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Tourist Hot Spots in Cities with the Highest Murder Rates: A comparative spatial representation analysis based on Instagram

Social networks have facilitated access to the spatial location of user-generated images and this has permitted studies of the spatial distribution of tourist images. To date, however, most studies have tended to focus on European or North American cities. The current research focuses on an analysis of the behaviour of tourists in cities with other social, economic and cultural contexts. To be more precise, we analyse the cities of Los Cabos, Acapulco, Tijuana and La Paz (Mexico), and Natal and Fortaleza (Brazil). These cities share the condition of being both tourist hot spots and some of the cities with the highest murder rates in the world. The main objective of this work is to analyse the spatial concentration of images taken by tourists in contexts that have hitherto received little analysis in academic literature. The results show a clear spatial concentration of user-generated images, especially around the spaces that offer the highest levels of safety.

Keywords: Spatial analyst, urban tourism, user-generated images, Instagram, Mexico, Brazil

Highlights

- User-generated images on Instagram are analysed using several spatial statistical techniques.
- The spatial concentration of user-generated images in cities with the highest murder rates is higher than in analyses performed in other cities.
- There are also differences between the types of attraction photographed and those that have traditionally been identified.
- The perception of safety in spaces that combine a historic centre and a seafront location increases the concentration of tourist photos.
- Differences in the spatial distribution of user-generated images are determined by such criteria as the perceived safety of the city visited.

Introduction

Geolocated information has become a key element in studies based on the spatial location of tourist hot spots (Brantner & Rodriguez-Amat, 2016). Obtaining access to these images has always tended to be methodologically difficult. However, thanks to images available via different social networks, it is now possible to study photographs taken by tourists from a number of different angles. The images that tourists share on social networks enable data to be processed more easily in comparison of both analogue and digital images taken by private users. It is therefore now possible to analyse urban spaces from a perspective that goes beyond

official statistics and which offers greater immediacy and dynamism (Shelton et al., 2015).

A considerable number of the studies that have analysed the relationship between photographs and tourism have concluded that images play an essential role in the choice of a destination (Garrod, 2008). However, the creation and management of a territory's image is no mean feat and largely depends on the capacity of a particular location to communicate existing perceptions of this space and of its inhabitants to the target market (Paül i Agustí, 2014a). The image that the potential market has of a location will therefore influence the reproduction of its image. This implies the establishment of a rather complex relationship in which the tourist is, at one and the same time, both the producer and consumer of the images in question (Urry, 1990).

Based on this premise, our research followed the line previously established by a number of earlier studies which had suggested that images can play a fundamental role in helping us to understand relationships between different societies and their territories (García-Palomares et al., 2015; Paül i Agustí, 2018). In particular, we have identified and analysed the spatial distribution of the images that tourists post on Instagram which, at present, still remains a relatively unexplored source of information for tourism research (Tenkanen et al., 2017). To date, several studies have been

based on social networks, like Twitter, which offer easy access to user-generated data. However, the emphasis that Instagram places on images – and their importance to users – is particularly worthy of study.

As Donaire, Camprubí and Galí (2014, 26) pointed out, the images posted on the Internet have had to pass a “double filter”. The first is imposed by the tourist, who has chosen the places to photograph. The second involves the choice of which images to post on the Internet. This double filter leads us to speak in terms of “places” and “non-places” for tourists at a particular destination (Girardin et al., 2008). The tourist therefore makes a previous selection of the images to post. Some authors have stated that this situation implies that “for tourists meaningful places (places with identity and relation, places in opposition of non-places) are photographed and uploaded to online platforms more often” (Bauder, 2018, 3).

This prior selection of information makes it possible to identify and map certain types of spatial behaviour associated with tourists. However, some authors have suggested that such a selection could lead to only the images of places with identity or history being shared online. Even so, this currently “remains (empirically) unproven” (Bauder, 2018, 3).

With this subtle detail, social networks could potentially be transformed into important tools for managing and marketing tourist

destinations (Shelton, et al., 2015). I must, however, be added that previous studies have tended to focus on only a small number of cases, most of which relate to Western cities with a long tradition of tourism. This is evident from the relatively limited number of indexed articles to be found on the Web of Science that include cartography and the keywords “Instagram” and “tourism”.

The cases analysed in the existing literature also tend to exhibit similar features: they mainly relate to cities in the USA that have a long tradition of tourism, such as Atlanta, Boston, Chicago, New York, Orlando and San Francisco (Zhou et al., 2015; Pat et al., 2015; Zhou et al., 2016). Other studies have focused on major European cities, such as Paris (Loiseau, et al., 2017), or on comparisons between the likes of Athens, Barcelona, Berlin, London, Madrid, Paris, Rome and Rotterdam (García-Palomares et al., 2015). Even in studies that have analysed aspects of a more social nature, such as long-standing problems of socio-spatial inequality, the cities chosen have tended to be located in the Western World, as in the case of Louisville, Kentucky (Shelton et al., 2015). Only Hu et al. (2015) had previously included cities from geographically broader contexts, though all of these have again tended to be important economic centres: Dubai, London, Mumbai, New York City, Paris and Shanghai.

