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Urban Surveys: Multimedia Documentation for Cultural Cities

The surveys of this research are related to six small cities which are sprawl along the oriental slopes of the Peloritani Mountains, between Messina and Taormina.

Casalvecchio is the last centre which was surveyed, the others were Mandanici, Forza d'Agrò, Ali, Fiumedinisi and Itala.

The centres were surveyed integrally with the help of innovative (laser scanner and drone) and traditional methods (over 180 participants worked with hand measurements on the sites). The obtained documentation is the base for future analyses and studies.

The research indeed could have many objectives.

The first one is related to the elaboration of a specific protocol for the urban surveys with the more innovative survey technics.

With Casalvecchio, in particular, the results of the laser scanner survey (made at ground level) will be confronted with the photogrammetric surveys (based on aerial photos).

The second goal regards the analysis of the urban space thorough the lenses of typology, style, history or environment. For example, regarding Itala, an App able to join the gaming and the territory knowledge has been hypothesized.

Furthermore the possibility to increase the awareness of the site with multimedia tools, able to involve not only the tangible aspects of urban space but also those which involve the fruition and the emotions, has been tried. For example, the methods for using the public space have been visualized through a continuous video-shooting of one of the main Ali sites.

Key words:
Survey; Drawing; Communication; Heritage

INTRODUCTION

Architectural Survey and Drawing. A combination that in the '80s tackled the theme of knowledge and dissemination of architecture with analogical instruments, almost archaic. To name it now, Drawing and Survey Duo's, it still seems to hear the sound of the technical pen that, resting on the edge of the triangle, literally engraves the opalescent silky surface of the roll of transparent paper. The architectural drawing, in those years, was made up of lines, discrete elements, white and black. Preserved in rolls like a precious papyrus, the drawings alluded to architecture rather than to show it.

The survey was, in most cases, a manual one. The architecture was touched with the metric roll, it was wrapped in a tangle of triangulations the denser they were the more the survey was careful and detailed. The moldings were measured with the comb profilometre, while for the more complex or the more important details were used plaster casts.

Since then, first the drawing and then the architectural survey, have undergone an evolution not only scientific but technological and economic that first modified the tools and techniques of survey and then revolutionized, through the reduction of costs, the amount of users and the data produced. For example, the so-called user-friendly technologies and the low cost of the products have enabled young architectural students to process highly sophisticated three-dimensional renderings and models, initially accessible only to large architectural firms.

The survey has changed pace in the last twenty years. From the theodolite to the total station the pace was not brief but with the introduction of the laser scanner, the Lidar and with the use of drones, the ability to access the knowledge of architecture seems to have no limits. Moreover, in recent years a lot of software, based on photogrammetry, allow the processing of detailed surveys with the use of simple cameras. The revolution of the survey is completed. The most advanced techniques and results are now available to the most people.

The challenge, which emerges, is about the functional management of the data. Clouds of dense points, extraordinary surveys, mimetic and immersive

representations, have anesthetized the amazement and the momentum with which users access the data obtained. In addition, the amount of data, already huge, can be further implemented by every single user with increasingly sophisticated, and at the same time more and more widespread, tools. This research tries to imagine how to decline the results obtained and what concrete effects on the territory these can generate.

A research on multimedia documentation of historical cities must reflect first of all on three crucial aspects: the value of the web as a reservoir of useful data for surveying and understanding the heritage; the places on which to focus the research; the ways in which to transform the collected data into concrete value for the community.

The three results that conclude this research describe a broad and multifaceted strategy for the documentation and communication of cultural heritage. The first is a protocol communication-oriented for the surveys of the cities and open to continuous updates; the second disrupts the

perceptive criteria of the city by detecting aspects that are underestimated or not visible in traditional surveys; the third result, has mixed the knowledge of the territory and new forms of graphic representation through a playful approach. All proposals are connected. Data and information migrate from one proposal to another, emphasizing the possibility that the data base from which they originate can be implemented to offer solutions and visual, cognitive and expressive experiences that are always different and perhaps not yet fully investigated.

