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Identifying tourism destinations from tourists' travel patterns

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ABSTRACT

Traditionally, tourism destinations have been delineated following administrative boundaries. However, it is questionable whether these boundaries are the most desirable spatial configurations to facilitate tourists' flows and the management of services within a geographical area. Several authors have argued that the way in which tourists consume a destination needs to be taken into consideration in order to improve destination planning and management.

This study advocates the geographical functionality of destinations based on destination travel patterns for the geographical consumption of their attractions and services. Territoriality of aggregated travel patterns within two different rural areas are explored to propose consumer-based destinations which would be better adapted to consumer needs. Furthermore, consumer-based destinations may improve destination planning and management by providing tourism actors with information on how tourists consume the destination.

This study contributes with methodological innovation by combining network and geographical analysis to explore a network of aggregated travel patterns and its geographical attachment. Thus, the main contribution of this study is the opportunity to adapt the destination to tourists by identifying consumer-based destinations boundaries and the factors that influence the specific travel patterns within the destinations. Ultimately, these travel patterns determine the size and shape of destinations from a social construction perspective, which differs from an administrative one. Secondly, the study reveals the role that certain attractions and accommodation hubs play in overlapping different destinations regions, and the opportunities this offers for improving destination planning and management.

1. Introduction

Tourism destinations are commonly planned and managed following the administrative boundaries of the corresponding territorial administration without considering how tourists geographically consume destinations. This means that a destination may not be adapted to consumers' needs. The destination may thus be missing out on the opportunity to improve planning and management to the detriment of sustainability and business-favorable circumstances. Furthermore, tourism mobility patterns have become more massive and complex, providing more evidence that the destination model based on administrative boundaries is severely outdated. There is thus a need to bring back previously unsolved debates on destination planning models and the definition of tourism destination boundaries (Framke, 2002; Getz, 1986). Tourists are the final consumers of a destination: destination managers therefore need to ascertain the most appropriate and effective geographical attachment for the tourists' use.

Previous literature has highlighted the fundamental role of understanding tourists' movements in order to plan and manage tourist attractions, accommodation, or transport links, but without proposing a method to redefine destinations (Lue, Crompton, & Fesenmaier, 1993; McKercher & Lew, 2004; Shoval & Ahas, 2017). The concept of base-camp travel pattern (Lue et al., 1993), is directly linked to the definition of local destination (Lew & McKercher, 2006, p. 405) as "the area containing products and activities that could normally be consumed in a daytrip from the heart of the destination". This implies that tourists are convenience-oriented when geographically consuming the destination.

Other researchers have suggested abandoning current destination limits, focusing on tourist's direct tourism flows and the spatial structure of attractions visited in sequence (Baggio & Scaglione, 2017; Beritelli, Reinhold, Laesser, & Bieger, 2015; Kang, Lee, Kim, & Park, 2018). However, they fail to explore the structure of attractions considering tourists' travel patterns throughout the complete stay at a destination.

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There is therefore a need for research that integrates the redefinition of tourism destination boundaries on the basis of the how tourists geographically consume the destination during their complete stay.

In order to fill this gap, the main aim of the present study is to identify tourism destination boundaries based on tourists' travel patterns during their stay at the destination. This first entails dismantling existing tourism destination borders, and, second, redefining tourism destinations in a way that takes tourists' visitation patterns into account. The study thus focuses on aggregate travel patterns within a destination to find systems of tourism attractions usually visited together. These systems should furthermore enable individual tourism attractions to belong to more than one destination system if travel patterns can justify it. New destinations should thus not be all-inclusive geographical areas distinguishable by borderlines (Beritelli et al., 2015), but rather areas containing tourism attractions that are usually visited together and which may overlap geographically (Dredge, 1999).

To achieve this general aim, the specific objectives of the present paper are twofold. Firstly, the paper sets out to propose and implement a method capable of identifying coherent functional areas for tourist use, based on the concept of local destinations (Lew & McKercher, 2006), the cumulative effect of tourist attractions (Lue et al., 1993) and the territoriality of travel patterns (Lew & McKercher, 2006). Secondly, the paper seeks to detect overlapping destinations by exploring factors influencing travel patterns and by focusing on elements of the destination largely affected by secondary travel patterns.

Two European nature-based areas have been selected as cases of study: one in the UK and the other in Spain. Data were collected using in-situ surveys from relevant preselected locations. Travel patterns from a number of individual tourists were compiled and aggregated to determine which places were usually visited together. The methods combined the analysis of the attractions' network (constructed from these aggregated data) and their geographical attachment. Specifically, community analysis (i.e. cluster analysis) was applied on the aggregated individual network, allowing groups of attractions to be distinguished that are frequently visited together during the stay in an area, representing the consumer-based latent destination. These networks were then exported into maps in order to analyze the spatial relationships within grouped attractions and associated accommodation hubs.

The findings identify consumer-based destinations that partially overlap with the neighboring ones and which are highly influenced by convenient travel patterns. The results identify time distance, the communication networks, accommodation hubs and certain prominent attractions as being elements that influence the resulting consumer-based destinations and their level of overlay.

This paper contributes firstly, by presenting an innovative method capable of identifying consumer-based destinations, which can represent an opportunity to adapt the destination to consumer needs. Secondly, this method reveals the territoriality of travel patterns within a destination, as well as the role of certain attractions and accommodation within and across the detected destinations. This represents an opportunity to improve planning and management in order to seek market opportunities and promote the sustainability of the destination.

The rest of the paper is organized as follows. The next section presents the literature review, which critically overviews tourism destinations and travel patterns to propose a research framework. The third and fourth sections introduce the case studies and the methodology respectively. The fifth section presents the results and discussion on thematic topics. The final section then highlights the main output and contributions of the study, summarizes the main ideas, and outlines limitations and future research opportunities.

2. Literature review

2.1. Tourism and political boundaries

Social scientists have widely addressed the topic of borders and their effect on tourism phenomena (Porcaro, 2017). Most research on this topic has focused on international borders and their effect on tourism, since they are the most significant when exercising influence on human experiences. An existing body of evidence has observed the undervalued possibilities of adjacent tourism areas on either side of the borderline, producing the artificial political division of latent or 'natural' cross-border destinations. The destination as a network of neighboring tourism actors may suffer a lack of co-development initiatives and inconsistencies in terms of tourism regulations, policies and promotion, because they belong to different administrative systems, which hinders destination development to a greater or lesser extent (Gunn, 1993a; Kang, Kim, & Nicholls, 2014; Lovelock & Boyd, 2006; Matznetter, 1979; Yang, 2018). Indeed, since most destinations are designed on an administrative basis, tourism policies tend to favor particular spaces within the area, and neglect, marginalize or exclude others (Kang et al., 2014). When cross-border cooperation exists, obstacles inhibiting tourism development may appear when the administrative interests of the respective bordering areas differ from the interests of the regional cross-border destination (Ioannides, Nielsen, & Billing, 2006). Furthermore, governments often coordinate any cooperative marketing or management strategies between attractions. This can influence cooperation between them in such a way as that they fail to focus on consumer needs (Yang, 2018).

The cross-border tourism literature provides ample evidence that tourists consume attractions from both sides of the border (Blasco, Guia, & Prats, 2014a, 2014b; Ioannides et al., 2006; Lovelock & Boyd, 2006). Yang (2018) compared tourist flows among attractions with the structure of tourist attraction cooperation as promoted by the government and found that government policies were frequently inconsistent. The resulting tensions and impediments are not only found in destinations divided internationally, but at all administrative levels to a greater or lesser extent. A number of studies have supported the idea that these boundaries may also be an obstacle to the natural development of a destination (Framke, 2002; Paulino & Prats, 2013; Paulino, Prats & Whalley, 2019a; Paulino, Prats & Schofield, 2019b). Timothy (2002), recognized that subnational boundaries and local administrative divisions also effect tourism significantly, as these internal boundaries are involved in developing the majority of jurisdiction regarding tourism policies and regulations. Indeed, destination management organizations (DMOs) are mostly delimited following subnational or local boundaries for the managerial convenience of the public administrations on which they depend.

Most research on tourism destinations take the existing boundaries of destinations for granted, without considering alternatives. However, an increasing number of studies advocate that administrative-based destinations are obsolete as they may not represent the destination visited by tourists. Indeed, tourists do not necessarily stop when they reach the limit of a destination, which suggests that destinations are often artificially divided. Modern DMOs fail to take consumer preferences or tourism industry functions into consideration by meshing everything within the DMO boundaries into one single, rigid brand that can only be distinguished by its borders (Beritelli et al., 2015; Buhalis, 2000; Saarinen, 2004).

2.2. The concept of tourism destinations

Researchers and practitioners of various tourism disciplines have been debating the concept of tourism destinations and their geographical boundaries since the 1970s. (Framke, 2002; Jovicic, 2019; Saraniemi & Kylänen, 2011). As yet, there is no consensus on whether tourism destinations should be fixed or fluid, functional or administrative-based, consumer-oriented or a production system, a geographical unit or value chain. (Asero, Gozzo, & Tomaselli, 2015; Buhalis, 2000; Edensor, 2009; Framke, 2002; Gunn, 1993b; Saraniemi & Kylänen, 2011).

