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Using Big Data to discover how the maturity of a heritage destination influences the use and attractiveness of urban cultural landscape. A case study of Antwerp, Bolzano and Kraków

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Abstract

Big data analysis, especially of user generated data, is an innovative data collection method in tourism research. This paper attempts to explain how analysis of user generated content helps to map and understand cultural landscapes in a destination. Using data obtained from TripAdvisor a two-step analysis is conducted in order to map spatial behavior of reviewers at the destination and to use review behavior patterns to understand the shaping of the cultural landscape. Three case studies in which the urban cultural landscape is both a primary tourist attraction as well as an important part of local identity are compared, namely Antwerp (Belgium), Bolzano (Italy) and Kraków (Poland) and each of these destinations can be positioned at a different maturity level when applying the tourist area life cycle model by Butler. The results of the hot spot analysis show that there exists a correlation between the maturity of the destination and the review behavior, both in intensity as in perception of quality of services. An intensive use of a relatively small part of the historic center of a heritage destination and in this zone the presence of a cluster of facilities offering low service quality was found to indicate a mature destination and can be distinguished by applying geographical Big Data analysis on review behavior. Finally, this paper explains how user generated content can be used in mapping spatial behavior of tourists in urban cultural landscapes and what the limitations to such studies are.

Keywords: *tourism area life cycle model, big data, heritage tourism, space production, hotspot analysis*

1. Introduction

With the rapid global expansion of tourism, pressure on a large number of tourism destinations is rising. Tourism pressure on natural areas has been documented extensively since the last decade (Buckley & Pannell, 1990)(Butler, 1980) but also more often urban tourism destinations are facing challenges due to the growing numbers of tourists and expansion of the tourism industry (Russo, 2002). With the example of Venice as a dystopian destination of a development trajectory with a dominant focus on tourism, local inhabitants of popular heritage tourism destinations, policymakers and academics are starting to look into the effects tourism can have on the cultural landscape of these destinations.

The interplay between the shaping and reshaping of cultural landscapes and tourism pressure is an upcoming field of research. For local communities, cultural landscapes bear importance as they are the places of memory (Cunningham, 2009; Waterton, 2005) and sources of identity, belonging and sense of place (Sampson, Goodrich, 2009) which can result in place-protective behaviors (Stedman, 2002). Tourists, on the contrary, see landscapes as providers of tourist attractions, hence reasons to travel and consequently, as sites of escape, leisure and relaxation (McKercher, 2005). The cultural landscape in this sense is the 'commons', a resources shared by everyone but with an unregulated usage which is sensitive to overexploitation (Healy, 1994). Since tourists and local communities both shape cultural landscapes, pressure from expanding tourism can be seen as a vital element to understand the development of cultural landscapes.

Based on previous work on the tourism area life cycle model by Butler (1980) and carrying capacity of urban heritage tourism destinations by van der Borg et al. (1996), Russo (2002) sketches the relationship between tourism pressure and the decline of the quality of the cultural landscape in heritage destinations as a 'vicious circle'. This vicious development shows how expanding tourism pressure shapes and affects the cultural landscape, a problem a growing number of destinations is currently facing (de Noronha Vaz et al., 2012; Neuts & Nijkamp, 2012; Popp, 2012). Until now, research providing tools which can assess the position of a destination on Butler's curve, or in the vicious circle based on the shaping and reshaping of the cultural landscape by tourism pressure is lacking.

Technological advancements created new approaches to study and understand space and tourism (Buhalis, 2000). Particularly the introduction of the internet and the emergence of Web 2.0, which allow the users to create their own content, provide means to study the representation of space contributing to the reproduction of space as well as (re)creation of space perceptions. The most used Web 2.0 platform related to travel and tourism is currently TripAdvisor.com. TripAdvisor provides user generated content (UGC) by tourist

and locals and provides its users with qualitative (descriptions of experiences by reviewers) and quantitative (average amount of reviews and score) feedback on destinations, hotels, attractions or other services like tours or restaurants (Shegg et al., 2008).