THE WEB: DATA TANK

The strength of data coming from network users and contemporary technology is there for all to see. Some systems have nourished themselves, literally, with the occasional contribution of users. The implementation of systems like Google Translate, with its *machine learning* algorithm, has exploited the linguistic skills of millions of users to produce increasingly effective translations.

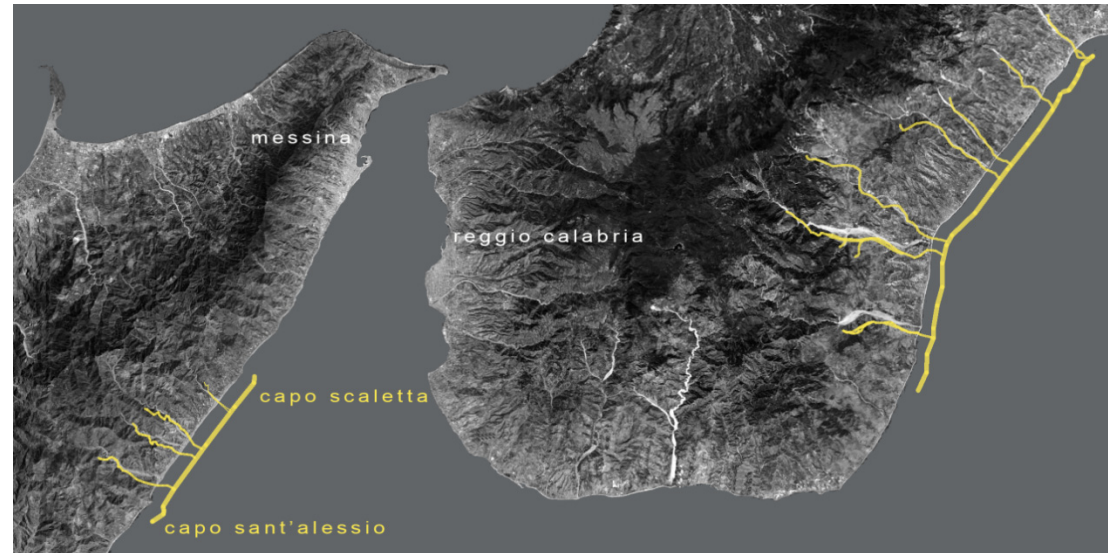


Fig. 1 – The field of investigation.

Similarly, Google Earth used data from random users, as well as those produced by students and professionals, to implement data about the territory and the cities: three-dimensional models, photos, reconstructions. Architectural survey, through photomodelling systems, is now within the reach of every citizen. If on one side the possibility of acquiring dimensional and formal data regarding the heritage of our cities has undergone a dizzying escalation in recent years, on the other side there is the necessity to analyse data through pre-constituted logical and syntactic structures.

To put it another way, an indistinct knowledge of data is equivalent to total ignorance of the same. Who organizes data for us? Who is interested in doing it? Who can manage surveys and modeling that multiply over time? Some sites have already taken this path. *Heritage Together* is an organization that has been operating online since 2013. The principle is simple. The users of the Heritage are invited; in this case the visitors of the Neolithic structures of Wales, to take photos useful for the three-dimensional modeling of the structures in question. The initiative, made by some professors of Manchester University, has

several outputs. The first concerns the construction of a capillary network of surveys. The second involves the user, making him aware and co-participant of the documentation and protection of the asset.

It brings him closer to the knowledge and study of other monuments of the same period present in different territories.

It therefore creates a network of interconnections between the various works and users. ^[1]

The authors of *Finding Paths through the World's Photos*^[2] (Fig. 8) show how it is possible to connect the photos that users share in the media to create three-dimensional and multi-scalar models of some of the most famous sites in the world. While *Aioli* is a platform that shows how, with the collaboration of users, it is possible not only to research the morphology of architectures but also to indicate the presence of damage and degradation phenomena which, marked on two-dimensional images, are then reported by the system on a three-dimensional point cloud. These platforms, maybe, could contribute to the creation of a useful database for the implementation of the Heritage Bim.

