Opportunities and precautions in the implementation of GIS-based analysis tools to cultural landscape restoration

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Abstract:

The protection of cultural and natural heritage has been extended to the surrounding landscape in the last decades. This tendency has been corroborated by a series of International Charters and the European Landscape Convention (ELC) of 2000. Despite *protection*, *management* and *planning* proposed by ELC some structural aspects of the territory have been disregarded because of the frantic enlargement of cities throughout the Twentieth Century. In many cases, urban investments and planning associated to the expansion of the metropolitan areas have overlooked a territorial heritage that is necessary to ensure the cultural landscape regeneration. Cultural itineraries are presented as a landscape architecture strategy for valorising the territorial heritage. Well-targeted design of these itineraries can also contribute to restore the dynamics of cultural landscape formation. Research is focused on the definition of a method for designing cultural itineraries able to restore the dynamics of cultural landscape formation. Particular attention is paid to the areas around the archaeological sites. Because of the territorial scale of the intervention, software based on Geographical Information Systems (GIS) turns out to be the most suitable for representing and analysing complex spatial phenomena. This paper explores the opportunities and precautions that must be taken into account to integrate a GIS-based analysis into the design of a landscape architecture like the cultural itinerary.

A systematic review of the scientific literature indexed in those databases with a wider international impact is elaborated in order to analyse the range of opportunities offered by GIS-based software in the area of theoretical and practical research on cultural landscapes. This review allows us to determine the state of the art, as well as to discover those applications and strategies that are generally used for each research field or intended aim. Knowledge of the recent discussions on the matter can be useful in that it can be integrated into the different phases of a method for designing cultural itineraries in an attempt to increase its level of technological innovation.

In first place, a sample must be extracted. To this end, a series of parameters must be determined beforehand. It is considered a valid sample that formed by more than one hundred entries, which is representative of the state of the art observed. The sample is examined afterwards in quantitative and qualitative terms. The systematic review is conducted according to the methodology proposed by Gough, Oliver and Thomas (2012, 2013). The databases used to elaborate the systematic review of the scientific literature are Web of Science and Scopus. The definite search is based on the combination in groups of three of four elements: GIS, the component archaeo*, the operation (route OR path) and the expression "cultural landscape".

The questions that are meant to be clarified by means of this systematic review are the following ones. First, to what discipline does the entries belong? Second, what is the research field? Third, what is the scope of application of GIS? And, fourth, what GIS-based functionalities are prevalent? Then the criteria for inclusion and exclusion are determined. The details of the flow of the review process can be observed in the diagram on the slide.

The distribution of the results by discipline allows us to observe how most of the articles and papers mainly belongs to the disciplines of archaeology and history. The significative but scant collection of writings that could be identified as belonging to the disciplines of architecture or civil engineering, may be due to the fact that the number of specific journals indexed in those databases is smaller in comparison with other disciplines. Most of the entries that were ruled out, because of the thematic dispersion, belong to the discipline of natural sciences and fail in considering human activity as fundamental in cultural landscape formation. The reduced number of entries belonging to the disciplines of architecture and civil engineering is considered here to be indicative of an unexplored research field.

Following a thorough review, it is concluded that the main research field in relation to architecture and civil engineering concerns the technological innovation. In this sense, scientific literature review allows us to conclude that

the main field of application of GIS in relation to architecture and civil engineering, when referring to cultural landscapes, is the development of protection, management and planning actions and cataloguing. The qualitative review of these entries has been useful to outline a possible integration of GIS-based functionalities into a method for designing cultural itineraries, as well as to prevent us from following some apparently innovative paths that sometimes lack of a solid scientific basis or that are far from the intended aim.

None of the articles and papers focused on the technological innovation in which the scope of application of GIS is the protection, management and planning of cultural landscapes, is centred on the design of cultural itineraries as a landscape architecture strategy. Neither were they focused on the definition of a conceptual framework to guide the design of the cultural itineraries. This allows us to verify the opportunity of a research in which GIS and, more concretely, their analysis tools assist the landscape architect when design is aimed to restore the dynamics of cultural landscape formation.

Having detected the main analysis tools that can contribute to cultural itineraries design and having considered in which way they are distributed by field of knowledge, research field and scope of application of GIS, we can then suggest a hypothesis to integrate GIS into our three-step method for designing cultural itineraries. In order to guide the design actions towards the restoration of the dynamics of cultural landscape formation, the methodological approach to the ecological design of settlements set up by different authors of the *Società dei Territorialisti/e* is taken as a reference. The synthetical structural descriptions that constitute the first part of the method, can benefit from the use of GIS-based analysis tools as they can assist landscape architect in the elaboration and refinement of the narratives about the evolution of the territorial heritage. The use of advanced spatial analysis tools should not be encouraged, however, in the elaboration of the interpretations. GIS software is used, both in the identity interpretations and the strategic scenario (the second and third phases of the method), as a visualisation and graphic representation tool. Basic functionalities allow us to manipulate and simultaneously observe different georeferenced datasets that can support the architect's interpretative work of synthesis. As so many qualitative and sensitive factors should be taken into account when interpreting the process of cultural landscape formation, landscape architect's design cannot rely on the abstract result of a GIS-based advanced spatial analysis. Although the use of algorithms is defended to lead to more precise results based on quantitative indicators, under no circumstances may the design of a landscape architecture be constrained by them, as identity features that have determined cultural landscape formation can hardly be codified.

After an in-depth review, it is concluded that the success and efficiency of the method depends on the careful balance between the designer's interpretation and the scope of application of the information technologies. It is defended that the automated result of applying advanced spatial analysis tools cannot supply the required interpretative work of the architect who pursues to restore the dynamics of cultural landscape formation through the design of cultural itineraries. Like any other operation of *restauro*, this restitution is subjective as it entails a revision of the past that should be necessarily interpretative. Thus, the use of predictive models based on the application of algorithms are discouraged in the interpretative phases because of the structural and historical complexity associated to the construction of the territory and landscape. Also, reluctance to ground the method on the implementation of GIS-based analysis tools lies in the fact that the highest levels of efficiency are meant to be obtained by focusing on the methodological innovation rather than on the technological one. GIS-based analysis tools integration into the different phases of the method for designing cultural itineraries mainly follows to ease the visualisation and comprehension of complex spatial processes that take place on the territory and it is always subsumed to the designer's interpretative work.

Acknowledgements

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