cities*, places can be perceived in opposing ways, which Tuan (1990) classified as topophilia and topophobia. *Topophilia* includes positive and pleasant feelings about places whereas *topophobia* is attached to negative and unpleasant feelings about places.

The methods used to capture peoples' perceptions of place have evolved over time. Traditionally, researchers have used retrospective surveys to gather information on peoples' perceptions of places and their feelings about them, e.g. fear of crime, feelings of safety (Solymosi et al., 2020). More recently, scholars have attempted

to capture individuals' perceptions of topophobia and topophilia using a variety of novel methods, such as participatory geographic information systems (PGIS), mental mapping, and sketch mapping (Denwood et al., 2022; Šerý et al., 2023). One consistent theme across most studies is that researchers rely heavily on cross-sectional data and static measurements to understand perceptions of places. Although this work provides useful information about the situational environment and its connection to emotion, scholars have raised concerns about recall bias and the ecological validity of retrospective surveys (Solymosi et al., 2020). Solymosi and colleagues (2020, p. 1014) argue that perceptions are "place-based, context-specific experiences" and, as such, need to be captured when and where they occur. Recent advancements in smartphone technology have enabled researchers to address these methodological limitations, allowing for granular information to be collected from smartphones as individuals navigate and move around places. These approaches are referred to as Ecological Momentary Assessments (EMAs), and typically involve the use of a mobile app¹ to send repeated signals or notifications to a smartphone device, which prompt the user to report their perceptions of their immediate environment at either a fixed or

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¹ A "mobile app" is the accepted and short-hand term for mobile application. A mobile app is "a software application developed specifically for use on small, wireless computing devices" (see e.g. Hussin et al., 2016).

random point in time (see Solymosi et al., 2020). Other forms of ecological momentary assessments seek to capture information relating to specific events (rather than sending notifications to a device at fixed points in time), with the goal to understand immediate experiences, reactions, and responses to a place.

The benefit of EMAs is that they allow for multiple points of data to be collected rapidly *in situ*. This data can then be analysed hierarchically to identify between-and-within groups variation in perceptions of space (i.e. changes in perceptions over time and across different locations). The benefits of this technology in understanding momentary perceptions of topophobia and topophilia, however, are yet to be fully realised. Although understanding resident's perceptions through participatory mapping of places is "viewed as one of the most in demand approaches within urban space planning," (Brisudová et al., 2020, p. 203), much of what we know about topophobia and topophilia comes from European cities and uses retrospective mapping methods. The current study seeks to pilot a bespoke mobile application (Cin City) that uses temporal and spatial triggers built into smartphones to capture momentary perceptions of topophobia and topophilia in two contrasting cities, Olomouc, Czech Republic and Brisbane, Australia. We are guided by the following research questions:

- Are mobile apps an effective tool for collecting real time data about perceptions of topophobia and topophilia in Olomouc and Brisbane?
- What type of places and times are associated with topophobia and topophilia in Olomouc and Brisbane?
- What factors influence subjective perceptions of topophobia and topophilia in Olomouc and Brisbane?

2. Literature review

As Tuan (1975, p. 157) explains, cities are designed "exclusively for human use" in which perceptions of places are influenced by peoples' primary senses (i.e. touch, hearing, sight, smell, and taste), experiences, aesthetics, and the social and economic activities that occur, as well as from secondary information sources (e.g. friends, family, and media), and broader dynamics such as time, seasons, and societies (Anderson, 2009). These processes are multi-directional – places inspire and influence emotions and perceptions, which in turn can directly and indirectly influence peoples' behaviour and what occurs in public spaces (Wanner, 2016). There is a large body of literature that explores perceptions of places, including safety and fear of crime (e.g. Hart et al., 2022), disorder (Ellaway et al., 2001), beauty and aesthetics (Florida et al., 2011), sense of place (Hay, 1998), and the atmosphere of urban places (Sumartojo et al., 2019; Thibaud, 2015).

Within this literature, there is a small but growing field of research which measures perceptions of place through the concepts of topophobia and topophilia. Topophilia has been described as the "human love of place" (Tuan, 1990, p. 92) and encompasses a person's positive affect to an environment, associated with feelings of pleasure and delight, an appreciation of visual aesthetics, and attachment to places through familiarity, memory, and sense of belonging (Hay, 1998; Tuan, 1990; Relph, 1976). Conversely topophobia refers to "fear of place" (Bowring, 2013, p. 109), linked with feelings of hatred, distrust, danger, and places to be actively avoided (Ruan & Hogben, 2007; Šimáček et al., 2020). Importantly, topophobia and topophilia are dynamic and influenced by various temporal, social, and physical factors, and peoples' subjective experiences and memories of a place (Brisudová & Klapka, 2023; Ruan & Hogben, 2007).

Perceptions play a key role in everyday life, providing a powerful and dynamic impact on peoples' emotions and interactions with their environment (Zadra & Clore, 2011). Peoples' perceptions of public and outdoor spaces have important impacts on a variety of

measures, including worry about personal victimisation (Chataway et al., 2017), physical and mental health (Ellaway et al., 2001), wellbeing (Burger et al., 2012), quality of life (Muhajarine et al., 2008), and feelings of safety, comfort, and pleasantness, especially for women (Carr, 1992; Heffernan et al., 2014; Navarrete-Hernandez et al., 2021; Šerý et al., 2023). There are also tangible economic and cultural benefits of public space, with several scholars arguing that public spaces provide a sense of community and citizenship (Florida et al., 2011; Pugalis, 2009). Wanner (2016) explored how historical and nostalgic architecture in Ukraine can provide cues to residents about the use of space, shape political and social ideals, and help people "feel at home" (p. 206), while other researchers labelled areas of Melbourne dominated by corporate spaces as "bland" and "oppressive" (Sumartojo et al., 2019). When residents feel unsafe or uncomfortable, they may avoid certain places and withdraw from community participation (Grohe et al., 2012; Šerý et al., 2023).