FIELD OF INVESTIGATION

Where to turn on the reflector of the survey and analysis? What parts of our territory should we investigate? The multimedia system, although widespread and capillary, ends up making the representations of some places become hypertrophic, which assume, in the collective imagination, a prevailing dimension capable of obscuring all the rest. Other areas of our country suffer from an economic crisis and visibility that has persisted for decades. Territories where production activities are reduced to a minimum and where the quality of the landscape and architecture are the only, fragile, resources. These are marginal realities that have conserved their heritage almost intact because of their laterality; realities that, far from the main flows, even virtual ones, end up having no stage and no visibility.

The area chosen for the research, started in 2012 and still in progress, is the Ionian coast of eastern Sicily: the portion included between Cape Sant'Alessio and Cape Scaletta. The region overlooks the Strait of



Fig. 2 – The six cities analysed: Forza D'Agrò, Casalvecchio, Mandanici, Fiumedinisi, Ali and Itala.

Messina and rests on the steep slopes of the Peloritani. The six cities are: Forza D'Agrò, Casalvecchio, Mandanici, Fiumedinisi, Ali and Itala. (Figs. 1, 2)

The region is strongly characterized by the uniformity of the landscape dominated by the sea towards the east and by the sight of a strip of Calabria. The steep territory directs the eye towards the sea and creates real visual rooms closed laterally by the numerous capes that alternate with the rivers. The territory therefore presents a complex orography generated by the folds of the slopes of the Peloritani which, shaped by the streams, steeply slope towards the coast.

The ancient ways of communication between the coastal region and the interior of Sicily were, around the eleventh century, located along the torrents. Here the monastic communities coming from the East, or according to a now obsolete diction, the Basilians, left numerous traces in the inhabited centres and in the artifacts that dot the region as monasteries, churches and *cuba*.^[3]

The social and dimensional evolution of the centres dotting the Ionian coast of Messina has been substantially homogeneous. This area, in fact, falls in the Val Demone, which had a period of economic splendor and relative autonomy between

1100 and 1500; in fact, the impervious territory, the high density of crops and inhabitants made the Arab conquest and the imposition of duties and taxes difficult. Mulberry and citrus cultivation made this region economically solid for many years. The centres that dot it, located halfway along the rivers, grew until the eighteenth century. The progressive and unstoppable depopulation was caused first by the decline of silkworms and then by urbanization and migration policies.

The six towns constitute a network of villages that are located in the area with similar prerogatives: they are around 200/400 metres above sea level; they are centres in which the phenomenon of depopulation has been constant for years; they the current morphology is attributable to the last great period of fortune of these villages, around 1600/1700; they are centres with about 1000/1550 inhabitants and with an extension of a few hundred metres. The homogeneity makes it a perfect field of investigation for formal analysis on the quality of the architectures and on the morphology of the centres, on the typology of the residential buildings.

PROPOSALS FOR COMMUNICATION AND AWARENESS

This research tries to transform urban survey data into graphical elaborations which are useful for the documentation and the communication of the historical cities. The examples below are related to one of the six surveyed centres but can be applied to all the others. The aim is to show different communication strategies for the valorisation not only of the centres but also of the data obtained.

The proposals put in place are three: detect to communicate; detect the invisible; to play to see.

The first concerns the development of a protocol for urban survey aimed at communicating the architectural heritage of the centre. In particular, as regards Casalvecchio, the results of the laser survey, carried out with ground shots, will be compared with those of the photogrammetric survey, based on aerial photographs.

