SLEDENJE PROSTORSKO-ČASOVNE DINAMIKE V KONTEKSTU URBANE REGENERACIJE JAVNIH PROSTOROV Z UPORABO GEOLOCIRANIH OBJAV IZ SOCIALNIH OMREŽIJ

TRACKING SPATIOTEMPORAL DYNAMICS OF THE CULTURE-LED PUBLIC SPACE REGENERATION USING GEOLOCATED SOCIAL MEDIA POSTS

Kaja Pogačar, Andrej Žižek

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IZVLEČEK

V prispevku je predstavljena alternativna metoda za sledenje prostorsko-časovne dinamike socialnih interakcij v kontekstu procesov urbane regeneracije javnega prostora evropskih prestolnic kulture. Analizirani so javno dostopni geolocirani podatki z družbenih omrežij Instagram in Flickr, za kateri je značilno spletno objavljanje fotografij. Količina objav na družbenih omrežjih v nekem časovnem obdobju je proksikazalnik za prepoznavanje in retrospektivno analizo privlačnosti ter analizo prostorsko-časovne dinamike socialnih interakcij v javnih prostorih. Na podlagi pridobljenih podatkov sta predstavljena dva primera regeneriranih javnih prostorov iz dveh evropskih prestolnic kulture, in sicer območje DEPO2015 v mestu Plzen (CZ) ter DOKK1 urbano nabrežje v mestu Aarhus (DK). Rezultati kažejo, da lahko podatki s platforme Flickr, ki omogoča dostop do natančne geolokacije objavljenih fotografij, razkrijejo atraktivnost javnega prostora. Analiza podatkov z družbene platforme Instagram, ki uporablja geografsko referiranje, pa omogoča zaznavo pomembnejših dogodkov. Rezultate analize podatkov obeh virov je treba razumeti kot dragocen vir za določanje splošne ravni socialnih interakcij v javnem prostoru. Predstavljena metodologija je posebej primerna za analizo centralnih lokacij in posebnih dogodkov, kot je projekt evropske prestolnice kulture.

KLJUČNE BESEDE

Flickr, Instagram, geolocirani podatki, javni prostor, prostorsko-časovna dinamika, evropska prestolnica kulture, urbana regeneracija

ABSTRACT

The paper presents an alternative method for tracking the spatiotemporal dynamics of social interactions in public space in the context of the European Capital of Culture-based urban regeneration. The paper analyses publicly available geolocated data from two social media platforms, Instagram and Flickr, which are characterised by the posting of photos on the Internet. The quantity of social media posts in a given time period is used as a proxy indicator to identify and retrospectively analyse the attractiveness and spatiotemporal dynamics of public spaces. Using georeferenced interaction data from social media platforms, two case studies of regenerated public spaces from ECoC cities are presented: the DEPO2015 area in Pilsen (Czech Republic) and the DOKK1 urban waterfront in Aarhus (Denmark). The results show that the data from the Flickr platform, which allows access to the exact geolocation of the posted photos, can reveal attractive public spaces, as the popular landmarks were clearly identified on the generated heatmaps. The analysis of data from the Instagram social media platform, which uses georeferencing, can reveal the most important events and should be thus considered a valuable proxy for determining the overall level of social interaction in a public space. The methodology presented is particularly well suited for the analysis of central locations and special events, as is the case with the ECoC.

KEY WORDS

Flickr, Instagram, geolocated data, public space, spatiotemporal dynamic, European Capital of Culture, urban regeneration

1 INTRODUCTION

Traditional approaches to analysing the dynamics, liveability and quality of public spaces by Jacobs (1961), Appleyard (1982), Gehl (2010) and others include quantitative and qualitative methods, such as counting the number of people gathered in public spaces, tracking their activities and movement paths, and observing and describing their social behaviour (Gehl and Svarre, 2013). These early beginnings of research into public space dynamics mainly involved analogous techniques and tools which, characterised by rather small research samples and the personal presence of the researcher on-site, could only measure current activities. In the 1970s, Donald Appleyard first used a video camera to record activities in public plazas in New York (Appleyard, 1982). Since the advent of information technologies, however, new approaches to measuring, recording and tracking the activities of people in public places have been introduced. Data is provided by surveillance cameras, mobile phones and other sensors installed on various devices. The advantage over traditional methods lies in the larger quantity and continuous collection of data, which can provide important information for successful urban management. However, these new approaches also raise the questions of data ownership and accessibility, as well as issues of personal data protection. These often-proclaimed negative aspects of the ICT[1]-driven transformation of public space through the instruments of control can contradict the very idea of the publicness. In this paper, we propose an alternative method that uses data collected from the digital layer (Žižek, 2018) of actual public spaces, which represent a digital footprint of existing social interactions and are not collected with any intent related to the described privacy issues. With the increasing number and reach of social media platforms, the availability of the associated metadata also increases, which improves application in urban research (Chae et al., 2014; Žižek, 2018; Barros, Moya-Gómez and García-Palomares, 2019; Han, Nguyen and Sahito, 2019). In addition to traditional methods, this alternative approach also enables retrospective research, overview and evaluation, as well as temporary data analysis.