Our study focuses on mapping the spatial distribution of user-generated images taken by tourists visiting cities with high murder rates: Los Cabos, Acapulco, Tijuana and La Paz, in Mexico, and Natal and Fortaleza, in Brazil. Our objective was for the resulting cartography to incorporate a new element into the debate about the impact of tourism on urban space and one that would reflect visitor experiences of tourist destinations (Balomenou & Garrod, 2014). The number of images and their locations were then used to highlight tourist preferences within different parts of the cities studied (Paldino et al., 2015).

The data have been mapped using 200-metre hexagons in order to make the results for the six cities analysed comparable. In particular - and following the lead of García-Palomares et al. (2015) - our analysis focused on highlighting the intensity of these phenomena on combining this with the use of spatial statistical techniques within a geographic information system (GIS). Our aim was to get away from an approach excessively based on computational considerations of the type that the majority of previous studies have tended to produce (Feick & Robertson, 2015). Instead, our emphasis has been placed on taking more analytical aspects into consideration too. This has permitted a more varied representation of tourist activity in the cities that were analysed.

This research described here therefore contributes to the debate concerning how user-generated images can play a fundamental role in improving our knowledge of the relations between tourism and territories (García-Palomares, Gutiérrez & Mínguez, 2015). To be more specific, our study helps to show how Instagram can serve as a very useful tool for mapping the distribution of tourism in urban spaces. The incorporation of new urban typologies, which – until now - had hardly been analysed by academic literature, has also helped to improve our understanding of the perception of urban space via social networks (Stepchenkova & Zhan, 2013).

Theoretical Framework

The image of the tourist destination

Images on social networks have helped to challenge traditional conceptions of public space (Bratner & Rodriguez-Amat, 2016). Space is a social construct (Watkins, 2005) rooted in a cultural process (Lefevre, 1992) and tourists help to construct this space through the images that they share on social networks. By travelling to the places that they are visiting, they also mobilise a number of economic, social, cultural and image-related elements (Paül i Agustí, 2013). Their participation in social networks both socially produces and reproduces the places that they visit (Bruner, 2005). The

movements of tourists and of virtual images are therefore interrelated (Sheller & Urry, 2006). This situation helps us to understand and analyse configurations of public space through the images of tourist destinations posted on social networks (Bratner & Rodriguez-Amat, 2016).

Destination image theory continues to be a fundamental approximation in tourism research (Hunter, 2016). It can be defined as “the sum of beliefs, ideas and impressions that a person has of a destination” (Crompton, 1979, 18). Some authors believe that the image of a destination is a ‘nebulous concept’ (Hughes & Allen, 2008, 30), while others stress that the promotion of tourism does not play a very key role in forming the image of the destination (Govers et al., 2007). Whatever the case, the majority of authors coincide in identifying the image of the destination as a ‘multidimensional concept’ (Gallarza et al., 2002).

The study of various components present in the image of the destination may help to improve our understanding of the way tourists represent the cities that they visit (Chon, 1990; Yan & Santos, 2009). Even so, there are multiple filters that can help us to fix a specific image in the collective imagination: realities, experiences, or - as in the case of this article - specific urban spaces. Similarly, the interaction between the tourist and the image of the city visited can be formed at different points in time: before, during, and after their visits (Tasci & Gartner, 2007). The

combination of these aspects can be crystallised in a division of the tourist destination image into two interrelated components: cognitive and affective images (Baloglu, 1997). The former involves each individual's beliefs about, and knowledge of, the destination. The latter refers to the emotions and feelings relating to this destination (Deng & Li, 2018). Some authors would also include a third, conative, filter which is derived from the other two. This would include acting, doing, or striving, understood as reactions to the previously highlighted inputs (Marine-Roig & Ferrer-Rosell, 2018).

It has also been shown that geotagged photos can be used to indicate tourists' preferences (Gilbert & Barton, 2013). There are, however, certain limitations to this. For example, in some cities, the tourist destination image tends to be associated with a single monument (Capone & Boix, 2008). This is a factor that conditions the reading of the image of the city, as it does not take into consideration the complexity of the area. To avoid this problem, there is a need for a more territorial approximation in which the existing spatial interrelationships are clearly identified. In this way, it is possible to make an analysis in which – following the lines identified by Tobler (1970) - everything is related to everything else, but the things that are closest together are more closely related than those that are furthest apart.

Every tourist generates their own social spaces on their social networks (Watkins, 2005). Superimposing images generated by different tourists helps to identify representations of different urban spaces (García-Palomares et al., 2015). This makes it possible to identify spatial differences between places where tourists are able to move around and freely interact and those where there is some form of restriction to their movement (Adams & Jansson, 2012). To be more precise, the present article will apply this methodology to analyse a group of cities that share the status of being important tourist destinations and some of the cities with the highest murder rates in the world.

Relationships between tourism and conflict

The use of mobile and geolocation devices is changing previous perceptions of tourist sites. They offer new ways to interact with and through urban space. According to recent studies, these relations are of two types. Firstly, the use of mobile and geolocation devices permits people to gain greater familiarity with the places that they visit: “space has gained new dimensions, resulting in a sort of hybrid space where digital information overlays the physical space revealing what was previous unknown about a place” (Frizzera, 2015, 29). Secondly, they also allow users to create place-based narratives that implicate citizens in the

management of the image of these spaces (Humphreys and Liao, 2011). This situation creates new discourses, which may even run contrary to what had previously been the hegemonic discourses (Paül i Agustí, 2014b).

