

How do tourists consume a wine destination in central Portugal? A space-time analysis

Como consomem os turistas um destino de enoturismo no Centro de Portugal? Uma análise espaciotemporal

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Abstract

Space-time tourist behaviour is influenced by numerous factors related both to tourists and the destination. Yet, however complex it may be, understanding and to some extent managing the way tourists move in space and time is crucial to ensuring the quality of their experience, as well as the effective and sustainable management of destinations and attractions. In the wine tourism context, studies on space-time behaviour are rare. The present study uses empirical data collected from tourists staying in hotels of the Bairrada Wine Route territory (N = 116), combining a GPS tracking study with a questionnaire survey. Using a time-geographical analytical approach, the GPS tracking data were mapped for a more detailed analysis of the tourists' movements in the Bairrada *terroir*. The findings highlight specificities of tourist consumption in the context of wine regions and provide valuable insights for destination planning, service design and marketing of the Bairrada Wine Route.

Keywords: space-time tourist behaviour, wine tourism, wine route, GPS tracking, Bairrada.

Resumo

O comportamento turístico espaciotemporal é influenciado por diversos fatores relacionados tanto com os turistas como com o destino. No entanto, por complexo que seja, compreender e, em certa medida, gerir a forma como os turistas se movem no espaço e no tempo é crucial para assegurar a qualidade da sua experiência, bem como a gestão eficaz e sustentável de destinos e atrações. No contexto do enoturismo, são raros os estudos sobre o comportamento espaciotemporal. O presente estudo utiliza dados empíricos recolhidos junto de turistas alojados em hotéis do território da Rota do Vinho da Bairrada (N= 116), combinando um estudo de rastreamento por GPS com um inquérito por questionário. Utilizando uma perspetiva temporal de análise, os dados de rastreamento por GPS foram mapeados para o estudo mais aprofundado dos movimentos dos turistas no *terroir* da Bairrada. Os resultados destacam as especificidades do consumo turístico no contexto das regiões vitivinícolas e fornecem informações relevantes para o planeamento do destino, conceção do serviço e marketing da Rota do Vinho da Bairrada.

Palavras-chave: comportamento turístico espaço-tempo, enoturismo, rota de vinho, rastreamento por GPS, Bairrada.

1. Introduction

Spatio-temporal tourist behaviour results from the interaction between individuals and the environment (Caldeira & Kastenholz, 2020; Lau & McKercher, 2006; Lew & McKercher, 2006; Xia, Zeepongsekul, & Arrowsmith, 2009). In wine tourism destinations, research on space-time tourist behaviour is still limited (Gu, Zhang, Huang, Zheng, & Chen, 2021; Popp & McCole, 2016), despite the advantages of better understanding tourists' itineraries for the development of sustainable wine tourism. Understanding the specific routes visitors tend to use, and which non-wine attractions they tend to visit can help wine route managers to make successful, information-based decisions regarding adequate visitor flows and impact management, stakeholders' collaboration, suitable infrastructure, signage and promotional materials, service quality and experience facilitation (Popp & McCole, 2016). An increasing number of wineries and wine trails have been established in numerous destinations and countries (Chong, 2017; Festa, Shams, Metallo, & Cuomo, 2020), but studies have focused mostly on wine tourists' purchasing behaviour, behavioural intentions, and activity engagement, lacking a full understanding of tourists' space-time activity in this context (Gu et al., 2021).

Given the increasing relevance of wine tourism for local and regional economies (Alonso & Liu, 2012; Correia & Brito, 2016), heritage preservation and sustainable development (Ruiz Pulpón & Cañizares Ruiz, 2019) and enhanced tourist experiences (Carvalho, Kastenholz, & Carneiro, 2021a; Kastenholz, Marques, & Carneiro, 2020), this paper explores how tourists consume a wine destination. The study was developed within the research project TWINE - Co-creating sustainable Tourism & WINE Experiences in Rural Areas, in the territory of one of the wine routes analysed: the Bairrada Wine Route, in central Portugal.

To our knowledge, research based on objective, tracked behaviour (e.g. using GPS devices) in wine tourism destinations is limited to one study in a wine region in Ningxia, China (Gu et al., 2021). The aim of the present study is to address this research gap and contribute to a better understanding of tourists' itineraries in wine areas, considering motivations and experience outcomes from a time-space perspective.

The paper is structured as follows. It starts with a literature review about wine tourism and space-time tourist behaviour in this context. In the following sections, the methodology and major research findings are reported and discussed. Finally, theoretical and managerial implications and limitations are discussed, and suggestions are made for future research.

2. Literature review

2.1. Experiencing wine destinations

Wine tourism has been defined as "visitation to vineyards, wineries, wine festivals and wine shows for which grape wine tasting and/or experiencing the attributes of a grape wine region are the prime motivating factors for visitors" (Hall, 1996, p. 109). An increasingly popular academic topic since the mid-1990s (Carvalho, Kastenholz, & Carneiro, 2021b), it is considered special-interest tourism (Charters & Ali-Knight, 2002; Ma, Kirilenko, & Stepchenkova, 2020) in the domain of cultural tourism (Brochado, Stoleriu, & Lupu, 2021) and rural tourism (Kastenholz et al., 2021). Based on a literature review regarding the period from 1995 to 2014, Gómez, Pratt and Molina (2019) identified three main themes in the study of wine tourism: wine tourism development especially linked to wine routes, service quality in wineries and cellars, and consumer behaviour models regarding wine tourists.

