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ICT as a tool to foster inclusion: Interactive maps to access cultural heritage sites

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Abstract. Within the European policies and strategies for a sustainable development, the role of cultural heritage as an economic, environmental and social driver has become increasingly significant. As an asset in people's lives, it's necessary to assure anyone the opportunity to access it, regardless of the physical abilities or cultural background of a person. In this sense, ICT could represent an important instrument in enhancing the level of inclusion in cultural heritage sites. This paper develops the discussion around interactive maps as a feasible solution to ensure a fully inclusive experience of a cultural heritage site. Thanks to the analysis of similar existing instruments, this operative tool has been conceived to perform two fundamental functions. First, provide an information system thanks to which everyone, particularly users with special needs, could be able to organize their movements and be aware of the proposed services (that also could be new ICT, like Virtual and Augmented Reality, implemented directly in the map) and opportunities to access cultural heritage. Second, offer a tool for the management of the projects related to the development of inclusion, therefore it is addressed to municipal administrators and other key actors involved in the governance of cultural heritage.

1. Introduction

From the 1972 UNESCO World Heritage Convention to the initiatives and events of the European Year of Cultural Heritage (2018), the role of cultural heritage as an economic, environmental and social driver has become increasingly significant.

To better understand its role, it is useful to recall the definition of World Heritage given by UNESCO, which states: "Heritage is our legacy from the past, what we live with today, and what we pass on to future generations. Our cultural and natural heritage are both irreplaceable sources of life and inspiration. [...] What makes the concept of World Heritage exceptional is its universal application. World Heritage sites belong to all the peoples of the world, irrespective of the territory on which they are located" [8].

The first part clearly underlines the importance of the cultural heritage in people's lives. In particular, with reference to Italian and European territories, its buildings and urban spaces house the main activities of the social life of a community, as well as the main cultural services. For this reason and for its architectural features, cultural heritage can play a key role in development strategies and policies. For example, it represents and reinforces individual and community identity and it can be an asset for new economic development opportunities, based on cultural tourism and the preservation of built heritage. Consequently, the real participation, in the social and cultural life of a community, is



possible only through ensuring the accessibility to cultural heritage. In particular, as asserted in the second part of the previous definition, heritage has a broader value and it is meant for all, without any distinction based on a person's physical abilities or cultural/individual background.

2. Towards a role for ICT in fostering inclusive policies

According to these premises, the goal of this paper is to deepen the discussion about the role that ICT could play in fostering public participation in cultural heritage sites. In particular, once understood the needs that inclusive policies must address, the proposal of an operative tool will try to identify how its implementation represents a key resource for an inclusive design approach and which challenges still have to be faced.

2.1. Inclusive cultural heritage sites: the challenges of the current condition

Given the universal value of cultural heritage, to which everyone should have access, it is important to understand the meaning the term "inclusion" assumes in this work.

On the one hand, the attention is focused on the enhancement of the physical accessibility of the built environment, as a place that can enable or disable people in achieving their functioning and consequently their well-being.

In this regard, a fundamental document in understanding the influence of the built environment on everyone's life is the International Classification of Functioning, Disability and Health (ICF) by the World Health Organization (WHO). In relation to the topic of disability, the ICF represents the latest version of a tool introduced to assess a person's health and well-being. The importance of this classification system lies in the acknowledgment of another element, other than the physical conditions, that influences people's functioning and their ability to do personal activities and participate in life situations: contextual factors. The latter are also divided into environmental factors, that are the physical and social features of the surroundings in which people live their lives, and personal factors, which involve the particular background of an individual, like the cultural one [10]. This connection with the built environment has also been underlined in the United Nations Convention on the Rights of Persons with Disabilities, which defines disability as the result "from the interaction between persons with impairments and attitudinal and environmental barriers that hinder their full and effective participation in society on an equal basis with others" [7].