Studies specific to topophobia and topophilia explored these perceptions qualitatively (Bowring, 2013; Munoz Gonzáles, 2005). Munoz Gonzáles (2005) examined how Spanish women could hold topophobic perceptions of their home as a "prison" (p. 203), as places of stress and monotony, or could be associated with topophilic feelings of comfort and tranquillity. Bowring (2013) examined the perception of topophobia and topophilia after the 2011 Christchurch earthquake with buildings once associated with feelings of comfort and peace were now places of revulsion and fear, while "unkept wastelands" (p. 112) were transformed to places to be protected and admired due to their importance in ecosystem regulation. Using ethnographic methods, Paquet (2023) found that racial segregation, white dominance, and poor levels of maintenance contributed to topophobia in South Africa. Areas design to exclude 'the racial other' became fortresses with high levels of surveillance, access control, and fear, impacting social connectedness.

There are a handful of quantitative studies on perceptions of topophobia and topophilia in public spaces. In the Czech Republic, physical characteristics associated with topophobia included noise, poor lighting (Šimáček et al., 2020), heavy traffic, poorly maintained and unpleasant buildings (Brisudová et al., 2020). Cucu et al. (2011) argued that neighbourhoods in Romania with vacant land, next to cemeteries, and poor accessibility to green spaces are topophobic as they are not desirable places to live. The social dynamics of places can also affect perceptions with places where intoxicated, homeless, or marginalised populations congregate, often perceived as dangerous (Šerý et al., 2023). The time of day can affect topophobic perceptions, where green spaces, parks, and historical town centres are admired and perceived as pleasant during the day, but places to be feared and avoided during the night (Brisudová et al., 2020; Šimáček et al., 2020).

Collecting feedback from people who use public spaces is integral to design and planning decisions (Pugalis, 2009). For example, Brisudová and Klapka (2023) discovered residents of Šternberk, Czech Republic wanted to see vacant areas turned into places related to civil amenities and quality of life, including sporting and outdoor activities, cultural facilities such as theatres, restaurants, and cinemas, and services such as markets, shops, and public transport stations. Creating spaces where people feel comfortable and safe, are accessible and sociable, is critical in urban design and planning for the creation of sustainable and enjoyable cities (e.g. Heffernan et al., 2014; Sumartojo et al., 2019).

3. Methodology

3.1 Study sites and participants

Participants were recruited from two cities, Olomouc in the Czech Republic and Brisbane in Queensland, Australia, as displayed in Figure 1. These cities provide contrasting examples

between (a) traditional, historic inland cities in Central Europe, and (b) new, modern coastal cities in Eastern Australia. These two sites were selected based on convenience and the University affiliations of the research team.

3.1.1 Site 1: Olomouc

The growth of Olomouc City began in the 13th century, with its central area evolving from the historical centre (Olomouc city neighbourhood). Over time, additional neighbourhoods were gradually incorporated into its core². The historical centre, together with adjacent streets, urban green spaces, and shopping areas, represents a space with a strong concentration of social activity within the urban fabric. The presence of the second oldest university in the Czech Republic, with its largest campus in the central parts of the city, further bolsters this function by attracting a significant population of young people. Parks, gardens, and recreational facilities provide opportunities for relaxation and outdoor activities in the central city neighbourhood as well as along the Morava River. The social function is closely intertwined with a significant transport function, particularly prevalent around the main railway station located in the Hodolany city neighbourhood. The remaining city neighbourhoods, including Neředín, Nová Ulice, Povel, and Nové Sady, are mostly residential, supported by their convenient locations and efficient transportation services.

3.1.2 Site 2: Brisbane

Brisbane is a modern sub-tropical city located in the state of Queensland, Australia. The Brisbane region comprises multiple council areas including Moreton Bay, Ipswich, Logan, Scenic Rim and Somerset council areas. We recruited participants within the city centre of Brisbane and 16 surrounding suburbs in the Brisbane Local Government Area (LGA). Brisbane city is more than a business precinct, it is home to several university campuses, hotels, residential buildings, cultural hubs, entertainment venues, restaurants, bars, and retail outlets. The city boasts several green spaces, and outdoor venues including the Botanical Gardens and the Riverstage outdoor concert venue. The surrounding suburbs/neighbourhoods are connected through an advanced transportation and roads network with bus and train services connecting residents and visitors to the city. Brisbane is also set to host the 2032 Olympic and Paralympic Games, with significant infrastructure and development planned for the city ahead of the games. The clear contrasts between the two cities of Olomouc and Brisbane presents an opportunity to explore differences in perceptions of older and younger cities.

3.1.3 Sampling Approach

To ensure that meaningful comparisons in perceptions of topophobia and topophilia could be made between the two cities, we sampled specific geographical boundaries according to population density (refer to Fig. 1 on the next page). In Olomouc, we recruited participants from the entire city in which approximately 100,000 residents live (MVČR, 2023). To obtain a similar geographical spread in Brisbane we targetted our recruitment in Brisbane city and 16 surrounding suburbs, containing approximately 158,000 residents (ABS, 2021). The recruited participants were allowed to report on places within the whole research area regardless of the suburb from which they were recruited.

Several recruitment methods from previous mobile app studies (Chataway et al., 2017) were used in both locations, including digital and paper flyers in key locations (e.g. cafés, university buildings, libraries, public noticeboards) and social media advertisements

on Facebook and Twitter. Recruitment occurred between January 2022 to December 2022 in Olomouc and February 2023 to September 2023 in Brisbane. By the end of recruitment, a total of 56 participants were registered and actively engaged in the study. Although the sample is small, it must be acknowledged that the unit of analysis in mobile app studies is not the number of participants, but rather the number of distinct reports collected by the app (Chataway et al., 2017; Solymosi et al., 2020). Across both sites, we received 952 reports from participants. Demographic data are presented in Table 1 below, which demonstrates that the average age of participants in Olomouc was lower and predominately male, when compared to Brisbane. The average age of men and women were similar in their respective cities.