The wine experience is considered "a complex interaction of natural setting, wine, food, cultural and historical inputs and above all the people who service the visitor" (Charters, 2006, p. 214). The 'winescape' is frequently highlighted within wine tourists' time-space activity, as the *terroir's* characteristics, the vineyards, landscape, and tourist facilities are crucial parts of the experience (Terziyska & Damyanova, 2020), being understood as a *terroir* for wine tourism. *Terroir* results from combination of local physical conditions of soil and climate and the technical conditions developed over centuries by the local communities. The concept of *terroir* refers not only to the particular physical conditions of a delimited wine region, where a specific agronomic approach is developed over time, but also to its historical, cultural and social features,

such as know-how, traditions and social relations, which all together influence the characteristics of wines and confer them identity and singularity (Lavrador Silva, Fernão-Pires, & Bianchi-de-Aguiar, 2018; Van Leeuwen & Seguin, 2006). The specific cultural landscape, which results from wine production, is recognized as a significant motivation for wine tourists (Magliulo, Di Lisio, Sisto, & Valente, 2020). Even if tourists' motivation to visit wineries and wine cellars is mostly associated with wine tasting, they often decide to visit particular wine regions according to their desire to learn about the region itself and to participate in other activities, not limited to wine tasting (Carvalho et al., 2021b). Therefore, *terroir* tourism, associated with wine tourism, has had increasing appeal for tourists (Marlowe & Lee, 2018) due to the various memorable experiences that it can provide (Brochado et al., 2021; Kastenholz et al., 2021), fostering awareness and purchase of local products and thus improving the quality of life of local communities (Kastenholz et al., 2016).

Wine is increasingly considered not just a consumer product but a potential development tool for rural territories, aiming at environmental sustainability, as well as the conservation and enhancement of heritage and culture (Zamarreño-Aramendia, Cruz-Ruiz, & De La Cruz, 2021). Tourists' *terroir* experience involves several actors and includes symbolic elements and material goods, such as wine products, culture, and landscape (Chiodo, Adriani, Navarro, & Salvatore, 2019). Tourists often explore this wine ecosystem moving along wine routes. In recent years, wine routes - which can be defined as partnerships between wineries and vineyards working together to attract visitors and promote their products - have been the most commonly developed type of themed touring routes around the world (Xu, Leung, & Barbieri, 2016). Wine routes add variety to destinations and contribute to the expansion of wine tourism (Festa et al., 2020). Offering opportunities for the promotion of cultural values, gastronomy and local products, wine routes are built on these key elements: gastronomy, traditional architecture, wine festivals, landscape, and wineries/cellars (Zamarreño-Aramendia et al., 2021).

2.2. Space-time behaviour in tourism

Resulting in changes of location over time (Golledge & Stimson, 1997), spatio-temporal tourist behaviour can be defined as the sequence of attractions visited by tourists within a geographic space and the respective movements between one attraction and another in that geographic space (Caldeira & Kastenholz, 2020; Xia et al., 2010). Space-time tourist behaviour is a dynamic process associated with consumption activities (Caldeira & Kastenholz, in press) and is described by spatial and temporal references (Xia, 2007) and attributive components, such as the nature of the place visited, time of arrival at attractions or the respective length of stay (Tussyadiah & Fesenmaier, 2007).

Based in Hägerstrand's (1970) time geography, the time-space framework has also been used in the context of mobility to analyse tourist movements. Studies in this context can be grouped regarding their scope of analysis (inter-destination, intra-destination, and intra-attraction mobility), geographical scale, theoretical models, and the mobility antecedents studied (Ferrante, De Cantis, & Shoval, 2016). Technological tools have fuelled a growing body of empirical research on space-time behaviour, especially in urban settings (McKercher, Shoval, & Birenboim, 2012; Shoval, Schvimer, & Tamir, 2018), but also in events (Pettersson & Zillinger, 2011; Zakrisson & Zillinger, 2012), natural areas (Dupuis, 2004; Walden-Schreiner & Leung, 2013), small islands (Bujosa, Riera, & Pons, 2015; Xia et al., 2010), confined attractions (Russo, Clave, & Shoval 2010; Xiao-Ting & Bi-Hu, 2012), and, to a lesser extent, in rural areas (Yun & Park, 2015) and thematic routes (Xu et al., 2016).

Nonetheless, technological advances must be sustained by sound theoretical foundations. Research encompasses two basic and complementary approaches and their corresponding streams of research: a cognitive approach, concerning the mental processes underlying objective behaviour; and a behavioural approach, relative to objective movements (Caldeira & Kastenholz, 2020; Xia, 2007). The first perspective focuses on spatial perception, mental maps and individual wayfinding. As for the behavioural perspective, two essential dimensions emerge when studying space-time tourist behaviour: movements and multi-attraction/destination visitation (Xia et al., 2010). Based on these dimensions and on a systematic literature review on space-time behaviour, Caldeira

and Kastenholz (2020) proposed a comprehensive framework of analysis for tourist movements, identifying the factors relative to movements (territoriality, linearity, locomotion, and wayfinding) and multi-attraction visitation (intensity and specificity).