Recent developments in Geographical Information Science (GIS) have opened the opportunity to identify spatial clusters of tourism sites and services and determine (tourism) hotspots based on quantitative information like number of reviews or average score (Getis & Ord, 1992; Ord & Getis, 1995; Peeters et al., 2015; De Valck et al., 2016). These hotspots of online representation of sites and services in a destination can help to map the use of space in a destination and via this serve as a proxy to describe the shaping and reshaping of cultural landscape by tourism activities. The interplay between perceived, physical and digital space is a combination which has not been studied before extensively but can significantly contribute to knowledge about the shaping and reshaping of cultural landscapes. The aim of this paper is therefore to (1) understand the relationship between spatial location of reviewed features and online review behavior in three selected destinations, Antwerp (Belgium), Kraków (Poland) and Bolzano (Italy) and (2) to see how this information helps us to map and understand the cultural landscape in the destination.

2. Literature review

2.1 Production of cultural landscape and maturity of destination

Current literature on landscape presents a spectrum of approaches to this concept, which vary from nature-based perspectives to perspectives treating landscape as uniquely a social construct (Stoffelen & Vanneste, 2015). This paper applies a social constructivism perspective on landscape. In the social constructivist approach, (cultural) landscape is understood as a container concept which refers to material and social practices and is perceived as a symbolic space which is the expression of 'cultural values, social behavior and individual actions' (Zukin, 1993, p 27).

Tourism is known to be a strong engine behind the production of space and shaping of landscapes (Healy, 1994; Ateljevic, 2000). The social construction of place through tourism is characterized by high levels of commodification for leisure purposes (Britton, 1991). According to Young (1999), such social construction of places consists of two sub-systems: (1) the production of place by the industry and (2) the tourists' consumption of place. The first sub-system focuses on place promotion and production and its main goal is to create place meanings which will be communicated to tourists and hence, will influence their spatial behavior at the destination. The second sub-system is that of place consumption by tourists who consume the presented place meanings in the context of their previous experiences, knowledge, preferences, travel history, country of origin etc. Psychological

research in tourism suggests that such personal characteristics much more influence tourists place meanings than an on-site experience (Pearce, 2005; Young, 1999; Fenton et al. 1998). Nevertheless, the relation between two sub-systems is cyclical as the tourists with their personal preferences and place meanings create demand for the specific tourism product/facilities, hence co-creating and reshaping cultural landscapes (Binkhorst & den Dekker, 2009; Ek et al., 2008).

In the majority of urban areas, tourism attractions and tourist behavior are more likely to be concentrated rather than spread out (Hayllar & Edwards, 2010). This can be explained by the nature of tourism in which spatial proximity has an important effect on behavior. The structure of tourism destinations, and associated tourism behavior is characterized by the prominent position of major tourist attractions or products surrounded by a system of ancillary services and facilities such as restaurants, bars, souvenirs shops etc. (Jansen-Verbeke, 1998). As a consequence, tourists but also local residents tend to cluster in these areas, which are in many cases historic city centers.

The relationship between tourism products, ancillary facilities, their quality and presence of tourists/locals is however not entirely straightforward and it depends on the level of maturity of destination. Butler's (1980) tourist area life cycle (TALC) model presents an evolution of tourism destinations in terms of number of arrivals as well as changes in the local milieu. The purpose of the model is to claim that destinations, like products, develop according to a life cycle which moves along certain stages and ultimately, could lose its attraction as a tourist destination (McKercher, 2005). Butler identified 7 stages which make up the destination life cycle, namely: exploration, involvement, development, consolidation, stagnation and either decline or rejuvenation (for more explanation see: (Butler, 1980)). The approach by Butler is based upon the assumption that 'tourism changes tourism', which is visible throughout the stages of the life cycle model (McKercher, 2005). Over time, according to Butler, natural and cultural attractions become commodified, new, often foreign actors emerge, investments in built environment and nature and scale of tourism change which affects local communities and the tourism product quality. In the final stages of the cycle, the carrying capacity of a destination is reached or even exceeded which in urban areas is mainly a psychological and social concept rather than an ecological one (McKercher, 2008).