Location	Gender	Age (M, SD)	Participants (n)	Records (n)
Olomouc	Male	27.6 (6.38)	24	252
	Female	27.5 (6.39)	11	382
	N	27.5 (6.39)	35	634
Brisbane	Male	40.7 (10.40)	6	95
	Female	40.0 (10.29)	15	223
	N	40.0 (10.29)	21	318

Tab. 1: Participant Demographics
Source: authors' elaboration

3.2 The Cin City mobile application

The Civic InnovatioN in CommuniTY (Cin City) mobile app was designed in collaboration with researchers at the University of Manchester and Palacký University Olomouc (Brisudová et al., 2022). Built using publicly available code from Solymosi et al. (2015), Cin City is currently available on Android devices, and in two languages (English and Czech). The app uses a simple user interface involving a short registration process after downloading it from the Google Play Store. After registration, notifications are sent to a participant's devices five times a day between 7 a.m. and 10 p.m. There was no timeframe imposed on use of the app, meaning that participants could record observations sporadically if they desired. Figure 2 outlines the process for registration and data input in Cin City. Participants in the study were not incentivised for their participation. The app received ethical clearance from the Human Research Ethics Committee at the Queensland University of Technology in Australia and the Ethical Committee of the Faculty of Science of Palacký University Olomouc in the Czech Republic (Ref. No.: 21-01).

3.3 Momentary assessments

Each time a participant was asked to report their perceptions of a place, they were presented with a short 1-minute survey containing four questions. Survey length is an important consideration in Ecological Momentary Assessments (Shiffman et al., 2008). As our goal in this study was to capture immediate perceptions of public places, it was critical that data be collected rapidly before someone exited a specific location. The first question was used to capture the type of feeling being experienced in the immediate environment and asked, "I consider the place where I am right now to be..." The response set included (a) pleasant, (b) unpleasant, or (c) abandoned. The next question measured the intensity of the experience, and asked, "How would you rate the intensity of this feeling?" with the following responses, (a) very low, (b) low, (c) medium, (d) high, or (e) very high. The next question was open-ended and provided the user with an opportunity to elaborate on their feelings within the place, which asked, "What

² In this study, we will use the word "neighbourhood" in the Olomouc site to define administrative divisions within the city. In the Brisbane site, we use the word "suburb" to signify residential areas situated outside the Central Business District (CBD). Suburbs are primarily intended for housing and community living. These distinctions may vary to readers in other countries.

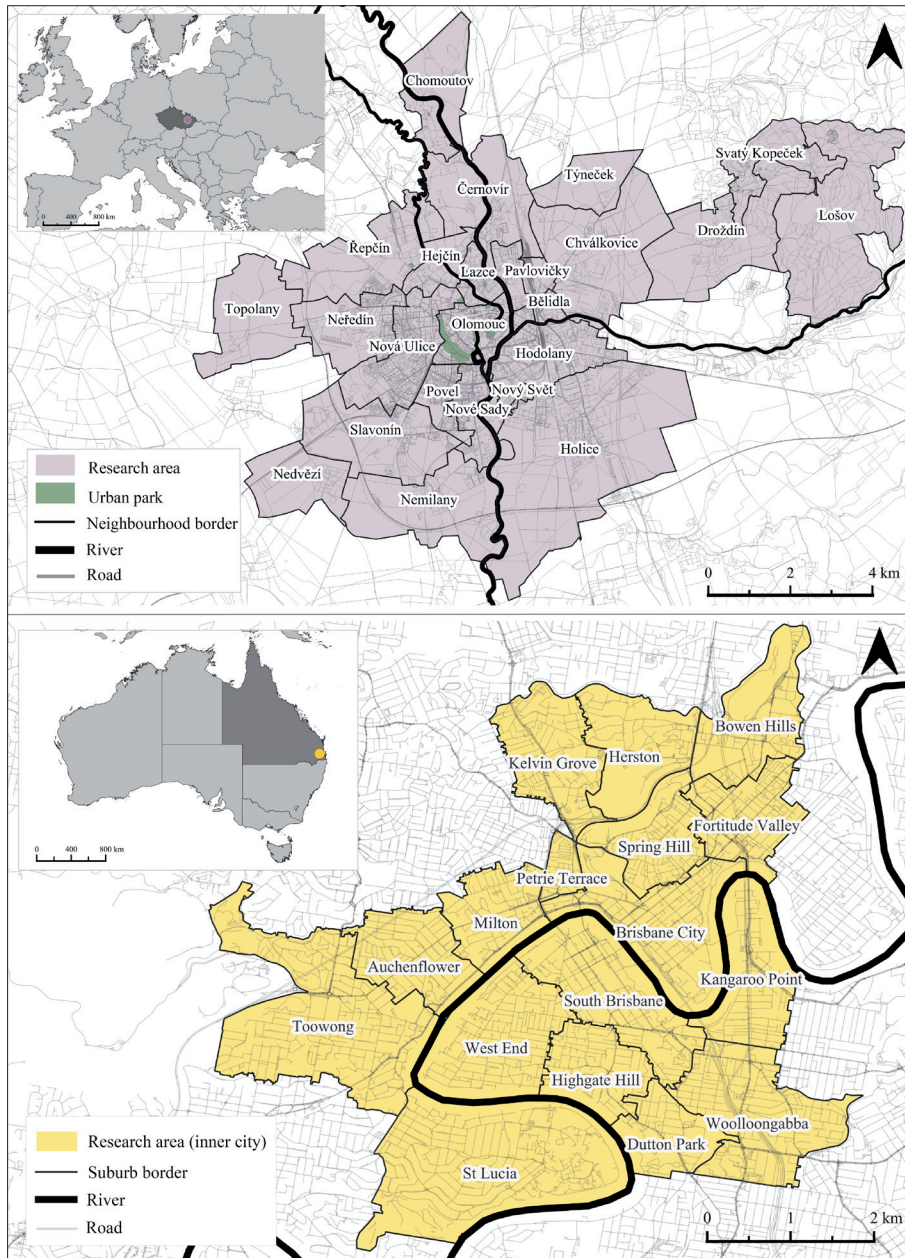


Fig. 1: Overview maps of Olomouc and Brisbane’s inner city
 Source: authors’ elaboration; background map © OpenStreetMap contributors