Two basic dimensions of the geometry of tourist movements were identified by Lew and McKercher (2006): i) territoriality (the spatial amplitude of tourist movements related to the concepts of dispersal and of spatial consumption), and ii) linearity (the configuration of the exhibited patterns of movement or the direction of the movement, associated with tourists' spatial involvement, exploratory behaviour, and activities performed). Adding to these two factors, research regarding tourists' movements has also studied: iii) locomotion, considering means of transportation used by tourists or indicators such as speed (Bauder, 2015; Zakrisson & Zillinger, 2012); and iv) wayfinding, examining the material aids of navigation used by tourists or their movements when getting lost (Caldeira & Kastenholz, 2018).

As for multi-attraction visitation, according to McKercher & Lau's (2008) findings, behavioural patterns can be examined considering: i) visitation intensity, indicative of tourists' engagement with the destination, reflected in number of attractions visited or duration of the visit (De Cantis, Ferrante, Kahani, & Shoval, 2016; Leung et al., 2012); and ii) specificity of attractions visited, identifying them and their particular characteristics (Kellner & Egger, 2016; McKercher & Lau, 2008).

Tourists' space-time behaviour results from the interaction between individuals and their environment (Lew & McKercher, 2006; Xia, Packer et al., 2009). Research has long examined individual antecedents of spatio-temporal tourist behaviour. They include personal characteristics (Chang, 2012; Xia et al., 2010; Xiao-Ting & Bi-Hu, 2012) and travel variables (Caldeira & Kastenholz, 2015; McKercher et al., 2012). In turn, the role of destinations' specific characteristics as antecedents of space-time tourist activity has also been studied, in terms of, for example, topography, attraction location, spatial configuration or accessibility (Hernández, 2003; Shoval et al., 2011), as well as destinations' suitability for tourism (Caldeira & Kastenholz, 2018; Edwards & Griffin, 2013).

In data collection, direct observation and travel diaries increasingly give way to technologies: wearable global positioning systems (GPS) technolo-

gy, mobile phone data, smartphone applications, Bluetooth or near field communication technology (Hardy et al., 2017), as well as user-generated contents (Shi, Xin, & Liu, 2020), transaction data (Zoltan & McKercher, 2015) and Zenith images obtained with drones (Donaire, Galí, & Gulisova, 2020). Questionnaire surveys complementing GPS tracking are frequently used, reinforcing accuracy (East, Osborne, Kemp, & Woodfine, 2017). They allow investigation of associations of objective space-time tourist activity with on-site travel behaviour, such as tourism expenditure (Domènech, Gutiérrez, & Anton Clavé, 2020); experience outcomes, like sensory impressions (Santos, Caldeira, Santos, Oliveira, & Ramos, 2019), satisfaction (Caldeira & Kastenholz, 2018) or loyalty (Park Lee, Kim, & Kim, 2019); or predicting tourist behaviour (Caldeira & Kastenholz, 2018; Zheng, Huang, & Li, 2017). In data analysis, different methods have been employed or combined: geographic visualization (Lau & McKercher, 2006; McKercher et al., 2012), sequence alignment method (Martins & Costa, in press; Shoval et al., 2015), mathematical algorithms (Xia et al., 2011), statistical analysis (Caldeira & Kastenholz, 2018; Höpken, Müller, Fuchs, & Lexhagen, 2020), network analysis (Kang, Lee, Kim, & Park, 2018) and social media analysis (Van der Zee & Bertocchi, 2018).

2.3. Space-time tourist consumption of wine destinations

In the space-time dialogue between tourists and territory, rural areas are specific performing places, where tourists create itineraries for consumption and exploration of individual places according to the spatial layout, landscape aesthetics and accessibility, as well as their own preferences and interests, travel context factors and navigation aids. Unlike urban areas, rural territories tend to provide less supply of transport and dispersed tourist information, as well as a lower geographic concentration of attractions, which is expected to foster a wider territoriality of tourist movements (Caldeira & Kastenholz, 2020). Tourists with a private car are expected to travel a greater distance (Hunt & Crompton, 2008). In the rural route travelling context, movement patterns are usually broader because the wineries and cellars are usually located further away from each other, with less accessibility compared to urban destinations, which places importance on

transportation, signage and navigation aids as key success factors (Sigala & Robinson, 2019). Regarding the multi-attraction dimension and, again, considering the distance between rural attractions, it is assumed that tourists engage in a smaller number of daily activities during the visit, which can be a sign of lower intensity (Caldeira & Kastenholtz, 2020). Characteristic specificity of rural tourists' movement patterns is also assumed, given the aesthetic dimension of the rural experience, and more specifically of landscape (Silva, 2021), which is often the primary motivation to travel to the countryside (Kastenholtz et al., 2012).

Tourist routes highlight the inescapable moving character of tourism, which is essentially a geographic phenomenon (McKercher & Lau, 2008). In the context of wine routes, individual factors, such as the know-how and preferences underlying the wine theme, among others, influence the tourist's terroir

experience, as well as their spatio-temporal behaviour (Bruwer & Lesschaeve, 2012).

According to Gu et al. (2021), who studied tourists' spatio-temporal behaviours in an emerging wine route in China, the spatial distribution of tourists was subject to the effects of spatial proximity, agglomeration, and transportation junctions, but also a result of individual travel behaviour and each tourist's personal interest in wine. The authors argue that the closer the attractions are to each other, the greater and more intensive the consumption of these attractions by tourists tends to be; conversely, the more dispersed the attractions, the wider spread the tourist movement along a wine route, which, consequently, tends to lower the tourists' consumption. According to Popp and McCole (2016), who examined tourists' itineraries in a wine tourism region in Michigan, United States, by means of paper-based itinerary mapping, stops in unplanned places increase multi-attraction intensity.