According to Russo (2002) building on the TALC model, shows the relationship between the maturity of a destination, processes of tourism development and tourist behavior and depicts this mutual dependence as a vicious circle of tourism development, which is especially visible in urban heritage destinations. The idea of this approach stems from the incapability of the heritage city to accommodate the growing tourism demand within the boundaries of the historic city, which leads to rising prices and eventually to tourism

infrastructure and facilities as hotels, but also local residents, moving outside the historic districts. The same applies for different types of tourists as low quality of services, high prices and congestion encourages them to seek alternatives outside of historical districts (Russo, 2002).

2.2 Web 2.0 and its effect on consumer behavior

A new generation of internet applications has given an opportunity to its users to express and share ideas and reviews to the entire community of users. This phenomenon, called Web 2.0, is a second generation of Web–based services, namely social networking sites, communication tools, wikis and folksonomies that emphasize UGC (O'Reilly, 2005). Web 2.0 has affected tourism, tourist behavior, tourism entrepreneurship and destination management. This trend, called Travel 2.0, involves travel plans, destination and hotel reviews, tourist guides, suggestions for restaurants or exhibitions etc. (Miguens et al., 2008). Travel 2.0 has influenced the way individuals create, share and use information about a destination and it has enabled tourists to share their experiences.

A significant amount of data on customer experience, behavior and opinions is stored on Web 2.0 websites. With Big Data analysis on publicly available TripAdvisor reviews it is possible to increase the knowledge of a destination based on behavior of tourists and locals.

3. Methodology

Two different approaches of the same methodology have been used to analyze three different destinations (Antwerp, Belgium - Bolzano, Italy - Kraków, Poland) to understand if UGC data from TripAdvisor can show and explain the maturity of a heritage destination related to spatial patterns in the intensity of use of the destination and the quality of tourism facilities. The choice of the destinations to analyze has been made considering diversity in terms of size, type of tourism, supposed lifecycle stage and its popularity on TripAdvisor (Bolzano: small city - cultural mountain destination - developing - approximately 34.000 reviews; Antwerp: medium size city - cultural destination – mature/stagnation - approximately 83.000 reviews ; Kraków: big city - UNESCO Heritage city - consolidation - approximately 238.000 reviews).

3.1 Data Acquisition

The database that has been used is assembled by UGC data from the TripAdvisor website and contains number of reviews and average score for every service categorized by TripAdvisor as the type 'restaurants' (Restaurants, Dessert, Coffee & Tea, Bakeries, Bars & Pubs). The data was collected between January and February 2016.

3.2 Spatial autocorrelation and hot spot analysis

In this study, the question is posed whether there is a relationship between the spatial location of features in the destination (tourist facilities) and attributes (online review behavior), and whether this information can be used to map and understand the cultural landscape in the destination. The spatial relation between features based on a certain attribute can be determined by calculating the level of spatial autocorrelation. Spatial autocorrelation tests the hypothesis that a feature and associated attribute are randomly distributed in space. If this is not the case, a certain level of clustering of features in the destination, based on number of reviews or average score, is present.

In this study, Incremental Spatial Autocorrelation was possible to determine the scale of analysis in all three case study areas. The output of the hot spot analysis can be explored and interpreted visually, as its output shows which input features deviate from the expected random distribution and form clusters of high (hot spot) or low (cold hot spot) attribute values. For an example of application of this methodology see (Mitchell, 2005).

4. Findings

Hot spot analysis shows the presence of spatial clusters based on a given attribute in the study area. In this study, hot spot analysis was applied for two attributes in the three study areas. The first hot spot analysis uncovers the intensity and scope of the use of the cultural landscape in the destination by looking for spatial autocorrelation between the location of facilities and their number of reviews. The second hot spot analysis enquires whether there is a relationship between the location of the facility and its average score given by reviewers.

4.1 Hotspot analysis of intensity of use of space in tourist destinations

The first analysis looks at the general use of space in the destination, and therefore applies an optimized hotspot analysis based on the aggregation of facilities using a fishnet polygon, and comparing the intensity of reviewing in each polygon cell with its neighboring cells. This process resulted in significant spatial clusters, both hot spots and cold spots, in all three case studies (figure 1). A hot spot indicates an area in which on average facilities are reviewed significantly more than facilities in other areas. Therefore the hot or cold spots of intensity of use are indicated by a colored zone in figure 1.

