

Social Media Geographic Information for urban space analysis: the case of Expo Milano 2015

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Introduction

Nowadays, urban planning and urban studies are increasingly based on the extensive use of digital geographic information. Traditionally, these processes utilize digital data, created by public administrations or private agencies within institutional or legal frameworks, called Authoritative Geographic Information (A-GI) (Ball 2010, 1; Goodchild and Glennon 2010, 233). The development and the use of A-GI is greatly fostered by the implementation of Spatial Data Infrastructures (SDIs), which allow planners to access and to share A-GI according to well established frameworks in order to better support the planning processes. At the same time, the development of Web 2.0 and the diffusion of geobrowsers and GPS (Goodchild 2007b, 5-8) allowed citizens to act as voluntary sensor for producing and sharing geographic information called Volunteered Geographic Information (VGI) (Goodchild 2007a, 2-3).

In addition, last years have faced a wide diffusion of georeferenced multimedia contents, produced by millions of users through social media platforms (e.g. Facebook, Instagram and Twitter), establishing a new source of spatial data, namely Social Media Geographic Information (SMGI) (Campagna et al. 2015, 42-47). SMGI is an implicit VGI (Craglia et al. 2012, 7-10) and shows the distribution in space of people's perceptions about facts (Campagna 2014). Consequently, a city planner could "listen" what the citizens feel

and communicate in the different places (Campagna 2014); therefore, SMGI could be used to extract useful information for urban planning (Campagna et al. 2015, 42-47). However, still now, there is a lack of a common analytical framework to investigate this new source of data.

The aim of the paper is twofold. On the one hand, it proposes and deepens the analytical framework developed by Campagna et al. (2015, 42-47) as a common methodology to analyse effectively SMGI. On the other hand, the long abstract explores if SMGI, singularly or integrated with A-GI, may be used to support urban analyses and planning, especially with regards to urban public space analysis. The actual case study of Expo Milano 2015 is presented in order to investigate these two perspectives..

Methodology

A potential analytical framework to investigate SMGI is proposed by Campagna et al. (2015, 42-47), wherein several methods are supplied to analyse SMGI both singularly or integrated with A-GI. Mainly, the provided methods concern:

- Spatial analysis of user interests;
- Temporal analysis of user interests;
- Spatial Statistics of user preferences;
- Multimedia content analysis on texts, images, video or audio;
- User behavioural analysis;
- A combination of two or more of the previous, such as spatial-temporal analysis.

In addition, it suggests the use of GIS for carrying out these analyses (Campagna et al. 2015, 42-47). The framework is recent and it was utilized successfully at the regional or local scale, but it was never applied at large scale of the public space. Hence, the paper applies the methodology for the first time in the analysis on the urban scale to support urban planning.

Case study: Expo Milano 2015

The authors selected the actual case of the World Exposition Expo Milano 2015 to prove the efficiency of the analytical framework on urban scale. Expo's site has a regular structure such as the traditional design of roman cities and different accessible typologies of spaces compose it. Consequently, the site is similar to an urban public space in a city centre and its analyses could give suggestions on the urban space analysis. In this study were used SMGI data from Instagram, a recent Social Media platform principally based on sharing photos and images, which has been seldom used in SMGI analysis research to date. The investigated information were all contents localized into the Expo's site. The dataset comprised 128.805 records (red points in Figure 2.1) published from 63.125 users. In addition, A-GI were integrated with SMGI in order to describe the different typologies of Expo's spaces (Figure 1) and to ease the analyses.