The second concerns the possibility of increasing the awareness of the place with multimedia tools that

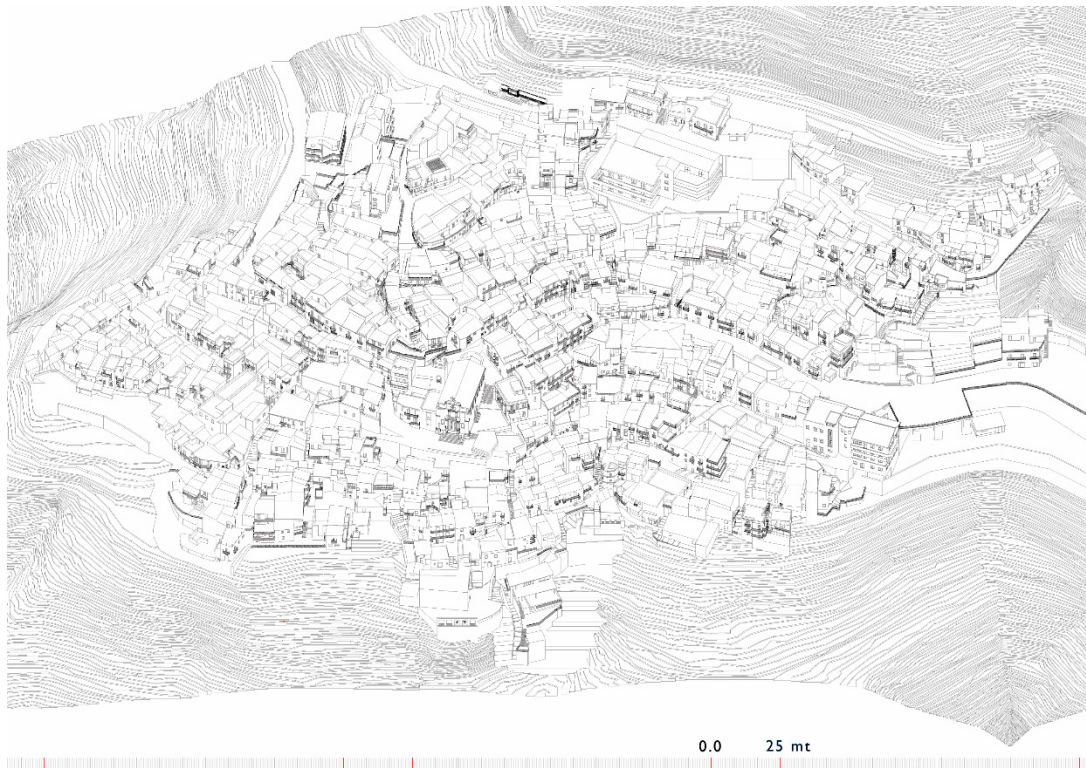


Fig. 3 – Casalvecchio: axonometric view.

Fig. 4 - Communication and awareness: survey with laser scanner of Casalvecchio.

Fig. 5 - Communication and awareness: photogrammetric survey of Casalvecchio.

