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## EARLY CAREER ARTICLE

### Smart paths for advanced management of cultural heritage

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Internet and mobile communication has transformed the manner of conventionally interacting with cultural heritage, creating dynamic networks for all those involved. It provides opportunities to experiment with innovative mobile applications that, valorizing historical and environmental resources, complement the broader context of smart cities/regions. This paper aims to study an advanced virtual on-site fruition of cultural heritage by users–consumers, applied in the region of Sardinia, through the simulation of computer-based relational augmented reality (AR) applications. This case study, which is a unique regional attempt at promoting regional cultural heritage using AR technologies, is interesting because of its tourist offerings that today remain fragmented.

**Keywords:** Sardinia; smart city; smart region; cultural heritage promotion

#### Introduction

The ‘smart city’ concept dates from the 1990s when academics and scientific experts initiated an effort to merge information communication technologies (ICT), ‘cognitive maps’, ‘global cities’ and the ‘network society’ (Castells, 1996; Mitchell, 1996; Sassen, 2001). In Europe, the concept has evolved in recent years towards a developmental, policy-oriented approach. This new approach considers in greater depth the six major factors identified by Giffinger et al. (2007) as crucial for ‘smartness’: mobility, economy, governance, environment, living and people. It has resulted in a change in perspective regarding developmental strategies for medium-sized cities. Although a clear and unambiguous definition of a smart city is lacking, the new models (Caragliu, Del Bo, & Nijkamp, 2011; Giffinger et al., 2007; Murgante & Borruo, 2013, pp. 630–642) are unified by their focus on issues commonly encountered when implementing smart city principles. What differentiates this approach from past development strategies is the unification of elements into a single framework, which previously had generally been addressed separately.

This interpretation does not ‘adapt both traditional and new forms of planning and intervention’ (Batty, 2014, p. 390) because it encourages the use of urban resources in short time horizons. However, the new concept of ‘smartness’, and the empirical approaches adopted in this area, have shifted the perception of a smart city from a theoretical construct towards an ‘ideological vision for self-promotion’ that can be pursued via projects based on local needs. It becomes an abstract projection of a new common good: a technological infrastructure able to create a dialogue between city users and

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tangible and intangible objects, thereby generating intelligence. In this conceptualization, the smart city, with its natural inclination towards ICT, generates innovation through user learning and creativity (Komninos, 2009) and initiates processes that make infrastructure more efficient and interactive.

‘Soft’ infrastructure (innovation, creativity, knowledge and users) is the social capital of a city (Caragliu et al., 2011) to which ‘smart’ infrastructure (new technologies) can be linked if the latter is constructed by an enlightened, smart government and smart community. Smart factors can therefore only lead to more efficient use of resources if integrated effectively into the territory, promoting and maximizing existing resources and making them more attractive.

This is supported by the way in which ongoing developments in technology and new mobile applications have influenced society. ‘Connected’ and ‘mobile’ users can use technology to exploit resources, learn, and manage the environment and surrounding area in a conscious manner. There are numerous examples of technologies with which this aim can be achieved: printed materials and signage using Bluetooth (Figure 1.a); quick response (QR) codes (Figure 1.b); near-field communications (NFCs) (Figure 1.c); augmented reality (AR) (Figure 1.d); and dedicated smartphone/tablet apps. All have in common the initial difficulty of convincing users to modify their existing practices, even if their quality of life is improved by the technology. Therefore, it is necessary to prepare the community adequately: resistance to technological solutions may restrict integration, change the community and limit their appreciation of potentially positive applications of this new technology.

The paper is structured as follows. The second section of the paper investigates the current relationship between smartness and the promotion of cultural heritages based on

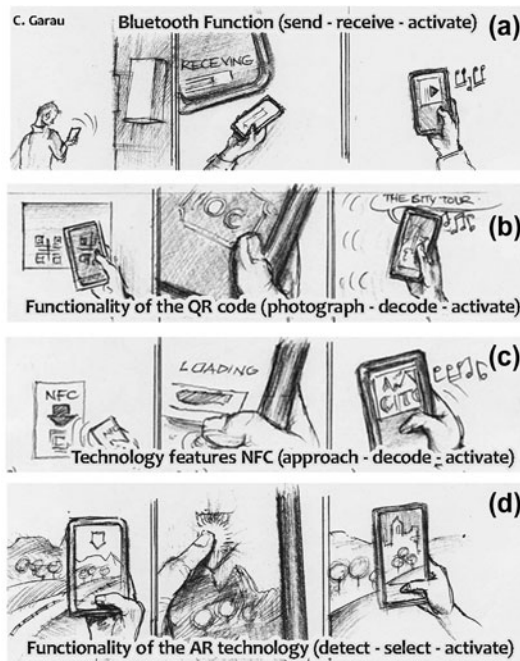


Figure 1. Evolution of technology on smartphones.

