

# OPEN DATA FOR CULTURAL HERITAGE

Place Based Digital Humanities  
between representation, design and innovation

a cura di Daniele Villa

Una ricerca di Daniele Villa,  
Bertrando Bonfantini, Marco Bovati, Marica Forni,  
con Elena Fontanella, Giorgio Limonta, Nausicaa Pezzoni,  
Cecilia Maria Saibene, Stefano Saloriani, Micaela Mander,  
Ludovico Vernazza, Vincenzo Zucco

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# Open Data, GIS, Applicazioni mobili: una metodologia di analisi e rappresentazione per migliorare la qualità dello spazio

Rolando Andrea, Scandiffio Alessandro

## 1 | Tangible and intangible relationships between users and cultural heritage

In the current paper some issues related to tangible and intangible relationships between users and cultural heritage have been considered, with the aim to investigate innovative actions and methods to exploit the big amount of available open data, through a combined use of web and mobile device applications. Particularly this paper shows a method of analysis and representation, applied to real case studies. This method has been based on three key points: open data, available on web portal, have been considered as data source, GIS (Geographic information system) as platform to manage georeferenced information, and mobile device applications as tool to enhance minor cultural heritage, especially when located out of the main centers, in urban fringes and in new contemporary landscapes. Tangible relationships and physical connections have been considered to access to cultural heritage; in this case the users exploration of places have been considered directly connected to the physical perception of the places and to the real accessibility of places. Instead intangible relationships refer to digital services and to the concept of “internet of places” (Morandi, Rolando, Di Vita, 2015), that nowadays can add value to users experience, and support them in the exploration of places, (location based services, geolocalization, cultural heritage information, pictures etc.) or eventually can replace the real experience through virtual reality. In the last few years it seems that the research is more oriented to investigate new ways to develop intangible knowledge tools (an application is preferred to a traditional map), also in the field of cultural heritage, through mobile device applications, that have been considered as important tools to experiment innovative interactions between the users and the surrounding physical realm.

Open Data, GIS, Mobile Applications: a method of analysis and representation to improve spatial quality

## **2 | Open Data available on the web**

The growing availability of open data on the web can produce a big information source to make new opportunities for economic growth and to make new digital services and products, related to ICTs (Information and Communication Technologies) sector. The digitalization process has involved public institutions, private operators and users, that freely can make new database for open web portals. Particularly the digitalization and opening data process in the public sector started through the European Directive 2003/98/CE, and goes on through European Directive 2013/37/UE, with the aim to ensure a broad access to public sector information, to facilitate the circulation of information not only for private operators, but also for public actors, in order to make new opportunities and economic growth through digital services. At the same time of opening data process, new technologies have been developed, that are able to exploit the big amount of available data and make new applications based on data aggregation and data combination.

This paper investigates a strategy that operates with open data available on the web and with specific digital tools (GIS, mobile device applications), with the aim to improve the accessibility to cultural heritage features. Particularly it shows new ways to access minor cultural heritage areas, that have high spatial qualities, but are localized in a fringe position respect the main infrastructure and cities, and need to be enhanced. Different open data sources have been considered in this research. Open data available on Regional and Local institution web portal, Open Street Map data mining, community web portals that share their personal experience on the territory (cycling routes portals, hiking portals, georeferenced shared pictures). In the specific case of this research, data heterogeneity is very particular because their different data sources and their specific characteristics. This fact means that data are various and with different formats, and a new data hierarchy needs to be created. It is important to consider that open data available on institutional portal can be considered 'trusted', because their source (recognized institutions); open data available on free web portal, made by users, are not completely trusted and need a procedure to 'validate' the content. Considering data heterogeneity two points seem to be clear. The first one is the advantage to have broader data availability, produced by different sources that offer a plural perspectives of the same issue. The second point is related to the big amount of open data that have specific characteristics and need to be filtered and managed in a GIS platform.