Destination boundaries are hard to define as each destination may

appear totally different in terms of shape, content, and its relationship with tourism actors (tourists, companies, residents, or public administration), which leads to multiple approaches. Some consider the destination as a 'Regiopolis' (Gunn, 1993), while others propose geographical clusters based on the time proximity of tourism assets (Blasco et al., 2014a, 2014b; Paulino & Prats, 2013). Others yet again focus on the supply side (Pearce, 1998), or even defend the need to consider both industry and tourist perspectives (Saraniemi & Kylänen, 2011). Although these varying perspectives offer a critical view of tourism destinations following administrative boundaries, they fail to take into consideration the consumer's point of view. Several authors have pointed out the need to plan and manage destinations from the consumer's point of view, given that tourists play a central role in the definition of a destination and they are the ones who ultimately consume it (Beritelli et al., 2015; Dredge, 1999; Leiper, 1990).

Leiper (1995) has defined tourism destinations from a demand-side perspective as a geographical area to which tourists travel to visit attractions. In this respect, Hong, Ma, and Huan (2015) and Asero et al. (2015) found that network links between attractions and the shape, dimension and structure of the destination are closely correlated with tourist flows. Tourism destinations should therefore move to a more dynamic model of subsystems based on how tourists geographically consume the space and their travel patterns in order finally to abandon the concept of a tourism destination as a rigid unit labelled following a delimited geographical area (Beritelli, Bieger, & Laesser, 2014; Beritelli et al., 2015; Dredge, 1999).

2.3. Tourism destination boundaries with a focus on travel patterns

Many economic and business-oriented studies criticize the present tourism destination boundaries and request a new managerial approach based on the structure of destinations (Beritelli et al., 2014; Yang, 2018). Several studies argue that tourists aid in activating or deactivating places through their travel patterns. The destination structure and the network relationship are therefore studied on the basis of tourist flows acting as activators of the supply side (Asero et al., 2015; Baggio & Scaglione, 2017; Shih, 2006; Stienmetz & Fesenmaier, 2013, 2015). Following this approach, tourism is understood as a social process initiated by the demand side, and which needs to encourage private supply and public services (Beritelli et al., 2015). Indeed, using the business-oriented approach to analyze tourists' 'touch points' is crucial in order to understand that tourism destinations are a system or network of elements connected by tourists' travel patterns, rather than being a continuous geographical space.

Even if the business-oriented perspective were to consider tourist travel patterns, however, it is still too focused on the supply-side of destinations, as it ignores elements of destinations that are valuable for tourists but not considered part of the value-chain. Moreover, most existing studies have failed to recognize all of the tourism phenomena within a destination as a system, only viewing it as a linear value chain, or a bilateral connection based on direct tourist flows or routes. Only Stienmetz and Fesenmaier (2015) considered the attractions connection from the perspective of the whole stay in the area, and not linear flows alone; however, their focus was on expenditure, and not on delimiting destinations from the viewpoint of tourists' travel patterns.

2.4. Travel patterns and influencing factors

Sociogeographic authors have contributed substantially to explaining and analyzing tourist behavior using grounded theory. One of the most important contributions to grounded theory from the field of geography is the usage of linear path models, which simplify thousands of individuals' spatial tourist movements, showing schematic theoretic patterns (Lue et al., 1993). In contrast, few studies have provided a theoretical background to territoriality of travel patterns which categorize tourists' explorations of a destination according to how far they venture from the heart of the destination (Gunn, 1993; Lew & McKercher, 2006).

Although this sociogeographic contribution is essential in order to understand tourism phenomena, it fails to enter into the discussion on destination boundaries (Framke, 2002). In addition, its geographical analysis tends to be overattached to the continuity of space, failing to fully reflect the way tourists consume destinations (Beritelli et al., 2015). Only a few studies, which apply territorial models (Paulino, Prats, & Schofield, 2019a, 2019b), observed that within-a-destination travel patterns goes beyond the administrative boundaries. However, these studies only considered the bilateral relationship between accommodation and attractions, without exploring all the elements visited by tourists during their stay in the destination area.

Authors in the fields of sociology and geography have also contributed to knowledge surrounding the factors affecting travel patterns through multiple case studies. In the 1960s, gravity and spatial interaction models were popularized in order to explain human space movement. Mathematical formulations incorporating push and pull factors were used to analyze and forecast spatial interaction patterns (Haynes & Fotheringham, 1984; Sen & Smith, 1995). However, these models have been criticized for their lack of theoretical background, and the need of taking for granted assumptions regarding the number of influencing factors and their weight in the mathematical formula. Although an augmented version of the gravity equation has emerged latterly (Morley, Rosselló, & Santana-Gallego, 2014), results still lead to deviations.

Recently, various technologies have led to significant improvements in research on travel patterns (Shoval & Ahas, 2017). These are able to accurately collect, map and analyze tourists' time and space behavior (Girardin, Dal Fiore, Blat, & Ratti, 2007; Raun, Ahas, & Tiru, 2016; Shoval, McKercher, Ng, & Birenboim, 2011). As a result, a number of factors affecting travel patterns have been identified.

Most researchers agree that tourist attractions, supported by the service sector, are the main decisive pull factor for visiting a destination (Gunn, 1993; Kušen, 2010; Leiper, 1990) and the key element influencing travel patterns (Chhetri & Arrowsmith, 2008; McKercher & Lew, 2004). Moreover, flows within a destination are modulated by the spatial distribution of tourism services and attractions such as the cumulative effect of tourism attractions (Lue et al., 1993). To this we can add market access, distance decay, 'time budget', communication networks, psychological barriers, cultural distance, and other factors, including personal ones (Lew & McKercher, 2006; McKercher & Lew, 2004; Smallwood, Beckley, & Moore, 2012).

As evidenced by the preceding discussion, the spatial behavior of tourists at a destination is complex and unique due to many factors. The theoretical background is therefore fragmented depending on particular factors and case studies. In turn, this leads to a lack of references providing a clear foundation for the factors determining the complete territorial experience of tourists in a destination.

3. Research framework

Adopting either a business-oriented perspective or a sociogeographic perspective reveals only a partial vision of the destination. Framke (2002) suggests merging both perspectives in order to understand the relationship between tourist behavior and the destination as a marketing product. In line with the aims of this study, it is argued here that both dimensions of a destination need to be considered: (1) the static dimension, or the place, and (2) the dynamic dimension, or the mix and agglomeration of products and services, which vary according to the changing tourist demand.

Parallel to this, tourism demand is changing rapidly and profoundly. Lately, tourists' mobility has grown and become increasingly massive and flexible, and traditional supply channels are being replaced with new ways to access information (Laesser, 2007; Llodrà-Riera, Martínez-Ruiz, Jiménez-Zarco, & Izquierdo-Yusta, 2015; Prats & Marin,

2014). In light of previous literature and rapid changes on the demand side, there is a need to resume the discussion on tourism destinations initiated 40 years ago. Classical models of the destination are no longer valid and need to be revised and reevaluated. Destinations need to adapt their structures and management in order to take consumer needs into account. This requires functional, flexible destinations that constantly adapt to the needs of tourists. In order to achieve this, researchers firstly need to know how tourists geographically consume the destinations, and secondly they should use this information as a tool to redefine tourism destination boundaries.

To fill this gap, techniques borrowed from economics and business studies are used in the present study (Baggio & Scaglione, 2017; Stienmetz & Fesenmaier, 2013, 2015), although a destination approach is taken (Gunn, 1993; Lew & McKercher, 2006). Here, the focus is on tourists' territoriality patterns within the destination (from arrival to departure at the accommodation point). New appearing destinations focus on tourists' functionality rather than administrative boundaries and allow for geographical overlapping (Dredge, 1999; Kang et al., 2014; Yang, 2018).

Subsequently, this paper is underpinned by socio-geographic literature (Lew & McKercher, 2006; Lue et al., 1993; McKercher & Lew, 2004), focusing on the territoriality of within-a-destination travel patterns and the factors that determine this geographical consumption. Deciphering these factors is relevant since they ultimately determine the shape and size of the consumer-based tourism destinations and the existence of overlapping areas. Furthermore, knowing them will allow to export this study to other similar study areas as well as to predict the evolution of territorial travel patterns when managing the destination.

4. Case studies

Most literature on travel patterns focuses more on analyzing urban and mass tourism than in rural areas. This is probably due to the lower influx of tourists in rural areas and the methodological difficulties associated with gathering data and identifying diffuse travel patterns there. In contrast, the present contribution aims to bring rural areas back into discussion, as they are an ideal case studies for the topic under study. The scarcity of public transport and tourism intermediation in rural areas gives tourists a higher degree of freedom, leading to the predominance of car-based trips and multi-destination patterns (Connell & Page, 2008; Lue et al., 1993; Smallwood et al., 2012). Rural areas thereby offer the opportunity to study tourists' travel patterns without a strong influence of intermediation.

Specifically, two European natural areas were selected to carry out this research: one in the UK and the other Spain. This enabled the method to be tested in two rural destinations with different characteristics. In spite of the differences in the selected areas, both show the typical spatial dispersion of tourism assets characteristically attached to natural and rural areas. Furthermore, the researchers had direct access to the two selected areas, as well as deep knowledge of their characteristics, which helped to ensure a comprehensive analysis.