On the other hand, the focus is set on the importance of socio-cultural component in defining human well-being and how architecture should foster access to knowledge and public participation, regardless of the cultural background of a person.

Culture has appeared as another fundamental need for human beings. In their different forms, socio-cultural factors influence the possibilities of participation in the public realm and human well-being, but the key issue can be identified in the topic of identity. The American psychologist A. Maslow, in developing his "Theory of Human Motivations" [3], among the basic human needs pointed out those of belonging, self-esteem and self-realization. In our society, all people perceive the need for a stable, solidly based and generally high evaluation of themselves, through their own inclusion within a broader group. A person needs to develop and express, at the same time, his own personal identity and the belonging to some collective system. Since culture is the maximum manifestation of this identity, it is essential that the built environment conveys the latter in its physical features, but especially it has to offer spaces that house services that manifest the culture intangible assets and through which promote public participation and the acquisition of new knowledge; in other words, places that develop identity.

2.2. Foster inclusion: which role for ICT?

The previous sections have allowed to better understand how inclusion assumes a specific meaning in relation to cultural heritage sites. In addition to the importance to assure their physical accessibility, it has become clearer which potentialities they have, in turn, in fostering inclusion, especially from a socio-cultural point of view.

Despite the relevance of the topic is widely acknowledged, the current design practice reveals multiple problems in developing inclusion in the architectural project, especially in cultural heritage sites. In order to better comprehend the issues that will be shortly described, it's necessary to highlight how this paper is part of a broader research aimed at develop a fully inclusive view of the project, especially regarding historical contexts. Through the analysis of multiple European case studies and especially an on-site investigation applied to Mantua (a city located in Lombardy region, Northern Italy, entered in the UNESCO World Heritage List in 2008, along with the site of Sabbioneta), it has been possible to identify two main issues that can be addressed by the implementation of ICT in the design process.

First, the management of the applied actions to foster inclusion certainly represents one of the main problems. The high number of actors involved and the lack of a comprehensive and long-term planning vision have led to the realization of inadequate and incoherent accomplishments. In this sense, ICT can provide the proper tools for managing the necessary inclusive design processes.

A second fundamental matter, related to cultural heritage, is the coexistence of inclusion and conservation needs, which are frequently considered in contrast, although A. Bellini, among the first that have talked about architectural barriers in restoration, remembered “We heavy many difficulties, insurmountable difficulties, in imaging a monument that has not been produced for men, which is protected and preserved in itself, as an abstraction, and not for fruition. [...]. It is not an asset if it is not usable, pure contemplation does not belong to architecture” [1]. In those circumstances where the goal of accessibility can be in conflict with the needs of conservation, these new technologies can represent the only instruments able to guarantee everyone the possibility to access a particular cultural heritage site and, more in general, to have a better experience of it.

3. Interactive map as tool for inclusion

For the purposes of the work, the conception of an interactive map has seemed the proper solution in the perspective of producing a feasible operative tool.

At this stage of the research, where the focus is principally in defining the main objectives and features of the map rather than its software architecture, this instrument has seemed the ideal interface to be used. It's easy to think of how, even in the daily travel activities, we resort to the use of digital maps; not only they let us to organize our movements, but they are also one of the first tools through which we become aware of a place. In this sense, when the reference is to cultural heritage sites, digital maps have a key role in collecting and sharing knowledge.

In addition to that, working through a cartographic base, this type of implement allows an easier integration with the existing documents and resources of urban planning, enabling to outline all the initiatives, whether they are architectural projects or not, necessary to allow inclusion to lead the transformation processes of the city.

3.1. Accessibility and interactive maps: background

In recent years, the success of digital maps has been widely recognized. This type of services, such as Google Maps, Bing Maps, Yelp and Waze, has contributed to the spread of an increasing number of information, although the data regarding the physical accessibility of the built environment are extremely poor.