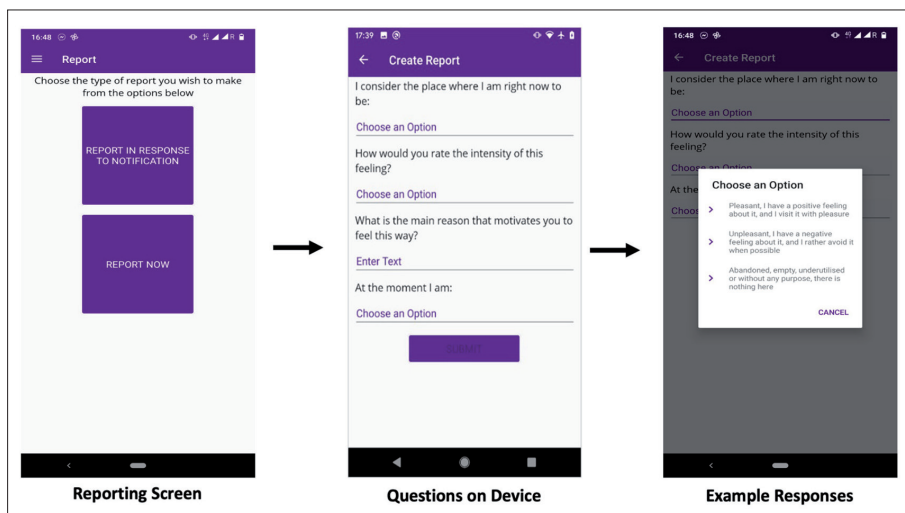


Fig. 2: The Cin City Mobile Application Survey Screen
 Source: authors’ elaboration

is the main reason that motivates you to feel this way?” The final question captured whether the user was alone in the space or with someone else, and was worded, “At the moment, I am...”, with the following responses, (a) alone, or (b) with somebody.

3.4 Analytic approach

Our analysis and results are presented in three sections below. First, we examine the feasibility of data collected using the Cin City app in Olomouc and Brisbane. This involves a descriptive analysis of the response rates for notifications and reports, and survey item responses. Next, we examine temporal patterns in positive and negative perceptions of places in the two cities, using temporal heat maps. Temporal heat maps are a static mapping approach that can be used to identify temporal patterns in momentary experiences in mobile app studies (Shiffman et al., 2008). We conclude our results with an analysis of hot spot locations of topophobia and topophilia among Olomouc and Brisbane residents.

4. Results

4.1 Descriptive analyses of reporting data

Most participants in Brisbane responded to signal notifications sent by the Cin City app (93%), rather than manually reporting information about a public place using the app (7%). In contrast, Olomouc residents were more likely to report information about public places manually using the app (72%), rather than responding to a signal notification (28%). This was an interesting finding and demonstrates that potentially a combination of signal contingent (random or fixed-intervals) and event-based triggers is needed for future work examining perceptions of places. In terms of item completion, a 100% survey completion rate was observed in both samples. This finding was expected, due to the length of the survey (four questions). Prior work has found that item completion is generally higher in smartphone studies due to short survey lengths (see, for example, Chataway et al., 2017). Due to limitations of the app, we were unable to determine notification response rates, as discussed below.

Out of the 952 records reported with the Cin City mobile app, 79.6% were topophilic and 20.4% were identified as topophobic. Both case studies confirmed a strong prevalence of positive perception (Tab. 2). Nevertheless, it is worth noting that the proportion of topophilic records outweighed topophobic records more prominently in Brisbane (86.8% vs. 13.2%) compared to Olomouc (76% vs. 24%). In Brisbane, participants not only identified more locations as topophilic, but also expressed their perception with greater intensity (Tab. 2). The perceptual intensity score, ranging from 1 (very low intensity) to 5 (very high intensity), averaged 3.90 for topophilic places in Brisbane and 3.54 for those places in Olomouc. Moreover, the score in Brisbane was considerably higher within the nighttime records than in daytime reports (3.90 vs. 3.50). Conversely, topophobia, more frequently reported in the Czech sample, had a higher average perceptual intensity score in Olomouc (3.30) compared to Brisbane (2.43).

4.2 Temporal Heat Map Observations

Research exploring topophilia and topophobia in urban spaces predominantly concentrates on analysing the spatial distribution of these phenomena to identify hotspots characterised by positive and negative perceptions (e.g. Cucu et al., 2011; Šimáček et al., 2020). Given the inherent connection between time and space, and the influence of time on peoples' daily movements, it is crucial for studies on perception to also explore the temporal distribution (i.e. hot times) of topophilia and topophobia.

We observed clear temporal patterns of positive and negative perceptions in both sites (see Fig. 3). Participants in Olomouc reported topophilia mainly between 8 and 11 a.m. in the morning and from 1 to 6 p.m. in the afternoon, peaking at 3 p.m. with a maximum of 50 records. The highest occurrence of topophilic records took place on Wednesdays (n = 92) and Thursdays (n = 96). In Brisbane, participants' topophilic records were more prominent from 7 to 11 a.m. in the morning and 3 to 6 p.m. in the afternoon, with Fridays (n = 49) and Wednesdays (n = 45) being the busiest days. While the number of topophilic records decreased in the evening hours in Olomouc, reaching a maximum of 29 records at 8 p.m., this pattern was not observed in Brisbane, where a substantial number of records (n = 29) were submitted at 10 p.m.

The disparities in topophobic temporal heatmaps between Olomouc and Brisbane are even more pronounced. In Olomouc, the highest number of topophobic reports was observed at 7 a.m. in the morning and at 1, 3, and 4 p.m. within the afternoon, with 4 p.m. being the overall peak (n = 17). Participants reported a significantly higher number of reports on Thursdays (n = 32) compared to the other days. Brisbane's topophobic reports, culminating on Tuesdays (n = 13), showed two notable hot times that deviate from the rest of the hours – at 7 a.m. (n = 11) and 3 p.m. (n = 10). In terms of reported topophobia, the evening hours represent a less prominent period of the day in both cities, although respondents often commented on the dangerous nature of places after dark. The lower number of topophobic records in the evening may be attributed to security reasons, as participants may avoid unpleasant places at night or prioritise leaving these areas as fast as possible instead of reporting on the mobile app.