In the UK, the selected area was the Peak District National Park (Fig. 1), which covers 1440 km^2. This natural, rural area is popular for its heritage and wide range of nature-based activities. At a regional

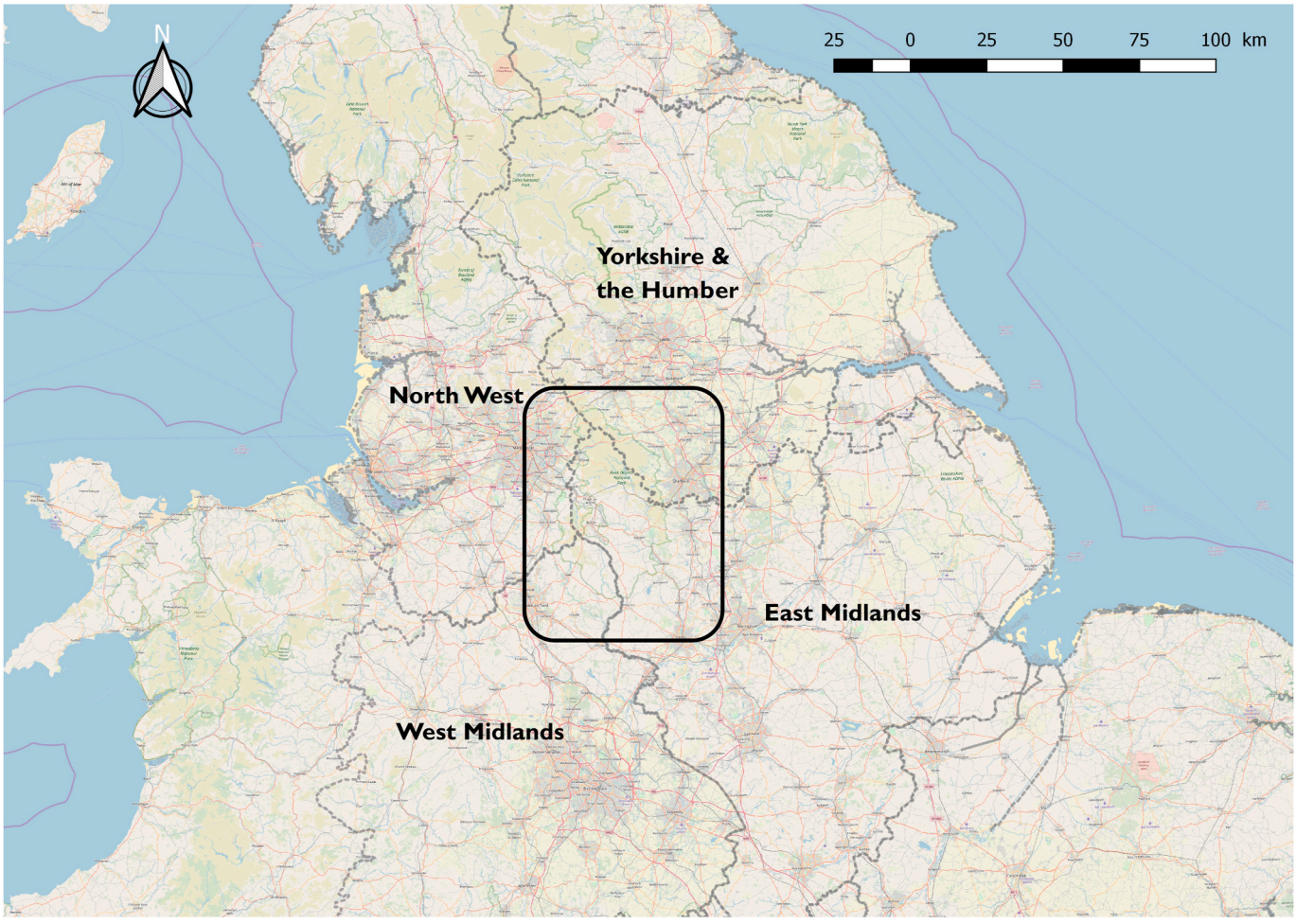

Fig. 1. Location of the UK case study: The Peak District.
Source: Authors's work based on the QGIS public carthography

administration level, most of the Peak District falls within the county of Derbyshire, in the East Midlands, and is managed by one individual DMO: Visit Peak District and Derbyshire. However, the Peak District also covers some parts of Yorkshire and The Humber, West Midlands and North West regions. In addition, the Peak District is divided into several counties and districts. The National Park is surrounded by some of the most populated cities in the UK, and this is expected to influence travel patterns in the area. In fact, with so many large cities nearby, the Peak District is one of Europe's most visited National Parks, and thus a good example of a crowded rural area.

The second case of study (Fig. 2) is the trans-boundary region falling between the Catalonia (Terres de l'Ebre area), Aragon (Matarranya area) and Valencia regions (Maestrat area) in the Western Mediterranean, Spain. The surveyed area covers 17,931 km^2 and includes a Biosphere Reserve (Terres de l'Ebre), a coastal Natural Park (The Ebro Delta), characterized by lagoons, marshes and natural beaches, and a neighboring mountain range (Els Ports), characterized by mountain rivers, trails and cultural heritage. The Ports mountain range includes two Natural Parks (Ports and Tinença de Benifassà) and a hunting reserve (Ports de Beseit), each managed by a different public administration. Indeed, with respect to tourism management, the multiple regional and local boundaries of this case study implies that planning and management of the area is the responsibility of multiple public administrations and DMOs. This case study is an example of an uncrowded area as there are no large cities in the immediate surrounding area and has low tourism intensity. This is also an example of an area combining rurality with sun-and-beach, as part of the area is by the Mediterranean Sea. It also borders two mature coastal destinations, where tourism flows were expected to pass on the study area and vice versa. Furthermore, this combination of rural and coastal destination involves the elongated development of accommodation supply characteristic of costal destinations (Smith, 1992).

5. Methodology

5.1. Data collection

Innovative methods for collecting data, such as GIS, geotagged pictures on social media, passive mobile positioning were discarded due to the existence of connection dead spots in both areas of study. Traditional 'in-situ' surveys were selected for their reliability, and to simplify the geographical data, compared to the excessive micro-scale of tracking techniques.

In order to avoid data deviation produced when selecting survey places, optimum survey locations were identified at attractions and accommodation hubs in each study area by means of two sources. Firstly, attraction survey locations were selected and classified following a content analysis of tourism guidebooks (Blasco et al., 2014a, 2014b; Paulino & Prats, 2013). The attractions were classified according to their level of popularity considering a number of criteria, such as format of text using bold fonts, length of text written in the guides, use of images, and ranking given by the editors to each attraction. Secondly, accommodation hubs were identified and classified according to official capacity. As a result, the number of survey-days at each location reflected