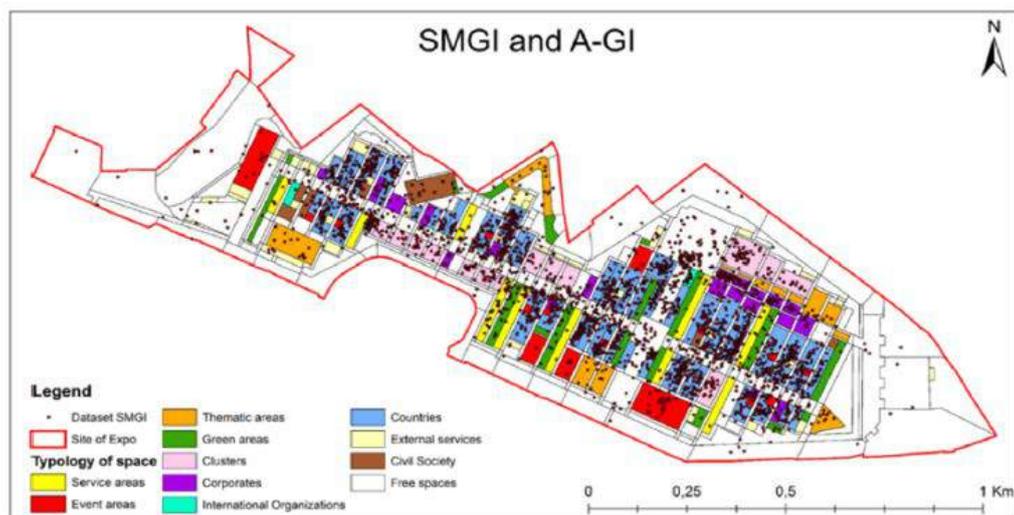


Fig. 1. SMGI and A-GI.

Results and discussion

With the aim of extracting useful knowledge from SMGI, the number of published contents (N. photos) and the number of users (N. users) were identified as two possible indicators of visitors' interest (or popularity). Below the results are discussed.

First of all, a spatial analysis was conducted on the N. photos and N. users in the different typologies of spaces and the results (in percentage) were compared to their total value on the entire site (Figure 2). The exposition areas "Countries" and the "Free spaces" show the highest popularity. In detail, the interest toward "Free spaces" (squares, and pedestrian paths) is concentrated (97.47%) exclusively in the space surrounding the "Tree of Life", one of the principal attractions of Expo. Therefore, this place may be considered as the only free space really utilized and appreciated by visitors, meanwhile, other free spaces were probably seeing exclusively as passages. Consequently, for the urban public space analysis it is not obvious the fruition of unbuilt areas, squares and pedestrian paths, although they may obtain more identity and utilization thanks to the presence of attractive elements inside.

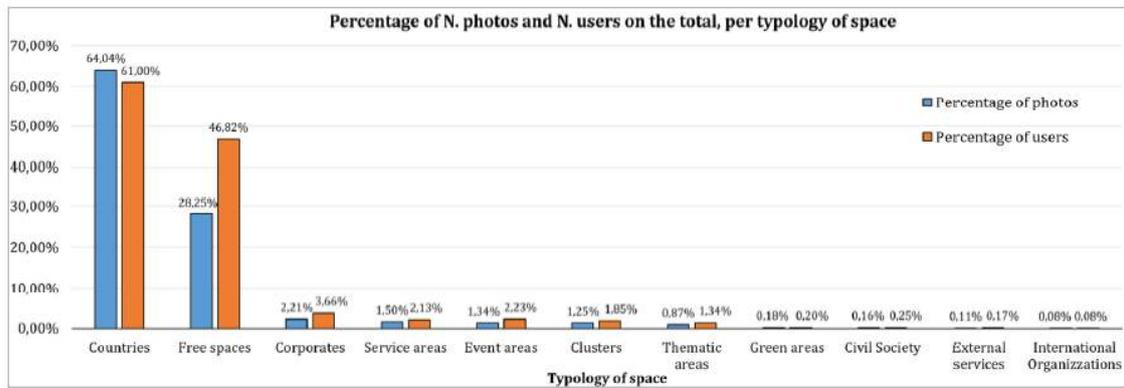


Fig. 2.

Secondly, the results arise from a spatial-multimedial analysis conducted on the SMGI dataset. The authors visualized samples of photos to understand the objects of interest, finding the three likely major reasons of popularity: external design, food brand, technological or attractive elements inside. These identified patterns could lead not only visitors but also citizens, in general, to prefer some sites, places or shops instead others; suggesting new knowledge on what city's areas are preferred and lived majorly by the people, thus supporting urban space analysis. Moreover, the places were also studied according to the temporal component of SMGI, relying upon a spatial-temporal analysis. For this purpose, the authors created and utilized a new indicator called difference of popularity:

$$\text{difference of popularity} = \left(\frac{N.\text{photos}_{t_i,j}}{N.\text{photos}_{t_i,J}} * 100 \right) - \left(\frac{N.\text{photos}_{T,j}}{N.\text{photos}_{T,J}} * 100 \right)$$