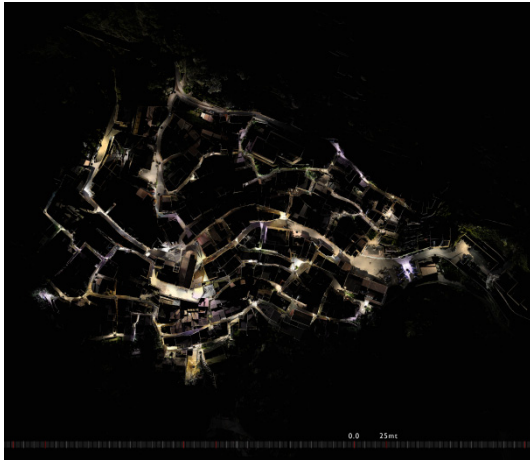
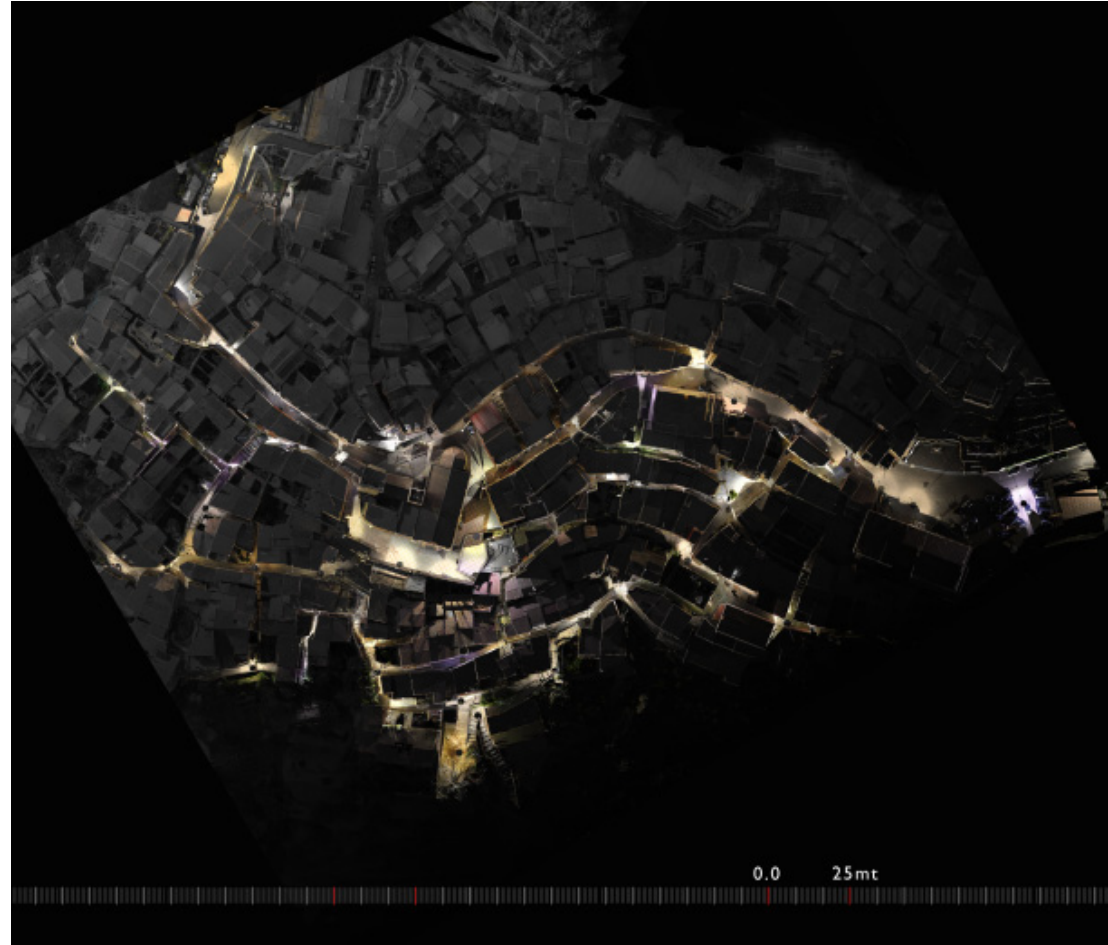


Fig. 6 - Communication and awareness: Casalvecchio photogrammetric survey overlapped to the laser one.



embrace not only the sensitive aspects of urban space but also those of fruition and emotion. For example some attempts have been made, through different approaches, to visualize the ways in which the public space of Ali, Mandanici and Fiumedinisi is used.

Finally, the possibility of investigating urban space was explored analytically applying typological, historical or environmental filters. The creation of an App, that combines gaming and knowledge of the territory, has been hypothesized.

The six centres, through the App, are within a ludic network which allows you to investigate some of aspects the architecture and of the landscape with ad hoc strategies.

SURVEY TO COMMUNICATE

The first proposal provides for the creation of a protocol for the complete documentation and communication of the small centres of the Ionian coast through an instrumental and manual survey. Furthermore, continuous data implementations can be hypothesized through direct surveys, workshops or geo-referenced Apps designed for three-dimensional modeling from photography.

Fig. 7 - Communication and awareness: survey with laser scanner of Casalvecchio, urban fronts.



