

Do people develop activities at places in which citizens have a sense of place?

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Abstract

The understanding of human behaviour is central in the social and geographical realms. The study of citizens' perceptions towards a place and the geographic area where human activities occur can offer a better comprehension of human nature and behaviour. In this research, we aimed to assess the existence of a potential spatial association between the areas identified with a sense of place by dwellers, and the locations of social media activity, for the specific case of Lisbon, Portugal. We collected information about the spatial sense of place through a web map-based survey and the locations where were registered social media activity on Twitter. Based on the analysis of the results, we identified a schema of spatial clustering and spatial dependence between both phenomena.

Keywords. sense of place, social media data, bivariate point pattern, cross-type K -function

1 Introduction

The surge of social media has opened a new approach for the research of citizens' behaviours and mobility along the city. Concretely, the adoption of location-based social networks (LBSN) by dwellers can act as a proxy for the study of human activities. A citizen is intrinsically a social creature (Toole et al., 2015) with associated social networks (Rutten et al., 2010). Furthermore, each of the places, where citizens develop their daily tasks, are also subject to become a meaningful place to them with emotional connections (Scannell and Gifford, 2017). However, the study of the correlation between concurrent places of human activity and the perceptions of these places by citizens has been not widely explored. The present paper draws on the better comprehension of the relationship between the locations of citizens' activities and the significant places for them from a geographical perspective. Specifically, our main goal is to understand the spatial behaviour and confluence of the two concepts reviewed in this study: the sense of place and human activity. Our research combines two different methodologies. We contrast the locations registered on a dataset of Twitter with the perceptions of sense of place and social capital collected through a map-based web survey (Acedo et al., 2017a) during the same period in the city of Lisbon, Portugal. We expect to find correlations between the areas with a sense of place for citizens and the most common places where people develop their activities.

2 Related work

2.1 Location-based social networks

Social media is conceived as Internet applications which allow creating, obtaining, and exchanging ubiquitous user-generated content (Kaplan and Haenlein, 2010) about events and facts that occur in the real world (Ferrari et al., 2011). Thus, social media data reflects human behaviour, prompting new alternatives to understand individuals, groups, and society (Batrinsa and Treleaven, 2014). LBSN can be a crucial tool in understanding city social processes due to its crowd-data nature and continuous use (Frias-Martinez et al., 2012; Silva et al., 2013).

LBSN data has been used, for instance, in urban planning (Frias-Martinez et al., 2012; Wakamiya et al., 2011; Zheng et al., 2014), modelling urban dynamics and human activity (Celikten et al., 2017; Franc a et al., 2015), extracting urban patterns (Ferrari et al., 2011), and discovering places (Ostermann et al., 2015). Also, Jenkins et al. (2016) studied ways to relate user-generated content (e.g. social media feeds and Wikipedia contributions) with the shared meaning of place. The authors observed the emergence of unique thematic social media feeds that characterize different locations and, simultaneously, the sense that people assign to specific spaces.

2.2 Sense of place

The sense of place notion has been intensely studied in the last 40 years. It reflects human experiences, emotions, thoughts (Stedman, 2003), and meanings, values, and feelings associated with a place (Chapin and Knapp, 2015). Jorgensen and Stedman (2001) define the sense of place as the cognitive, affective and behavioural dimensions of the relationship that an individual has towards a specific geographical area. Human activities that imply movement within the city have been questioned as an enhanced or diminished of the attachment towards a particular area (Lewicka, 2013). However, place maintains its importance in a globalised world, and it is an object of intense affection (Lewicka, 2011). Citizens are moving in the city because of combining periodic movements (geographically limited) and some others related to their social networks (Cho et al., 2011). Therefore, it is relevant to gather the subjective components of the human–environment relationship, such as the sense of place, as well as where human activities are happening since both are potential inhibitors to endow meaning to spaces and singularise them into personal and unique places (Acedo et al., 2017b).

3 Methodology

3.1 Data collection

Two parts compose the data collection: (1) gathering of geolocated tweets and (2) collection of sense of place of Lisbon citizens. We run both procedures in the same period; between June 12th and July 2nd, 2017. The citizens who answered the questionnaire are not necessarily the same people whose tweets were gathered for this study. It is certain that all participants of the map–based survey are living in Lisbon. Hence, we are gathering a global sense of place composed of Lisbon citizens. However, the users who created the geo–tweets are not necessarily city inhabitants.

3.1.1 Social media data

We use the `tweet2r` (Arag and Juan., 2016) package from R software to obtain geolocated tweets through a connection to a Twitter API from the Lisbon metropolitan area. The process produced files in GeoJSON format which we transformed into a table with the location (longitude and latitude) of each tweet. The analysis of the information ruled out the events registered outside of the boundary of the city.