These new tools make it possible to improve our knowledge of the images of tourism destinations. In this way, it is possible to identify new spatial location patterns and to show differences in tourist behaviour (Su et al., 2017). This also enables us to highlight spaces that are potential centres of conflict or inequality (Urry, 2007). In the present study, we will concentrate on analysing the situation of urban spaces. These spaces have experienced major growth over recent decades, until they have become tourist spaces of the first order (García-Hernández et al., 2017).

The relationships between urban tourism and conflict have been analysed by different authors (Rolfes, 2010; Altindag, 2014). Most studies, however, have treated tourists as victims of theft, corruption or terrorist attacks, without going on to analyse the spaces where these acts take place (Santana-Gallego, et al., 2016). The most usual approach has been that of looking at how various forms of conflict have dissuaded tourists from visiting certain places (Lorde & Jackman, 2013) either to a given country (Neumayer, 2004) or to specific neighbourhoods (Dürr, 2012; Freire-Medeiros, et al., 2012). In both cases, the studies have focused far more on international tourists than on those from the host country (Rolfes, 2010).

These approaches have tended to give priority to a form of treatment based on making a separation between spaces associated with conflict and tourist spaces (Andrews, 2014). There are, however, some urban areas where it is difficult to make a clear distinction between the two. For example, in 2012, there were murders in 109 of the 119 neighbourhoods of the city of Fortaleza (Brazil) (IPECE, 2013). However, despite such events, the city still welcomed 1.9 million foreign tourists in the same year (*Ministério do Turismo*, 2013). Catai and Rejowski (2005) have similarly shown that despite the high murder rate in the city of São Paulo, it is not considered to be particularly dangerous because its tourism predominantly concentrates in areas in which the crime rate is comparatively low. We are not, however, aware of any study that specifically highlights spaces that tourists could consider as being "safe", using spatial location. To date, there have, therefore, been a lack of studies that have analysed the spatial behaviour of tourists after they have taken the decision to visit a potentially conflictive space.

If we examine the new mobilities paradigm (Sheller & Urry, 2006), the division between tourist and non-tourist spaces becomes somewhat blurred. Tourism and different lifestyles, contexts and spaces are interrelated and any analysis based on a prior delimitation of potentially conflictive spaces and tourist spaces would only offer a segmented view of

reality. In fact, a number of recent studies have shown that the relationships between tourism and conflict are highly extensive and complex: “a lack of security increases the perceived satisfaction of an experience and the costs of protection (for the domestic service provider) also raise the costs tourists have to incur” (Santana-Gallego et al., 2016, p. 4).

Each individual’s perceptions of different urban spaces, of their authenticity, and of the potential dangers that they present, will tend to vary (Conran, 2006). They can, however, be influenced by considerations such as age, education and experience. It has also been shown that, in some cases, if a tourist perceives a setting as being “unsafe”, this may limit the number of photographs that they take, or even dissuade them from taking any at all. This is, for example, the case of tours organised in Dharavi, India (Dyson, 2012). It also implies that it can be difficult to delimit an urban space prior to a visit (Hu et al., 2015). Even so, others have argued that such situations should be considered exceptional (Dürr, 2012). Freire-Medeiros et al. (2012) noted that most tourists take photos in the favelas (shanty towns) of Rio de Janeiro. In fact, the advent of social networks has contributed to an increase in the number of this type of photo being taken. Tourists of every kind have their own particular motives and expectations, which they reflect in the images that they post on social networks. This tends to result in different types of spatial behaviour (Stepchenkova &

Zhan, 2013). By overlaying these representations, it is possible to analyse the spatial behaviour of tourists within the city. It is also possible to identify the points where tourists coincide, zones with well-differentiated forms of behaviour, and spaces that do not need to be visited; all of these are analysed in this article.

Methodology

Case studies

The choice of case studies was based on the ranking of the world's most violent cities, which is produced annually by the Citizens' Council for Public Security and Criminal Justice (CCPSCJ, or CCSPJP in Spanish). This civil organisation analyses the incidence of murders in cities with more than 300,000 inhabitants but excludes cities located in countries currently at war.

Our study was based on data for 2017 (CCSPJP, 2018). We selected the cities with the highest murder rates that received over 2 million tourist visits per year (Table 1). Various authors, including Lorde and Jackman (2013), have shown that in order to avoid projecting a negative image, certain destinations do not provide accurate data. In contrast, in areas where crimes are reported in the media, such as the cities analysed here, relationships between expected tourism and crime are much easier to

describe. We excluded Caracas, the second city in the ranking of cities with the highest murder rates, because of the small number of tourists who visit it each year.

Table 1. Cities selected.