Figure 1
Bairrada Wine Region¹.
Source: own elaboration.

Since the *terroir* landscape displays highly relevant natural and cultural heritage features and fosters unique and memorable experiences, regional and tourism actors must ensure its sustainability and attractiveness (Ruiz Pulpon & Canizares Ruiz, 2020). Strategic governance and collaborative practices are key to proactive landscape and visitor management and enhancement of the tourist experience (Gómez et al., 2019; Sigala & Robinson, 2019; Silva, 2021).

3. Methodology

3.1. Study area

The Bairrada Wine Region is the study area (Figure 1). Formally delimited in 1979, Bairrada was recognized as Appellation Origin Controlled (AOC) in 1998. With a moderate climate, the region comprises approximately 1,250 km² and is located on the coastal strip of central mainland Portugal, between the cities of Aveiro and Coimbra (Brás, Costa, & Buhalis, 2010). Managed by the Bairrada Route Association, this wine route is organized in eight itineraries and comprises 24 wineries open to visitors, four tourist information offices, and relevant natural, landscape, cultural, historical, gastronomy and wellness resources (Lopes, Seabra, Silva, & Abrantes, 2017; Silva, 2021). In the region, the natural and historical heritage of the Bussaco mountains and the hot springs of Curia and Luso have long attracted tourists (see also Kastenholz et al., 2021). In gastronomy, the renowned “leitão à Bairrada” (suckling pig) draws numerous visitors to Mealhada restaurants (Oliveira, 2008), along with Bairrada wines (specifically its natural sparkling wines), which led to the creation of three wine museums.

The territorial delimitation of Bairrada as the research area relies on the concept of local destination (WTO, as cited in Lew & McKercher, 2006), and, for the purposes of this study, is operationalized as the territory within the physical boundaries of a day trip (World Tourism Organization & Terzibasoglu, 2007).

3.2. Data collection and analysis

The empirical research presented here characterizes the space-time behaviour of tourists in the Bairrada region based on data obtained through GPS tracking and a post-visit questionnaire survey. Data were collected from tourists staying in two accommodation establishments (N = 116): i) Curia Palace Hotel, Spa & Golf and ii) Hotel Eden located in the towns of Curia and Luso respectively, between February and August 2020. The process was highly conditioned by the COVID-19 pandemic, reflected in both the limited sample and the small number of accommodation establishments that agreed to host the research team, despite our efforts to include more hotels, also from other parts of the Bairrada territory, potentially more linked to wine tourism. Potential respondents were invited to participate in the hotel on their way out to visit the destination. Once informed of the research objectives and methods, those who agreed to take part in the survey received a sports watch (Garmin Vivosport) with GPS equipment and were asked to return it to the research team at the hotel at the end of the day visit, following the procedures suggested by Edwards, Dickson, Griffin and Hayllar (2010). The device recorded the time, speed, distance, position, and direction of movements. To increase the accuracy and breadth of the information collected, the tracking study was complemented with a personally administered post-visit questionnaire upon return of the GPS device. The target population were leisure tourists in the Bairrada region, and its selection followed a cluster sampling approach, defined in time and place (Kastenholz, 2004).

For the purpose of this research, three parts of the questionnaire, developed by the TWINE research project team, with versions in Portuguese and English, were considered: travel motivations, trip characteristics (length of stay, place of accommodation, travel group, means of transport used, sources of information, familiarity with the destination), and socio-demographic profile. The spatio-temporal data were analysed using Garmin Connect and Google Earth online software. The accuracy of the collected data was increased by validating GPS-based information with survey results. Tourists' spatio-temporal behaviour was studied in terms of its essential dimensions: movements and multi-attraction visitation, following the conceptual framework proposed

¹ The map of the Bairrada Wine Region was built based on the limits of the parishes that constitute it according to the Decree-Law No. 301/2003 of 4 December. The limits of the parishes prior to the administrative reorganization of Law nr. 11-A/2013, of 28 January were therefore used as the cartographic basis.



Figure 2
 Framework of the descriptive statistical analysis of spatio-temporal tourist behaviour.
 Source: Based on Caldeira (2014) and Caldeira and Kastenholz (2020).

by Caldeira (2014) and Caldeira and Kastenholz (2020), as presented in Figure 2.

The spatial analysis was performed using the free, open-source GIS QGIS 3.20.3. With the georeferenced data obtained by GPS tracking, two thematic maps were built: i) one corresponding to the number of tourists' passages by parish, i.e. the number of times that visitors cross each polygon (parish), and ii) a heatmap with the intensity of the visit relative to the total length of time. In order to assess the length of stay of tourists in each parish, the shapefiles of all routes were intersected with the shapefile of Bairrada region parishes. The duration of visits in

each parish was calculated using Excel. The heatmap or kernel density map was constructed with the help of the processing tool "Heatmap (kernel density estimation)". This tool calculates the density of a given phenomenon per area (m² or km²), using point vector data. After defining the point layer, the radius from which the distance around a point is specified is selected. With this tool a map was constructed regarding the intensity of time spent by tourists. All the tracks obtained were studied together, giving priority to their aggregate analysis in order to understand how the Bairrada region is consumed by tourists as a whole. The aggregated data also makes it possible

to locate the most popular territories and those that tend to be neglected by tourists (Shoval et al., 2009).