AR and smartphones. The third section uses the region of Sardinia (Italy) as a project example of a smartphone/tablet app demonstrating how the model of a smart city can be understood at the regional level. The focus of this paper is to understand the contribution that AR can provide to region smartness, aggregating user (in this case tourist), preferences to guide other users more effectively through the mosaic of cultural assets in Sardinia.

### From smart city to smart region

Factors in the categories of ‘smart living’, ‘smart people’ and ‘smart governance’ in part affect the attractiveness of a location and its potential for tourism. To exploit these factors fully and maximize an area’s potential, planning and management processes must include local resources at all levels (La Rocca, 2013). Based on its habitat and historical and cultural features, a territory should be regarded as something more complex than simply the sum of its museums, archaeological areas, parks, archives and libraries, especially at the provincial or regional level. A territory can be seen almost as a ‘living museum’: a ‘tourist product’ that can be admired and visited to enjoy the harmonious ensemble of its ‘staging equipment’, ‘fixed furnishings’ and participating actors. Based on this conceptualization, in certain circumstances it may be appropriate to expand the classic ‘smart city’ factors to a regional level. As with a smart city, a smart region is rooted in local values, both tangible and intangible. It is crucial that the model considers all the potentialities for tourism that are able to meet the current and growing demands of users.

In the model outlined in this paper, the promotion of cultural heritages should be seen as a combination of different *polarities*, specific cultural, political and economic vocations that are inherent in the territory, and a set of containers that are usable *en plein air* through AR and smartphones, which act as ‘pocket guides’. The different types of users involved generate different flows of information. The resident-user belongs firmly to the community owing to his/her roots, feelings, work and everyday life. The tourist-user chooses to join in a transitory manner to verify whether that location meets his/her expectations. The regional administrator-user has to know the community to govern it effectively. The ICT experts need to know the territory to communicate with and promote it. Promotion goes beyond the localization of cultural heritage and, instead, activates a process of collective learning that is managed primarily by experts, but can be implemented by all users (Lee & Wicks, 2010). The users themselves (including not only industry professionals, intellectuals, students, visitors and tourists, but also residents eager to discover the emblematic and symbolic aspects of a location) can post and share comments as well as reviews. It is possible to define the type of content and useful services for all users involved while favouring one and providing different paths allowing the model to respond effectively to each visitor-user’s requirements.

This approach can produce positive effects for cultural heritage not only in the largest and strongest urban centres, but also in the most marginal peri-urban areas, through complementarity and integration.

### Smart solutions for promoting Sardinian regional cultural heritage

In Europe, more than 80% of cities are medium sized (between 100 000 and 500 000 inhabitants) and contain 40% of the population (Giffinger et al., 2007). In Italy, however, 70% of municipalities have fewer than 5000 inhabitants, accounting for 17% of

the population. In Sardinia, the proportions are higher: 83% and 31.5%, respectively (Fondation IFEL, 2012). Cultural heritage, therefore, is not concentrated in large cities: it is spread among a number of small and medium-sized municipalities and towns that are less exposed to the processes of renewal. Sardinia serves as a good case study for illustrating how developmental practices for cultural heritage can be adapted into a smart regional model. Employing conventional development strategies, its situation would likely result in many individual projects, with a high failure rate because of a lack of a strategic and unified vision. Therefore, an alternative strategy for culture and tourism promotion is more appropriate.

Numerous research and cataloguing projects have been performed by the Sardinian Region (RAS) to ensure that cultural heritages are more accessible (including for tourism). These include, for instance:

- the Project for the Development of the Integrated System for the Management and Enhancement of the Natural and Cultural Heritage (2005) (*Sistema integrato per la gestione e la valorizzazione del patrimonio ambientale e culturale – SICPAC*) introduced electronic cataloguing and focused on archaeological heritage, artwork and goods owned by the RAS; and
- the Mosaic of Historical–Cultural Goods (*Mosaico delle emergenze storico-culturali*) undertook the task of mapping Sardinian regional heritage (it currently includes approximately 15 000 cultural goods) and serves as a basic tool for the study of cultural landscapes.

However, despite the many projects currently implemented, Sardinian tourist offerings remain fragmented, lacking integration between different elements (e.g., heritage, food and wine, accommodation, cultural–recreational offerings). To address this shortcoming, the possibility of simulating virtual paths was conceived, bringing together the full range of administrative levels, from the regional and provincial to the municipal and neighbourhood scale.

A proposed smartphone/tablet app, currently in the concept stage, would balance and merge the classic bottom-up and top-down approaches and include consultation with residents. From the bottom, the community of users would perform a significant and instrumental role in implementing the system for the promotion and valorization of places; and from the top, the initial stimulus would come from local and regional authorities (who finance the project) and ICT experts. Utilizing the knowledge of both types of stakeholder and considering the characteristics and requirements of the territory, the project aims to use a participatory model to develop *ad hoc* technological solutions and dynamic interactions, where sharing, cooperation and collaboration are necessary and of fundamental importance to creating continuous interactions and links between smart communities and smart technologies.