City	Country	Position in 2017	Murder rate per 100,000 inhabitants	Population in 2017	Tourists	Source of tourism data	Year
Los Cabos	Mexico	1	111,33	328.245	2.500.000	https://www.elsudcaliforniano.com.mx/municipios/280-mil-habitantes-en-los-cabos-2-5-millones-de-turistas-al-ano	2017
Acapulco	Mexico	3	106,63	853.646	5.225.259	https://suracapulco.mx/2018/01/21/por-cuarto-ano-consecutivo-cancun-supera-a-acapulco-en-numero-de-turistas/	2017
Natal	Brazil	4	102,56	1.343.573	2.000.000	http://natalbrasil.tur.br/o-rio-grande-do-norte/?lang=es	Estimate
Tijuana	Mexico	5	100,77	1.882.492	6.800.000	http://www.tijuana.gob.mx/dependencias/tesoreria/cp/2015-4/III/cotuco.pdf	2015
La Paz	Mexico	6	84,79	305.455	2.152.136	http://www.datatur.sectur.gob.mx/ITxEF/ITxEF_BCS.aspx	2016
Fortaleza	Brazil	7	83,48	3.917.279	2.902.250	http://diariodonordeste.verdesmares.com.br/cadernos/negocios/online/turistas-deixam-r-7-3-bi-no-ceara-em-2017-1.1880349	2016

Source: Own research based on CCSPJP, 2018, and cited websites

To strike a balance between different urban typologies, we included cities meeting a variety of different characteristics: medium-sized cities with populations of around 300,000 (Los Cabos and La Paz); cities extending over larger areas with populations of around 1 million (Acapulco and Natal); and cities with populations of considerably more than 1 million (Tijuana and Fortaleza).

Data collection

The data analysed were obtained from the social network Instagram. While Instagram is predominantly based on image sharing, comments and ratings also play an important role on it. Instagram was also chosen because of the highly representative nature of its results. For example, recent studies have shown that it outperforms Twitter and Flickr in representing monthly visitor patterns for various African natural parks (Tenkanen et al., 2017).

For the purposes of our research, only publicly available images were used. Ours was therefore not a study of all tourists, but only of those who took photographs and shared them via Instagram. This study assumed that tourists had previously made a selection of the images that they posted. Even so, various authors have reported that there is evidence that the images that appear on social networks tend to coincide with the photographs that tourists take on their travels (Stepchenkova and Zhan, 2012; Donaire et al., 2014).

The platform allowed us to conduct preliminary research into the places where the photos had been taken. In our case, this research was based on territorial criteria: “Los Cabos. Mexico”; “Acapulco. Guerrero”; “Natal. Rio Grande do Norte”; “Tijuana. Baja California”; “La Paz. Baja California Sur”; and “Fortaleza. Brazil”. While other research criteria could have been used, these were the ones that offered the greatest volume of activity and

reliability. For this reason, this was also the criterion used to select images for our research.

The period of analysis spanned a selection of 10 days. Longer time intervals could have captured changes occurring in these cities, or in the use of the social network, and this would probably have modified the results obtained (Feick & Robertson, 2015). The dates chosen were the 1st and 15th days of the month for the months between February and June 2018. These dates were selected with the aim of including different types of behaviour, following the approach suggested by Stylianou-Lamber (2012). The period chosen included public holidays, such as 1st May, and other festive days corresponding to longer holiday periods, such as Easter Sunday (on 1st April). It also included another Sunday (15th April) and numerous working days (the rest of the days).

On the dates chosen, more than 100,000 images of the chosen cities were captured and analysed (Table 2). Fortaleza was the most photographed city, accounting for more than half of the total number of images taken; in contrast only 1,600 images of Los Cabos were captured.

The images were then analysed in order to distinguish between those taken by residents and those taken by tourists. Those captured by local residents were identified by referring to the user profile information provided by Instagram. This information also enabled us to see where the

user had been when they took their previous photos. If a user posted a photo of Acapulco, for example, but their previous photos were of another city, they were considered to be a tourist. In contrast, if their previous images had mostly been taken in Acapulco, the user was classified as a local resident. The language in which each visitor wrote their comments was another of the criteria used to discriminate between tourists and residents. The images posted by residents were discarded based on subsequent research.

If the identity of the photographer was not sufficiently clear, the photograph was discarded. Following Stylianou-Lamber's methodology (2012, p. 1825), a series of guidelines were established to avoid subjectivity and a pilot study was conducted. In this study, two coders used the same criteria in order to code 80 different images. In our case, the initial rate of overlap was 87%. After discussing any elements which caused disagreement, the criteria were further clarified and homogenised. When the pilot procedure was repeated, the level of inter-coder reliability rose to 94%.

We should underline that our study considered two types of tourist image: those of places (images of monuments, landscapes, streets, beaches, etc.) and of activities (dining in restaurants, shopping, visits, etc.). This approach enabled us to establish that 6% of the images (6,094 photographs)

had been taken by tourists. However, the percentage varied from city to city. Thus, the total percentage of tourist images was around 25% for Acapulco and La Paz, but only 3% for Fortaleza.