3.1.2 Map–based web survey

The data to spatially study the sense of place was collected by applying a map–based web survey application (Acedo et al., 2017a). The survey was sent to the Lisbon participatory budgeting database. 373 Lisbon citizens replied to the questionnaire. Participants were invited to define the geographic dimension of their sense of place areas (based on Jorgensen and Stedman (2001) conceptualization of sense of place) on a base map using a set of spatial tools. Each participant could specify more than one geographical area of sense of place. We used QGIS geometry tools for obtaining

the centroids of each area and build a spatial database with those locations. The reason to extract the centroid from the sense of place areas is the suitability of this shape to compare with the twitter geolocated data.

3.2 Data analysis

We conduct an observational study due to two main reasons. First, Twitter streaming API gives a small portion of all generated tweets and besides only a part of them are geolocated. Second, the web–map survey was a voluntary participation process where we invited many dwellers to answer the questionnaire without conducting a probabilistic sampling technique.

Our strategy of analysis considers locations of social media activity and centroids of the sense of place as a pair of spatial point patterns (Diggle, 2013). We evaluate the null hypothesis that states both types of locations are independent spatial point processes (Baddeley et al., 2015). Initially, we determine the intensity functions through the kernel density estimation (Baddeley et al., 2015; Diggle, 2013; Batty et al., 2012) utilising Scott’s criterion to select the bandwidth (Scott, 2015). We study the univariate spatial distribution of each pattern with Ripley’s K function and judge the hypothesis of complete spatial randomness (CSR) with Monte Carlo simulations. Finally, we use the cross–type K –function for testing our supposition of spatial interaction of the patterns (Baddeley et al., 2015; Diggle, 2013; Illian et al., 2008). We finally compare the percentage of both type of events in green recreational places and city point of interests (see Table 1) using spatial analysis tools.

4 Results and Discussion

We collect 8987 tweets located within Lisbon, none of them correspond to a retweet, of which 1633 belong to a unique position (non–repeated). From the web–map survey, we obtain 237 participants who define 520 geometries of the sense of place. Figure 1 shows the map with the distribution of these events along the city. We get 1.93×10^{-5} tweets and 6.13×10^{-6} centroids of sense of place per square metre, respectively. This latter means that geolocated tweets are denser than centroids of sense of place. We add over the maps with letters, from A to G, relevant areas of the city (see Table 1) with aiming to facilitate analysis and discussion of results.

Table 1: Studied zones in Lisbon, Portugal

Key	Region
A	City centre
B	Belém
C	Exposition centre (Expo’98)
D	Airport
E	Stadiums
F	Castel
G	Bairro alto

We apply Scott’s method that returns values of 624m and 823m for both bandwidths; the geolocated tweets and the sense of place centroids, respectively. We use kernel quartic and the previous values to estimate the spatial intensity.

Figure 2 presents the map of both spatial kernel smoothing estimates after standardising to a common grey-scale 0 (black) to 1 (white) (Diggle, 2013), both kinds of events are clustered and coincident in some places in the city. However, the schema of clustering is different, locations where social media activity occurs are concentrated in three areas: Belém, City Centre, and Expo'98 area, while sense of place comprises more parts of the city.