For this reason, various initiatives focused on the issue of accessibility have been developed in parallel to these tools. One of the best-known examples is Wheelmap.org [9], an online map that collects accessibility information that has been reported by the users of its smartphone application, through on-site visits of the different points of interest within a city.

However, this kind of solutions still has several limitations. First of all, they suffer from a lack of records. If we consider the example of Wheelmap.org, a report on open accessibility data, made by Ding *et al.* in 2014, unearthed that only the 1,6% of the points of interest on the map had accessibility data [2]. In addition, this information refers only to punctual situations, measuring the accessibility of the single facilities without considering the paths that connect them. On the contrary, there are also

some services that focus their attention only on the accessibility of the urban environment, like Project Sidewalk [5]. Developed in Washington D.C., this project has been aimed at mapping all the accessibility issues that the city sidewalks present, through virtual exploration of the streets.

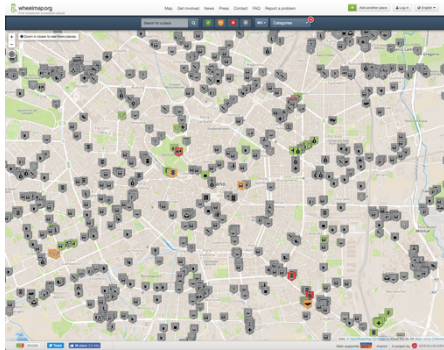


Figure 1. Screenshot of Wheelmap website. In the case of Milan (Italy), it's possible to see how many POIs still have missing information (in grey). Source: <http://wheelmap.org>

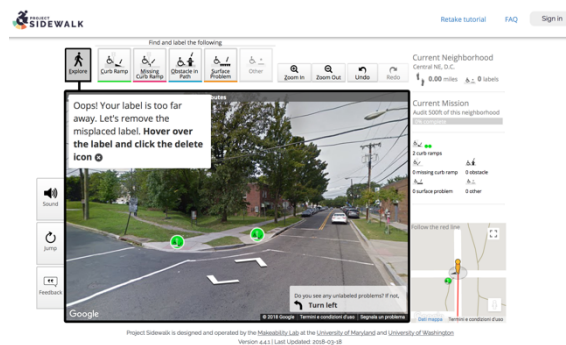


Figure 2. Screenshot of Project Sidewalk website. In this image is visible the user interface through which is possible to map the accessibility issues of the city sidewalks. Source: <http://sidewalk.umiacs.umd.edu>

Certainly, the data collected establish an important basis to develop inclusive policies, but the absence of information about facilities and other important “urban components”, such as public transport, doesn't allow to have a complete vision of the city system and, in the case of end users, to be able to organize your movements. Moreover, these multiple tools also have the side effect of scattering information, since each service contains different one, making it complex for the final user to acquire thorough data about the accessibility of a place.

A further fundamental aspect that must be taken into consideration is that this kind of instruments are mainly based on crowdsourcing. This model surely allows a faster and more widespread data collection; however, the accuracy of the information can be strongly variable. On the one hand, it can be necessary to evaluate the survey methodologies and their effectiveness, as the experimentation developed by Salomoni *et al.* on three different mobile apps to crowdsourcing urban accessibility has shown [6]. On the other hand, it's very important to underline how the concept of accessibility can be interpreted differently from map to map and especially from person to person. In case the data have not been previously verified or no objective indications on the parameters used to define the level of accessibility of a place have been provided, the risk is to produce a strong discrepancy between users' expectation and their actual travel experience, aspect that has been recognized as one of the greatest difficulties disabled people have in traveling [4].

In addition to the previous limitations, it's necessary to draw attention on how these tools are mostly addressed to people with physical disabilities, without considering those affected by sensory or cognitive impairments. In this case, the reference is not only to this kind of parameters, completely missing when defining the level of accessibility of a place. In fact, the fundamental issue is to identify the proper technologies and solutions that allow visually and cognitive impaired users to obtain the same information provided by the map.