By analysing publicly available geolocated data gathered from social media platforms using the REST API[2] technology (Barros et al., 2019), it is possible to track the spatiotemporal dynamics of social interactions in public space through their different development stages. Photo-sharing social media platforms have become interesting for urban research because photos have an emotional connection to places, events and people and contain a symbolic value when published on social media platforms (Iglesias-Sánchez et al., 2020). In addition, photos as social media posts contain valuable metadata that can be used for analysis and information discovery. Using the described approach, this paper presents two case studies of the cities of Pilsen (Czech Republic) and Aarhus (Denmark), both European Capitals of Culture (ECoC). Cities associated with the ECoC[3] were selected for the case study because it is known that this program has a significant impact on the urban regeneration of public spaces (Garcia, 2005; Richards and Wilson, 2004). The program attracts a lot of attention with various events and activities and offers an opportunity for posting photos on social media platforms.

The aim of the research is to present an alternative method for tracking attractiveness and dynamics of social interactions in selected public spaces. Two types of changes will be tracked, the first referring to the attractiveness of a particular public space observed from the social media perspective. The second will refer to changes in dynamics and the intensity of social interactions in public space. In both cases, the main

[1] *ICT - Information and Communications Technology*

[2] *REST API - Representational State Transfer / Application Program Interface*

[3] *Since its launch in Athens in 1985, the ECoC programme has focused on providing the selected cities with a comprehensive cultural program for one year, promoting cultural objectives, intercultural dialogue and cultural diversity between European countries and citizens. Culture has been recognised as a catalyst and driver of urban regeneration and image renaissance.*

indicator is the quantity of social media posts related to the particular location acquired from the two social media platforms, Flickr and Instagram in a given time period. We want to show that data collected from the social media platforms reflects these changes as a consequence of the urban regeneration process.

2 STUDY AREA

2.1 Selection of public space

Main research locations were selected with the focus on open public spaces. For the selection of public spaces, two main criteria were used. The first related to the availability of data, while the second criterion was based on the prerequisite that the open public space was repurposed or renewed in connection to the ECoC. Main development plans and infrastructure investments in the urban renewal of the ECoC program were identified for each city through various sources, such as official evaluation reports, official websites, etc. Related to the availability of data, all ECoC cities between the beginning of 2015 and the end of 2018 were considered. This was because, in the period before 2015, not enough data was available on both platforms and, after 2018, there was no possibility to track the immediate impacts after the conclusion of the ECoC. The observation period was divided into three parts: the period prior to the ECoC, the whole year of the ECoC and the period after, at least one year or more. By searching for appropriate research locations, all cities in the aforementioned period were analysed as follows: the ECoC cities of Pilsen (Czech Republic) and Mons (Belgium) from 2015, San Sebastian (Spain) and Wroclaw (Poland) from 2016, Aarhus (Denmark) and Paphos (Greece) in 2017 and Leeuwarden (Netherlands) and Valleta (Malta) in 2018. All these cities[4] invested in public space renewal and revival activities, though sufficient data was not available in all cases, therefore the decision was made to select the city of Pilsen and the location of the DEPO 2015 (Figure 1), as well as the city of Aarhus, with the renewal of a former docks area into a contemporary urban waterfront area (Figure 2).

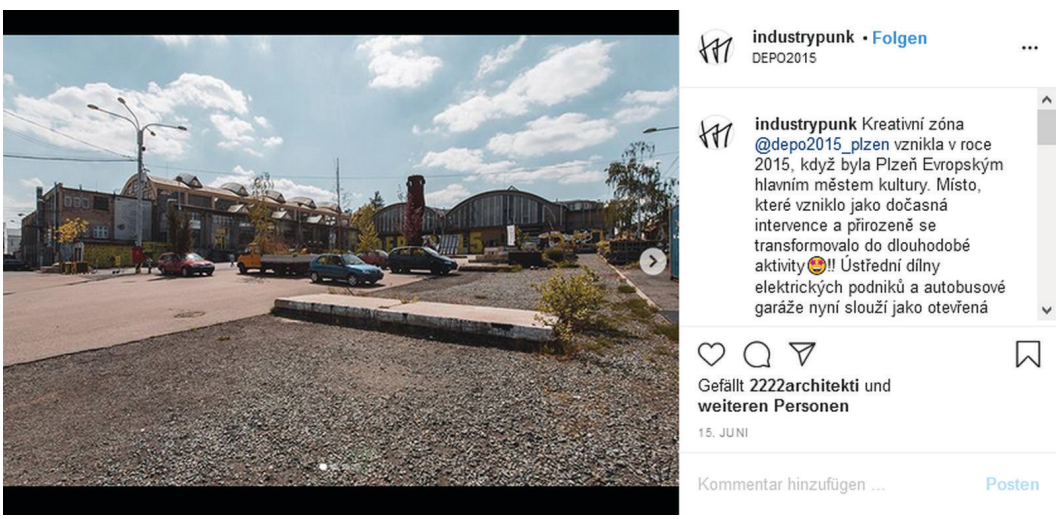

Figure 1: Example of a posted photo of DEPO2015 in Pilsen, retrieved from the Instagram social media platform (Source: Instagram).