In all three case study areas significant clusters are present. However, the three case studies show different patterns of review intensity. Antwerp has a small and dense hotspot area in the city centre, where the main cultural attractions of the city are located: the Cathedral and

the main square (Grote Markt). It is relevant to underline that the city centre is surrounded by neutral, i.e. non-significant areas and there are no cold spots in the city. In other words, outside the main hot spot, there is no relationship between location and number of reviews. Interestingly, facilities surrounding popular sights and attractions outside the historic city (e.g. the MAS museum and central station, the most reviewed sights on TripAdvisor) are not considered hot spots, and attract a number of reviews which is not deviant of the amount one would expect when they would be randomly distributed over space. The historic centre of Antwerp is the most intensely used space in the city (average 56.20 on average, see table 1) indicating tourists and residents use the services located in this area more often than services in other locations in the city (39.45 reviews on average). Visual exploration of the hotspot, its location and size indicates that area has a limited size, concentrated noticeably close to the main historical heritage sights of the destination.

Bolzano represents a different pattern. The entire city centre, with the main square, museums and the main shopping streets, can be considered a hot spot and is used more intensely than other areas (69.81 reviews on average). A clear centre-periphery distribution can be found starting as a hotspot at the historic city centre, losing strength towards the fringe of the city centre turning into neutral just outside the city centre and turning into a cold spot (30.72 reviews in average) as distance to the city centre increases. A clear relation can be seen between location and intensity of reviews. Nevertheless, the relative size of the hot spot compared to the rest of the destination, which is bigger than the relative size of the hot spot in Antwerp even if Bolzano is smaller than Antwerp, shows there is less concentration in Bolzano. However, the significant difference between the number of reviews in the hot spot and cold spot indicate the relative popularity of the historic city centre.

Kraków has an extensive hotspot area which encompasses the UNESCO Heritage site of the Old Town as well as the Jewish district. The most visited area (89.33 reviews on average) is much more spread out than in the other two cities with a high number of frequently visited places. In the direct proximity of the hot spot, there are several cold spots, in the north and south, much less visited by the tourists and/or local residents (32.09 reviews on average). The majority of the facilities in Kraków are located within the hot spot area.

Table1: Hotspot analysis from number of reviews

Destination		Average n. of reviews	(Standard deviation)	Average score	(Standard deviation)	Number of facilities
Antwerp	hot spot	56.20	(84.66)	3.97	(0.6308)	289
	neutral	39.45	(54.88)	4.00	(0.5978)	624
	cold spot	--	--	--	--	--
	total	44.75	--	3.99	--	913
Bolzano	hot spot	69.81	(116.90)	3.82	(0.6180)	162
	neutral	24.21	(37.92)	3.95	(0.5024)	48
	cold spot	30.72	(57.92)	3.78	(0.6582)	54
	total	53.52	--	3.83	--	264
Kraków	hot spot	89.33	(187.56)	4.21	(0.5480)	838
	neutral	11.54	(15.08)	4.13	(0.6545)	112
	cold spot	32.09	(87.18)	4.27	(0.6245)	91
	total	75.73	--	4.21	--	1041