Table 2. Data analysed

	Images posted on Instagram	Images identified as captured by tourists		Mapped tourist images	
	Total	Total	% tourist images	Total	% mapped images
Los Cabos	1,656	406	24.52	308	75.86
Acapulco	4,224	1,066	25.24	624	58.54
Natal	29,174	1,862	6.38	1,384	74.33
Tijuana	9,686	508	5.24	332	65.35
La Paz	2,834	654	23.08	224	34.,25
Fortaleza	52,702	1,598	3.03	1,400	87.61
Total	100,276	6,094	6.08	4,272	70.1

Once all the photographs taken by tourists had been identified, it was then necessary to analyse those that we could locate on the map. We rejected any photographs that did not allow us to identify the location. To do this, we applied the ‘eye-catchers’ approach. Eye-catchers are photos in

which 50% or more of the image is occupied by an eye-catching device designed to attract the observer's attention (Pritchard & Morgan, 1995, p. 28). If over 50% of the image was occupied by something that was not related to the specific location - as in the cases of selfies, photographs of fine details, sunsets or images of clouds – the images were discarded.

Once these elements had been removed, we sought to identify the specific place where the image had been taken. This was done in three different ways. Firstly, we referred to comments made on the app, which allowed us to directly identify the different places in question. Secondly, we were able to recognise some of the locations in the images (due to photographs showing the names of shops or addresses, etc). Thirdly, we used the Google images app that allows users to search for images; the results provided us with links to pages with similar images in which the location was often identified.

In total, we were able to locate 4,272 images; this represented 70% of the total number of images linked to specific places that had been uploaded to Instagram by tourists. This figure clearly exceeded the number used in other studies, such as that by Stylianou-Lambert (2012), which analysed 400 photos shared on Flickr and Picasa. For most of the cities, it was possible to locate more than 50% of the images captured. The only exception was La Paz. As this municipality has a long seafront, it was not

possible to clearly identify the precise places whose images had been captured in many of the photos. It should also be noted that during this process, the different places photographed were marked on a map; this was done instead of registering the places from which the photographs were taken. There were fewer than 40 photographs in which there was obviously a significant distance between these two points; such cases typically occurred when photographs were taken from one of the city's viewpoints using a zoom lens. In these cases, the resulting photographs were discarded.

A statistical analysis of the relations between the murder rates in the different cities and tourist images that were mapped showed a close relationship between the two variables (Table 3)

Table 3. Summary Output/Anova

City	Registered homicides	% tourist images
Los Cabos	365	24,52
Acapulco	910	25,24
Natal	1.378	6,38
Tijuana	1.897	5,24
La Paz	259	23,08
Fortaleza	3.270	3,03

SUMMARY OUTPUT	
Regression Statistics	
Multiple R	0,850913
R Square	0,724053

Adjusted R Square	0,655067
Standard Error	661,3658
Observations	6

Annova						
	df	SS	MS	F	Significance F	
Regression	1	4590807	4590807	10,49556	0,031683	
Residual	4	1749619	437404,7			
Total	5	6340426				
	Coefficients	Standard Error	t Stat	P-Value	Lower 95%	Upper 95%
Intercept	2652,185	485,111	5,467172	0,005444	1305,301	3999,069
X Variable 1	-89,5429	27,63939	-3,23969	0,031683	-166,282	-12,8037

As can be seen, R2 had a value of 0.72. This implies a strong and significant relationship between Y and X. More specifically, it implies that 72% of the changes in the number of tourist images posted on Instagram could be explained by the number of murders registered in these cities. Since the p value for this hypothesis is inferior a p = 0,05, the null hypothesis can be rejected.

Data processing

The data were processed using a GIS tool (ArcGIS 10.4.1), in line with the methodology developed by García-Palomares et al. (2015). The study area was therefore defined by applying criteria that enabled data from different cities to be compared. First, a buffer zone reaching 12 km from the centre

of each city was established. However, to prevent an edge effect, work was only carried out in that part of the municipal area that fell within a 10 km radius of the city centre. Maritime areas and, in the case of Tijuana, areas corresponding to the United States were therefore discarded.

For most of the cities, the centre was defined as the spot where the historic city hall was located. The exception was Los Cabos: its capital is San José del Cabo, but the part of the city of greatest interest for tourism is Cabo San Lucas, which is located some 32 km from the capital. In this case, the buffer zone was measured from the headquarters of the "*Coordinación de Servicio Públicos*" (Public Service Coordination) in Cabo San Lucas.

The different data obtained were then aggregated in hexagons, with each side measuring 200 m (figure 1). Hexagon tessellations are often used as sampling units for multiscale spatial analysis (Feick & Robertson, 2015). The urban areas of greatest interest were then obtained; these were areas that either contained local landmarks, commercial centres, and/or recreational zones, or that simply provided a good scenic view of the city (Hu et al., 2015, p. 204).

Data relating to the density of the attractions on the maps was supplemented with descriptive statistics. To be more specific, we calculated the standard distances and spatial distribution patterns (Figure 2). The

standard distance of the photographs enabled us “to measure the degree to which features were concentrated or dispersed around the geometric mean center” (García-Palomares et al., 2015). To identify spatial distribution patterns, the Getis-Ord General G statistic and the Global Moran's I statistic were calculated. The General G index measures the degree of clustering for either high or low values. The Moran's I index simultaneously measures spatial autocorrelation based on both feature locations and feature values. Contiguity by edges was the method employed to define different neighbourhoods.