Descriptive statistical analysis was performed, using SPSS Statistics 25, concerning the questionnaire data and quantitative data extracted from the GPS tracking using the Garmin Connect application ('distance travelled', 'route geometry', 'time in motion', 'total route duration' and 'average speed') and Google Earth ('maximum distance from accommodation').

4. Results

4.1. Sample profile

Within a sample of 116 respondents, 111 GPS itineraries were validated for spatial analysis. Table I sums up the characterization of the study sample as for sociodemographics and travel behaviour. Respondents were 50.9% female, with a mean age of 42.7 years, and 43.9% holding a college degree. Only 2.6% came from abroad, which may be explained by the dramatic reduction of international tourism in 2020. With regards to travel behaviour, about 50.9% were repeaters, and 64.7% travelled as a couple. Most (87.1%) of the study participants stayed in Bairrada from one to three nights, with Bairrada being the main destination for 57.4%. The most frequent motivations to visit the destination were leisure/holidays (75.9%; n = 88), followed by relaxation (51.7%; n = 60), being with the family (35.3%; n = 41) and contact with nature (34.5%; n = 40), in line with recent studies (Bruwer & Rueger-Muck, 2018; Vorobiova, Pinto, Pintassilgo, & Lavandoski, 2020).

4.2. Data analysis and discussion

Data collected via survey and by the tracking study (Figure 3) was explored mainly by descriptive statistics and spatial analysis. Following the framework of spatio-temporal tourist behaviour (Figure 2), descriptive statistics allow the characterization of the respondents' space-time activity according to the different factors of analysis:

- *Multi-attraction specificity.* Among the respondents, the most visited attractions were

Table I

Profile of the respondents

Characteristics	Frequency	Percentage (%)
Gender		
Men	57	49.1
Women	59	50.9
Age		
18 to 24	15	12.9
25 to 34	25	21.6
35 to 44	21	18.1
45 to 54	22	19.0
55 to 64	27	23.3
65 to 74	6	5.2
Education		
Elementary	29	25.4
Secondary	35	30.7
Higher	50	43.9
Country of residence		
Portugal	113	97.4
Spain	2	1.7
United States	1	0.9
Prior destination experience		
First-timers	59	50.9
Repeaters	57	49.1
Travel group type		
Couple	75	64.7
Family	48	41.7
Friends	13	11.2
Alone	1	0.9
Length of stay		
1 to 3 nights	101	87.1
4 nights or more	15	12.9
Bairrada as destination		
Main destination	66	57.4
Relevant but not main destination	28	24.3
Transit destination	21	18.3

Source: own elaboration

Serra do Bussaco (48.3%; n = 56) and the spas (32.8%; n = 38). As for the typology of attractions visited, the 'natural areas' (72.4%; n = 84) were the most visited, followed by 'museums and historical heritage' (33.6%; n = 39), 'spas' (32%; n = 37) and 'cities/towns' (30.2%; n = 35), in part because 22.4% (n = 26) travelled beyond the limits of Bairrada region and some visited urban areas. Noteworthy is the fact that only 2.6% (n = 3) of respondents