[4] *Projects related to ECoC cities that haven't met the criteria for selection: i.e. Strait Street project in Valleta, renovation of the public space in front of the main train station in Leeuwarden, Harmoniekwartier in Leeuwarden, artistic activation of a public square in Mons with the Passenger Project, the 'Open Air Factory' in the climate-friendly city of Paphos, which enabled around 70% of events to be organised outside, in squares and natural sites, etc.*

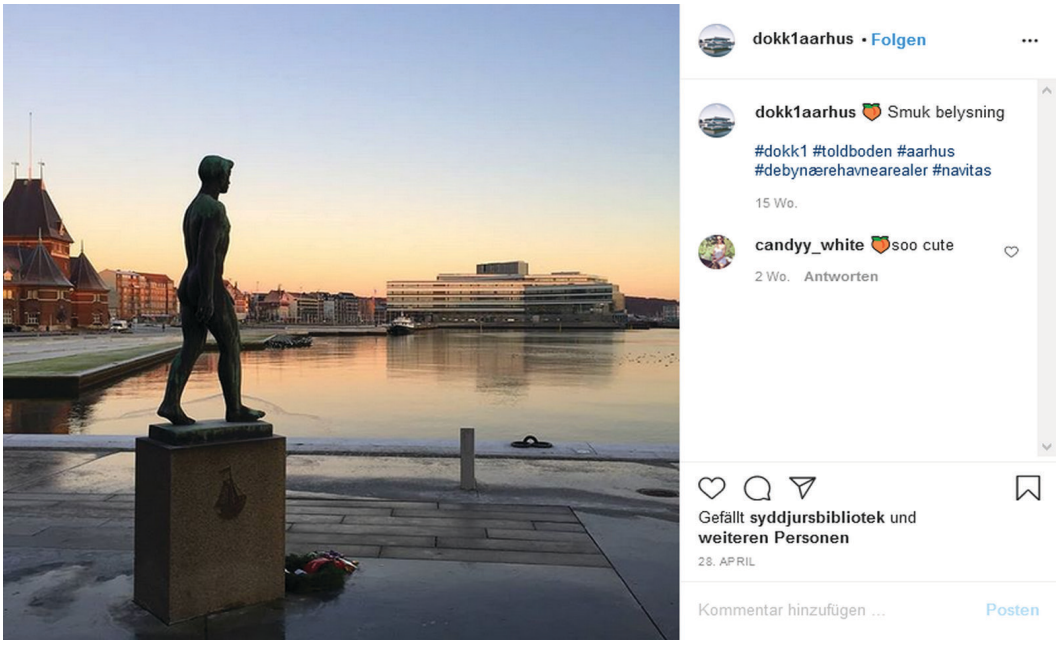

Figure 2: Example of a posted photo of DOKK1 urban waterfront in Aarhus, retrieved from the Instagram social media platform (Source: Instagram).

2.2 Study areas and ECoC context

Investment in the cultural infrastructure in the city of Pilsen included several projects, among them DEPO2015, which was found to be most appropriately related to the research criteria and was, according to the official final evaluation document by the European Commission, named as one of the most important projects of the ECoC (Fox and Rampton, 2016). It represents the reconstruction of a derelict bus depot into a cultural zone with a large open space that was renovated using a design that still indicates former use and the industrial character of the zone. The zone, which brings together business with cultural and creative industries, was opened in 2015 and offers co-working spaces, exhibitions space, art residences and more. The former bus yard was transformed into a multifunctional space, where different workshops, events and concerts are held (the largest with 20,000 people) (Fox and Rampton, 2016).

In Aarhus, a large part of the ECoC's planning focused on construction and infrastructure developments around the waterfront area of the city. A former industrial harbour was, as part of the 'Urban Mediaspace Aarhus' project (Jensens Tegnestue, 2015), transformed into a new central urban waterfront, comprising several public squares (Harbour Square, Tolbod-Plads and Europaplads), including the construction of DOKK1, the largest library in Scandinavia. The waterfront is the size of four football stadiums (23,000 m^2) was converted into public and recreational spaces (i.e. for concerts, flea markets, funfairs, Aarhus Festival, circus, beach volley, ice skating, open-air cinema and more) (Fox and Rampton, 2018). The DOKK1 urban waterfront[5] area was completed in the summer of 2015.