Concerning the temporal distribution of records throughout the week, weekends (Saturdays and Sundays) are characterised by lower numbers of reports for both types of perception in each city. The most significant decrease is observed in Brisbane's topophobic records, with only three reports submitted on Saturday and none on Sunday, which may reflect infrequent use of the app on weekends.

In general, the patterns of reported topophilia and topophobia in Brisbane exhibit a more structured distribution into specific hours compared to Olomouc's records. This difference may be ascribed to the fact that participants in Brisbane regularly responded to notifications on their smartphones, a behaviour less common among participants in Olomouc.

Location	Time period	Topophilia		Topophobia	
		Records (%)	M Perceptual Intensity Score (1–5)	Records (%)	M Perceptual Intensity Score (1–5)
Olomouc	Daytime	80.5	3.53	79.6	3.02
	Nighttime	19.5	3.56	20.4	3.10
	All Olomouc data	76.0	3.54	24.0	3.30
Brisbane	Daytime	64.9	3.50	81.0	2.47
	Nighttime	35.1	3.90	19.0	2.50
	All Brisbane data	86.8	3.90	13.2	2.43

Tab. 2: Temporal distribution of reports and their mean perceptual intensity score
Source: authors' elaboration

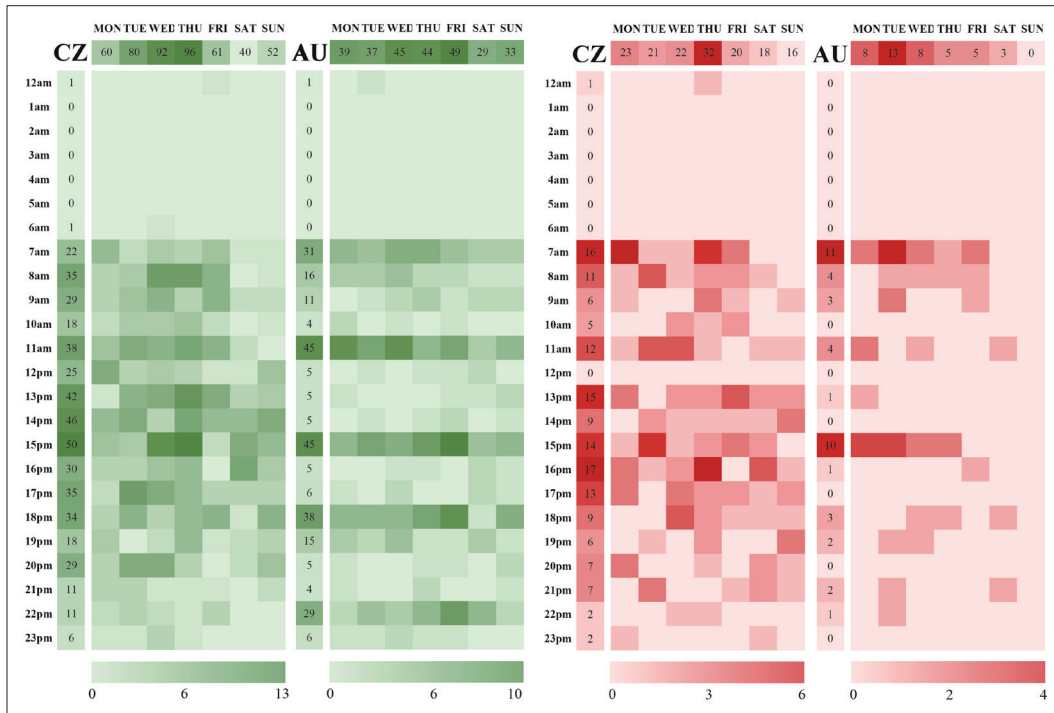


Fig. 3: Hot times of perceived topophilia and topophobia in Olomouc (CZ) and Brisbane (AU)
 Source: authors' elaboration

4.3 Hotspots of Topophilia

The Heatmap analysis tool in QGIS (version 3.34.0) was used to display hotspot locations from all records. Appropriate radius for heatmaps was computed via the Distance Matrix tool as twice the average of the closest distances between reported locations for both research areas. Such a parameter was chosen as the most suitable graphic characteristic capturing the essence of the observed phenomenon. The hotspots were displayed and analysed separately across day (6:00 a.m. – 5:59 p.m.) and night (6:00 p.m. – 5:59 a.m.) records.

Figure 4 depicts hotspots of topophilia during both day and night in Olomouc and Brisbane. In Olomouc, the main topophilic hotspots identified by participants during the day cover the main university campus area, various streets in the city centre and urban parks, along with the rose garden. Participants frequently highlighted the pleasant environment in the Olomouc neighbourhood (“Open space, nice architecture, greenery, benches for sitting”), university campus area (“pleasant environment for studying”), and the advantages of urban green spaces (“A pleasant greenery for walks and relaxation”). At night, the topophilic hotspots were more concentrated in the city centre particularly around the two main squares, the city’s town hall, and streets leading to the main railway station. These reports reflect locations with lively nightlife, as evidenced by comments such as “fun with friends” or “beer and friends”. Additionally, a few smaller topophilic hotspots were present in adjacent city neighbourhoods (Hodolany, Nová Ulice and Neředín), characterised by residential areas with family houses and apartments blocks. Topophilic places reported in Olomouc at night, in contrast to daytime reports, were in well-lit public areas, with only occasional or non-existent reports in side streets and urban greenspace areas.

In Brisbane, hotspots of positive perceptions reported during the day were prominent in four primary city suburbs – Wolloongabba, Auchenflower, West End and South Brisbane. The strongest hotspot was associated with an area in Wolloongabba full of cafes, restaurants, boutique live music venues, and local shops, and perceived by participants as “familiar,” “bright,” and “safe.” Feelings of safety in this area could be linked to various factors,

including the proximity of nearby hospitals. Another cluster of topophilia was identified in Auchenflower, where reports were concentrated along the riverbank, featuring benches, pedestrian walkways, and bikeways. West End, representing the third hotspot of positive perception, emerged as a vibrant urban area where people can meet in numerous cafes, restaurants, and bars or spend time in urban green spaces. Participants frequently highlighted these locations in their comments with topophilic experiences, noting aspects like “lots of people around. Good to see West End busy” or “lovely park, river moody, people enjoying themselves.” Brisbane city seamlessly connects to the popular suburb and tourist location South Brisbane, with reports concentrated around the modern South Bank area, proximate to local shopping centres, restaurants, universities, and urban green spaces such as Musgrave Park.