A platform was envisioned to offer a range of paths based on user-specified requirements (age, time available, difficulties and practicability of the route). Paths would be based on cultural information (the yellow Smart Path (SP) in Figures 2.a and 2.b), local folklore (red SP) and history (pink SP), and nature trails (green SP). The platform would also display information regarding public transport and accommodation through user-controlled display filters (Figure 2.c).

The appreciation of historical and cultural heritages requires synergy between the territory's diverse range of assets, based on interrelations between different individual containers (Figure 3).

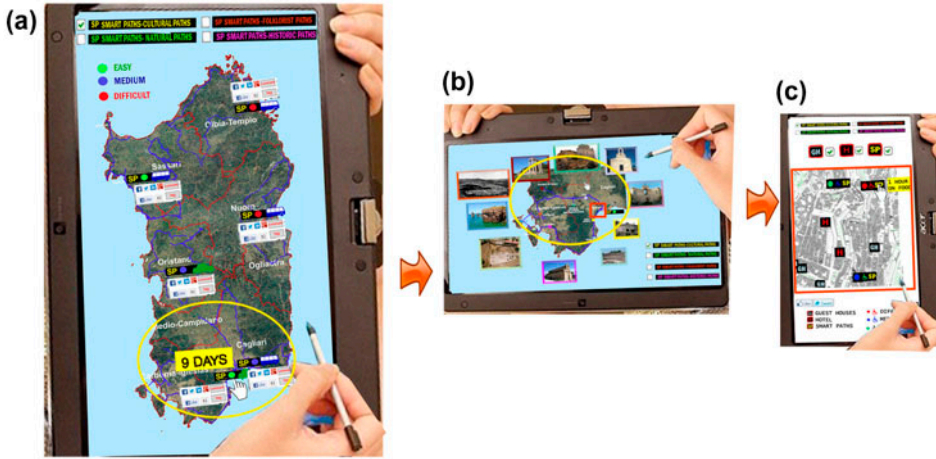


Figure 2. Choosing a route with an indication of the average time taken and its subsequent display.

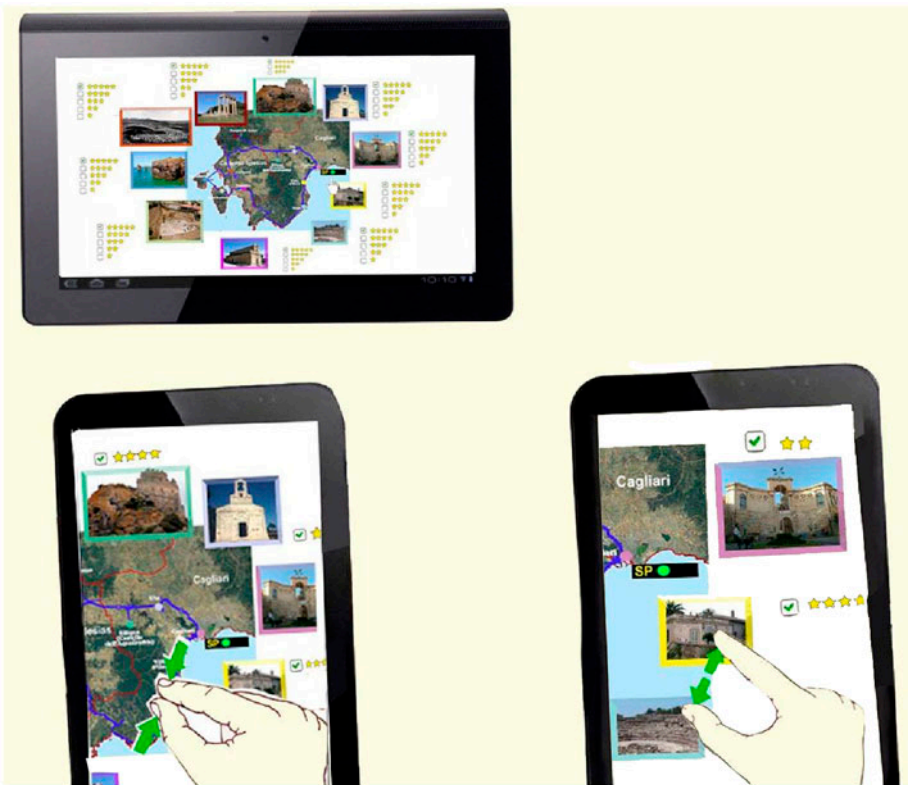


Figure 3. Users' feedback.