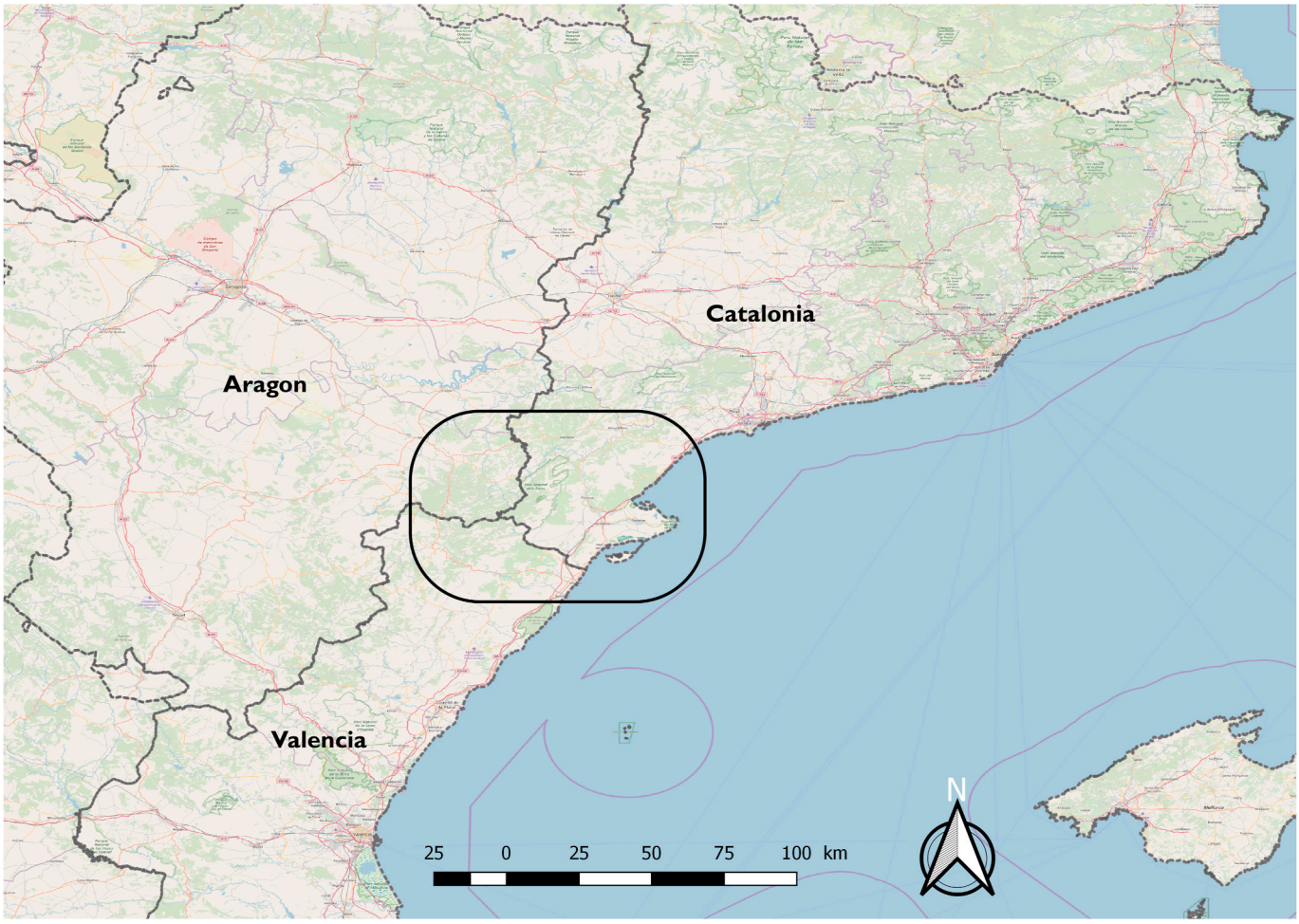

Fig. 2. Location of the Spanish case study: Terres de l'Ebre-Matarranya-Maestrat.
Souce: Author's work based on the QGIS public carthography

the number of beds, and the number and popularity of attractions. Furthermore, halfway through the survey period, other significant attractions, which had not been identified during the content analysis, were established due to the high number of responses. In order to obtain a representative sample of tourist travel patterns, these locations were added to the survey schedule.

The sample consisted of leisure tourists who had spent at least one night in the study area or nearby. Therefore, day trippers and long-stay tourists (over 60 nights) were excluded from the survey: the former for not staying overnight, and the latter as they tend to experience life in a similar way to residents (Esichaikul, 2012; Ono, 2008). Visits by tourists staying at accommodation outside the surveyed area were not discarded. This meant that transboundary patterns could also be analyzed, thus expanding the study area. A total of 3163 completed questionnaires were obtained: 1722 at Terres de l'Ebre-Matarranya-Maestrat, Spain; and 1441 at the Peak District, UK. Participants were asked to answer a complete survey consisting in the range of attractions visited during their stay at their accommodation point.

5.2. Network construction and main analysis

Some tourism researchers have used network analysis (NA) as a data-analysis technique to study tourist travel patterns, by considering a tourist attraction as a node, and tourists' spatial movement as a link (Baggio & Scaglione, 2017; Kang et al., 2018; Shih, 2006; Stienmetz & Fesenmaier, 2013, 2015). These studies analyze the network characteristics of directed tourism flows to uncover mobility patterns among attractions. The approach adopted in this research is different, as the focus of the study is to identify overlapping clusters of attractions (as defined by the tourist experience) by analyzing the network formed by attractions visited together during the same stay. More specifically, the networks analyzed here were constructed from information about the range of attractions visited by tourists during their stay in an area, without considering the exact sequence of visited attractions. Consequently, the connections form undirected networks that do not contain orientation information but the existence of relationships between the two connected attractions.

Firstly, individual matrices have been created, representing visits of single tourists during their stay in the destination area. Following Stienmetz and Fesenmaier (2015), Fig. 3 illustrates an example of the matrix construction for Respondent X, who visited attractions A, C, and D. Subsequently, individual data from surveys of each case study have been aggregated into two single-weighted, symmetric matrices containing all tourist visits and analyzed using the *Gephi* network analysis tool (Bastian et al., 2009). Relational information arranged in this way is called *adjacency matrix* in network analysis terminology.

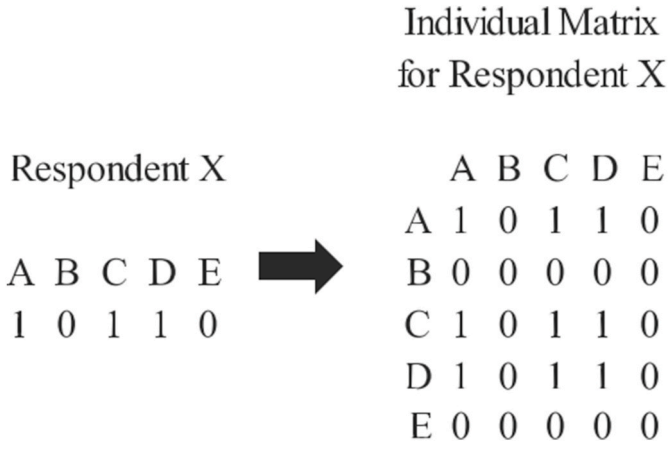

Fig. 3. Example of an individual response matrix.
Source: Stienmetz & Fesenmaier, 2015.

Generally speaking, networks are formed by nodes connected through links. In this study, nodes correspond to visited attractions, and links between two of them means that at least one tourist visited them both during the stay at the destination. The intensity of the relationship between two attractions, measured as the number of tourists visiting both of them during the same trip, was incorporated to the network as the weight of the link.

In order to aid visualization, attractions with low degree of centrality were filtered out. In particular, in order to focus on main patterns without losing data quality, only nodes with a degree centrality above 19 (in the UK case study) and 24 (in the Spanish one) were showed, following the dendogram based on distribution of degree centrality at each case. Moreover, self-loops (i.e. connections of an attraction with itself) were discarded in order to emphasize the interaction between attractions.

Once constructed, attraction networks of each area were divided into groups of densely connected attractions in order to assess their general structure. These groups of attractions can be seen as attraction clusters usually consumed together by tourists. To this end, the Lovaine method (Blondel et al., 2008) was used to obtain the so-called *community structure* of each network (i.e. the number and composition of such groups of attractions). This method was chosen for being especially suitable to consider the strength (i.e. frequency) of network connections among attractions (Fortunato & Hric, 2016). The significance of the resulting division of networks into communities, was validated by positive values (0.398 in the Spanish case, and 0.243 in the UK one) of the modularity quality metric (Newman & Girvan, 2004).

Community structure identification was complemented using k-core components analysis (Bollobás, 1984). This technique identifies smaller and even more densely connected clusters of nodes than those provided by the community detection algorithm. Consequently, k-cores can be considered to be the centre of network communities or, in other words, the heart of the destination (Lew & McKercher, 2006).

After analyzing general structural features and the community structure of the two networks, the focus of the study shifted to the role played by specific nodes as a function of their position within the network (e.g. bridging neighboring communities). Specifically, three centrality network metrics were used, namely degree, weighted degree and betweenness centralities (Freeman, 1978; Stienmetz & Fesenmaier, 2015). The degree and weighted degree of an attraction measure the number of connected attractions and the intensity of such connections. High values of these centralities would therefore correspond to top attractions within the destinations. Betweenness centrality allowed exploring the brokerage role of certain attractions. In other words, high betweenness centrality values corresponded to attractions connected to more than one attraction cluster, thus involving partial overlapping of such destination clusters.

5.3. Visual representation

As is usually done in network analysis, the assessment of the above-presented network metrics was complemented with the graphical representation of the two networks, using Gephi's visualization tool. The thickness of links among nodes was set proportional to their weight (i.e. the frequency of common visits by tourists). Moreover, node size was set to represent the degree centrality of each attraction. In order to visualize communities of attractions detected at each network, each was marked with a different color in the graphs. This allowed for easily differentiating destination components, as well as identifying partial overlapping among them (marked by mixed-colored links between nodes of different clusters).

Both the detected destinations clusters (Community structure) and their cores (K-core) were then exported to a geographical basis. Although map visualization loses quality when it comes to displaying the links, it is useful for seeing how the destinations and their cores look like in geographical terms, as well as to reveal the effect that the

geography and communication network have on travel patterns. To complement this information, the time distance between attractions (quickest driving route with Google maps) was used to help map interpretation. Furthermore, accommodation hubs linked to the data were included in order to analyze how the specific location of accommodation hubs influences the network.

To avoid possible errors produced by the finite territorial continuity of data, several techniques were used before interpreting the results. Firstly, graph representation enabled several surrounding disconnected attractions to be identified and grouped into a circumforaneous cluster. Secondly, repulsion of nodes in graphs showed single attractions grouped into one destination cluster but placed far from the cluster gravity center. Their disconnection was subsequently confirmed by map representation, either through a considerable spatial distance of these attractions, or a deficient road connection.

6. Results and discussion

The clusters obtained in each case study represent those attractions that tourists commonly visit together during their stay. Each destination detected is unique. However, an in-depth analysis of the results found several common patterns. Firstly, the results demonstrate the lack of influence administrative boundaries and tourism brands have on visiting the destination geographically. Secondly, results identify several factors considered to be the main 'ingredients' for building consumer-based destinations in rural areas: geographical barriers, the road network, time distance, availability and distribution of accommodation hubs, the geographical dispersion of attractions, and the specific location of single primary or secondary grouped attractions.