[5] *The observed area includes the new library building DOKK1 and approx. 800 m of the waterfront area located next to this building. As there are many different names appearing for this area in literature, a decision was taken to use the name DOKK1 urban waterfront (and DOKK1 u.w. for tables and figures).*

3 METHODOLOGY

A methodology is proposed for verification of general observations on the increase in public space interactions caused by the associated investment in spatial improvements, in the new landmark architectural projects and other spatial upgrades. The methodology applied in the research consists of four general steps (Table 1).

Table 1: Methodology in steps.

1. step	2. step	3. step	4. step
selection of public space (repurposed/renewed)	data collection (from Flickr and Instagram)	data visualisation (via heatmaps and time-series)	data analysis and interpretation

3.1 Data collection

Data was collected from social media platforms on selected public spaces using the REST API technology. Two social media platforms, Instagram and Flickr, were selected based on the availability of metadata on the locations and the relevant semantic relationship of the analysed posts to the observed locations. Besides, both Instagram and Flickr use the posting of photos as the central prerequisite for user interaction. Posted digital photos contain useful metadata, including time and location. At the same time, posted images represent a symbolic link to public space, depicted either as background or as the main object of interest (Figure 1 and Figure 2). Flickr was one of the first photo sharing and storage platforms, created in 2004. Instagram, an even younger platform, was launched in 2010. In addition, the two selected platforms, Flickr and Instagram, differ in the key areas of research as the use case, the tools used, and interaction motives are also different (Table 2). Another difference is related to the availability of location data. In the case of Flickr, access to the location metadata is not restricted, and the exact location of the post is transmitted with latitude and longitude. In the case of Instagram, as of May 2018, the location metadata of each individual post is deleted and replaced with the location ID, which represents the general geographic location, i.e. square or a street with a recognisable name, but it does not reveal the exact location originally stored in the uploaded photo. The described differences in the collected data from the two social media platforms dictate two varied approaches to the analysis.

Table 2: Differences between Flickr and Instagram.

	use case	tools	motives
Flickr	designated for a hobby, amateur photographers	posted images are often made with photographic cameras	artistic motives and architectural highlights
Instagram	casual photography, visual messaging	images are taken mostly with mobile phones	casual images of persons, places and food (lifestyle)

3.1.1 Flickr data

The Flickr REST API was used to collect metadata from geolocated posts within a radius of 500 metres around each city centre. This wide coverage enables the mapping of several public spaces in the vicinity of the ECoC-designated public space, thus enabling the identification of those most frequently photographed. Duplicates were removed from the collected data, as well as chain uploads represented by multiple photos with the same location and time stamps. Subsequently, heatmaps for both cities were created with GIS software, using the exact geolocations of the posts. The analysis of temporal dynamics based on Flickr data was not considered due to the lower data frequency.

Furthermore, it must be mentioned that data from Flickr is not appropriate for showing temporal dynamics and is only used to identify locations; therefore two maps were prepared for each location (A - before the ECoC and B - during and after the ECoC). The presentations based on the Flickr data are constructed considering the limits of the data availability. Further dispersion in time slots (before, during and after) would not provide relevant results. To identify temporal dynamics, Instagram data was provided after the location had been identified as relevant and attractive in Flickr.

3.1.2 Instagram data

In order to enable an analysis of the temporal dynamics of interactions in public space, data from the second social media platform, Instagram, was collected. As mentioned above, Instagram enables a more casual interaction with the platform by using personal devices, such as mobile phones, to generate posts. As a result, the number of posts related to the observed locations is much higher. The locations of the posts were identified using Instagram's location (Clement, 2020). The temporal dynamics of the collected data points are presented as a time series showing the weekly number of posts within the defined time span.

The availability of data from both platforms and for both locations is presented in Figure 3 and Table 3.