4.2 Hotspot analysis of quality of individual facilities

The second hot spot analysis investigates whether the average score reviewers assign to a facility is correlated with its location in the destination, i.e., whether there are clusters of facilities which are rated lower or higher than would be expected considering the rating of facilities around them. Table 1 shows on average, facilities located in hot spots do not have a significantly different average score compared to locations outside hot spots. Different from the optimized hotspot analysis, the second analysis does not calculate the neighborhood of each facility by applying a binary threshold distance based on Incremental Spatial Autocorrelation. Instead, a function based on distance decay is applied. This means that the score of the facility is compared to the score of neighboring facilities in which closer neighbors are assigned a higher weight than neighbors further away.
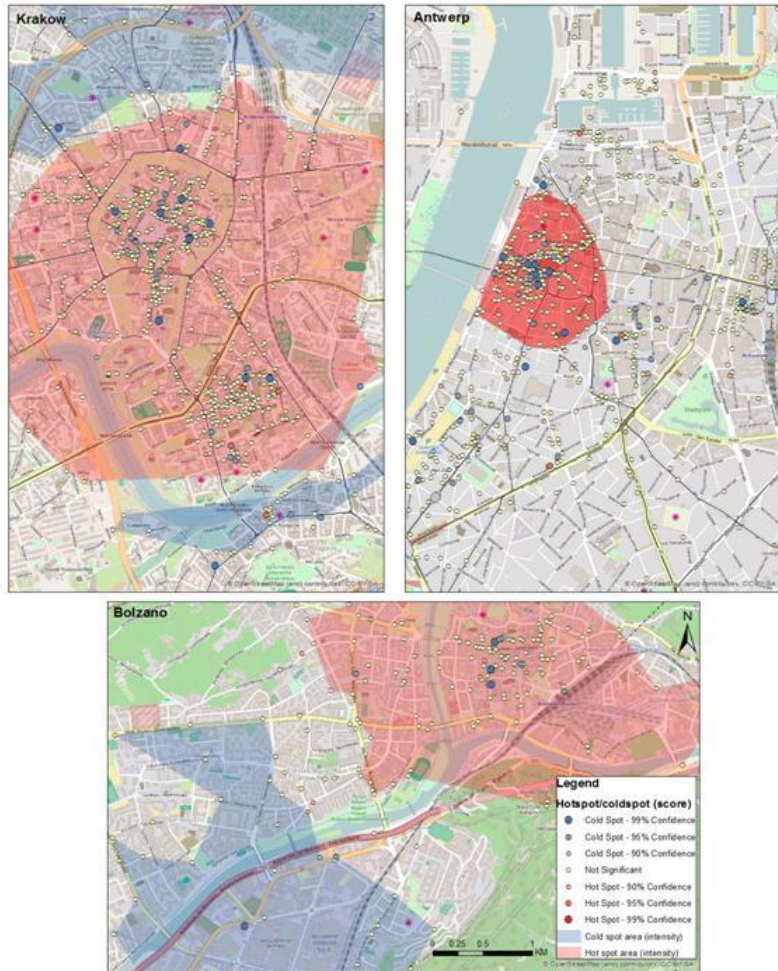
Figure 1: Mapping of the use of cultural landscapes by applying hot spot analysis

In all three destinations cold spots are more prominently available than hot spots. While on average the assigned average scores of facilities are very high (see table 2), some pockets where significantly lower scores are present can be identified. Visual analysis of the location of these cold spots shows that in two of the case studies (Antwerp and Kraków) spatial clustering is present inside the intensity-of-use hotspot (figure 1). The most intensely reviewed areas by tourists and local residents also boasts a cluster of facilities with a lower perceived quality level. In all three cases, cold spots get a significantly lower average score

rate but are also less frequently reviewed compared to all other places, while hot spots follow the same but reversed trend, meaning that average number of score rate is higher but the average number of reviews is lower, indicating the presence of 'hidden gems' or 'rising stars'.

As shown by figure 1, the three analyzed destinations present different patterns in terms of quality of facilities comparing to the other facilities of the destination. Antwerp presents a concentration of two cold spot areas (8.76% of the total facilities): one in the city centre close to the main sights of the destination and the other close to the railway station. This shows that the facilities situated in those area are perceived as bad quality service providers (average of 2.82 on a 5-point scale) compared with the hotspots (good quality perceived - 4.93 on a 5-point scale) or neutral facilities. Even while the cold spots have a low perceived quality of services they are still visited quite frequently (average of the reviews 31.53) compared to the hotspots (only 16.50 on average). This is caused probably because cold spot facilities are situated in the city centre and close to a big mobility hub, which are the most visited places in the destination as also shown by the intensity-of-use analysis.

In Bolzano a different distribution of hot and cold spots can be found which does not permit to identify a specific pattern in the city. The city centre where most of the facilities are located does not show a visually present cluster of cold spots. It is also possible to underline the same trend of the other cities that showed that for bad perceived quality of the places (cold spots are 5.68% of the total facilities with a score rate of 2.53 on a 5-point scale) is corresponding a moderate number of reviews (38.60 on average) in comparison to hotspots of good perceived quality (score rate of 4.95 on a 5-point scale) with a low number of reviews (4.95 on average).