Tourist products would be developed not only to interpret local identity based on cultural offerings (art galleries, museums), but also to address specific user requirements in cultural terms. This implies that the bottom-up model allows a generic user to become a ‘DIY tourist’ regardless of the time of year or location. The user could create new routes with the application, which would also allow the user to provide feedback about the quality of services offered, affecting the way in which other (similar) users interacted with it. Stylizing this process in terms of the challenges involved in constructing a smart region, these processes are an attempt to encourage the user/tourist to approach cultural heritage in the manner that suits them best.

### Lessons from the case study

The case study suggests lessons and reflections that could inform other, similar projects, in terms of how the app has been envisaged and planned, including: determining and balancing the needs of various groups, problems encountered, proposed solutions and potential regional benefits.

The main *strength* of the proposed platform is that feedback from users allows improvements and monitoring by service managers and permits other users to choose paths based on user comments (Figure 2.a). The range of use of cultural heritage is not simply ‘imposed from above’ in a method that involves an asymmetric flow of information, but instead allows for activation of the hidden potential of cultural expectations through active listening and a willingness to share.

An important *weakness* is that the internal and rural municipalities of Sardinia have ageing populations, resistant to change and overly parochial, making the implementation of these ideas more difficult. The problem of the digital divide must be considered. Some people do not have a smartphone, or, despite having and using one, do not want to participate actively. This means that the data collected may be biased and reflect the desires of only a small proportion of the community (te Brömmelstroet et al., 2014). This weakness can be avoided by evaluating the effectiveness of actual levels of app utilization, user types and/or usability of the app.

Furthermore, no organization currently defines a shared plan and common set of goals and actions. It would be necessary for a public figure to assume ownership of coordinating the entire system of skill sets to realize a Smart Region model.

In terms of *opportunities* for development, optimal technological solutions inevitably ‘collide’ with both the local community and casual tourists who demand ever-increasing levels of service. The app can interact with users and their needs dynamically in real time; face-to-face or individual relationships can establish a more complete understanding of the platform. The potential complementarities between them will improve the use of the app and will suggest strategic methods to involve users not accustomed to technology. Conversely, these methods can generate potential conflicts, such as reduced confidence in this new technologic tool.

However, the app will not replace individual relationships established with people, attractions and unique, local cultural heritage. Rather, it will create new perspectives and, owing to its inherent sharing of information, provide users with ‘new eyes’ that will strengthen the identity of the location.

Potential *challenges* should not be underestimated. There could be issues with the quality or integrity of data entered by users. It could lack proper localization or be unreliable because of inadequate filters on incoming information. In this situation, it could be difficult to correct the information. Given the voluntary nature of uploading, the

quality of information and the certainty that all people involved give feedback cannot be guaranteed a priori. Consequently, the involvement of people to supply quality information and provide feedback needs to be fostered and promoted continuously and the system requires regular maintenance, implying that paid staff would be necessary. Institutional ownership is important as well as secured funding over a longer period.

## Conclusions

This paper has outlined some of the challenges that exist in attempting to implement smart city principles at the level of a policy-centric city region to facilitate accessing cultural assets and infrastructures.

Technological innovations alone cannot guarantee dialogue and reconciliation between the public and private sectors. The roles and responsibilities of the various categories of people who engage in the process at different levels of governance and management of cultural heritage are clear and necessary. It is not possible to exclude a central figure in the government who, acting from the top down: (1) synthesizes bottom-up information and conveys it in a unified and coherent way; and (2) coordinates and brings together the key contributors involved in territorial management and development. This is particularly important for a smart region, as the contributors would be more numerous than in the case of a smart city. The issue is the method for accomplishing these tasks. It must be based on the shared management of information but contributors may be unaccustomed to such sharing. Effective network management, developed and constantly monitored by all users, is required to unite different visions and produce improvements in an area's cultural resources.

The nature of the data for apps produced at the regional level and the related technological infrastructure are challenges. However, the merger of public and private knowledge can lead to excellent opportunities for: (1) the promotion and development of local tourism; and (2) increased competitiveness in the regional marketplace (integrated advertising campaigns and creation of paths, that can provide a combination of different cultural offerings).

Batty (2014) suggests that the opportunities provided by the big, user-generated data that are at the core of the smart city movement are 'based on much shorter time horizons where planning for efficiency is uppermost', to the extent that 'most of this big data is not very useful, for it is non-representative, unstructured, and difficult to adapt to both traditional and new forms of planning and intervention' (p. 390). The challenges of smart technologies for facilitating city and regional development should be able to support multidisciplinary integrated planning (involving a long time horizon), and developing information of 'value'. The suggested case study has shown that it is possible to start an efficient and reliable process that exceeds simply segmentation and dispersion. It could enhance the entire cultural heritage of the territory and could become part of the daily habits of involved community members.

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