Figure 1: Locations of events

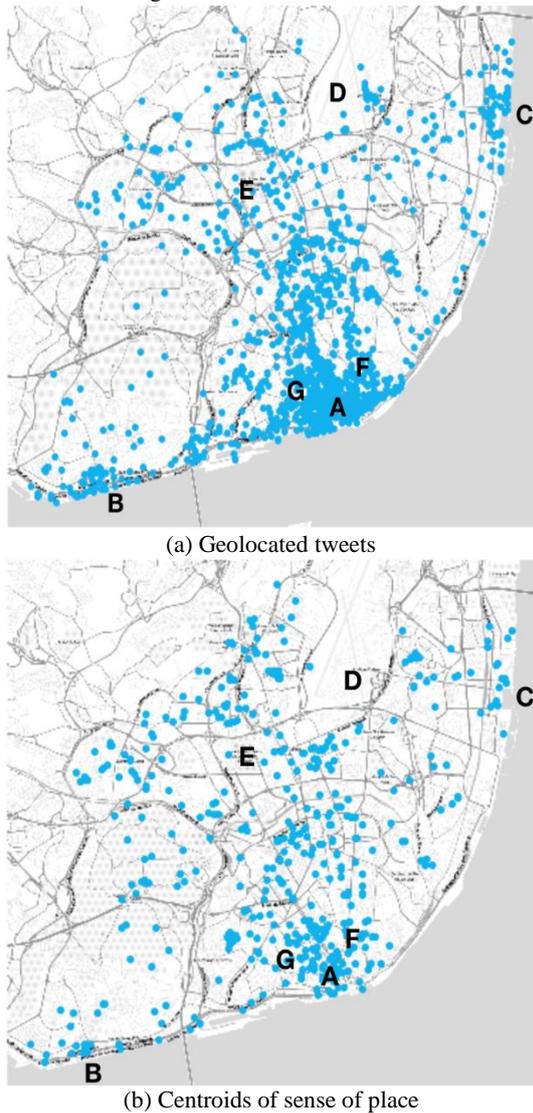


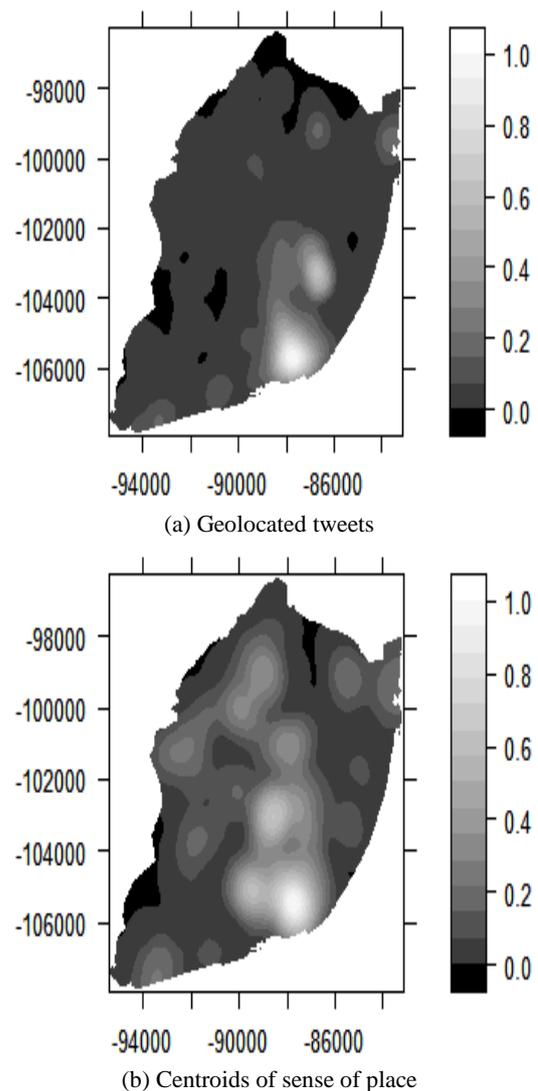
Figure 3 shows the plots of Ripley's K function of each pattern, and we do 199 Monte Carlo simulations to build the envelopes for judging the null hypothesis of CSR. We identify that both series of events exhibit spatial clustering in all scales.

We perform the cross-type K function and simulate 199 bivariate point patterns (see Figure 4) for testing the hypothesis of non-spatial interaction. The results show that the empirical estimation of the function (black line) for all distances is over the region defined by the envelopes, this

means that there is a schema of spatial aggregation in both types of events in all scales.

Finally, we also make a comparison between the percentage of each type of cases (geolocated tweets and sense of place centroids) in some general and specific kind of areas (see Figure 5). After the study of both cases, we find that only the 5.51% of tweets analysed are inside gardens, parks, or some green spaces. On the other hand, almost a third of the sense of place examined is within those kinds of areas. If we focus on examples of functional, recreational and emblematic places to study the behaviour of the tweets and sense of place distribution across the city of Lisbon.

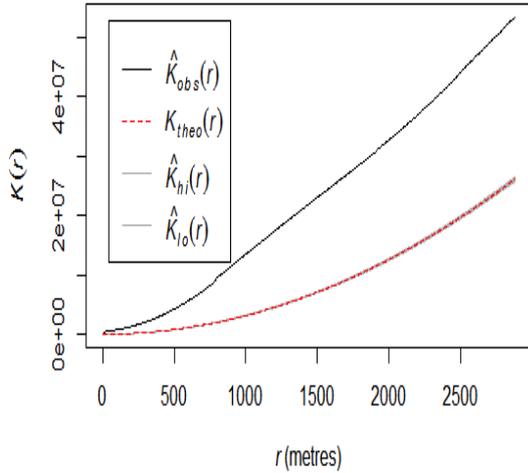
Figure 2: Intensity functions of the two events