## **3 | A method of analysis/integration/management of open data based on GIS platform**

The big amount of georeferenced data need to be managed into a GIS platform with the aim to generate new data set for mobile device applications. GIS allows to manage different typologies of data (raster and vector format), organized in different topological entities: points, lines and surfaces. Commonly GIS is considered as a very powerful tool in the geographic information field. Many operations can be made in this platform. Digital image of historical map can be inserted and geolocalized in GIS, in order to compare historical routes and old cultural hotspots, with current territorial configuration. This operation is very important to recognize historical in-

formation, drawn in the map (points of interest, historical routes, morphology) and integrate them in the new database. Points of interest available as open data on Regional and Local institutions web portals can be freely downloaded and inserted in GIS. At the same time these data can be integrated, in the same database, with points of interest marked by users and shared on community web portals. The combination of different data formats, can be managed in a GIS platform, through different operations: assignment of single 'id' to each entity, assignment of geographical coordinates on the same geographical reference system, realization of the attribute structure that allow to query entities and make relationships between objects of the same typology. GPS tracks related to historical and touristic routes, available on thematic web portals, but also GPS tracks made by users that explore the territory (hiking and cycling web portal) can be used in GIS, to understand what are the most frequented and recognized routes by users (Shoval, Isaacson, 2010) (Rolando, Scandiffio, 2013). Geolocalized pictures, uploaded by users and visible on web portal, (es. Google Panoramio) can be managed in GIS, as geolocalized points, and can be analyzed as indicator of people's place liking. Some of these data can be also obtained by Open Street Map, that collect a big amount of open geographical data driven by a community of users that contribute to create and update data (Topf, Ramm, 2010). Effectively in this project open data by Regione Piemonte and web portal have been used to make a new database and particular to identify: cultural heritage points, protected natural areas, railways and motorway system, GPS routes (Picture 2).

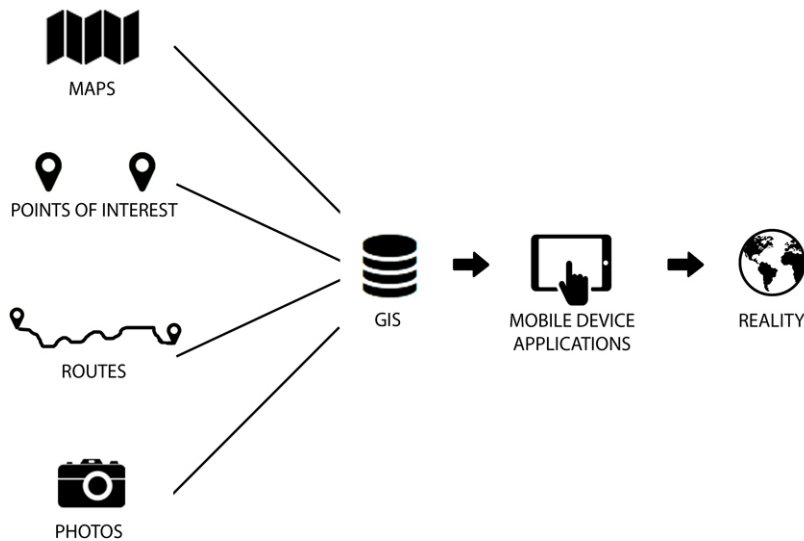


Figure 1 | Work flow diagram: different data sources (paper maps, points of interest, paths, photos) can be managed in a GIS platform in order to make a new dataset for mobile device application that can be considered as 'interface' between users and reality.

It is also important to consider that GIS is a very powerful tool, able not only to collect and represent geographical data in a map, but also to make urban and territorial analysis to find new relationships between entities. In this research, a Kernel density analysis have been used to investigate the concentration of cultural heritage hotspots (density map), as method that allow the identification of the main routes. Eventually this kind of analysis can generate 'new data', that can be added to the original data-

base to implement it. GIS can generate a new dataset with specific attributes that include names, typology of places, categories, local institutions, destinations, functions, geographical coordinates, that can be exported. All data can be transferred from GIS to a dedicated web based platform that has been created to be directly connected to the mobile device application, that is the most commonly used tool by users in the last few years. In the sense any kind of update of the original GIS database can be quickly imported on the web based platform and then to the mobile device application. In this procedure the web based platform plays a key role for the entire work flow, because it represent the 'link' that allows open data to be directly transferred into the mobile device application.

