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The digital restoration of ancient maps in Italy. Experiences and reflections

Keywords: history of cartography; manuscript cartography; information technology; digitization of maps; virtual restoration of maps.

Summary

The digital revolution has taken every kind of iconographic expression in the last years and it has given a deep input to reproducibility. It has concerned artistic works and cartography that has a lot of links with art, as geo-cartographic literature has often shown. New digital systems have favoured a new kind of cartography, but they have also allowed to put on the web maps of past centuries and so to spread them to a lot of people. Nowadays there are also experiences about virtual restoration of ancient manuscript maps: we will examine particularly the restorations of the anonymous *Pianta della città di Parma e suo territorio con parte di Borghigiano e Reggiano* (1460-65, Archivio di Stato di Parma) and of the *Carta degli Stati Estensi* of Marco Antonio Pasi (1580, Biblioteca Estense Universitaria di Modena). Now it's time to analyze these themes in order to evaluate advantages and disadvantages of these techniques and to give a correct way of treating digital cartographic images.

Introduction

The rapid evolution of information technology and the increasingly widespread scope of its applications cannot be ignored by any discipline, also because of its advantages for all fields of research. Geographers are not the only scholars to appreciate the usefulness and extent of the scope of geographic information systems, which have also shown their considerable potential for reconstructing the territorial organisations of the past, conducting surveys of the cultural and environmental heritage, and enhancing and safeguarding landscape resources (Azzari, 2002: 8). In the field of historical cartography, the objective has until now been to devise systems for storing maps from the past and computerised catalogues that are available from websites (Andreani, Azzari, Fineschi, 2002: 31-32), but there has also been an attempt to exploit the possibilities that the most recent information technology gives for storing, reading and interpreting maps from previous centuries.

We shall examine both virtual restoration of damaged maps and the simple digitization of representations in order to make them easier to read by using all the functions that information technology tools provide. Objections might be raised regarding the validity of using virtual copies of old maps for research and study, because the virtual copy does not correspond to the original. The answer to this objection, which is implied in the objection, is that consulting the original is anyway an essential part of the detailed work that the scholar has to perform on one or more geographical images and on the mapmaker and has not been superseded. The virtual copy simply makes reading easier and therefore makes it

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easier to interpret what is difficult to decipher on the original because it is too small, because of deterioration over the years and because of subsequent overprinting. On the other hand, it is now recognised that a geographical representation in itself constitutes a virtual image of physical and material space, a reading and a metaphor that reflect the culture and the symbols through which a given society, in a given period interprets the world or simply the space where it operates: this is especially noticeable in pre-scientific cartography, before the introduction in the eighteenth century of the two-dimensional geometric sign to indicate components in space (Giorda, 2000: 22-23). The virtual reading of an old hand-drawn map or an intervention on its image reproduced on the screen of the computer to restore even the smallest details should not be seen to be an improper procedure or a profanation of the most rigorous systems of cartographic analysis.

Virtual restoration

At least two important experimental interventions exist involving the virtual restoration of maps that were conducted by the company Fotoscintifica of Parma: the first was commissioned by the National Archives of Parma and the second was commissioned by the Estense University Library of Modena. The interventions were very recent and involved the restoration of valuable manuscript maps that had been particularly damaged and therefore needed to be restored. The company devised and used the RE.CO.RD system for these projects. This is a system of digital recovery, storage and restoration aimed at a vast range of documents, from illuminated codes, to manuscripts, drawings, parchment, watermarks, palimpsests, and plans for which individual customised approaches are elaborated. The system visually restores graphic features compromised by discolouring, fading of the constructional features or merging of the colours; graphic signs that have become illegible due to fading or the acidity of the ink, superimposed mould or stains, worn or fire-damaged lettering; the system highlights, reconstructs and decomposes illegible signs. The system also provides: the digital image on the visible spectrum; representation consisting of the series of alphanumeric characters of the document to ensure fidelity to the original and the stability of the obtained data; digital investigation on the invisible band; rereading the document on frequencies other than the visible to retrieve hidden information; collating information and displaying on the monitor the recovered signs to explore the documents in their original integrity (CD-Rom Fotoscintifica, 1998). It is obvious that the possibilities offered by the system that we have briefly described are of great interest for recovering, storing and studying old maps, as can be seen from studying the two examples of.