Topophilia reported in Brisbane at night mirrored daytime patterns, although with intensity variations across city suburbs. The most robust nighttime hotspot emerged at the border of South Brisbane and West End, where respondents’ positive feelings aligned with the late-hour atmosphere. Examples include statements such as “I went for a walk around the block, and it's a nice night out. It's also cooler outside”. Nocturnal topophilic reports were frequently linked with feelings of security (“I felt safe and happy”) and personal experiences (“I've seen some scary and uncomfortable things around here, but it has never been really targeted at me”). Unlike in the first case study in Olomouc city, participants in Brisbane continued to express positive perceptions of well-lit and popular urban green spaces like Musgrave Park at night.

Auchenflower exhibited heightened topophilia at night, with reports still concentrated along the riverbank. Positive feelings were diverse, with participants remarking on elements like “sunset light over the river” or “Saturday evening chilled times”. In contrast, Wolloongabba, a suburb perceived pleasantly during the day, received fewer reports of nighttime topophilia.

Overall, perceived topophilia was shaped by diverse factors in both cities, encompassing the physical attributes of the locations, feelings of safety, and broader patterns like weather conditions, which contribute to overall judgments about these places.

4.4 Hotspots of Topophobia

Figure 5 illustrates hotspots of topophobia, representing unpleasant perception, during the day and night in Olomouc and Brisbane. Topophobia in Olomouc was reported during the day in three main hotspots. The most significant one was situated around the main railway station (in the city neighbourhood of Hodolany), generally described as a very unpleasant and dangerous space with the presence of homeless and intoxicated individuals.

Another hotspot emerged in an old, neglected city market space (city neighbourhood Olomouc), adjacent to a public transport node (“There are often many homeless people around stops of public transport. Overall, it’s a busy place”) and the Šantovka shopping mall reported as “overcrowded”. The third high-intensity concentration of topophobic records was reported within the area of busy central roads 1. máje and Komenského, where the centre of charity for homeless and socially disadvantaged people is located.

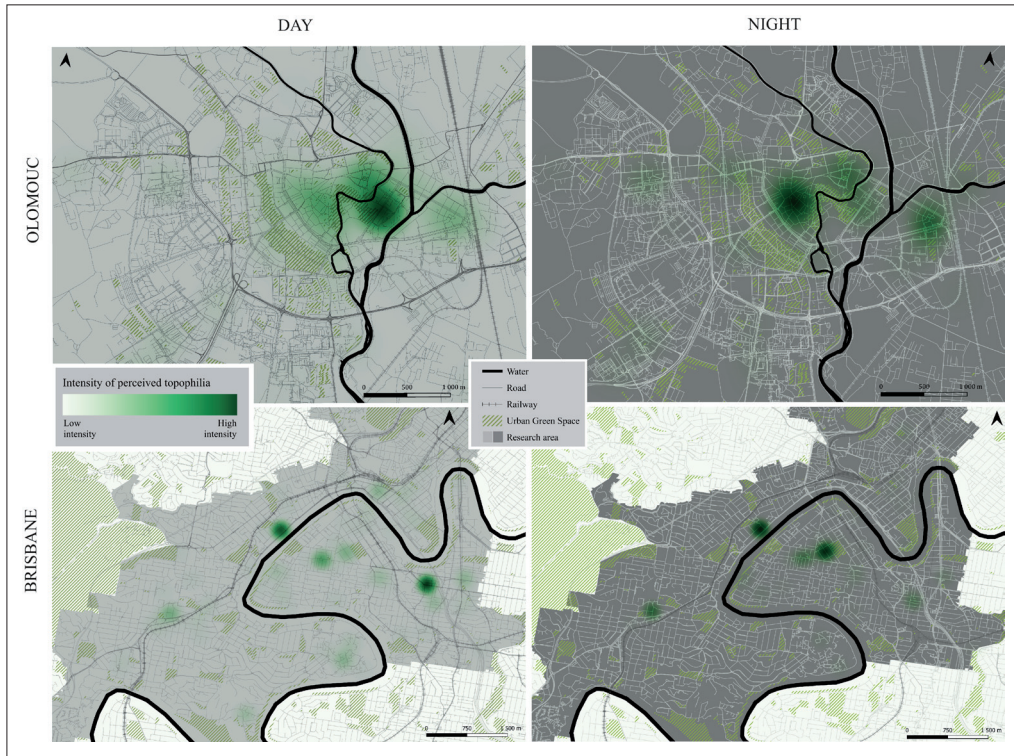


Fig. 4: Hotspots of recorded topophilic locations in Olomouc ($n = 482$) and Brisbane ($n = 276$) during the day and night
Source: authors' elaboration; background map © OpenStreetMap contributors