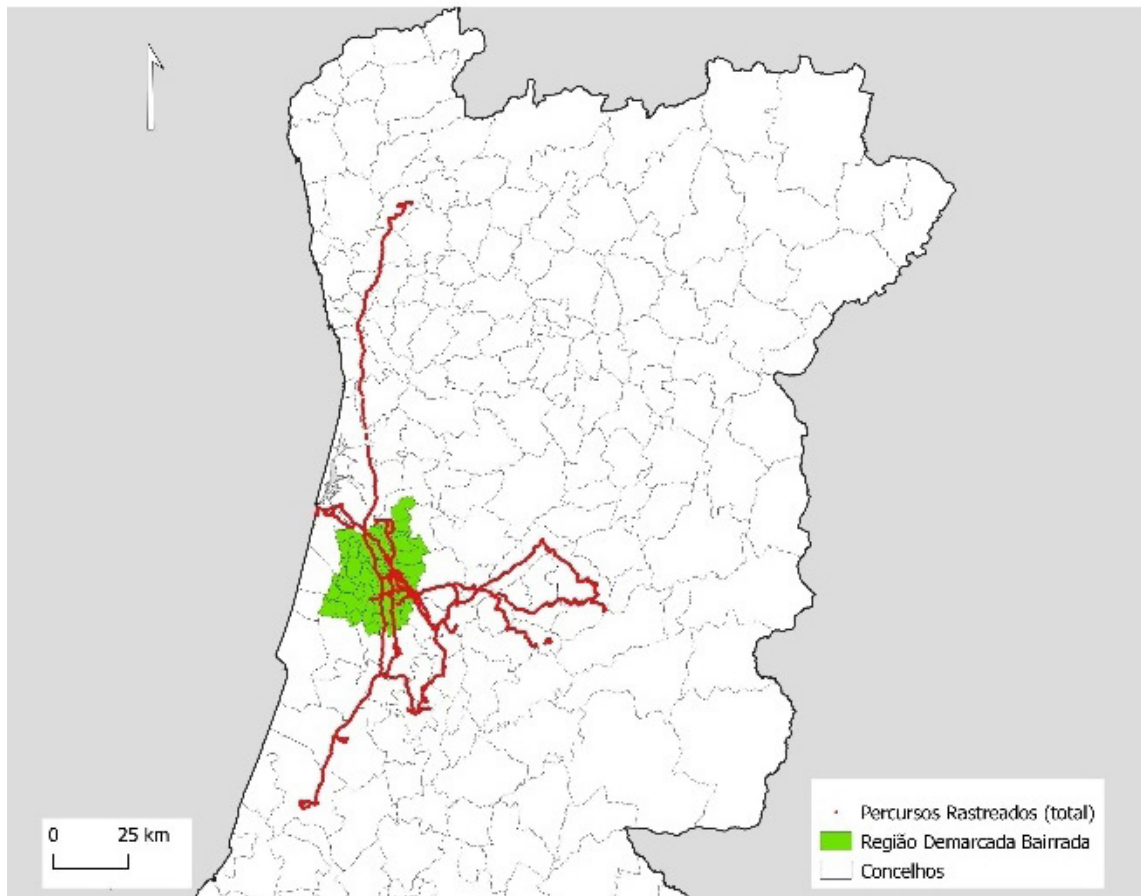


Figure 3
Tracked tourist routes.
Source: own elaboration.

visited ‘wineries/cellars’ during the day they participated in the study.

- *Multi-attraction intensity.* The mean of total duration of the tracked visit was 5 h 04 m. The shortest visit lasted 51 minutes and the longest visit lasted 8 h 09 m. In the questionnaire, visitors were asked in which places/attractions they had the perception of having stayed longer, on the day they were tracked. Most of them (50.9%) indicated Serra do Bussaco, followed by Luso (9.5%), the hotels they were staying in (8.6 %) and river beaches (6.0%).

- *Territoriality of movements.* Regarding movements, the average total distance travelled was 43.6 km (SD = 52.3) and the average distance from the accommodation was about 13.5 km (SD = 21.5), exhibiting broader

movements than in urban areas (Caldeira & Kastenholz, 2018; Martins, 2020).

- *Linearity of movements.* As for the geometry of the route, most respondents, about 88.3% (n = 98), took a complex route, with only 2.7% (n = 3) exhibiting a circular route. This low percentage contrasts with movements in urban landscapes, some of them based on city tours and with greater concentration of attractions (Caldeira & Kastenholz, 2015).

- *Locomotion.* Also, in contrast to urban destinations, the vast majority of individuals (90.5%; n = 105) used their own car on their visit, even more markedly than in the study by Gu et al. (2021). On average, individuals were on the move for 2 h 47 m, corresponding to 55.2% of their travel motion time, which is in

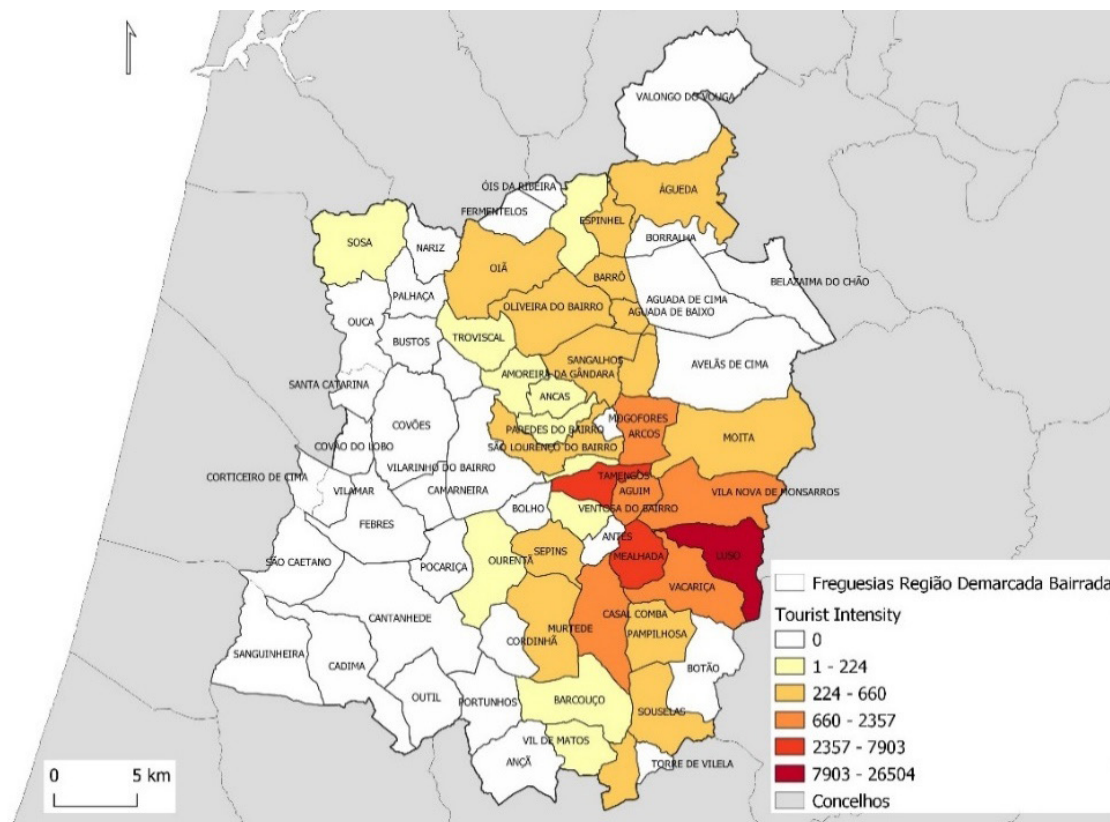


Figure 4
Intensity of tourist movements in terms of number of passages per parish.
Source: own elaboration.

line with the longer distance travelled in rural areas, with an average speed of 7.71 km/h.