The first intervention was conducted on the *Pianta della città di Parma e suo territorio con parte di Borghigiano e Reggiano* held at the National Archives of Parma, which is dated 1460-65, measures 59.1 x 92.5 cm and is drawn on parchment. This map underwent traditional restoration to remedy the damages of time and past interventions (in the early nineteenth century) using methods and materials that are incompatible with correct conservation. For this purpose photographs were taken using infrared and ultraviolet rays and fluorescence to measure the loss of paint pigments over time and to highlight the successive interventions at different periods. Traditional restoration was then carried out that



Figure 1. The Adriatic Sea and the Comacchio Lagoons in the *Map of the Este States* by Marco Antonio Pasi (Estense University Library of Modena): the original copy (south is in the top side). Courtesy of the Ministero per i Beni e le Attività Culturali.

consists of cleaning, flattening the plan, regluing the paper cornice (added in the early nineteenth century), applying a cardboard support and a wooden frame with a technique that enables the plan to be detached at any moment from the cardboard or the frame without damaging it. The plan was then photographed with a digital camera that is able to provide images that are much better than analogue ones: a digital backing was used that enables non interpolated files of 6000x7520 pixels to be acquired. Owing to the complexity of the document and the presence of details of very small dimensions, the document was photographed in five separate sections and was then recomposed in a single file, which is impossible to achieve using traditional photographic techniques. Breaking up the document in this way enabled the definition of the five images to be increased and five times the informative data to be obtained than that which was available from taking a single photograph. The digital images obtained were subjected to virtual restoration that enabled the original document to be reconstructed and made more readable. This procedure would not have been possible on the original, which was too delicate to undergo major reconstruction of the colours, drawing and place names. The very high resolution and the great number of very enlarged data have enabled details to be identified that were impossible to see with the naked eye: analysing the endless series of trees – a feature of the map – which are very small and apparently the same, has enabled at least four different types to



Figure 2. The Adriatic Sea and the Comacchio Lagoons in the *Map of the Este States* by Marco Antonio Pasi (Estense University Library of Modena): the virtually restored copy. Courtesy of the Ministero per i Beni e le Attività Culturali.

be identified. In terms of settlement patterns, the constructional features of the numerous castles and structures scattered along the roads and watercourses can be examined in infinitely greater detail (Fotoscientifica, 1997: 30-43).

The second case was the *Carta degli Stati Estensi* (Map of the Este States) by Marco Antonio Pasi, dating from 1580, which measures 176 x 312 cm and is divided into 8 parchment sheets held at Estense University Library in Modena. In this case it was decided not to carry out any traditional restoration of the original, although colours had faded, writing and place names had disappeared or become illegible, geographical features had disappeared or become very difficult to interpret, there were patches of damp and the support had deteriorated. It was decided only to restore the original virtually at first to protect it from the risks and damage that could arise from actually working on the original (Federzoni, 2001: 241). The same procedure was used to digitise the map as was used for the plan of Parma and the results were just as interesting from the point of view of restoring colour and reconstructing compromised drawings and disfigured or faded place names:

the small stretch of the Adriatic was found to contain different forms of vessel that in the original had been reduced to vague stains.

Positive and critical aspects of maps' virtual restoration

Virtual restoration of maps is a decidedly innovative operation, also because it started only in the last few years using tools that have only been available for a very short time. Apart from the detailed illustration of the technical and methodological approach adopted by the virtual restoration company Fotoscientifica (1997: 37-44), there is therefore no literature on its potential. We thus feel that we should very briefly set out some considerations and doubts in order to stimulate a discussion that is able to form a basis for a reasoned assessment of what virtual map restoration can offer the cartography historian. We naturally refer to the two quoted examples, which are manuscript works, characterised by a design that is typical of the period in which they were drawn up – which is not the same – that is evocative and not abstract. Manuscript cartography requires more interventions of this type than printed cartography and is certainly more suitable for such interventions. The positive aspects of the operation can be summarised as follows.