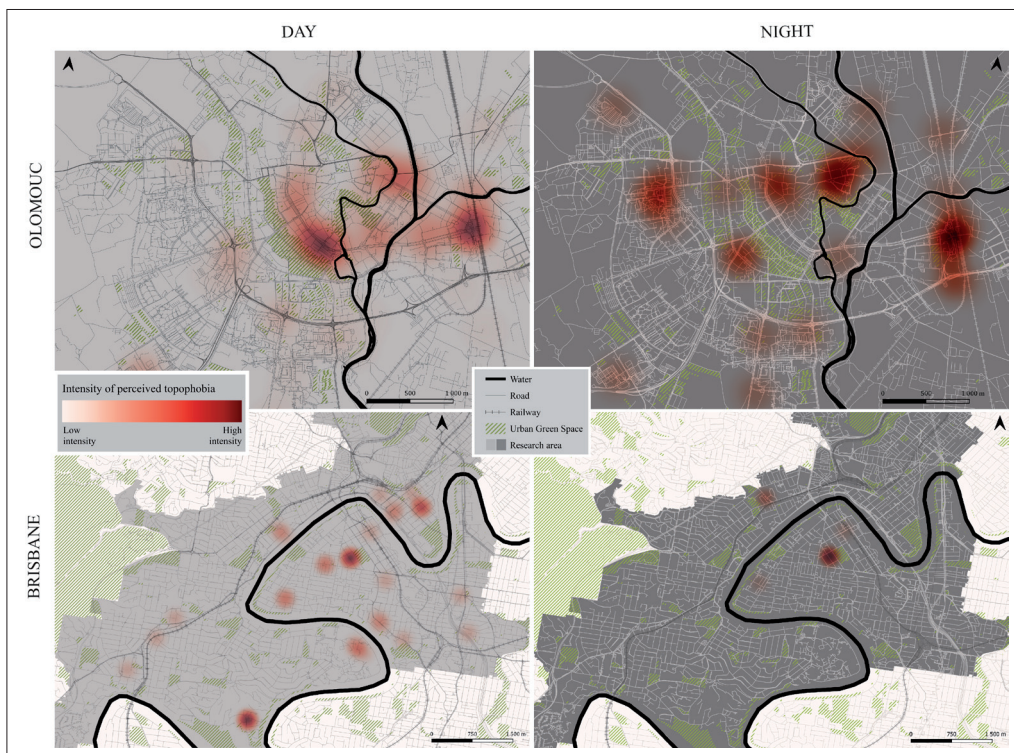


Fig. 5: Hotspots of recorded topophobic locations in Olomouc ($n = 152$) and Brisbane ($n = 42$) during the day and night
Source: authors' elaboration; background map © OpenStreetMap contributors

Additionally, this area was associated with challenging traffic situation, poor air quality, dirt and noise (“Lots of slow-moving and parked cars, bad quality air, no trees. You cannot cross to the other side of the street”). Other low-intensity hotspots in the city also reported a negative perception due to traffic and bad smells.

Unlike daytime reports, topophobia reported at night is concentrated in a higher number of hotspots spread across the city. The unpleasant perception around the main railway station was more intense at night, with comments associated in these locations including “homeless people”, “abandoned place, neglected” and “not many familiar people”. Lack of lighting, a busy road without crosswalks, and the presence of homeless people contributed to one of the reported hotspots in the centre. Another central hotspot was located near bustling bars and tram stops. Less-intense hotspots include reports in other busy roads and underpasses, which can be challenging for pedestrians and evoke fear.

Hotspots of daytime topophobia in Brisbane were scattered across parts of the city in varying degrees of intensity. In some cases, participants perceived the same location both positively and negatively, termed topo-ambivalence. For example, in Brisbane, an inner-city park called Musgrave Park received both positive and negative reports (see Figs. 3 and 4). The most pronounced topophobic hotspot in the South Brisbane suburb, for instance, derived from concerns about the physical state of places, including complaints about litter and neglected environment (e.g. “The bins were emptied this morning and they’re strewn across the sidewalk and rubbish is on the ground”). Another hotspot in the south part of the research area (Indooroopilly) reflected a combination of participant frustration with the work environment in this part of the city and personal issues. The central part of the city (Brisbane City) faced criticism for an abundance of office buildings, a lack of greenery and lighting, an unpleasant smell on the streets, and heavy car traffic. Respondents repeatedly expressed discomfort with various locations in the city, describing them as, “Not very pedestrian friendly, traffic is loud, no footpath”.

Nighttime topophobia contained fewer reports, with only two concentration hotspots. The first one is located in South Brisbane where concerns about safety after dark (“I need to walk my dog, but I don’t feel safe going out this late at night”) together with an unpleasant real time experience (“There is a woman screaming on Musgrave Park and I don’t know what to do”) contributed to the negative perception of these places. The second hotspot occurred in Milton and was associated with the concrete environment and noisy, congested traffic.

5. Discussion

This study sought to investigate the use of a novel smartphone app for collecting spatiotemporal information about perceptions of topophobia and topophilia in two cities. Our findings suggest that smartphone apps are a suitable and robust tool for collecting real time information about topophobia and topophilia. Analyses determined that positive and negative perceptions of places vary substantially across time and place. In line with previous research, we found that specific characteristics of places trigger unique emotional responses. These emotions are highly subjective, with some places in our studies evoking mixed and varied opinions between users of that place. There were also observed differences in the intensity of these feelings in our two samples. We unpack these findings in more detail below.

5.1 Feasibility and Data Collection

In our study, there was a 100% item response rate to each survey, with no missing data recorded. This finding is in line with prior research using mobile apps as a data collection tool,

which have also reported reasonably strong response rates to survey prompts (De Vries et al., 2021). In their systematic review of 32 EMA studies, De Vries et al. (2021) found that participants completed on average 71.6% of all EMAs with a range between 43 to 95%. Our high response rates may be attributed to the short four item survey. Further, our sample may also contain ‘super contributors’ (Solymosi et al., 2018) who may exhibit high levels of intrinsic motivation to participate in smartphone research. Due to limitations of the Cin City app, we were not able to compute more detailed compliance and engagement rates, which are usually reported in EMA studies (see De Vries et al., 2021 for a review). Regardless of this limitation, the participatory based approach to data collection produced robust and reliable spatio-temporal information about perceptions of topophobia and topophilia.

5.2 Understanding Places and Times Associated with Topophilia and Topophobia

In both cities, there were more positive reports about places than negative ones, but there were significant differences in participants’ perceptions. In Olomouc, the spatial distribution of hotspots of positive and negative perception captured in real time unveiled a tendency of night-time avoidance behaviour in areas with urban green spaces. The pattern of avoidance behaviour has been documented in studies employing retrospective participatory mapping (e.g. Doran & Burgess, 2012). Our study builds upon previous findings and emphasises the importance of addressing the question of personal safety as a top priority. Conversely, results from Brisbane indicated that participants frequently cited weather and traffic conditions as key factors influencing their subjective perception of the environment. For example, some participants noted certain smells (e.g. garbage, urine) or sounds (e.g. traffic, loud music) influenced their perceptions of a particular place. This shows how external conditions, such as weather, season, noise, or current mood, play a role in shaping perceptions of different places. It is also interesting that certain senses (e.g. hearing and smell) played a more direct role in shaping perceptions of a place and the people belonging to it.