Results

Intensity

Establishing the locations of the images photographed (Figure 1) made it possible to get an initial idea of how the attractions photographed by tourists were distributed. As can be observed, while the situations differed in each of the cities analysed, the concentration of the photos taken clearly tended to be higher in two areas: the economic and functional centres, and along the seafront. These were practically the only places where photos were taken in the cities of La Paz, Los Cabos and, to a large extent, Acapulco. This was also true for Tijuana, although the seafront and the centre of this city were some 9 km apart. In the cases of Natal and, in

particular, Fortaleza, the dispersion was even greater. Spots including the local football stadium, some parks and several shopping centres were also identified. However, the main concentrations in these cities coincided with the places described.

The spatial concentration of photos became higher when we statistically analysed the results obtained (Table 4). The number of hexagons where tourist images were located was very limited and, in all cases, below 1‰. Fortaleza was the city with the greatest dispersion of images. In contrast, the different images identified in La Paz were located in only 9 different hexagons. A similar spatial distribution was observed for the coefficient of variation (CV). The highest CV values for La Paz and Tijuana indicated a greater concentration of tourist images. The lowest values for Fortaleza and Natal indicated a greater degree of dispersion.

Figure 1. Density of tourist photos

Table 4. Distribution of mapped photos

	Photos	Number of hexagons	Density (photos per hexagon)	Hexagons with photos	Hexagons with photos (‰)	STD	CV	Max
Acapulco	624	1,943	0.32	29	0.15	1.71	10.77	50
Fortaleza	1,400	1,812	0.77	68	0.38	2.72	7.20	42
La Paz	224	2,454	0.09	9	0.04	0.81	17.74	40
Los Cabos	624	1,846	0.34	19	0.10	0.86	13.29	25
Natal	1,384	1,553	0.,89	50	0.32	3.12	7.80	50
Tijuana	332	1,680	0.20	15	0.09	1.61	16.27	56

From the previously mentioned maps and data, we found that the distribution of photo images was clearly concentrated in the most central spaces. These were the most visited spaces and where the sensation of safety was greatest. This relationship between photos and safety increased when we bore in mind the fact that 10 of the 15 most photographed spaces corresponded to enclosed or limited-access venues. When we expanded the sample, 46 of the 100 most photographed spaces fell into this category. There was therefore a clearly important relationship between spaces that were considered safe and secure and those where tourists took photos.

Distance

The standard distance served to identify the degree of dispersion of tourist images in relation to the city centre. This made it possible to identify whether tourism was either concentrated in specific areas of the different

cities or spread across most of their area (Table 5). As can be seen from Map 2, the situation varied from one city to another. La Paz showed a high degree of concentration: approximately two thirds of its tourist attractions could be found within a radius of 780 m. At the other end of the spectrum, Tijuana exhibited the highest values of dispersion, with its tourist attractions spread over a distance of more than 4,000 m. This situation was due to the attraction that tourists feel for visiting the wall separating Mexico from the USA, which stretches into the Pacific Ocean. This tourist attraction was located nearly 9 km from the city's historic centre but it was a place where a large volume of photos were taken.

Table 5. Standard distances (in metres).

	Standard distance
Acapulco	2,646.3
Fortaleza	3,650.2
La Paz	781.7
Los Cabos	1,671.7
Natal	3,133.5
Tijuana	4,459.2

In general terms, the values obtained were clearly different from those presented by García-Palomares et al. (2015, p. 414), whose work established a standard distance for tourist photos whose values ranged from 5,027 m (Rome) to 7,312 m (Athens). The results obtained for all the cities

analysed in our study showed that the spatial concentration of user-generated images was clearly higher. The same would have been applicable in the study of Vancouver by Feick and Robertson (2015). In that case study, it was necessary to draw a radius of 5 km to include 75% of the tourist images captured. For the cities analysed in our study, the concentrations were higher, with around 70% of the photos being located in areas that were just over 3 km from the city centre.

The results obtained for the six cities analysed showed photo location areas that were approximately half as large as those previously identified in European cities. This would seem to indicate different types of tourist behaviour and is something that had already been observed in the maps of photo density. It is perhaps significant to note that the cities analysed were all coastal. However, while the photo concentration at some spots along their seafronts was very high, it was virtually non-existent at others. Since the degree of attraction remained stable, what we observed must have been differential behaviour. This type of behaviour was not, however, found in the case of Barcelona (García-Palomares et al., 2015, p. 414), where the presence of photographs taken along the seafront was quite homogeneous. We therefore seem to have been able to show that in cities with higher murder rates, there tends to be a higher concentration of the spots where

tourists take photos, with many of these tending to be concentrated around certain central spaces which are considered safer than other outlying areas.

Spatial autocorrelation: identifying spatial clusters

We then used the Getis-Ord General G Statistic and Moran's Index to identify global spatial distribution patterns for tourist-generated images. For both indicators, the p-value obtained for the six cities analysed was <0.05. We were consequently able to reject the null hypothesis that the phenomenon analysed was randomly distributed.

The results obtained from the two indicators showed large clusters with a high degree of statistical significance. The Anselin Local Moran's I statistic calculations distinguished High-High Clusters (HH) (statistically significant clusters of high values), Low-Low Clusters (LL) (statistically significant clusters of low values), High-Low Clusters (HL) (outliers in which a high value was surrounded by low values), and Low-High Clusters (LH) (outliers in which a low value was surrounded by high values). As summarised in Table 6, the number of clusters identified was relatively limited, which reinforced the idea of spatial concentration. Of the clusters identified, most were HH; in a few cases they were HL and LH. We did not, however, observe any LL clusters.