- *Wayfinding.* In terms of wayfinding during the day-visit, 43.1% (n = 50) of respondents reported the use of GPS and about 17.2% (n = 20) used maps, with most respondents (87.9%; n = 102) claiming not to have got lost. Among those who have, the main reasons were the ‘lack of signage’ and the ‘poor GPS functioning’.

The tracked itineraries were also studied using GIS, further exploring the tourists’ space-time behaviour. The number of visitors that passed through each parish (Figure 4) permits the conclusion that most parishes located in the westernmost part of the Bairrada region were not visited. There is a very asymmetrical distribution of visits with a strong concentration in the parishes of Luso [26504 passages], followed by the parishes of Mealhada and Tamengos [2375-7903 passages]. The main access and circulation corridors within the Bairrada Wine Region are the A1 and the IC2, two roads parallel to the

coastline that divide the region into an eastern part, neglected by visitors, and a western part, where visits are concentrated. Since the parish of Luso has a concentration of remarkable natural and cultural heritage, as tourists move away, the density of routes decreases sharply. Findings are obviously related to the respondents’ accommodation location (Luso and Curia) and to other attractiveness elements, as disclosed further below.

As for temporal data, the parish of Luso was the most visited and the one where tourists remained most time, as revealed by the heatmap (Figure 5), being this the main tourist hotspot for the sample surveyed. It is followed by the parishes of Tamengos, Mealhada, Arcos and Sangalhos. This kind of map “allows the researcher to distinguish between ‘Hot Spots’, locations that are well-exposed to the visitor; [and] ‘Not Spots’, locations that do not exist for the visitor and are not visited at all” (Shoval et al., 2009, p. 45). Consequently, a significant part of the territory of the Bairrada region was not visited by the tourists who participated in the study. The high concentration

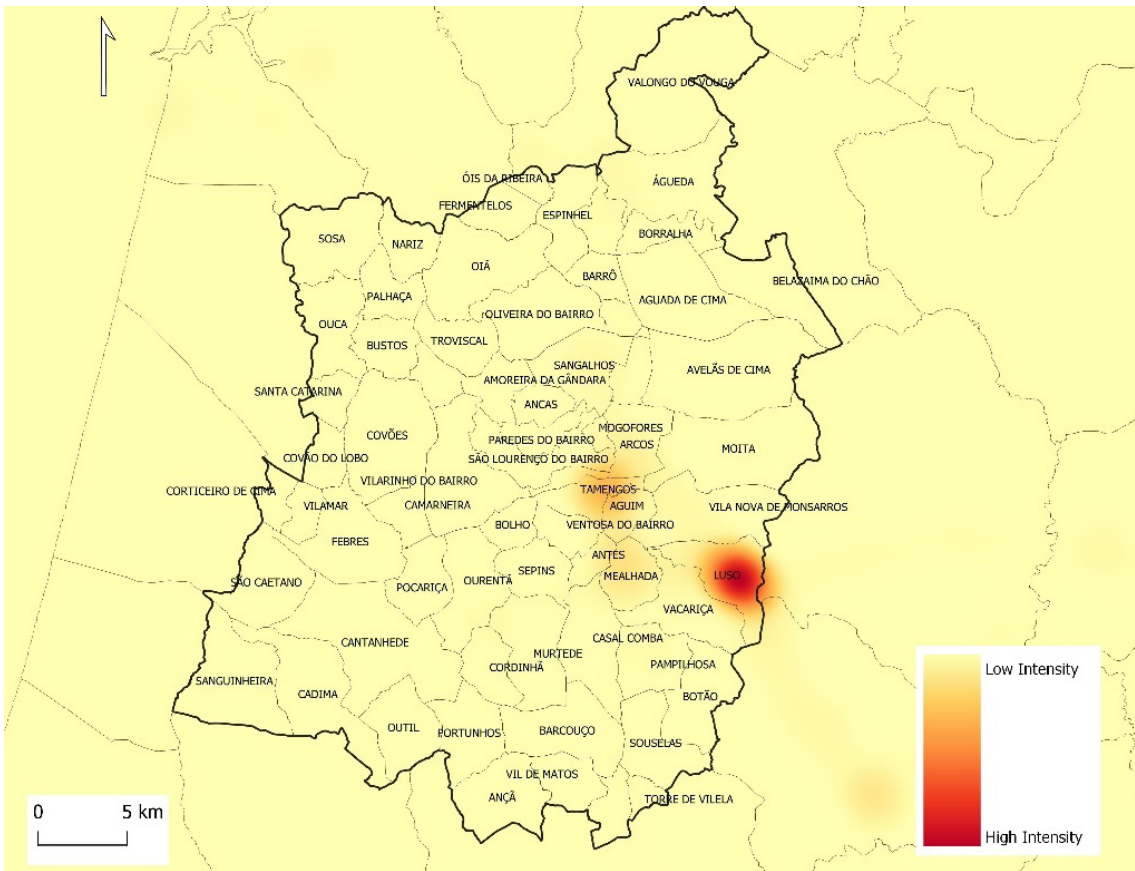


Figure 5
Intensity of tourist movements in terms of length of stay.
Source: own elaboration.

of movements and visits in the parish of Luso is explained because 74.1% of the respondents were staying there, starting their visit from their hotel, and due to particularly iconic attractions in the region: the Luso hotel and water spring (Fonte de São João), and the national forest of Bussaco, which includes the Bussaco Palace Hotel of neo-Manueline style, the military museum, and the thermal springs. In the parish of Mealhada, the various suckling pig restaurants were the main attraction. In the parish of Tamengos, where Curia is located, with its thermal springs, hotel, train station and headquarters of Bairrada Wine route, the thermal springs and the park in Curia were the most visited. In Sangalhos, the Aliança Underground Museum registered some visitation, as did the urban centre of Anadia in the parish of Arcos. A large number of parishes in the Bairrada Wine Region work only as transit corridors, where visitors pass by but do not stop, on their way towards Luso.