6.1. Administrative boundaries and tourism destination brands fail to coincide with the consumer-based destination

Results represented in Figs. 5 and 6 show that none of the detected destinations follow the present administrative or tourism boundaries, and that clusters built from travel patterns respond to other criteria. Thus, in line with previous studies, tourists do not take administrative boundaries into consideration when visiting a destination (Beritelli et al., 2015; Ioannides et al., 2006; Lovelock & Boyd, 2006; Yang, 2018). Substantial differences exist in how these destinations are managed and how they are actually geographically consumed and failing to take the consumer's perspective into consideration may lead to many missed opportunities.

The results not only show the transboundary tendency of detected destinations, but also the existence of transboundary destination cores. The clearest example was found in the Ports destination in Spain (Fig. 4). After filtering the network to 150 links with the use of network components (almost half of the of the whole network links), highly connected attractions were exposed, representing the destination core. Here, the core was clearly transboundary, grouping attractions from both Catalonia and Aragon administrative regions. Attractions in this destination core were more likely to be disconnected from other surrounding attractions in its own administrative area than from attractions in the other administrative areas. Only when a filter larger than half of

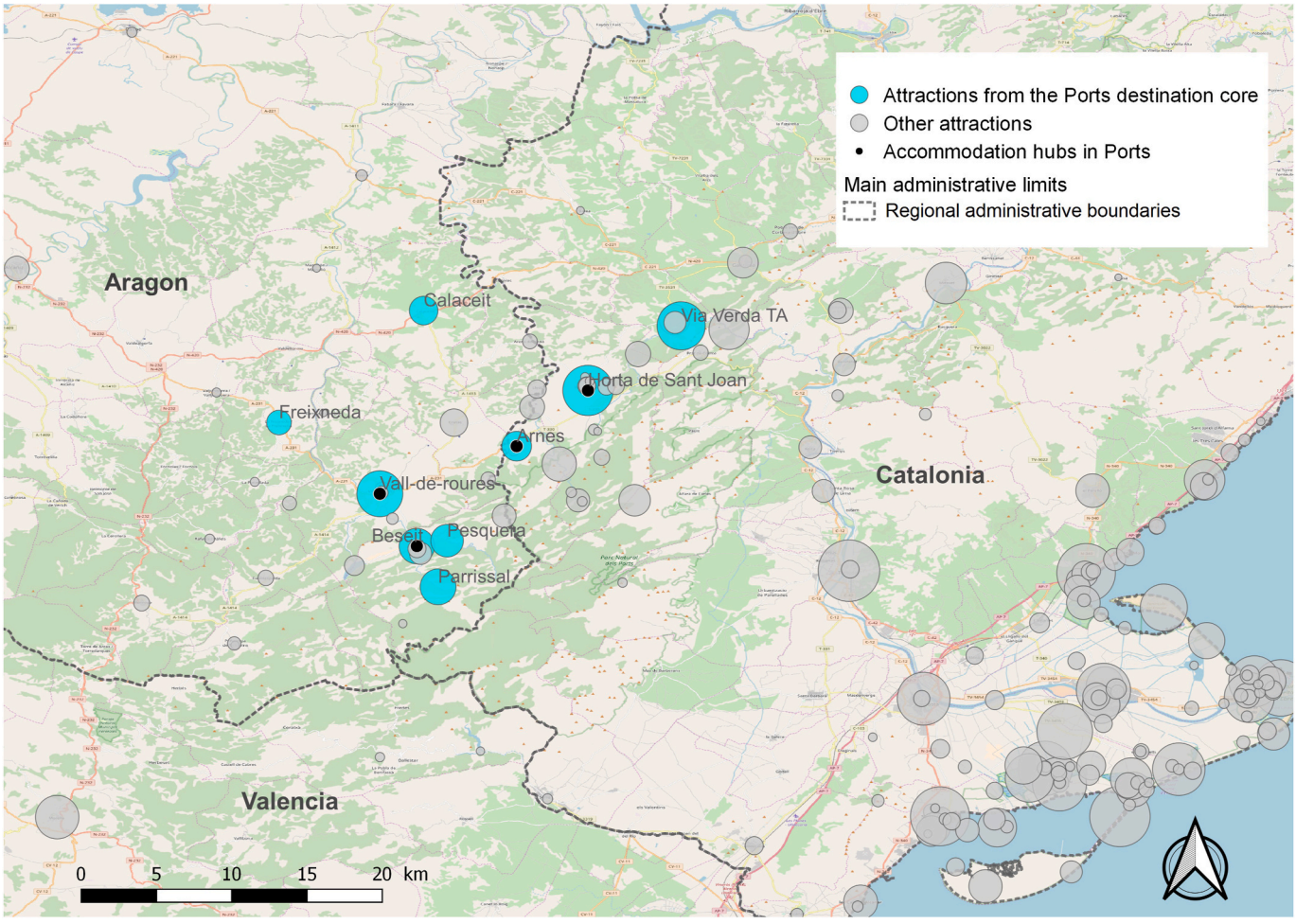

Fig. 4. Output map from the network components calculation with a filter of 150 links corresponding to the Spanish case study.
Source: Author's work based on the QGIS public carthography

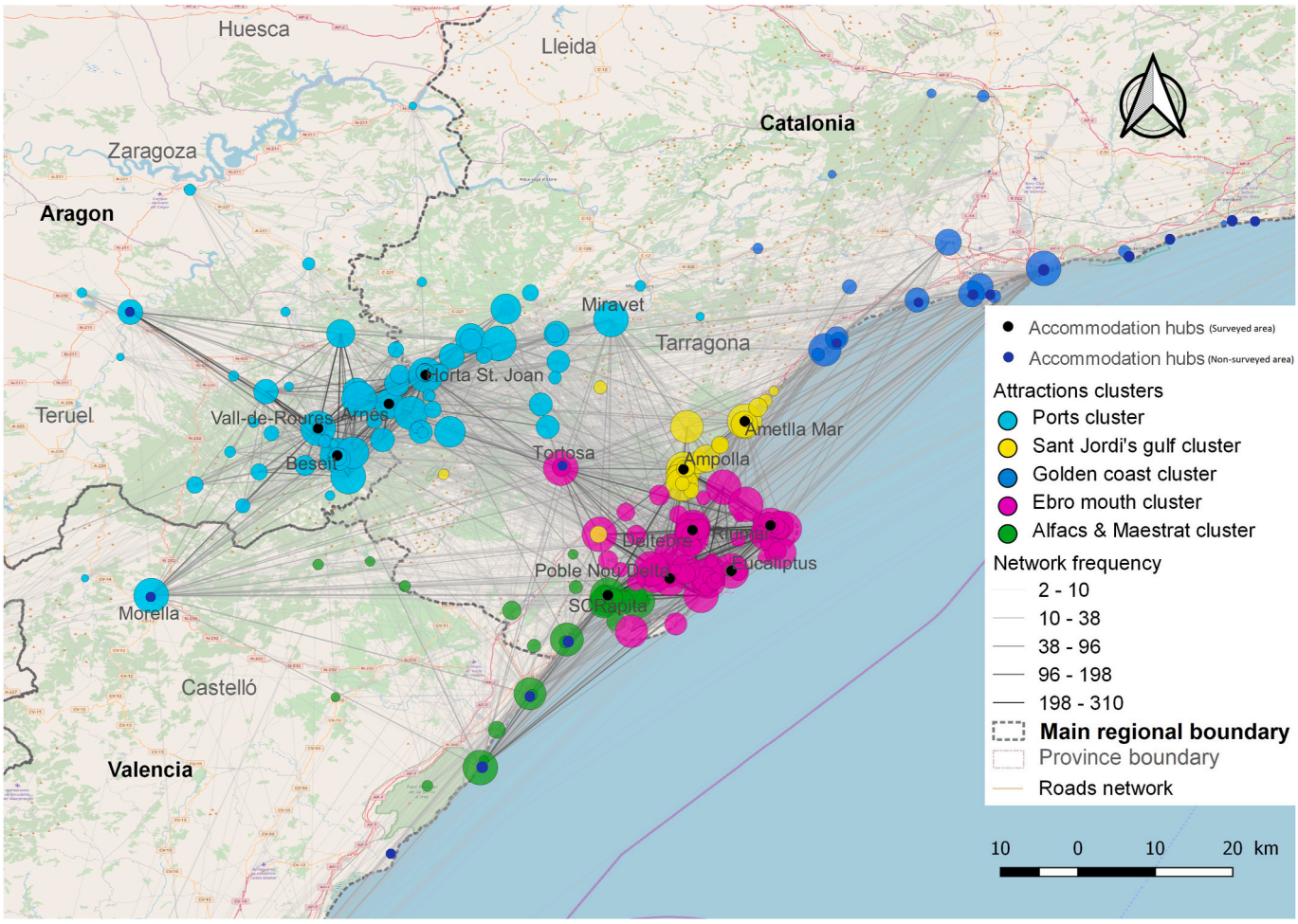

Fig. 5. Output map from the modularity statistic of the Spanish case study and its main accommodation hubs.
Source: Author's work based on the QGIS public carthography

the network weight was applied, was this destination core no longer transboundary. However, at that filter point, only a very small number of attractions remained grouped, indicating that the filter is too strict.