Where: t_i indicates four time intervals analysed (10.00-13.00, 13.00-16.00, 16.00-20.00, 20.00-23.00), T represents the total time considered, j the typology of space investigated and J the entire Expo's site. Therefore, the difference of popularity investigated the increasing or diminishing interest for each typology of space compared to the total site's interest, according to time (Figure 3). The charts in Figure 3 show how the visitors' interests and uses are mostly in the principal exposition areas (column left) and in other spaces (column right) during the day and in the evening events in the night (central column). Therefore, the analysis could give the possibility

to monitor the citizens' perception of an urban public space in real time, fostering the elicitation of knowledge about how the persons live and use the spaces.

Conversely, spatial-users analysis was used to study the dynamics of visitors and site, selecting the users with more than one expressed interest (published photo). For each of them was calculated the ratio between the envelope's surface of their photos with the envelope's surface of the entire site; the Figure 4 shows these values. The 77 % of multi interest users have a ratio minor than 10 % (small areas). Accordingly, it could possible to assume that the visitors enjoy only a small portion of the Expo site. This result may suggest some clues on the urban public space's design or Expo's design, such as the presence of a big number of attractions in a small part of the entire area or a difficulty of movement (caused by queues), which may be two possible causes of the obtained output.

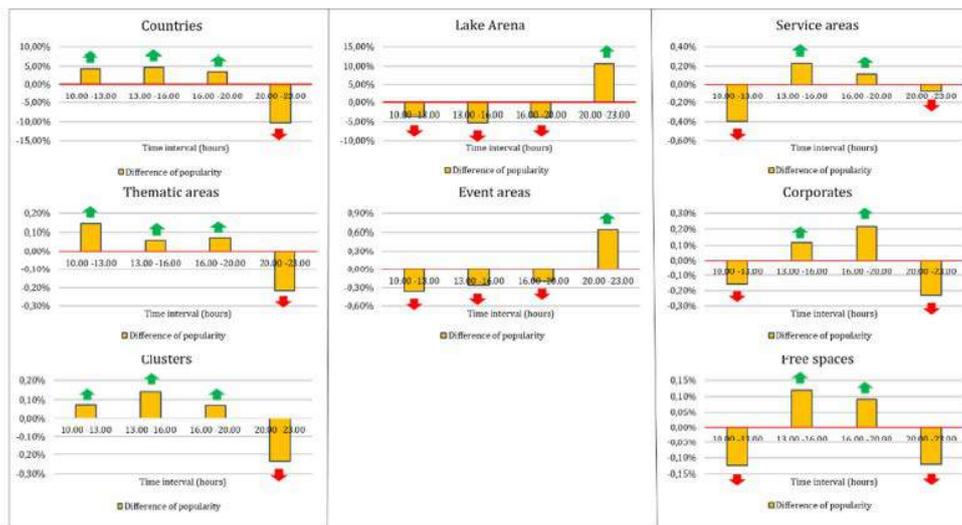


Fig. 3. Value of difference of popularity per typology of space, on time. The green narrows represent an increase of interest, the red ones a decrease.