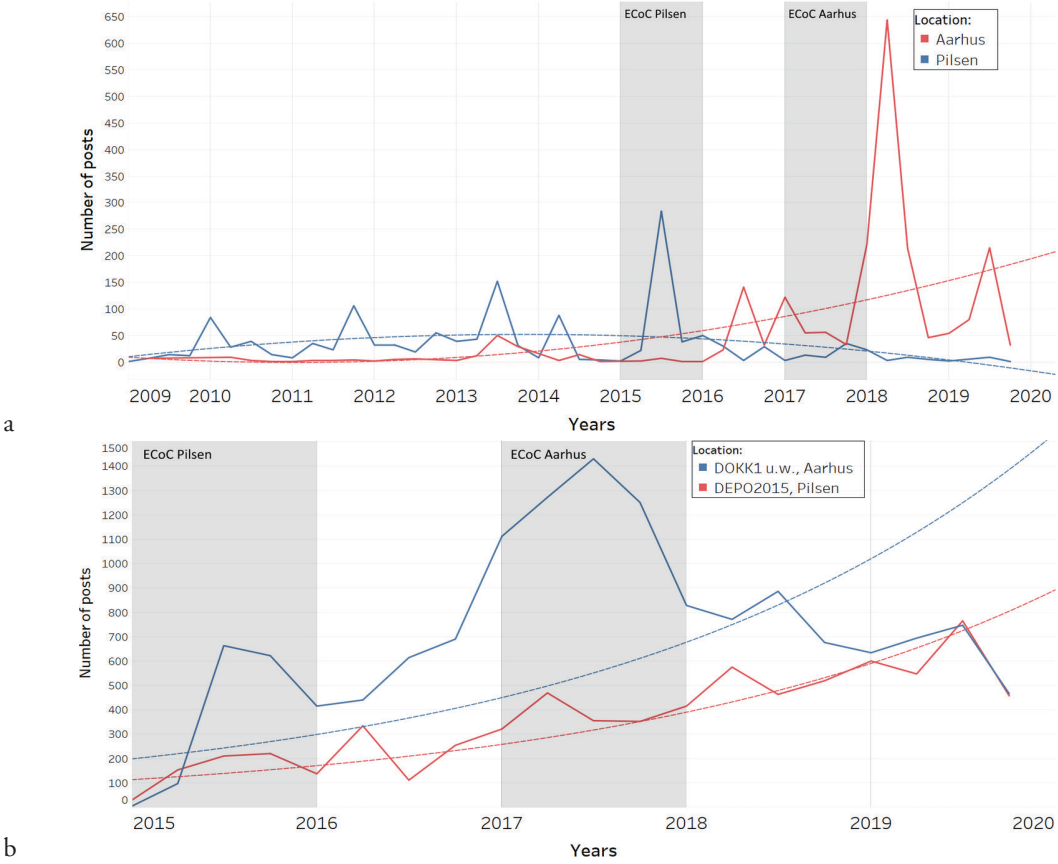

Figure 3: a) Flickr social media data availability for Pilsen and Aarhus, b) Instagram social media data availability for DEPO2015, Pilsen and DOKK1 u.w., Aarhus (in quarters).

Table 3: Number of collected posts from Flickr and Instagram.

ECoC city	Pilsen	Aarhus
Flickr		
radius	500 m	500 m
research period	2009–2020	2009–2020
posts collected (total/used)	1470/445	2205/565
Instagram		
focus location	DEPO2015	DOKK1 u.w.
research period	2015–2020	2015–2020
posts collected	7470	14774

3.1.3 Social media data as a proxy value

The use of social media data does not directly correspond to the data collected, i.e. through manual counting of visitors in public spaces (Gehl and Svarre, 2013) or through various observation methods, such as behaviour mapping (Goličnik and Ward-Thompson, 2002). However, geolocated data from social media can and should be considered a valuable proxy for determining the general level of social interaction in a public space (Cheliotis, 2018; Cvetojevic and Hochmair, 2018; Taylor et al., 2014). The final evaluation of the data underlies demographic representation bias, such as the local adoption level of ICT and population groups using online platforms to varying degrees, depending on age, gender, education, etc. (Greenwood, Perrin and Duggan, 2016).

3.2 Data visualisation and analysis

In the third step, collected data was visualised, and in the fourth step, data was analysed according to two aspects, as a basis for the quick evaluation of the impact of the ECoC programme:

a) *The change in the attractiveness of a public space observed from the social media perspective.*

When trying to capture the changing dynamics of public space and the impacts of urban regeneration, the adjective liveable (Gehl, 2010) could be more appropriate, but because this study uses posted photos as an indicator, it was decided to use the term 'attractiveness'. The attractiveness of a particular space, observed from the social media perspective, is retrieved from the heatmaps of city centres generated by the Flickr posts, as the ambition of photographers and the quality of the images is in general higher when compared to the images posted on Instagram.

b) *The change in dynamics and the quantity of social interactions in a public space based on social media interaction data.*

This aspect relates to the general daily interactions and activities of residents and visitors. The dynamics of social activities is visible from the number of weekly posts on Instagram, where peaks in the number of posts are understood as a result of special circumstances, such as public events, which could reflect the particular nature of the observed space (i.e. as an event space) and its dynamics.

4 RESULTS

4.1 Pilsen case study

The data collected from the Flickr social media platform for the defined area in the centre of Pilsen (Figure 4) shows changes in highlighted locations resulting from two observation periods. Map A shows the period between 2009 and 2014, where the highest concentration of posts was identified along the axis between the main train station building in the east and the old city centre. The observed location of the former bus depot on the map A does not show any accumulated posts in the aforementioned period. However, posts collected in the period between 2015 and 2020 show a significant increase in their number as a result of the transformation of the site into DEPO2015, visible in map B. Within the area of observation, the location of DEPO2015 is the most exposed, also in comparison to other marked areas.