3.2. Interactive maps: objectives

On the basis of the presented limitations of the existing services and the unanswered needs identified through the case studies and on-site investigation, the following sections of the paper try to contribute to the discussions about the objectives and features that this kind of tools should fulfill. In particular, this interactive map has been conceived to perform two fundamental functions.

In accordance with the analysis conducted on existing tools, the primary purpose is to provide an information system for people. Especially for contexts of high tourist attraction, it has emerged how information is indispensable to ensure the ability to access and move in the built environment. In particular, people with disability need to receive as much data as possible, in order to know the level of accessibility of a place. The goal of defining a new interactive map is to offer only one and easy to use tool that makes everyone able to organize their movements, according to their personal needs and the possibilities offered to them through the proposed services and fulfilled projects from local institutions.

Furthermore, if properly designed, this map could become the appropriate tool with which citizens can participate in the process of fostering inclusion. In line with the model of crowdsourcing, users can use it to advise the administrative bodies of the critical situations located within the city. Although, for what have been said above, it is necessary a professional supervision, it is important to maintain this element because in this way, not only the sense of social participation can be fostered, but the planned interventions would be aimed at answering to real needs expressed by people, who could guide the design process, ensuring the effectiveness of the design actions.

In relation to what has just been said, there is another important function for which this tool has been considered suitable: the management of the projects related to the development of inclusion, therefore it is addressed to municipal administrators and other key actors, such as public or private institutions involved in the governance of cultural heritage. In this sense, the map should locate within the city all the situations representing a physical barrier that restricts people's public participation. This complete cognitive framework, which should be integrated with recommendations on how to overcome physical barriers, will be able to support the planning of the necessary interventions, in accordance with several parameters, such as priority and financial resources, which can be evaluated from time to time. This kind of tool should guarantee a general and long-term vision, capable of adapting to various external factor that could influence the fulfillment of the initiatives to be undertaken.

Another essential aspect is the possibility of coordination among the different actors involved in the development of inclusion. As it has been said, the latter is defined by multiple components, whose supervision is entrusted to many executives. For this reason, the interactive map should be aimed at be the only tool that everyone can interface with, so the planned actions can be combined and properly realized to reach the highest possible level of inclusion. In addition, if conceived as a single instrument, this managing system can offer the adequate supervision to data coming from crowdsourcing, ensuring the accuracy of the information provided. Finally, this tool should be conceived to allow the continuous monitoring of the achieved inclusion. In fact, after the first surveys, the map should be constantly updated, notifying the issues that have been resolved and the new criticalities that could emerge, always providing the most recent vision of the level of inclusion reached within the city.

3.3. Interactive maps: features

Once the two main aims have been defined, the focus of the discussion must necessary move on the features and functions the interactive map should possess.

First of all, this tool should be able to provide information on the presence of architectural barriers within the city, both at urban and building scale, if of public interest. As already mentioned above, this data could be the results of professional surveys led by local institutions or reports from crowdsourcing. For this reason, prior to the development of the map, it is necessary to designate a series of unambiguous parameters that can then be made available on a designated area of the website and smartphone application. This would allow both the records from crowdsourcing to be as objective as possible and the end users to be aware of how the level of accessibility has been defined. In addition, these data should be pointed out in different ways, depending on the identified type of criticality. As it has emerged through the analysis of different experiences and the on-site investigation

of the case study of Mantua, it is possible to classify three sorts of physical barriers: the punctual situations, the ones with a linear profile and those that develop on an extended surface.

This distinction is critical both for end users to easily understand the extent of the limitations present and for the management purposes, because it already allows to express some preliminary evaluations on the interventions needed, the difficulty level of overcoming the architectural barriers and the relative costs to do so. The need to have this multiple information requires the map to be structured to provide an overall view of the city and, at the same time, more exhaustive and always updated data related to specific situations. In this sense, the proposed tool should overcome the approach of offering the assertion of the accessibility status, in favor of a more detailed information system that allows the end users to assess, according to their needs, the level of accessibility of a place. For this reason, in order to get this complete cognitive framework, a pop-up window must be associated with every situation identified. In this sense, also multimedia (like images, videos, etc.) should be integrated as an important objective resource for people to evaluate the existing possibilities and organize their movements.