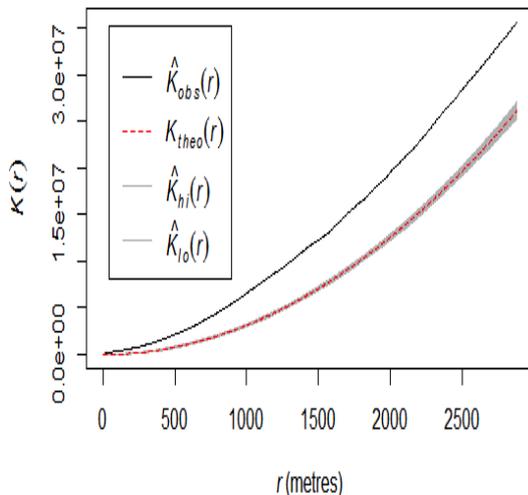
The airport holds a few areas of sense of place since, as a transport infrastructure, this space is more related with transport activities than, it seems, to be significant a place for Lisbon's citizens. As it was expected, the city centre comprehends a considerable amount of both sense of place geometries and geolocated tweets. Two emblematic zones

such as Belém area and Expo’98 area follow similar behaviour with, approximately, the same attachment and human activity. Surprisingly, castle zones and football stadiums hold neither intense human activity nor a citizen’s sense of place. This can be related to the no occurrence of a football game or castle-related event during the days of the experiment.

Figure 3: Ripley’s K function for the two events



(a) Geolocated tweets



(b) Centroids of sense of place

5 Conclusions

The results show that recreational places such as parks, gardens or forests are tightly connected with the sense of place of Lisbon citizens. Furthermore, for specific locations mixing residential, green zones, and important city landmarks (city centre, Belém and Expo’98) the quantity of citizens’ attachment and people activities are similar.

We conclude that there are coincidences between the places of attachment of citizens and the sites where people perform their social media activities, e.g., Twitter. Although, the sense of place by the inhabitants has a broader range of spatial

variation, i.e. covers a larger area along the city than the gathered social media activity. The analysis performed in this study allows us to consider the existence of spatial dependence between both phenomena; those locations where people do their activities correspond to places with the sense of place for citizens. This association can be crucial in urban participatory and planning processes for two reasons. First, social media data becomes a proxy for defining the sense of place spatial dimension with the characteristic that it is faster and cheaper than conventionally survey sample techniques. Second, our approach denotes a good performance for monitoring possible spatial conflicts related to the increase of the space use. Therefore, a comparison between two different sources for two distinct concepts (human activity and sense of place) provides an approach to detect those locations of most activity and attachment for the citizenship. Future work can be in line with (1) considering the whole spatial dimension of sense of place areas instead of their centroid to approach a more extensive comprehension of individual-spatial context in comparison with human activities and, (2) to perform a text mining over the content of geolocated tweets.

Figure 4: Cross-type Ripley’s K function

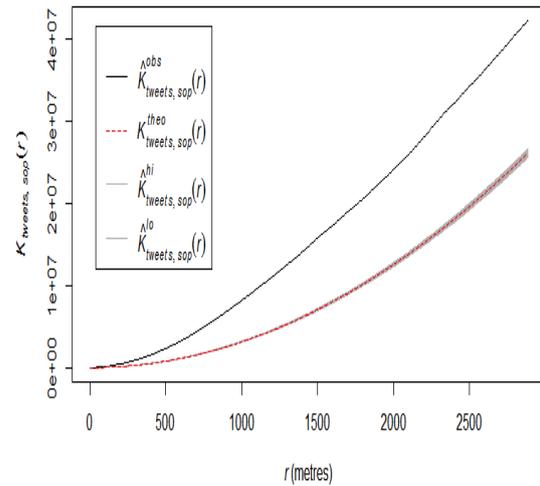
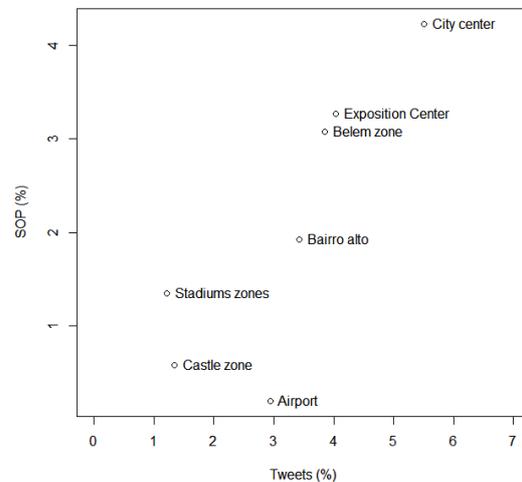


Figure 5: Relation between sense of place centroids and geolocated tweets



Acknowledgement

“The authors gratefully acknowledge funding from the European Union through the GEO-C project (H2020-MSCA-ITN-2014, Grant Agreement Number 642332, <http://www.geo-c.eu/>) and the collaboration with the Câmara Municipal de Lisboa in facilitating the application of the on-line survey.”

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