Figure 2. Clusters according to the Anselin Local Moran's I statistic

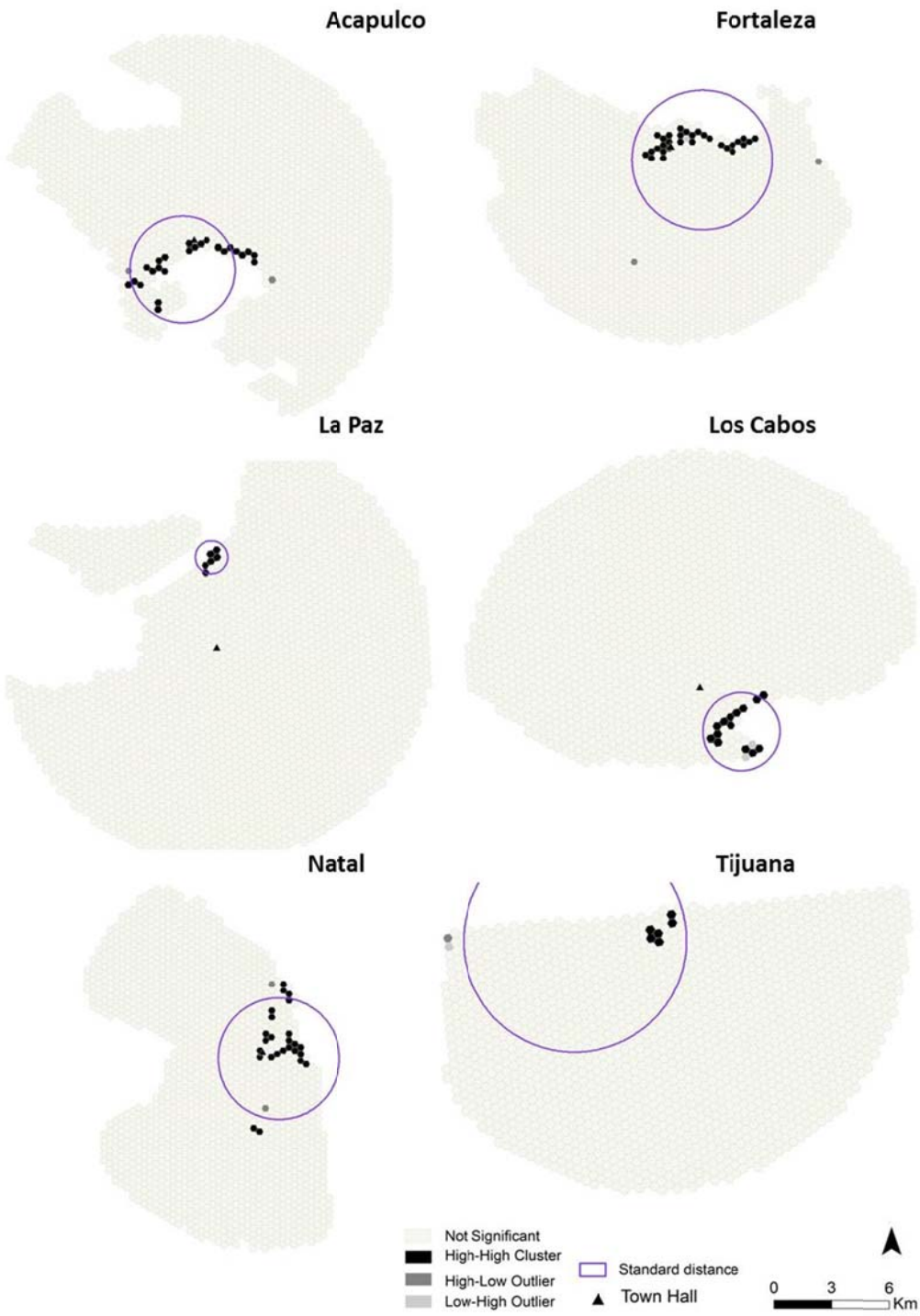

Table 6. Clusters according to the Anselin Local Moran's I statistic (Number of hexagons)

	HH	HL	LH	LL	Not significant
Acapulco	24	2	0	0	1,917
Fortaleza	30	2	1	0	1,779
La Paz	6	0	0	0	2,448
Los Cabos	14	0	2	0	1,830
Natal	25	2	0	0	1,526
Tijuana	6	1	1	0	1,672

In Figure 2, we mapped the results obtained from the Anselin Local Moran's I statistic calculations. A clear concentration of HH clusters was observed in the central areas of these cities. HH clusters usually coincided with the area defined by the standard distance. We only found HH clusters outside this area in Acapulco, Los Cabos and Natal. In the first two cases, these corresponded to seafront areas and were very close to the centres defined by the standard distance. In contrast, Natal was the only city with HH clusters that were relatively far away from the area where most of the tourist attractions are concentrated. They corresponded to an area where several shopping centres were located in close proximity to each another. We therefore once again found a distribution of the main photographed attractions that responded to a logic of spatial concentration around central areas and/or enclosed spaces. In both cases, these spaces were perceived to be safe and secure.