6.2. *The profound influence of road networks in the within-a-destination travel patterns*

Road networks play an important role in car-based trips (Connell & Page, 2008; Smallwood et al.) as they conveniently connect several attractions and may contribute to time-saving, depending on their quality. Previous studies have argued that topographical characteristics of a destination and distance traveled affect travel patterns, influencing tourists to travel further away from, or closer to attractions (Lew & McKercher, 2006; McKercher & Lew, 2004). In rural areas, road networks often simplify the topography, as most roads follow the natural terrain (e.g. along valleys or coastlines) avoiding natural barriers (e.g. steep slopes). The results of this study not only clearly supported previous literature, but also shed light to show that communication networks in rural areas combine topography and time distance, rather than geographical distance. Resulting destinations showed two main tendencies: firstly, they were elongated in shape along main roads; secondly, most of the attractions visited were located alongside the road network or nearby.

The resulting destinations on the Spanish coast represent an example of the elongated shape influenced by roads. Here, the main highways running along the coastline, promoted travel patterns following them (Fig. 5). The Ports destination, located in the countryside of the same case study, also shows an elongated shape following the main road and its immediate intersections, which pass along the north-western slope of the Ports mountain range. This effect can be further observed in the White Peak and Dark Peak destinations in the British case study (Fig. 6).

Contrastingly, a lack of main roads, or a more complex network of secondary roads in an area, resulted in less elongated clusters. This is exemplified in the Ebro mouth and the South Peak destinations (yellow clusters in both case studies). In such cases, attractions which were geodetically close, but poorly connected by road networks due to natural borders (i.e. steep slopes), were not normally visited as part of the same destination, and thus grouped in different clusters.

6.3. *Time distance as a constraining factor in travel patterns within a destination*

Stienmetz and Fesenmaier (2015) suggest that clusters between attractions can be formed by geographic proximity. Indeed, the limited dispersion of visits demonstrates that tourists' visits are constrained due to distance, but the impact of road networks demonstrates that this distance should be time distance rather than geodesic or geographical distance. Although previous literature generally defines tourism in terms of the use of time (Dietvorst & Ashworth, 1995), and some studies focus on spatiotemporal dispersal of tourists within a destination (Wu & Carson, 2008), the majority of the literature on travel patterns registers distance traveled as being geodesic or road distance, which hinders comparison of results. However, after undergoing the required transformations, the results seem compatible with findings in previous

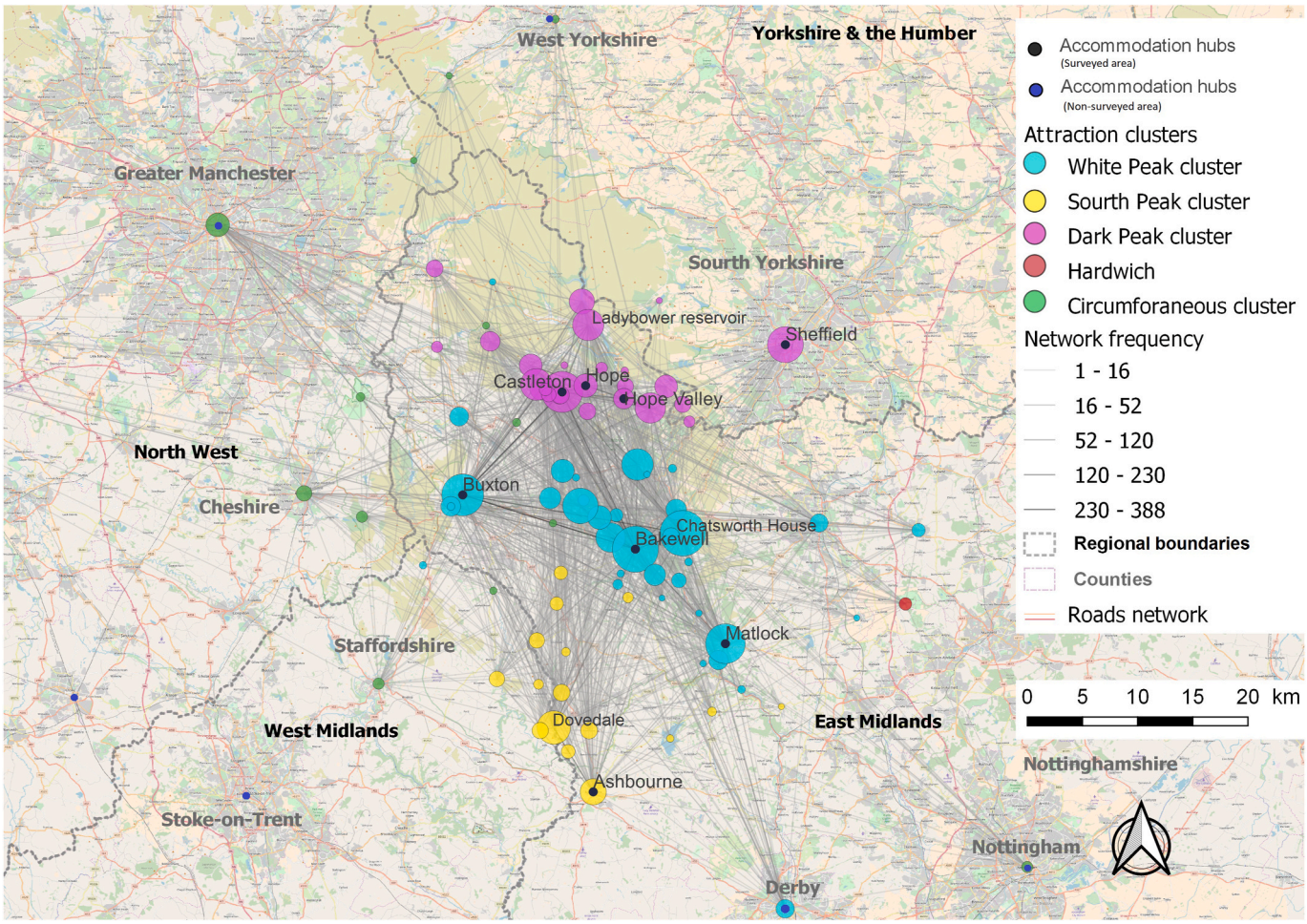

Fig. 6. Output map from the modularity statistic of the UK case study and its main accommodation hubs.
Source: Author's work based on the QGIS public carthography

literature. The maximum time distance between further attractions at the same destination is of 1 h and 35 min, which does not exceed the maximum of 193 km found by Smallwood et al. (2012).

The results of this study show that most attractions in the same destination, including the most distant ones, are constrained within 60 min of travel distance. There are only a few visits to peripheral attractions, in which time distance from other attractions located at the other peripheral side of the same destination is more than 60 min travel distance. This shows that the resulting clusters are local-like destinations, which can be consumed doing convenient side trips from the heart of the destination (Lew & McKercher, 2006; McKercher & Lew, 2004).

6.4. *The centrality of accommodation hubs as the main service component*

In accordance with previous studies indicating that tourism depends on a symbiotic relationship with services offered at base-camp (Lew & McKercher, 2006; Lue et al., 1993; Paulino et al., 2019a, 2019b; Shoval et al., 2011), the results of the present study indicate that accommodation hubs are a relevant actor within the attractions cluster.

Firstly, attractions with a higher degree centrality tend to have nearby accommodation hubs. Although this pattern could be observed over all the results, the clearest examples were found in Alfacs & Maestrat (Fig. 5) and White Peak (Fig. 6). Both destinations confirm the tendency for accommodation hubs to be located close to the top attractions with higher degree centrality: these are Buxton, Bakewell, Chatsworth House and Matlock in the British case study; and Horta de Sant Joan, Arnes, Beseit and Vall-de-Roures in the Spanish case study. Similarly, the coastal destinations in Spain (Fig. 5) are a good example of linear attraction (Wall, 1997), and its effect was shown in the typical elongated accommodation development in coastal destinations (Smith, 1992).

Secondly, the location of accommodation hubs substantially affects the territoriality of flows (Lew & McKercher, 2006; Shoval et al., 2011; Paulino et al., 2019a, 2019b), and consequently, attraction clusters. The results show that in some of the destinations detected, accommodation hubs are centrally located, whereas in other destinations they are located at the periphery. In destinations where accommodation hubs are not located at the periphery (e.g. White Peak and Dark Peak in the UK area; and Alfacs & Maestrat, Ebro mouth, Golden coast, Sant Jordi's gulf and Ports in the Spanish area), a hub-and-spoke travel pattern is likely to occur within the destination (Lue et al., 1993). The Ports destination (Fig. 5) is the clearest example to propitiate the classical hub-and-spoke travel pattern. The availability of central accommodation hubs in the destination enables the whole area to be visited by way of side trips. Furthermore, the Ports destination has a lack of accommodation hubs in the surrounding area, which makes tourists highly dependent on the central accommodation hubs and increase the optimal hub-and-spoke travel pattern.