Similar considerations have been noted in other studies emphasizing the significance of various factors when collecting affective responses to space (Degen & Rose, 2012; Klettner et al., 2013; Huang & Gartner, 2016; Sumartojo et al., 2019). Tuan (1997), in their seminal work on sense of place, notes that such sensory experiences occur through direct, repeated, and routine engagement with places. Through this process of habituation, humans experience and develop core memories about places and their time in them (Degen & Rose, 2012; Tuan, 1997). Based on our findings, and the studies mentioned above, future research could explore whether there is sensory dominance in individuals’ experiences of places and how this influences place-based memory and recall of personal experiences in a place.

Temporal heatmap analysis confirmed that the perception of topophilia and topophobia in urban space is dynamic, undergoing changes and evolution over time. This was observed within a short-term period (days and weeks), which aligns with previous studies that reported changes in an individual’s perception during the day (Šimáček et al., 2020) and week (Doran & Burgess, 2012). Further, individuals’ activity spaces are not confined to being exclusively positive or negative; rather, they are often perceived ambivalently. Our case studies exemplify topo-ambivalent perception, as participants reported on several locations (e.g. city centre) as both topophilic and topophobic simultaneously (as described in Brisudová et al., 2020). In the current study, we asked users to indicate if they were in a location alone or with somebody else. Most users in Olomouc reported they were alone (65% of all reports). Conversely, in Brisbane, 58.5% of reports were made when the participants had company with them in a particular

place. Endogenous factors, such as population density have been found to influence peoples' perceptions of places and their feelings of safety, in both positive and negative ways (Hong & Chen, 2014). Future research should seek to investigate the association between population density and perceptions of topophilia and topophobia using more robust internal features of smartphones. For example, Bluetooth, video recordings and static images can all be used to develop an estimate of the number of smartphones and individuals within a specific place at the time of a report.

5.3 Limitations

This study is not without limitations. First, the Cin City app is limited in the background data it collects on user engagement and adherence. As noted above, the app is only available on Android devices, thereby limiting access to iOS users in both cities. In Australia, it is estimated that iOS represents 61% of the operating system market share (StatCounter, 2023). The opposite pattern is observed in the Czech Republic, with Android representing roughly 71% of the operating system market share (StatCounter, 2023). In addition to the above issue, the Cin City app does not provide passive tracking capabilities. Passive tracking would have enabled the research team to map activity spaces and users' engagement with a variety of spaces. It must be noted, however, that there are challenges associated with enabling passive tracking within smartphone apps, including the impacts it has on the smartphone battery life, data storage, analysis, and overall accuracy (de Vries et al., 2021).

Second, the sample sizes in both cities were quite small, comprising of mostly women, with age differences observed between to two sites. Gender and age can influence perceptions of places and safety (e.g. Hart et al., 2022). Small sample sizes are observed in most smartphone EMA studies, however, and can be attributed to a variety of potential causes, including the increased burden associated with repeated measurement and technical faults (i.e. loss of location or cellular service). Systematic reviews of EMA studies across several disciplines have also noted that compliance with EMAs is generally higher in studies that offer incentives to participants (Wrzus & Neubauer, 2023). They have also found that study design and sample characteristics are not significantly associated with lack of compliance in EMA studies. Further research is needed to understand the motivators for participating in smartphone app research. In addition, during the app development phase, there needs to be better consideration of user interaction with the app. Researchers need to look for ways to promote higher levels of genuine engagement in app research, independent of incentives. For example, using gamification to involve users in games within apps while collecting data may be one way to increase participation, compliance, and motivation (Mouchabac et al., 2021).

Finally, the research team were unable to completely differentiate responses to app notifications from public or private spaces in the two cities. We relied on the qualitative data from participants to remove any reports about private places (e.g. a residence). It must be acknowledged that a small number of users did not provide sufficient information about the type of place where a report was submitted. Adding a new question into the survey that asks the participant to indicate the type of place they are currently in, would address this limitation in future research (Hektner et al., 2007).

6. Conclusions and policy implications

Like the dichotomous narrative "it was the best of times, it was the worst of times" written by Charles Dickens in his famous novel, *A Tale of Two Cities*, our study shows the dualistic nature of human experiences with places. Topophobia is characterised by unpleasant feelings about places and can include emotional expressions such as worry and unease. Conversely, topophilia refers

to the pleasant emotional attachment one has to a place. Using data collected by a bespoke mobile application, called Cin City, we were able to show the complex interplay between individuals and their urban environment, and how these two distinct phenomena shape human perception and reactions to the built environment. The current study paves the way for urban planners and researchers to look for new and innovative ways to address negative feelings about places in order to make places safer for all.

Our findings provide further guidance to urban planners interested in improving places. As noted above, many of the unpleasant locations in both cities were associated with everyday physical incivilities that were linked to the senses (e.g. the smell of urine, the smell of garbage, loud traffic). This information is valuable for urban planners and local governments tasked with enhancing safety, social cohesion, and attachment in public areas (Šerý et al., 2023; Wanner, 2016). As Thibaud (2015) argues, urban design must move beyond prioritising the static built environment and incorporate dynamic elements of sound, celebration, and ambience to create interesting and enjoyable cities. Further, real-time reports of topophobia could inform rapid and immediate responses to problems in public spaces, including the targetted allocation of resources, clean-up crews, and local traffic management teams (Solymosi et al., 2018). Moreover, insight from our comparative study revealed that the occurrence of both pleasant and unpleasant locations fluctuates over time. Similar to past research (e.g. Šerý et al., 2023; Solymosi et al., 2015) we found that the temporal variability of urban space influences peoples' perceptions of the environment and, subsequently, their spatial behaviour patterns. Policymakers should take this information into careful consideration when designing urban spaces to ensure they not only align with the general purpose of the locations but also meet the demands associated with different times of the day, week, or seasons of the year. Overall, in line with several urban space scholars (e.g. Šerý et al., 2023; Šimáček, et al., 2020; Sumartojo et al., 2019; Thibaud, 2015) we recommend the continued incorporation of residents' views on urban spaces to create safe, lively, and sustainable modern cities.

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