The centres are recorded in their entirety, taking into account only the public space. The survey therefore concerns the perceptive aspect of the city, its architectural language, the form with which architecture anthropizes the terrain, the way in which the network of streets and buildings frame the landscape, in a few words how much of the city falls under the our senses.

Each centre has been detected and represented in the same way, in fact the protocol provides:

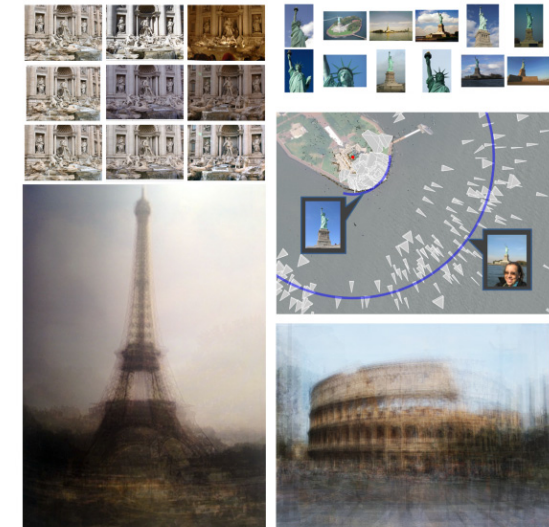
- Preliminary operations; collection of maps, aerial photos, historical information and inspections.
- Design and implementation of the collective direct survey; morphological analysis of the centre, carried out with the help of cadastral maps, topographic map, and aerial photos to highlight the predominant axis, the axis of greater visibility of the centre according to the orographic and morphological trend of the centre itself ^[4]; identification of the areas in which to fragment the centre, square compartments with the sides between 60 metres and 80 metres. Cataloguing of all the real estate units present, the data sheet shows the photos of the elevations, the indication of the coverage and the state of conservation of the property.

Fig. 8 - Corinne Vionnet, Photo opportunities and Finding Paths through the World's Photos.

c. project and execution of an integrated instrumental survey; for each centre, laser scans of at least one topical site were performed: the main square and the cathedral. The instrumental survey, for the cities of Fiumedinisi, Itala and Casalvecchio, innervates the whole centre following the main path, usually arranged according to the isolines. The survey always includes paths in counter-slope creating a comb structure useful for uniformly cover, even if not completely, the city. Often, for a better verification of the instrumental survey, closed paths are carried out. The survey of Casalvecchio, carried out in April 2018 with altogether 165 scans from the ground, is confronted with a photogrammetric survey, obtained through 300 photos taken from a drone^[5]. (figs. 4-6) The images show the compatibility of the two methods and the richness of the representation obtained (Fig. 6).

The quality of the laser scanner survey carried out on the ground shows its strength in the elevations. In fact from the laser scans we have obtained the orthophoto of many urban fronts. (Fig. 7)

d. Communication. The restitution of the collective manual surveys is based on the instrumental one and implements its information. The data obtained are



transferred into a three-dimensional model of the entire centre designed for an optimal printing to a 1: 200 scale. Various procedures have been carried out to simplify the overall model and to make it more homogeneous and legible. The works created for all the centres are: roofing plan, planimetry, transversal and longitudinal sections made inside the paths to reveal the morphology of the elevations and the relationships between architecture and site (Fig. 3).

e. Documentation. All the collected materials constitute a reservoir for further analysis concerning the architectural language and the urban morphology as a whole.

SURVEYING THE INVISIBLE

One of the objectives of this research is to explore the potential of the representation at the service of the survey. The strength and mass of data coming from the web can give rise to very different results. In *Finding paths through the world's photos*, the authors, including a Microsoft researcher, use the photos on the web to realize three-dimensional photomodels of the major sites of world interest. With the same photos, the artist Corinne Vionnet^[6], in *Photo opportunities*, gets dreamy images, close to the evanescent paintings of Turner, but totally virtual. In the first case the large number of photographs creates perfect reconstructions; in the second case the greater freedom of movement and the very high number of photos create more fluctuating and complex images^[7]. (Fig. 8)

The Vionnet images are, indeed, more a collective portrait of those who take pictures than of the places represented. They tell us how people enjoy urban space. In fact if the mass on the one hand feeds on the collective imagination, looking for iconic places, on the other hand it increases the visibility of these places by multiplying the shots on social media.