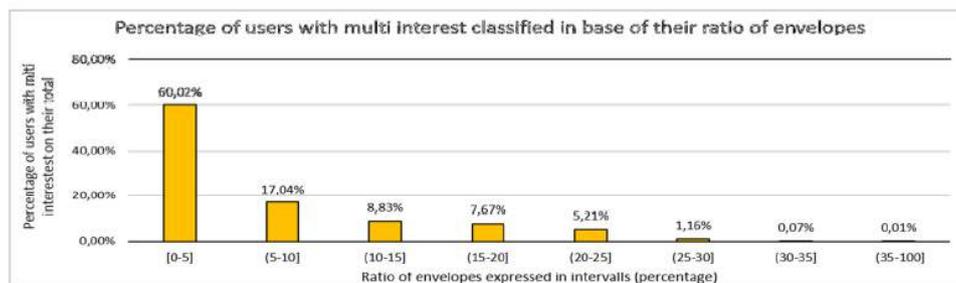


Fig. 4

In addition, a temporal-spatial statistic was measured using the Emerging Hot Spot Analysis to gain further information on visitors' dynamics within the Expo. The method divided the Expo site in regular cells and identified the cells whose N. photos probably depended spatially by the number of surrounding photos. In Figure 5, there are clusters of cells and the pavilion, inside them, with spatial dependence. Therefore, it is possible to use this analysis to investigate if a place in an urban public space is attractive on its own or if attraction is partially due to near popular areas. Lastly, the results above described are resumed in Table 1 It identifies for each type of analysis the obtained output, showing the relationships existent between the adopted framework and the new extracted knowledge for Expo and eventually for urban public space.

Comparison between SMGI and empirical information

SMGI does not ensure quality and credibility of results due to its particular nature. To address this issue, the authors compared the results obtained from SMGI analysis with data provided by empirical information (e.g. official surveys), showing how SMGI could give reliable outputs.

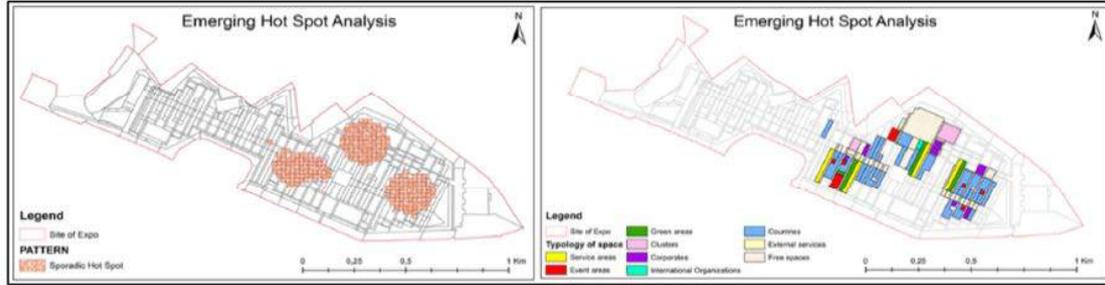


Fig. 5. Clustering of cells with spatial dependence (left) and the pavilion inside (right).

Tab. 1. Results of the analyses from the adopted framework.

Analysis	Results of Expo	Results of urban public space
<i>Spatial analysis</i>	Possible trend of visitors' interests	Possible way to use the free spaces
<i>Spatial-multimedial analysis</i>	Possible reason of visitors 'interest	Possible reason of interest of places
<i>Spatial-temporal analysis</i>	Possible interest and use of places in space and time	Monitoring
<i>Spatial-user analysis</i>	The use of the site by visitors	Suggestion on the urban public space's design
<i>Temporal-spatial Statistic</i>	Spatial influence of visitors' interests	Possible use of SMGI to know spatial influence

Policy of publication

The authors also studied the policy of data publication by Instagram, showing how the social platform changed the rules for georeferencing data during the study, de facto decreasing the spatial accuracy of SMGI and thus limiting the potentiality of investigation. Further studies may face the relations between technicians and companies like Facebook, which hold the entire datasets without no one standard or agreement.

Conclusions

SMGI is a new source of information made available by recent advances in ICT and Web 2.0 technologies. Often, SMGI precision is not known and the potentialities for using this kind of information may depend on the agencies/companies that publish it. Despite these issues, SMGI may provide useful information for urban planning. In this regard, an innovative analytic framework to investigate SMGI (Campagna et al. 2015, 42-47) is introduced and applied on an Instagram dataset for exploring urban public context. The paper shows as the methodology may be able to extract effectively information from these data, analysing also SMGI in an integrated way with A-GI. In addition, the obtained results could give innovative suggestions on:

- the relation between visitors and Expo's site;

- the relation between citizens and urban public space;

In conclusion, SMGI and the proposed analytical framework may represent a way to gain new knowledge, useful for integrating traditional data and supporting urban space analysis.

Acknowledgment

The research was conducted by the precious contribute of all four authors. In addition, Campagna and Rabino has selected the theme; Campagna and Massa have lead the acquisition of data; Campagna, Gallo and Massa have operatively treated and investigated the dataset according the analytical framework and Campagna and Gallo have interpreted the results.

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