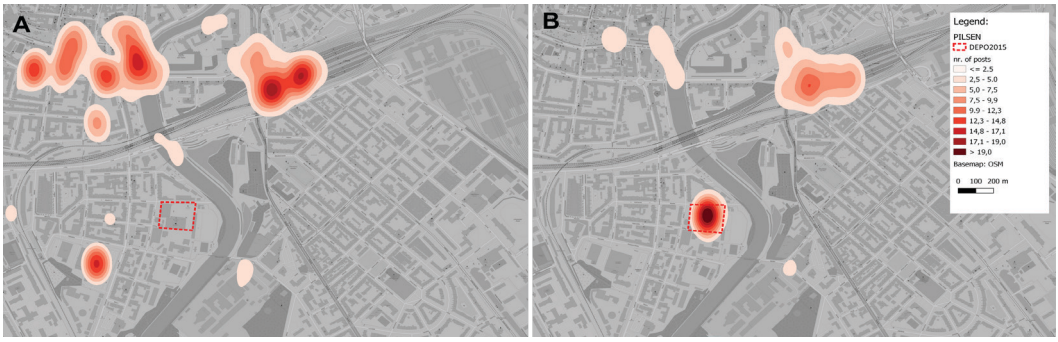

Figure 4: Heatmap compiled according to the frequency of data-points for Pilsen city centre: A) shows a period between 2009–2014, B) a period between 2015–2020 (map scale 1 : 10,000).

In the second phase of the analysis, the impact of the DEPO2015 project on the temporal dynamics of the related public space was analysed. Figure 5 shows the temporal dynamics of posts collected from the Instagram social media platform for the location of DEPO2015. No data was available before 2015, because the area opened in 2015, just before the ECoC began; the data available since then reflects the social interactions in the observed space.

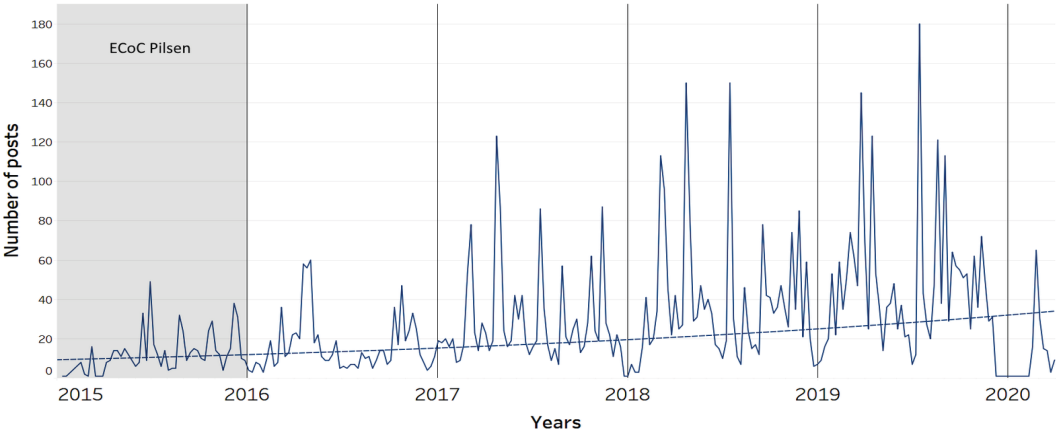

Figure 5: Weekly number of posts for DEPO15 on Instagram (2015–2020).

It is noticeable that, during the 2015 ECoC period, several events are clearly present, which can be seen in the higher number of posts. They show the emergence of dynamic activity in the observed area, which is more pronounced in the second half of the year, indicating an increase in the activity and popularity of the site (Figure 5). Furthermore, a steady increase is visible in the number of posts from 2015 to 2020. Although it was expected that the year of the ECoC 2015 would be more explicitly accentuated on the graph, the data availability was low, reflecting the limited use of Instagram at that time. Just for orientation, the dynamics of the events and the numbers of visitors measured on-site, as indicated in the final report, showed that 100,000 people visited the area in 2015 as a whole and, for some events, more than 10,000 people were present at the weekends (Fox and Rampton, 2018). It is not possible to establish a direct correlation between the number of posted images and the number of visitors counted on-site, but it is possible to identify a pattern of spatial dynamics shown in the data, as individual events are visible on the trendline and the trendline seems to be rising.

4.2 Aarhus case study

The data collected from Flickr for the centre of Aarhus (Figure 6) shows several accentuated areas of attractiveness. Between 2009 and 2016 (map A), the waterfront area does not show a significant number of posts. The most accentuated areas are located between the Aarhus Central Station and around the Aarhus City Hall, as well as in the space around the Cathedral. Between 2017 and 2020, the waterfront area is, however, visibly accentuated. It is also noticeable that the general attractiveness of the observation area increased significantly, probably as a result of the rich programme implemented during the ECoC. A total of 88 projects were focused only on developing urban space and the environment. The most highlighted area among them shows the location of the popular rooftop terrace of the Salling.