5. Conclusions

This study permits an exploratory assessment of the space-time behaviour of tourists in the Bairrada Wine Region. Results confirm the advantage of data collection combining GPS tracking and a questionnaire survey, and corresponding data analysis using both statistical and spatial approaches, revealing new insights into activity patterns of visitors in a wine destination.

Findings reveal particularities of tourist consumption in the rural context, especially in terms of the territoriality, linearity and locomotion of movements. This also may derive from the fact that rural and natural landscapes foster a strong aesthetic experience and act themselves as an attraction, enjoyed ‘along the way’. As “when time is short, space is conserved” (Fennell, 1996, p. 814), broader movements imply more time travelling, and less time is left to visit attractions or engage in activities.

Therefore, higher territoriality tends to reduce multi-attraction intensity, i.e. less attractions are visited, or fewer activities performed. Additionally, circular itineraries are not common among respondents, suggesting complex linearity patterns and involvement with the space. The flexibility of using one's own car may foster freer exploratory behaviour. As for the multi-attraction dimension, in line with Gu et al. (2021), the spatial proximity and agglomeration of attractions influenced time-space tourist activity, not homogeneously dispersed but concentrated in some 'hot-spots'. Thus, cumulative attraction (Hunt & Crompton, 2008) is registered, to some extent, in this wine region.

Given the uneven spread of the tracked respondents' movements in the Bairrada region, the most interesting wine-related experiences and existing complementary attractions should be widely publicised, fostering the corresponding dispersion of tourists and avoiding crowding at certain 'hotspot attractions'. This dispersion could also be stimulated by: i) fostering greater dispersion of the accommodation on offer, ii) supplying an efficient public transportation system, iii) providing territorially more extended guided tours, even using bicycles in some areas, thereby also contradicting the high reported use of private car, while lending value to certain landscape and cultural potentialities. The Bairrada Wine Region is visited mostly by car. However, Curia has a train station, which is actually used as the wine route headquarters with interesting information and an appealing shop, in a historical building. This could be the starting point of more sustainable, less carbon-intensive regional exploration, possibly using rented bicycles or small electric vehicles, possibly with a guided tour and arrangements that include accommodation. This kind of offers could also make Bairrada more interesting for foreign visitors, who are interested in wine tourism, but do not like to drive a car in a foreign country (even less when drinking wines) or prefer slow tourism or more sustainable transportation. A good public transportation link to the parish of Luso, which stands out as a 'hotspot' (see also Kastenholtz et al., 2021), where the largest concentration of attractions is located, seems of interest.

Luso and its adjacent Bussaco forest is a relatively small tourist destination where walking is the most popular means of locomotion. As most of the time budget dedicated to visiting the region is concentrated in the relatively small area of Luso and

its adjacent Bussaco forest, the increase in visitor numbers may contribute to congestion, which may require an adequate management of visitor flows in time (Kastenholtz, 2004).

The inclusion of natural and cultural heritage sites on the itineraries suggested by the Bairrada Wine Route seems appropriate since tourists reveal diversity-seeking behaviour concerning the attractions visited. Nevertheless, results suggest that wine is a complementary motivation to travel to Bairrada, with only 2.3% visiting wineries and 22.4% travelling beyond the limits of Bairrada region. These findings demand effective marketing efforts directed to tourists' pre-visitation and on-destination choices in order to increase awareness of the region's wine attractions as well as other resources not located at the Luso/Bussaco hotspot. In this context, it is crucial to develop an offer that includes more diversified, appealing, and differentiated tourist experiences, as well as improving visitor management, signage, access, and service convenience. Yet, competitiveness must be increased via sustainable and collaborative destination planning and management, ideally using social and environmental sustainability also as a key for differentiation and attractiveness (Kastenholtz et al., 2016).

As limitations to the study, we must acknowledge the strong predominance of residents in Portugal in the sample, partly due to the limitations on data collection due to the COVID pandemic. Data collection was also limited to visitors staying in two hotels, located in hot springs towns, which agreed to collaborate (despite the pandemic), because the delivery of the GPS devices and administration of the post-trip survey could only be controlled at accommodation establishments. Other intervening factors, such as specificities of the *terroir*, as well as of the wine route configuration and offer, or travel group dynamics, should be considered. However, the main exploratory findings are relevant and partly confirm results from a netnographic study on tourist experiences in the Bairrada Wine Route (Kastenholtz et al., 2021).

For validation of the results, the study should be replicated in the Bairrada Wine Route, after the pandemic, and also in other wine tourism geographies to understand if tourist movements in Bairrada present particularities, as well as include other factors of analysis and diverse sampling procedures. Also, an in-depth qualitative methodology,

interviewing tourists as well as supply agents (e.g. wine route agents, tour operators) and even promoting a debate amongst supply agents using focus groups, may bring more insights into space-time behaviour in wine routes and useful reflections on how to potentially plan for a more sustainable spread of tourist flows, maximizing benefits for all involved.

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