At the other extreme, a destination may be suboptimal if it has peripheral accommodation hubs. In these cases, attractions within the destination, but far from the accommodation hub, tend to be less visited. For example, in the South Peak destination, there being only one accommodation hub (Ashbourne) located in the far corner of the destination explains the low degree centrality of attractions and the low

cohesion of the cluster. As shown below, peripheral accommodation hubs may also produce overlapping areas.

6.5. The role of key-attractions, accommodation hubs, and their geographical continuity in overlapping areas

The cluster analysis classified each attraction into excluding clusters considering predominant travel patterns but leaving aside secondary or residual travel patterns. The color-mix of links between nodes of different attraction clusters, complemented by the gravity and repulsion of nodes, demonstrates that secondary and residual travel patterns exist, producing overlapping areas (Dredge, 1999). However, with this technique only the South Peak (Fig. 7) and Ports destinations (Fig. 8) can be clearly distinguished, since is scarcely overlapping with neighboring destinations. Contrastingly, it is rather difficult to distinguish the level of overlap between other destinations. The maps representation allows it to be further demonstrated that attractions attractiveness and their location exerts an impact on overlapping areas. The maps also show how the spatial distribution of accommodation hubs and the road network have an effect in overlapping areas, confirming the two dimensions of a destination argued by Framke (2002): the static (or place) and the dynamic, (or mix of products and services). However, neither the graphs nor maps provide certainty about whether travel patterns among attractions of different clusters are relevant enough to consider their inclusion in several destinations.

Firstly, bearing in mind previous literature on factors affecting travel patterns (McKercher & Lew, 2004), it can be noted that the destination core is key to understanding how tourists geographically consume the destination. As observed in Figs. 8 and 9, destination cores are frequently made up of single unique attractions, or several proximal attractions with medium or high attractiveness acting as a nuclear mix (Leiper, 1990), and one or several proximal accommodation hubs (Shoval et al., 2011). The core analysis greatly simplifies the identification of the heart of the destination; however, when there is a geographical continuity between both attractions and accommodation hubs, such as in the Spanish coastal area, the identification of cores is more complicated. In these cases, travel patterns frequently transcend

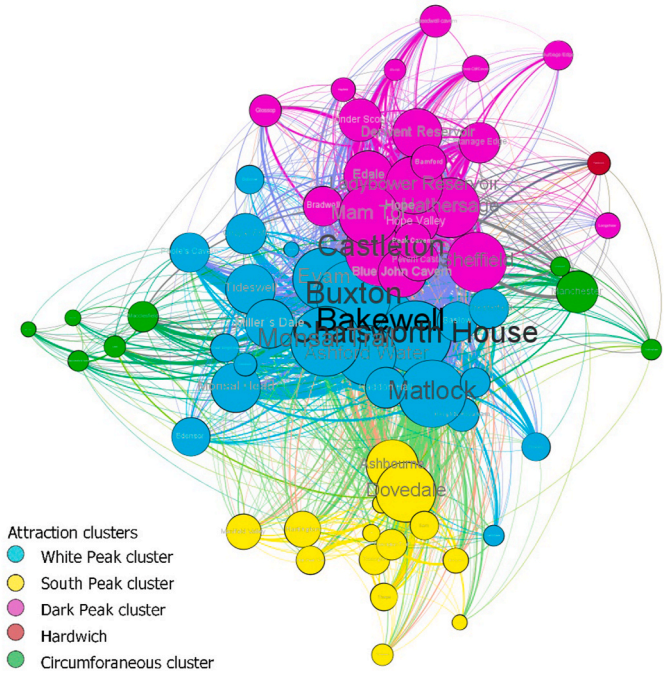

Fig. 7. Output graph from the modularity statistic corresponding to the UK case study.
Source: Author's fieldwork

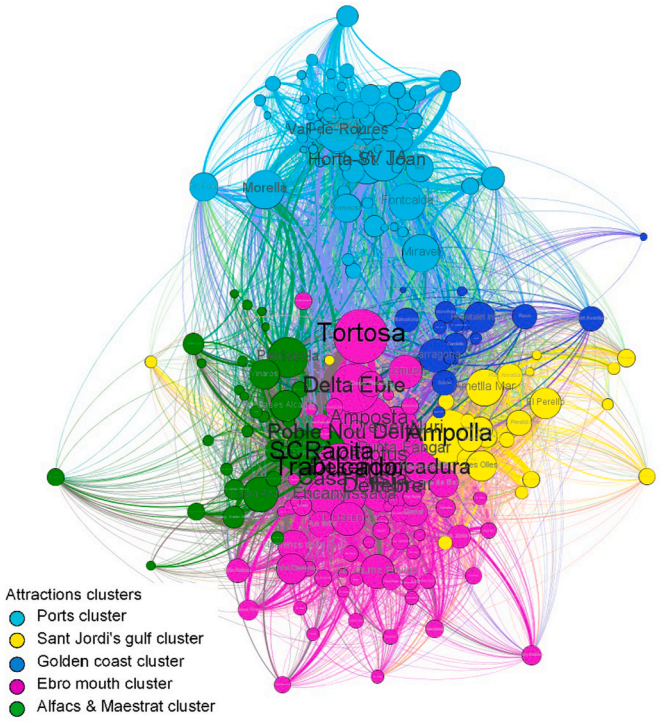

Fig. 8. Output graph from the modularity statistic corresponding to the Spanish case study.
Source: Author's fieldwork

the cluster limits, even if cores represent predominant and very frequent travel patterns. Thus, destination mangers should bear in mind that even destinations cores may overlap with neighboring ones.

The destination cores are frequently well connected by road to other main or secondary attractions located in the surrounding area (Lew & McKercher, 2006; McKercher & Lew, 2004). Results suggest that, when these surrounding attractions are not further than 60 min driving distance from the destination core, they are likely to be part of the consumer-based destination. However, these surrounding attractions show more probabilities of producing overlapping areas with neighboring destinations.

Secondly, repulsion of nodes within a cluster (Figs. 7 and 8) in combination with the maps (Figs. 4 and 5) can be used to identify single attractions on the peripherally that may be better connected to other neighboring destinations. This is especially the case of those attractions with medium and high degree centrality which represent a large share of the travel patterns located at the extreme area of the case of study. Some of the clearest examples can be found in the Ports destination in Spain. Here, Morella and Miravet, with high degree centrality, are repulsed from the core of the destination, and geographically located at the periphery. This indicates that they may be singular attractions of a neighboring destination and have been included in the present cluster due the use of finite data. To help managers of the destination to take this decision, other techniques must complement this information.

Thirdly, attraction nodes with a significant intermediary role (i.e. when a node acts as a bridge between two destinations), indicate another situation of overlapping areas. The clearest example of this is Tortosa, as the high betweenness centrality reveals (Table 1). Although cluster analysis groups Tortosa in the Ebro mouth cluster, the significant amount of connections with the Ports cluster makes it worthy of consideration for overlap. Indeed, Tortosa is an example of a renowned attraction geographically positioned between the two destinations and with a good communication connection with both areas.

Fourthly, outstanding attractions can also lead to overlapping areas, since they exert a bundling power around them, making them able to

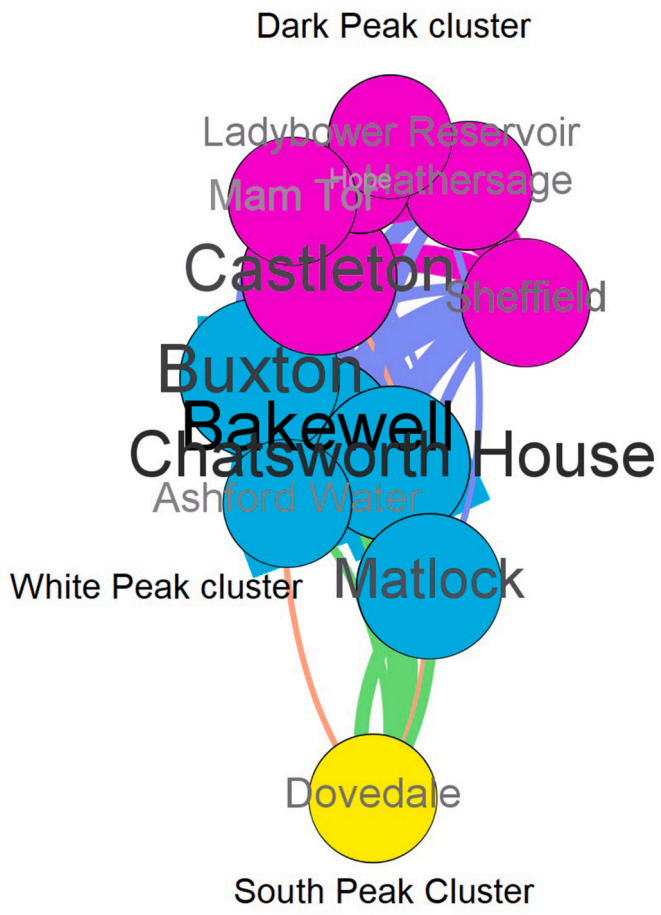

Fig. 9. Output graph from the modularity statistic corresponding to the UK case study after filtering edge weight to 14, representing destination cores.
Source: Author's fieldwork

attract a large number of tourists (Kang et al., 2018; Leiper, 1990; Lew & McKercher, 2006). High degree centrality denotes that an attraction is visited a great deal by tourists within a nuclear mix and may play an important role in creating overlapping areas. The most relevant cases are Bakewell in the White Peak cluster, Trabucador in the Ebro mouth cluster and S·C.Ràpita in the Alfacs and Maestrat cluster. They should therefore be understood as overlapping, and as well included in the neighboring destination. Furthermore, taking the weighted degree centrality into account, Bakewell and S·C.Ràpita draw attention within the other attractions (Table 1). Their large mixed-color of links (Figs. 7–10), shows how travel patterns to these attractions frequently far exceed the limits of the detected destinations.