1. Digital restoration does not harm the original – which can be restored using traditional techniques if this is desired – and thus enables both the reconstructed and the original document to be consulted.
2. The restorer reconstructs the signs deleted by time and the lost colours by enlarging the image and comparing it with the best preserved parts of the map.
3. The restorer works on a digital image and can easily correct any reconstruction that is found to be incorrect. It is also possible to proceed by trial and error without the worries about slips of the hand that beset someone restoring an original work. However, at this point the scholar should intervene because although he lacks the basic technical skills and instruments for carrying out the restoration, he does have the skills required for guiding and correcting the restorer's work. The geographer and his knowledge are also required to make any sort of map constructed using modern IT systems. However skilled a technician is, his skills are not sufficient to produce a good representation (Favretto, 2000: 12).
4. The restoration results in a CD-Rom that enables it to be read, even after enlargements, with a very high definition and shows details that a lens does not normally reveal. For example, in a manuscript and illuminated map the individual strokes of colour can be clearly identified, which also enable the hand of the artist to be recognised. Lastly, it becomes much easier to analyse features of the map such as the signs or drawings relating to relief, vegetation, settlements, roads, etc, and to distinguish their types.
5. The virtual image is not the reconstruction of the map that has just been finished by the mapmaker: it also contains additions or subsequent corrections and enables them to be recognised more easily than on the original thanks to the cleaning and reconstruction performed by the restorer. This is important for tracing the representation and the use that has been made of it over time.
6. In the case of the plan of the city of Parma, the presence of a significant number of buildings, especially castles, scattered over the area, each of which is in a different

building style, has provided a chance to analyse the architectural design: the files have been transformed from colour images into black and white images that have been subsequently elaborated so as to highlight only the graphic structure, emptying the construction of both volume and colour. In this way it has also been possible to eliminate traces of later restorations and interventions that sometimes used questionable techniques and methods. The architectural structure is more decipherable, as the colour that is superimposed on the sign often makes it difficult to interpret.

7. Today the restoration of a geographical map, like every digital reproduction, can be linked to a network of other images, texts and documents which illustrate and investigate different aspects: in this way it becomes a hypertext, contained on a CD-ROM, on a DVD, or on a website, which, through knots (chunks of information) and links (connections through knots) encourages an exploration of the topics, which is not linear but reticular. A multimedia product on a cartographic topic can integrate within it images (geographical maps), texts, reproductions of documents, photographs, and, if necessary, graphic animations, voices, sounds, music, which have a cultural, historical, spatial, etc. relationship with the cartographic images. What is transmitted in a book through fixed images and written text, in a hypertext can be diffused through a wider variety of languages. As an example, it would be very useful for a scholar to be able to “click” on all the locations present in an ancient geographical map and receive the necessary information on it at the time of editing the representation and visualise the other contemporary cartographic or pictorial images of the same location. Furthermore, it would be important to be informed on the political and economic situation of that territory in that period, on how it was run by those who ruled it; on the culture in general, within which the author of the map moved, on his role in local or state administration; on further maps which were inspired by this prototype. While a book leads the reader down a pre-established route of the author, the hypertext on the other hand, allows a lot of freedom in the choice of routes to follow through numerous links. The hypertext reproduces, in an up-to-date form, the functions of the large medieval world maps (Ebstorf and Hereford in particular), where the images and vignettes which enrich them were linked to text, sometimes even extensive, intended to expand and clarify the meaning of the drawing. The links can have an even more direct access on computers equipped with touch sensitive screens, which users skim with their fingers indicating some details and immediately opening – without use of the mouse – requested contents (Sbrilli, 2001: 114-116). Today, as well as maps restored digitally, there is also an excellent and simple digitisation of geographical maps (such as, the multimedia series *I tesori delle biblioteche italiane (The treasures of Italian libraries)*, an initiative backed by the *Direzione Generale per i Beni Librari e gli Istituti Culturali del Ministero per I Beni e le Attività Culturali* of Italian Government, which only take advantage of the potential of the zoom: this allows you to make considerable enlargements (up to 400% without losing any definition), but they do not allow for all the functions which a hypertext would. A model for those who wish to take better advantage of the potential of information systems could be the digital copy on CD-ROM of *Mappamondo di Fra Mauro (Fra Mauro's World Map)* (Venice, circa 1450), carried out by the Marciana Library in Venice: the World Map includes over 4000 inscriptions, some of which are large texts connected to relevant geographical

particularities, which can now be read in a modern transcription – a database with a complete textual apparatus – simply by “clicking” on a place name or inscription, however long or short it is. Furthermore, the opposite is also possible, from texts to locating them on the map. Even the very recent digitization of the *Righas Charta* – work carried out by Righas Veletinlis in 1757 and printed in Vienna in 1796-97, which includes the Balkan peninsula from the Danube to Crete – allows one to get information on the numerous medals and coins present by “clicking” on each one: we were able to see this during this Second International Workshop.