This distribution differed in two ways from that reported by García-Palomares (2015) for European cities. Firstly, we found fewer HH clusters in the cities analysed. Secondly, they were clearly less spatially dispersed. Even in European cases in which concentrations were observed (such as Madrid, Athens and Berlin), the spatial diffusion of the attractions was clearly greater than in the cases observed in this study.

We identified very few LH cases and these were located in zones near those previously described. The cases corresponding to the HL category tended to be seafront spaces. There was a relatively large number of photos for such cases, but these were often taken in areas far away from tourist attractions. These points corresponded to a concentration of hotels and to the casino to the south of Acapulco, to a well-known restaurant (Coco Bambú) and to the airport at Fortaleza, to the Natal stadium, and to the border wall between the USA and Mexico in Tijuana. Again, these were mostly private spaces with private security and could therefore be considered safe and secure. Quite significantly, the only open space we located was a border point, which would obviously have had more security.

This concentration of tourist images did not include some other spots that could have been photographed. We have already mentioned the case of parts of the seafront of various cities. There were also other elements that were not identified despite them being potential subjects for tourist photos

given their characteristics, history or visibility. These included: several historic buildings in Benito Juárez street, in Tijuana; the Igreja do Patrocinio, in Fortaleza; and the Farol de Mãe Luíza, in Natal. The same could also be said of certain parks and natural areas. Those located in city centres tended to be photographed, whereas those located farther away - even though perhaps close to some hotel areas - were not photographed.

We were therefore able to make an analysis of locations where photos were taken by tourists that showed a clear spatial concentration. The only spaces identified that diverged from this general logic of concentration were those with high levels of security. The distribution of photos taken in other urban spaces was extremely limited.

Conclusions

This study has identified certain behavioural typologies associated with the tourists who visit the cities with the highest murder rates. In these cities, it is possible to observe a clear concentration of tourists in historic centres and seafront areas. Outside these zones the location of tourist photos was extremely limited. The highest concentrations of tourists tended to coincide with spaces that offer good levels of security, and – in particular – to shopping centres. This has led us to the conclusion that security is a local determinant that can affect tourist behaviour and, as a consequence, the

photographs that they share of a particular city. This is a finding that complements the existing academic literature. Focusing on the European and North American contexts, existing studies have tended to show a territorial diffusion of tourist images that is clearly much wider and that tends to include multiple spaces within a given city (García-Palomares, et al. 2015).

The question of territorial differences in tourist behaviour based on to the perceived safety of the destination is one seldom mentioned in the literature. Most articles tend to show differences relating to time, tourist buying power and the length of the tourist visit. The approach taken in this work has, however, shown that there are also spatial differences related to levels of safety and security at the destination visited. This factor has a direct impact on the images projected by the different cities. This is a factor that affects considerations such as the management and marketing of these types of destination.

We have observed how areas that have the potential to attract tourists in other cities (certain seafront spaces, monuments and parks) are often not photographed when they are far away from central spaces. The images projected by tourists visiting the cities with the highest murder rates is, therefore, noticeably limited to certain central areas. This hinders the

creation of new images, the mobility of tourists towards outlying areas and/or the strengthening of the urban brand on social networks.

These are all aspects that, in the field of image, would need to be incorporated through new critical studies. Studying different cases would provide grounds for confirming or refuting the trends described in the literature for European and North American cities. We should point out that the present study has enabled us to identify new lines of research still to be developed. Future studies should likewise incorporate possible segmentations amongst those who use social networks. This could be done, for example, based on the provenance of tourists, the times when they take photos, or the activities taking place in the various spaces photographed. This information would help to improve our understanding of the different types of behaviour expressed by tourists. This, in turn, would help to identify other factors that could be key to urban managers, and not just in fields such as tourism, but also in areas related to the whole of the population, such as the management of safety and security, population flows and traffic, etc.

Finally, it is important to note some of the possible limitations of the method employed. Restricted access to Instagram data meant that it was necessary to resort to the manual collection and exploitation of all of the information used. The automatization of these processes would help us to

extend the number of cases analysed. This would also allow us to conduct studies at other scales. It would similarly be of interest to be able to compare the concentration of images with certain other variables which are not currently available, such as the number of visits made to/received by a particular site, the timing of these visits and how much money tourists spend while visiting them. Having this information would help to improve our understanding of the impact of tourism on the city.

This work shows how photos posted on Instagram can help us to identify the spatial behaviour of tourists. The study goes beyond the usual approach of providing a simple representation of the density of photos at certain spots and instead takes a more objective line, based on spatial statistical techniques. This has made it possible to obtain comparable results for cities located in very different contexts.

More specifically, it has been shown that the cities studied, which had some of the highest murder rates in the world, have the potential to expand their respective tourist areas. The presence of clusters in different seafront areas also showed that tourists were interested in discovering new spaces. In this respect, the identification of places that have high concentrations of photos could help urban managers to decide where to invest and develop tourism in the future. Improving the sensation of safety in such areas would almost certainly help to increase the number of tourists

visiting them. This would have a positive impact on the quality of life of their citizens, the use of their public spaces, and the creation of local business; it would also help to changes their city's image.

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