Fig. 9 - Surveying the invisible: All life trails in the in the cathedral square.

Fig. 10 - Surveying the invisible: Mandanici pedestrian movement.

Fig. 11 - Surveying the invisible: Fiumedinisi hint of life.



In the cities of the Ionian coast, multimedia visibility is practically absent. The very presence of the inhabitants is limited in some areas of the city or at certain times of the day. In a half-empty city the rarefaction of movement has something poetic about it. With little effort we can follow the movement of the inhabitants, capture their habits and the use of space with short photographic sequences.

You can draw, inside a square (fig 9) or a road (fig.10), life trails, fluid trajectories, strong and straight lines, long breaks and stops. The signs are added to the traditional ones that every survey gathers so the drawing tells something that all the inhabitants of the place know but that no one ever sees.

In the town of Fiumedinisi (Fig. 11), oriented to the north-east and in shade most of the year, the houses with the facades parallel to the slope seem to rotate to conquer the distracted gaze of the passer-by together with the rays of the rising sun.

The city, therefore, lets itself be seen from afar, apparently empty and motionless: the windows open and fill with heavy shadows, the smoke of the narrow chimneys disappears in a few moments, the clothes hanging in the sun sway and the leaves that dot thin and flexible branches tremble in the breeze. And finally, among the corroded and uneven tiles, the parables, which stand out concave and sidereal like modern sunflowers, rotate in unison to capture the invisible satellite rays.

TO PLAY FOR LOOK AT

The third option for the communication of data obtained is the creation of an app capable of networking the six Sicilian Ionian centres. The App can be downloaded for free through the link conveyed by a QR code. The goal of the App, in line with European and regional directives for the development of small

villages and for the development of alternative routes to seasonal ones, is to be encouraged to have a deep understanding of the places through a playful and light approach.

App and Go (Fig. 11) exploits augmented reality technology to hybridize the real context with the multimedia one by proposing new representations of reality. The game offers different types of targets, (architectural details, views and monuments) scattered in the territory of the villages and in the immediate vicinity.

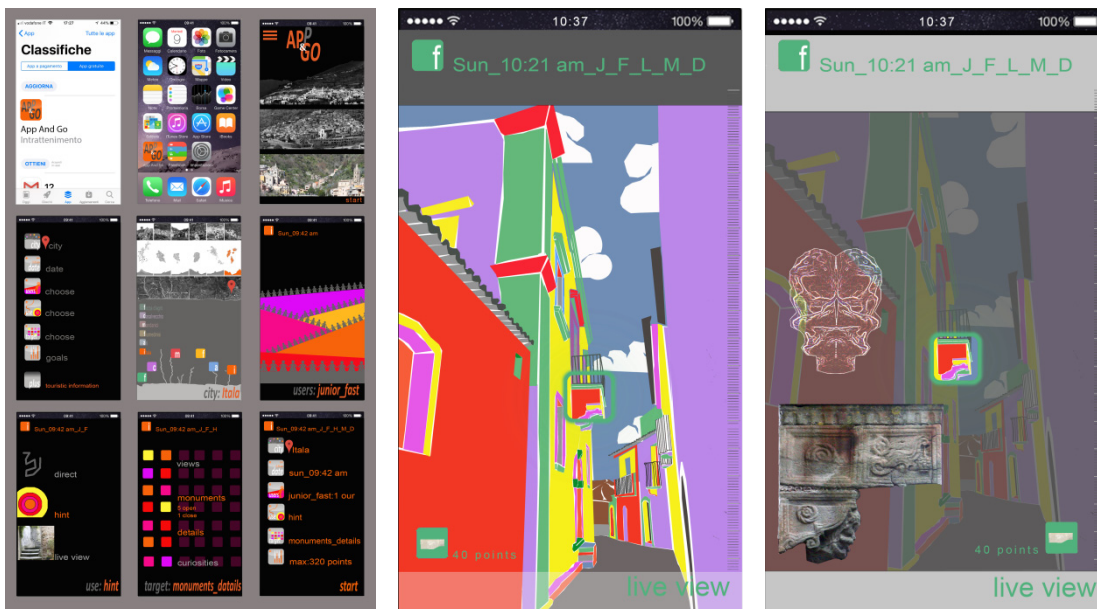
The targets interact with the user through GPS localization and allow a visual, graphic and cultural experience of the centre. The aim of the game is, of course, to reach the highest score and to virtually challenge past and future users.