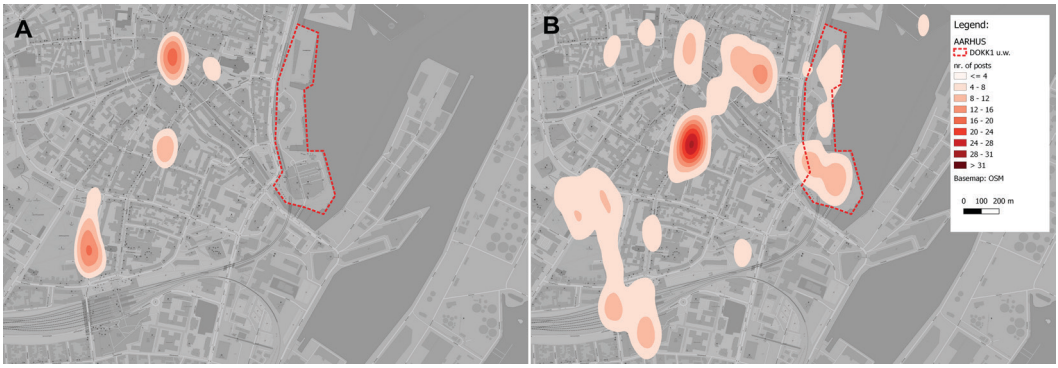

Figure 6: Heatmap compiled according to the frequency of data-points for the Aarhus city centre: A) shows a period between 2009-2016, B) a period between 2017-2020 (map scale 1:10.000)

The temporal dynamics of posts collected from the Instagram social media platform for the location of the DOKK1 urban waterfront area (Figure 7) show that no data was available in the period before 2015, as the area was opened in the summer of 2015. The graph shows a significant increase in the number of posted images taken in the year of the ECoC. The day of the opening ceremony, on January 21, 2017, is the day with the highest number of posts (the first spike in Figure 7 in the year 2017). During 2017 several other events, seen in the higher number of posts, are noticeable, reflecting the particular event

dynamics. Data on the number of people visiting the location of the waterfront area was not available, though the general number of visitors stated in the final report is remarkably high. The decline in the number of posts after 2018 can be explained with the lower number of events and visitors in the city of Aarhus compared to the ECoC year 2017.

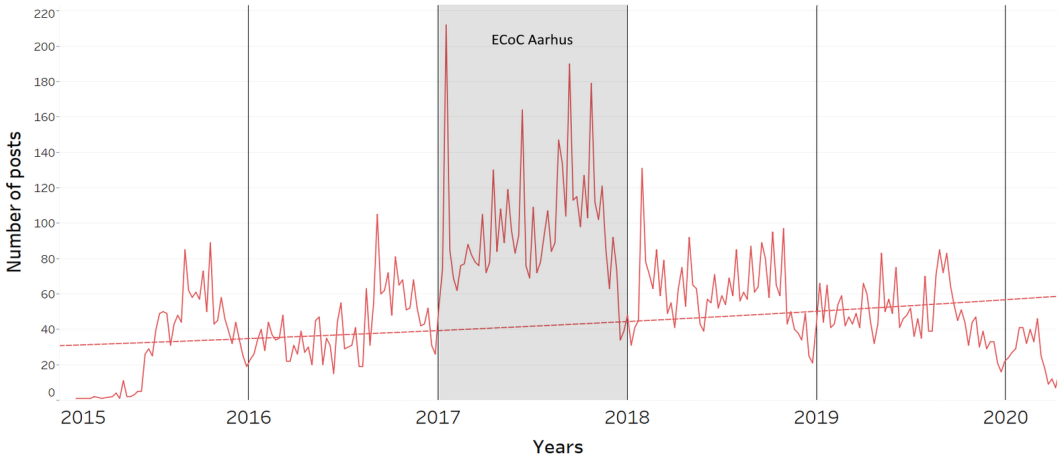

Figure 7: Weekly number of posts for DOKK1 u.w. area (2015–2020).

According to Fox and Rampton (2016), the Aarhus ECoC project was, in terms of sustainability, described as an example of good practice, being a key part of the ECoC's overall legacy, which can also be confirmed by the research results.

5 DISCUSSION

In this paper, we have investigated how data posted on social media platforms can show the attractiveness and spatiotemporal dynamics and intensity in specific public spaces in relation to the ECoC programme. Although the proposed method is not precise, it works well as a proxy evaluation tool. It enables research based on the georeferenced data covering several years of activity available on social media platforms.

It has been shown that the data from the Flickr platform, which allows access to the exact geolocation of the posted photos, can identify attractive locations, as the well-known landmarks in both cities have been clearly identified on the generated heatmaps. All the maps presented showed locations that were perceived as sufficiently important and attractive by the inhabitants or visitors to document them, which speaks of a certain motivation or even quality that conforms to the expected correlation.