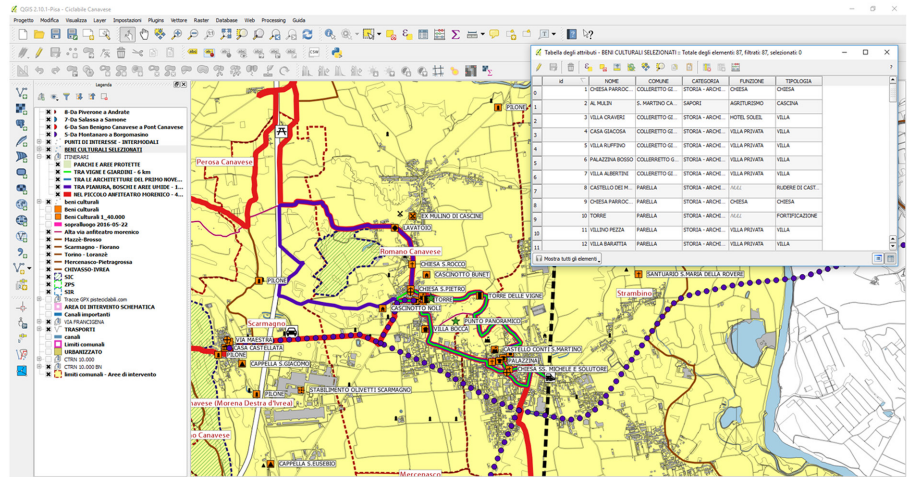


Figure 2 | GIS geodatabase: the same data represented on the map as geographical entities and as table of attributes.

#### 4 | Mobile device applications as interface between users and cultural heritage

In the last few years the increase of availability of open data is strongly connected to the proliferation of mobile device applications, mainly based on smartphones and tablets, that represent the technologies commonly used by people to receive information and to access web services. In this research mobile device applications have been considered as 'interface' between users and cultural heritage, that are able to add value to the exploration of landscape. In this procedure mobile device applications have been considered as a tool that can be used to visualize geolocalized information connected to cultural heritage and landscape. The mobile device application name is "Tracce Comuni" and it is the final outcome of a project, whose main goal is to create a network of places connected by various optional scenic routes. Many typologies of places have been considered with the aim to include, at the same time, main and minor cultural heritage: churches, castles, old towers, farmhouses, historical villas, votive pylons, small chapels, bridges, old factories and mills, but also protected natural areas, gardens, significant points of view etc. Four categories have been created in the geodatabase to organize all recognized places: 'history and architecture', 'nature and landscape', 'production and work', 'food and gastronomy'. The second key point of project is to map 'cultural routes' that allow the connection between selected places by different means of transport. The main strategy was to create routes that should be well connected to the main infrastructural nodes (railway stations, mo-

torway exits, service areas on the motorway), in order to obtain a good accessibility and encourage the intermodality between infrastructure (railways, motorways) and bike routes or foot paths. The proposed routes connect different places, localized in the towns or in the countryside; these routes have different lengths (the first route is 42 km long, the second route is 11 km long, the third and fourth routes are approximately 5 km long). The structure of application includes specific slides for the description of each routes, interactive map to visualize routes and points of interest according to own real time position. In fact a specific tool in the mobile application automatically calculate the distance between the current position and the next place to see. In the mobile application each place has been shown in the map with a specific color (each of mentioned categories have a specific color), through pictures and short description (Picture 3).

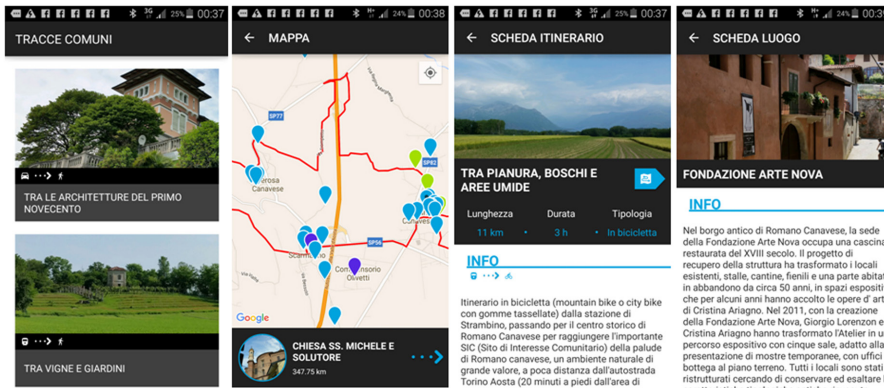


Figure 3 | 'Tracce Comuni' mobile device application: a new tool to explore a territory and visualize geolocalized information. Project developed by E. Franco – TMC, F. Parodi – StudioAnd, A. Rolando - DASTU, leaded by the Municipality of Romano Canavese (TO), supported by Risorsa Canavese Fund.