The score obtained gives access to various benefits and is calculated by parametrising the options initially chosen. Average scores may offer discounts in accommodation facilities in the district, while high scores allow entry into the centre's "hall of fame".

The user is asked to choose his profile: junior /senior, fast / low; how to reach the targets: straight, hint, live view; and the type of targets: views, monuments, details, curiosities.

In the junior/fast /live view mode (fig.12) the App offers a re-elaboration of the urban centre image in pop version with full colours and simplified details. The user identifies the area in which the target is present, in the example a corbel of the building in via SS. Announced at Forza D'Agrò (Fig.13) the target, once framed, offers a score that contributes to the final result.

The targets are pre-selected by the system based on the choices made previously, the views are places where you can observe a particular landscape or urban view and are chosen by the system taking into account the weather conditions and the position of the sun. The voice curiosities contains elements which are not properly architectural, it indicates the livelier squares, the unusual decorations or the information that previous users have added.



Figs. 12,13,14 - To play for look at: APP&GO three screenshots.

NOTES

[1] In this regard, see a research carried out a few years ago where we investigated the possibility of monitoring the degradation of the Moroccan kasbahs that rise along the Draa valley through the active involvement of tourists. The project involved the construction of a digital platform capable of accepting data and addressing their acquisition. In fact, local tourists were provided, with the app, a clear indication of the data that were not yet present in the survey. The App was able to direct the tourist/surveyor who, through a calibrated series of shots, could contribute to the realization of the final survey. It must be said that the buildings in question, built in rammed earth, are susceptible to changes and collapses, so the survey carried out by tourists could, and should, be repeated many times to monitor the state of conservation of the works. Arena, M. (2017). Definition of a Protocol for the Knowledge, the Analysis and the Communication of the Architectural Heritage: Single Monument, Network of Monuments, Historic Settlement. In A. Ippolito (Ed.), Handbook of Research on Emerging Technologies for Architectural and Archaeological Heritage (pp. 94-131). Hershey, PA.

[2] Noah Snaveley, Rahul Garg, Steven M. Seitz, Richard Szeliski.

[3] Some examples of religious architecture dating back to the twelfth century are: the Monastery SS. Maria Annunziata in Mandanici; the churches of St. Peter and Paul in Casalvecchio and Itala, the church of Santa Maria a Mili, and many other examples. In addition, remains of Spanish fortifications are present in Sant'Alessio, Forza D'Agrò, Savoca, Roccalumera, Fiumedinisi and Ali.

[4] Some of the centers of this territory are arranged halfway up (Ali, Casalvecchio) or are located on the banks of a stream (Fiumedinisi, Itala, Mandanici) while some others are situated on the ridges like Forza D'Agrò and partly Ali. The centers are mostly compact, extend for a few hundred metres and stretch out towards the Strait due to the slope of the land that degrades, between the folds of the rivers, from the heights of the Peloritani to the sea. It follows that almost all the centers are oriented to the South, South/East; only exception: Fiumedinisi facing North/Est.

[5] The survey with the drone was done by Gabriele Candela.

[6] Corinne Vionnet, Photo Opportunities, published by Kehrer Verlag, foreword by Madeline Yale, 2011

[7] Emblematic is the case of the Statue of Liberty portrayed from obligatory points of view while the Eiffel Tower, with an infinite number of points of view, has a fluctuating and complex representation.

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