Finally, the lack or peripheral accommodation hubs is another indicator of overlapping areas. Following previous studies, results denote that the availability and distribution of accommodation hubs significantly impacts the areas tourists explore, drawing flows around them mostly following the hub-and-spoke travel pattern (Lue et al., 1993; Shoval et al., 2011; Paulino et al., 2019a, 2019b). In cases where the

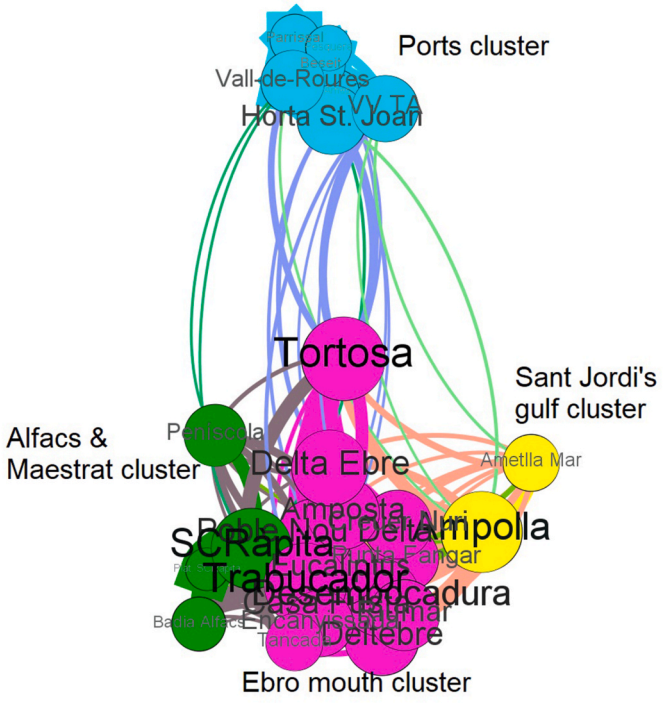

Fig. 10. Output graph from the modularity statistic corresponding to the Spanish case study after filtering edge weight to 14, representing destination cores.
Source: Author's fieldwork

Table 1
Nodes with highest degree in each destination, weighted degree and betweenness.

Country	Attraction nodes	Degree	Weighted Degree	Betweenness
United Kingdom	Bakewell	106	3360	0.03415599
	Chatsworth House	105	1791	0.03415599
	Buxton	96	2124	0.03415599
	Castleton	94	2719	0.02937275
	Matlock	91	1043	0.02633880
Spain	Tortosa	170	1784	0.10427648
	Trabucador	167	3632	0.01159894
	S.C. Ràpita	163	3906	0.02377938
	L'Ampolla	162	2814	0.02220924
	Desembocadura	154	2642	0.01443961

Source: Authors fieldwork

location of an accommodation hub is thus not optimal for visiting the attractions in a cluster, destinations are likely to overlap. Indeed, most accommodation hubs of the case of studies are not ideally placed in the center of the detected destinations; thus, overlapping areas may occur to some degree. The clearest example is the South Peak destination, where the only accommodation hub is at the periphery and together with the influence of neighboring accommodation in the White Peak, implies the partial overlapping of destinations.

7. Conclusions

This new approach to tourism destinations, based on how tourists geographically consume a destination, has achieved the two objectives set. Firstly, it has applied a method to delineate the destination following the consumer geographical functionality. Secondly, the study has identified the main factors conditioning the territoriality of travel patterns and which determines the shape and the overlapping areas of consumer-based destinations. Both achievements imply an opportunity for destination managers to rethink destinations on the basis of tourists needs, with the aim of improving destination planning and management and detecting new business opportunities.

The results from the clustering method denote that tourists tend to consume attractions that are close to each other in time distance while staying in a destination area, regardless of administrative boundaries. Thus, using administrative boundaries is not only ineffective when managing tourism destinations but can also contribute to confusing tourists. Previous research had already identified influential factors on travel patterns in both, territorial models from central accommodation (Lew & McKercher, 2006; Paulino et al., 2019a, 2019b) and linear models (Shih, 2006). However, this is the first study to merge these concepts and to focus on the territoriality travel pattern with the focus on destinations.

The results show that patterns are affected by the specific location of accommodation hubs and road networks (Lew & McKercher, 2006; Shih, 2006). Both factors are very much related to the time distance that tourists have to travel within the destination, and most flows are within a 60-min driving distance. This demonstrates that consumer-based destinations are local-like and can be visited on a day trip (Lew & McKercher, 2006). Furthermore, the analogous results obtained in two different natural areas indicates that other similar natural destinations should obtain comparable results.

Nevertheless, the results show that the consumer patterns are not unique and secondary travel patterns transcend the detected consumer-based destinations, influenced by the geographical distribution of both attractions and accommodation hubs and the connection network. The method used sheds light on those secondary travel patterns that may be frequent enough to be considered by the destination managers The bundling power of single outstanding attractions (Leiper, 1990), the peripheral main or secondary attractions and the peripheral accommodation hubs acting as a base-camp (Lue et al., 1993), are clear examples of elements generating travel patterns outside of the detected destinations, which lead to overlapping areas. This demonstrates that detecting consumer-based tourism destinations is not an easy task for the multiple actors affecting travel patterns. To detect them, destinations should collect data related to travel patterns, apply the clustering method, and explore how certain attractions and accommodation hubs affect areas of overlap.

From a general perspective, this paper contributes with an understanding of how tourists geographically consume destinations, using this as a tool to rethink the way destinations are being delimited and managed. As managerial implications, this provides valuable information on within-a-destination travel patterns which can help destination managers improve management and planning, as well as detect new business and network opportunities between tourism actors. Furthermore, as pointed out in previous studies, forming networks among attractions can be seen as a strategy to increasing a destination's competitive advantage, while at the same time reducing market competition (Hong et al., 2015).

From a methodological perspective, this paper contributes to the literature by combining several complementary perspectives that reflect the network characteristics of aggregate travel patterns and their geographical attachment. The method is able to reveal systems of tourist attractions through attraction networks drawn up by travel patterns within a destination and propose this as the ideal consumer-based destination. The key difference between this study and previous research is the focus on networks of tourist attractions built from tourist visits throughout their whole stay at a destination, and not simply 'touch points' of particular tourist flows linked together. This manuscript relates thus to territoriality travel patterns, and the factors determining the specific size and shape of each consumer-based destination. Furthermore, this paper contributes with a method to identify individual actors who play a critical role in enabling destinations to overlap. These contributions are essential to be able to extrapolate results to other similar destinations, in order to improve destination planning and management, thus benefiting both tourists and tourism actors.

Finally, from a theoretical perspective, this manuscript contributes with combining literature about travel patterns and destination management, by venturing into the topic of tourism destinations after questioning the current model, and by placing the consumer in the center of the tourism phenomenon. This contribution offers up the opportunity to rethink the concept of tourism destinations understood as non-static overlapping areas which comprises attractions and services connected among them due to tourists' travel patterns.

Future research should combine this analysis with statistical methodology, to further explore whether secondary travel patterns are relevant enough to be considered as overlapping areas when managing the destinations. Results from this study can also be combined with results obtained by other researchers on direct flows between attractions in order to detect main routes, according to travel patterns, within the detected destination. For example, it could allow for a categorization of individual attractions as 'Main arrival points to a destination' (i.e. those with a much higher out-than in-degree) or 'Complementary attractions of a destination' (i.e. those with a much higher in-than out-degree). This would provide destination and attraction managers with more relevant information. Further research is also required to explore the extent to which each of the factors affect travel patterns within a destination, and thus contribute to the gravity equation. Finally, this paper represents only a first step in the process of rethinking tourism destinations. Collaboration between actors in the detected destinations with a view to better governance has not been addressed in this article. Governance should be explored in order to establish a platform which can involve actors from both the detected destinations and the overlapping areas.

CRediT authorship contribution statement

Isabel Paulino: Conceptualization, Methodology, Investigation, Software, Data curation, Formal analysis, Writing - original draft, Visualization. **Sergi Lozano:** Methodology, Formal analysis, Software, Validation, Writing - review & editing. **Lluís Prats:** Conceptualization, Supervision, Validation, Writing - review & editing.

Declaration of competing interest

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