Clearly, if it is essential to identify all the critical situations within the city, the final information that the map needs to offer is different in relation to the two main goals previously define for this tool. From the managing point of view, the key aspects are: the definition of the design proposals, the subdivision of the competencies of the single interventions, so, if necessary, it would be possible to coordinate different actors among themselves, and planning the projects that will be implemented.

Instead, as an information system for people, the data the map should supply are of different nature and more general interest. In fact, they should allow a person to identify the points of interest and the paths for reaching them. In particular, the tool should be accessed through a user profile, previously set according to the capabilities and consequent needs of the person. Therefore, this solution would allow to filter all the available data, in order to guarantee the best solutions to move within a place in complete safety and accordance with personal urgencies. In addition, this information should be provided with a simplified language, so everyone can be able to understand them regardless of their cognitive abilities.

Finally, in relation to physical accessibility issues, the information given not only has to focus on architectural barriers, but especially on those elements and services of the built environment, such as public transport, that could enable a better experience of social participation.

4. Conclusion: ICT implementation for a richer experience of cultural heritage

Through the discussions about the main objectives and features to which an interactive map should respond, it has been possible to highlight the new role that ICT can assume within an inclusive design approach. For the development of a fully inclusive environment, it is no longer enough to work on the component of physical accessibility, but also on the ones, like information, belonging to a managing dimension.

The discussion around the proposal of a new operative tool made it possible to transfer, in the ICT sector, the same measures that an inclusive design approach should implement, analyzing limitations and perspectives of these instruments. This isn't to be considered as the final step of a research. In fact, this paper is aimed at identify the opportunities that an instrument such an interactive map could offer.

From these premises, once defined a basic software architecture that allows the diffusion of this kind of instrument, it will be possible to assure an easier access to knowledge, especially in relation to cultural heritage. Particularly, this tool could be the user interface through which easily access additional ICT services, and not only related to accessibility issues. The reference is to new technologies, such as Virtual and Augmented Reality, which represent, in addition to being in some cases the only solutions to access/understand cultural heritage, a richer experience for everyone, fostering social participation and communities' involvement in heritage conservation.

References

- [1] Bellini A 1998 La pura contemplazione non appartiene all'architettura *Tema* **1** 2–3
- [2] Ding C Wald M and Wills G 2014 A survey of Open Accessibility Data *Web for All Conference*
- [3] Maslow A H 1943 A theory of human motivation *Psychological review* **50** **4** 370-396
- [4] Packer T L McKercher B Yau M K 2007 Understanding the complex interplay between tourism, disability and environmental contexts *Disability and rehabilitation* **29** **4** 281-292
- [5] Project Sidewalk [online] Available at: <http://sidewalk.umiacs.umd.edu> [Accessed February 26, 2018]
- [6] Salomoni P Prandi C Roccetti M Nisi V and Nunes N J 2015 Crowdsourcing urban accessibility: Some preliminary experiences with results *Proceedings of the 11th Biannual Conference on Italian SIGCHI Chapter* 130-133
- [7] United Nations 2006 *UN Convention on the Rights of Persons with Disabilities* (United nations)
- [8] United Nations Educational, Scientific and Cultural Organization, *World Heritage Definition*, [online] Available at: <http://whc.unesco.org/en/about/> [Accessed January 17, 2018]
- [9] Wheelmap.org [online] Available at: <http://wheelmap.org> [Accessed March 02, 2018]
- [10] World Health Organization 2001 *International Classification of Functioning, Disability and Health: ICF* (World Health Organization)