With regard to the evaluation methodology using the data collected from the Instagram social media platform to analyse the spatiotemporal dynamics of activities, it has been shown that the generated time-series reflect the intensity of activities carried out in public spaces, even if they fall short of providing a complete picture, mainly due to the relatively small data pool. However, as the example from the Aarhus shows, even a relatively small number of posts can help to identify the dynamics of activities in public spaces, as the day of the ECoC opening event in the Aarhus was clearly identified in the time-series presented, as well as the whole year of the ECoC. Other, more time-limited events or activities, which last only minutes or an hour, would require additional research to be consistent with the available data.

In combination with additional data-sources, this method could become more reliable, as it currently only provides basic insight and can, therefore, serve as a guide for future research and action. It is also not possible to redetermine the types of activities from the graphs, but rather the dynamics behind the pattern. It is assumed that the data collected does not reflect the actual daily activities of the residents, as they are not motivated to post photos while they are going about their necessary daily tasks (e.g. going to the library, reading the newspaper on a bench, waiting for a friend, eating ice cream), but rather to show special events that take place and that can be photographed by both locals (i.e. their children singing in the choir in the public space) and visitors (i.e. attending the concert in the public space). The method provides information about the nature of the public space rather than the actual daily routine. In addition, larger amounts of data would allow a better link to the activities actually performed in public spaces. Combining the presented data-sourcing method with additional data-sourcing approaches can expand its practical applicability, i.e. by using other types of Volunteered Geographic Information (VGI) in many ways related to georeferenced data from social media, as discussed by authors such as Capineri et al. (2016) presenting the use of the Flickr data, and Čekada and Lisec (2019), who describe the possible use of VGI for administrative purposes. However, to analyse the temporal dynamics of interactions in public space, more specific approaches are needed, based on personal mobile devices and different scenarios of public data participation, such as gamification as described by Martella et al. (2019) or the provision of smart information services by public authorities that enable the collection of high-frequency real-time data.

When comparing the proposed methodology with similar research, both similarities and important key differences were identified. In the introduction, two main research works were cited, both of which use social media data as a proxy value for general physical activity in observed public spaces (Barros et al., 2019; Iglesias-Sánchez et al., 2020b). In the first example, Barros et al. (2019) used the Flickr data to evaluate the visitor activity in the Spanish nature parks. The temporal distribution of visitors, activity peaks and the most frequently visited places were identified and analysed. The second research example by Iglesias-Sánchez et al. (2020) uses the Instagram data to identify the most attractive places for tourists in the Algarve and the Costa del Sol regions. The emotional tone of related posts has also been analysed, providing additional qualitative information. Alternatively, the presented study on the ECoC's locations suggests combining both social media platforms as a source of research data, focusing on the specific features they offer: (1) high location accuracy of the Flickr data versus (2) high temporal frequency of the Instagram data. This approach allows the most efficient identification of attractive locations and the identification of related temporal dynamics and provides a more effective tool for research on ECoC-driven impacts in urban public spaces.

The proposed methodology can, therefore, help urban planners and city managers to plan and latter assess the distribution of activities and ensure a better balance in urban planning for complex public events, rather than allowing overcrowding in just a few specific locations. Finally, in order to apply the presented methodology, it is necessary to understand the different groups of people who use social media platforms while visiting places of interest. In the case of a well-designed and vital public space in a residential area, used only by residents who may not wish to post photos of their children playing in the playground, the proposed methodology would make it difficult to identify the attractiveness and usage patterns of such public spaces. Therefore, this method is only suitable for the analysis of central locations and popular public events, as it is in the case of the ECoC.

6 CONCLUSIONS

The research has shown that the methodology presented can be used for rapid evaluation of the ECoC, but also for other similar projects, i.e. investments in the new spatial interventions and public space activities. Especially for ongoing events, this can be combined with the tracking of additional information and indicators. Finally, both observed public spaces from Pilsen and Aarhus show many differences in size, approach, investment and planning. Nevertheless, the proposed methodology has recognised both of them as important spaces in their respective cities, with a vibrant dynamic of use. It is also valuable to be able to collect data on specific activities in the observed public space long after the actual events have finished.

In the future, more metadata from other social media platforms and alternative sources will be available, allowing for a more detailed analysis and effective detection of deficiencies in public spaces. Mainstream ideas about smart cities (with technical devices, connected devices for monitoring) will be further developed with alternative approaches to the rigid idea of IoTs and will enable wider access to useful data. In conclusion, there is enormous potential for retrospective research using the comparative method, but also for linking new ICT-driven approaches with traditional methods.

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Kaja Pogačar
University of Maribor, Faculty of Civil Engineering, Transportation Engineering and Architecture
Smetanova ulica 17, SI-2000 Maribor, Slovenia
e-mail: kaja.pogacar@um.si

Andrej Žižek
DOBA Faculty of Applied Business and Social Studies Maribor
Prešernova ulica 1, SI-2000 Maribor, Slovenia
e-mail: andrej.zizek@doba.si