8. The CD-ROMs displayed at cartographic exhibitions were a great success with the public, who were normally well educated, but for the most part not expert in this area. But this does not matter if the success increases the interest in maps from previous centuries.

The critical limits that can be identified regarding virtual restoration are the following.

1. Some people may object that working on a virtual map or also on the paper copy that can be obtained from it feels like working on a forgery or on a revised and corrected reproduction that is very different from the original, also because the marks of the passage of time are missing. There is a sensation of “newness” which is similar to the sensation conveyed by monuments or paintings that have just been restored, that seem to have lost the fascination of time. However, geographers are certainly not the first people to have pondered this point: one need only think of the fairly recent restoration of Michelangelo’s *The Last Judgement* in the Sistine Chapel that some experts have acclaimed and others have condemned in damning terms.
2. There is a risk that the restorer or scientific consultant who supervises him may take too many liberties in reconstructing what is illegible or badly damaged in the original. It is clear that if they do not follow a rigorously philological method they risk producing a copy that is not only incorrect but also mystifying and prejudicial to all subsequent analyses. The virtual copy ends up having the same features as maps in general. It is a tool for study, information and persuasion. It can direct our researches in one direction rather than another. If the map is a tool of mediation, its virtual copy is a further mediation. If the map is a tool and mirror of an interpretation, the virtual copy is the tool and mirror of a further interpretation because it must be recognised without illusions that also the restorer has to interpret.
3. The impression of the virtual copy that is gained from the computer screen is that the colours are garish, brighter than they would have been on the original paper copy. But also this may be irrelevant to the purposes of analysing the image and confirms that the original needs to be consulted.
4. Computer screens in general are rather small compared to the dimensions of geographical maps, which means the virtual copy, seen in its entirety on the screen, appears at a scale which is much smaller than the original. Usually, it is possible to see certain particularities only on the original scale, which can make it difficult to locate them within the space on the whole map, as not all of it can be seen. There are tricks which can remedy these inconveniences, such as inserting a schematisation of the complete map in a small window in a corner of the screen, with an indication of the position of the detail being observed in that moment: nevertheless it is not a very satisfactory solution (Falchetta, 2006: 79-80).

5. There would be a greater diffusion of results of digital restorations or of simple digitisations of geographical maps: in many cases when the digital copies are carried out by public institutes, remain confined within these organizations (libraries, archives), sometimes they can only be consulted in situ, sometimes they can be consulted on the institute's website, sometimes they are not even available to the public.

Today, with the recent publication of the *Linee Guida per la digitalizzazione del materiale cartografico* (Guidelines for the digitisation of cartographic material) carried out by the *Istituto Centrale per il Catalogo Unico delle Biblioteche Italiane* and prearranged by a work group made up of experts, there has been an attempt at individualising common standards with the aim of coordinating digitisation projects which different Italian cultural institutes, both public and private, have envisaged for their cartographic patrimony. The following has been identified: 1) criteria for the selection of cartographic documents, so as to distinguish those which have been well conserved from those which are in need of restoration, both traditional and digital; 2) criteria for the acquisition of images, in order to obtain the highest definition possible; 3) criteria for the conservation of magnetic support, which currently have a rather short lifespan. Furthermore, the work group seeks to increase the high quality digital patrimony and to encourage the accessibility to the public, through consultation on the web, and it concentrates on problems which come to light reading a large-format image-file, which takes up a considerable amount of RAM memory.

The digitization and digital restoration of the patrimony of geographic maps of centuries gone by constitutes a field of study and of experiments which are still largely unexplored and are rich in possibilities of development, even in relation to the evolution of information technology. It is important that progress in this field, at present unpredictable, will give good results with the aim of improving reading and interpretation of old cartography and aboveall will facilitate its accessibility.

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