Kraków shows a concentration of places with a low perceived quality as the majority of cold spots can be found in the UNESCO area close to the Main Market Square contrasting the Jewish district where the majority of facilities are neutral. A more dispersed pattern of the distribution of hot spots can be found. The average score for cold spots (7.19% of the total of the facilities) is 3.27, but despite the low amount of reviews, the cold spots are three times more often reviewed than hot spots (33.42 vs. 11.56 in terms of average number of reviews). In all three destinations, for the majority of facilities there is no relationship between location and average score.

Table 2: Hotspot analysis from score rates

Destination		Average n. of reviews	Standard deviation	Average score	Standard deviation	Number of places
Antwerp	hot spot	16.50	33.74	4.93	0.1734	50
	neutral	47.99	70.42	4.054	0.4438	779
	cold spot	31.53	31.27	2.82	0.5146	84
	total	44.75	--	3.99	--	913
Bolzano	hotspot	4.5	5.13	4.95	0.1381	12
	neutral	56.94	102.76	3.85	0.4755	237
	cold spot	38.60	50.67	2.53	0.4988	15
	total	53.52	--	3.83	--	264
Kraków	hotspot	11.56	12.83	4.81	0.2420	16
	neutral	80.29	178.84	4.31	0.4068	952
	cold spot	33.42	66.76	3.27	0.7098	75
	total	75.73	--	4.21	--	1043

5. Discussion

The two step data analysis allowed to identify patterns of tourists behavior at the destination in terms of their spatial distribution as well as their perception of quality of tourism facilities in the presented three case studies. The findings of the hot spot analysis by the intensity of use of space revealed different levels of destination maturity, while the individual analysis of perceived quality of tourism facilities allowed to uncover detailed clusters of cold spots of service quality. It turned out that there exists a link between maturity of destination and the perceived quality of services. Bolzano, the city in the earliest stage of tourism development among the selected case studies, in terms of number

of reviews presents a gradual decrease from the city center to the suburbs, nevertheless little correlation is observed regarding the quality of services with only few cold spots in the city center.

Kraków, which can be positioned on the Butler's curve in the consolidation stage, has an equal dispersion of the number of reviews with the strong tourist presence in the Old Town and Jewish district, its two main tourist attractions. However, certain decay of perceived quality can be seen within UNESCO Heritage Zone (Old Town) with a relatively high amount of cold spots located around Main Market Square, which is as one of the main tourist attractions. Certainly, much less cold spots are visible in the Jewish District which is still known much more as a local place rather than a tourist one.

Finally, Antwerp can be positioned on Butler's curve in one of the last stages, most likely the stagnation stage which is characterized by a strong concentration of tourist presence in a very small territory around the Grote Markt and Cathedral. The quality of services in this area is relatively low with a high number of cold spots.

Therefore, the findings confirm Russo's thesis about the relationship between spatial organization of tourism (hence, tourists distribution as well) and quality of services can be confirmed. A high level of touristification of the historical center of Antwerp can be found, and Kraków risks joining this stage as well. It is clearly visible that in case of these two cities, the historical districts bear the consequences and costs of tourists presence as their cultural landscape is highly commodified and quality of a share of the offered services is relatively low. One of the implication of Russo's (2002) model is a sustainable management of heritage cities and continuous 'adjustment' of tourism policies. Bolzano, the smallest of the three cities where tourism development is still in an early stage, can definitely learn on the basis of the examples of Antwerp and Kraków and implement pro-active management of its cultural landscape in order to maintain its good quality, even with increased number of visitors.

6. Conclusion

This study, following this claim, has applied an innovative approach to analyze cultural landscapes via traces left behind on Travel 2.0 platforms (in this case TripAdvisor) in order to better understand spatial behavior of tourists in the destination and its relation with the quality of cultural landscape. The results show that there are patterns indicating that the more mature the destination, the more spatially concentrated tourism behavior will be and the quality of offered services in the midst of this concentration declines. This conclusion has been drawn on the basis of the prominent presence of several cold spots in more

matured destinations such as Kraków and Antwerp and lower amount of them in an emerging destination, Bolzano.

This study underlines the potential value of hot spot analysis by using big data from UGC containing different kinds of information which is suitable for better understanding of destination dynamics.

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