Effectively the use of the mobile device application can be considered from two different points of view. Users can use the mobile application as tool to explore the territory, to visualize the map, receive information about places and tracks, find a correspondence between pictures and real places, and definitely improving their knowledge about the place during the experience on the site. In this case the experience of users can be defined as 'real'. The second possibility corresponds to the remote use of the mobile application, in the sense that contents can be visualized and used even at distance and not in the specific site. According to this second perspective the users experience is no longer connected to the reality, but can be considered more 'virtual'.

## 5 | Conclusions

This research has shown a practical method that involve different typologies of open data connected to cultural heritage field, GIS and mobile device applications. In terms of methodology this procedure can be divided into two main stages: the first stage is about the 'analysis' of open data available on the web and their management in GIS platforms. This part can be identified as the most 'theoretical' one, because can produce and increase 'knowledge' on places, requiring specific skills and higher education of operators. The second stage is about the 'synthesis' of information, collected in the previous stage. Effectively the big amount of data generated in first stage must be made available by mean of mobile device applications to a large num-

ber of users. It is therefore possible to have a situated knowledge, more real if it this process happens directly on the place, more virtual if it takes place from a distance, through the internet web (Picture 4).

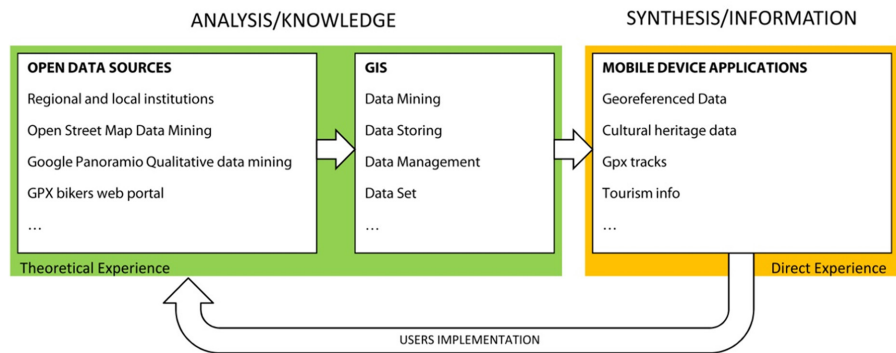


Figure 4 | Syntetic scheme of methodological aspects: on the left the 'analysis/knowledge' stage, on the right the 'synthesis/information' stage.

Some aspects of this procedure seem to be improved in the future. The first point deals with the possible 'contribution' of users, that can implement, share and therefore improve the database with their eventually acquired situated knowledge (increase the quantity of cultural heritage, feedback about people's emotional reports, pleasantness of the routes etc.). In this way it is possible to involve users in the entire procedure, and obtain a virtuous cycle process of auto-implementation of open data. The second point is about the 'validation' of open data that need to reach an higher level of reliability. The last point, is more practical, concerns with 'data mining/filtering' that should be based on fixed level of standards, to improve a better shared knowledge and a true interoperative users process.

## Responsibility

The editing of the chapter 1 is by Andrea Rolando  
 The editing of the chapter 2 is by Alessandro Scandiffio  
 The editing of the chapter 3 is by Alessandro Scandiffio  
 The editing of the chapter 4 is by Andrea Rolando  
 The editing of the chapter 5 is by Alessandro Scandiffio

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[www.openstreetmap.org](http://www.openstreetmap.org)

Open Data Regione Piemonte  
<http://www.dati.piemonte.it/>

Web users portal that collect gps tracks by mountain bikers  
<http://www.mtbpiemonte.it/>