Considerations about Old Maps in the Digital Era

Lia M. Papa

Abstract

Old maps often corroborate the studies performed in many fields of design, but they also provide a wealth of precious data which, in an increasingly interdisciplinary manner, can retrace transformations in parts of a territory or urban context; these changes are often radical, made either by man or triggered by natural events.
Although maps are sometimes poorly appreciated the interaction between their signs creates and transmits significations that depend on their historical and social context as well as on their interpretation, i.e., the way in which the user intends to use the cartographic drawing, quite apart from the reason why it was produced.
This article focuses primarily on nineteenth-century maps; during this century extensive progress was achieved in the fields of science, technique and organisation; this had not only a fallout on map making, but also led to the emergence of several important figures in the fields of education and technique.

Keywords: iconic/symbolic, cartographic culture, transformations.

Introduction

Transformations of territories and urban centres, coupled with environmental and safety problems, underscore the importance of a multiscalar analytical and design approach involving all drawing disciplines, influenced as they are by considerations about changes in culture and technology.
In this context, cartographic representation is again an interesting research topic, not least due to the increasingly pressing need to enhance cultural and landscape resources, govern urban transformations, and manage the latest technologies since the latter make it possible to compare and georeference outputs produced in different eras and inspired by different cultures.
In a recent issue of this journal Vito Cardone wrote: "after the shift in the frontiers of infographics, graphic representation has broadened its borders; new fields have been sown and produced important, novel fruits, but yet more are in the offing. Nevertheless, fertility has slowly waned; the 'light' that initially imbued the entire scientific community is becoming dimmer and we are starting to see more and more routine work, without any truly innovative ideas. […] Sometimes however –as in certain studies about territorial and urban representation submitted above all by Argentine, Brazilian and Spanish congress participants– the authors have travelled to the frontiers of representation, beyond which we can glimpse endless prairies with the tracks of the possible, long-awaited paths towards future developments in our scientific and disciplinary fields" [Cardone 2018, pp. 5-7].

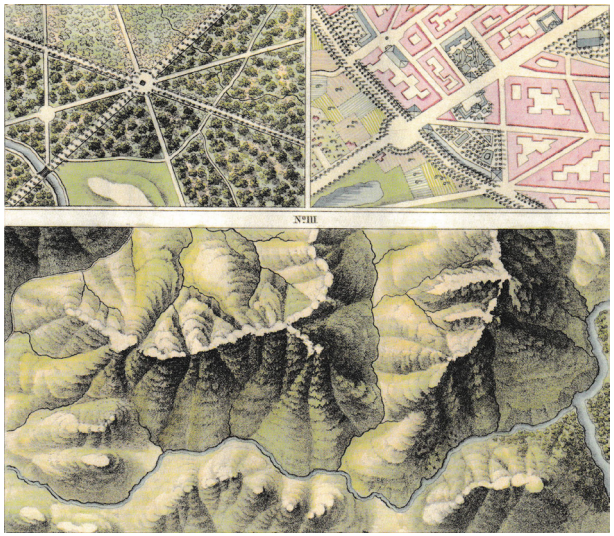


Fig. 1. Topographic models drawn and watercoloured by A.M. Perrot, Table IV. Florence: P. Fumagalli, 1819-1829.

The specialisation that has typified the world in which we live, above all since the late eighteenth century, has led to different, well-defined languages; this is why in the era of interoperability we need to ask ourselves whether drawing can take on the responsibility of triggering a renewed impulse towards comparative knowledge and conveying interest in the description of places – in the broadest sense of the term. This interest should consider the material and immaterial dimension which are not rigidly defined but require multiple viewpoints and hybridised languages since specialisation has facilitated expressive modes and stricter dedicated codes.

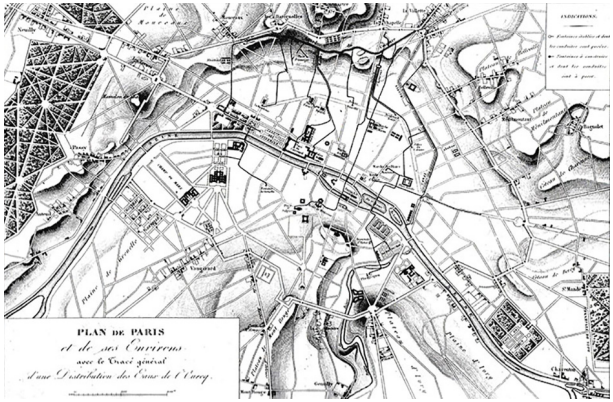
Technical-scientific developments and visual innovations in the nineteenth century

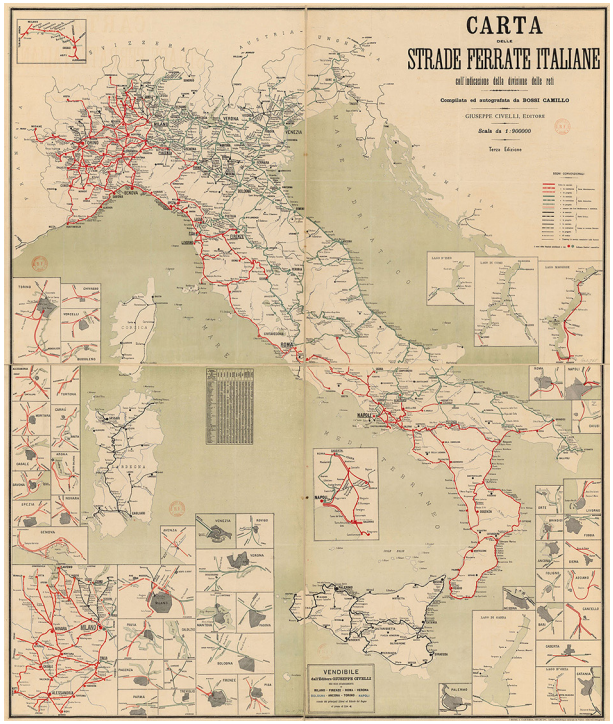
In the eighteenth century the cartographic representation processes that began primarily in European countries were consolidated, disseminated and diversified.
Medium- and large-scale survey became a key factor in the broader issue of objective representation, as did the grammatical rules used to describe places. The lack of a uniform expressive method depended on the fact that often the method was influenced not only by the expertise which operators had acquired either while training or on the job, but also by their personal drawing skills [Rossi 2018]. A systematic reorganisation of topographic styles began when a commission was set up by the *Directoire* in Paris in the early nineteenth century (1802); their work has been the focus of numerous studies.
Amongst other tasks, commission members were mandated to "discuter les moyens de simplifier et de rendre uniformes les signes variés qui, sur les cartes et les autres projections, servent à exprime les accidents du terrain" [Mémorial topographique et militaire 1803, p. 2].
According to the rules of the *Mémorial Topographique*, every draughtsman working in this field had to reproduce "le même effet que fait un relief parfait du terrain, ou plutôt la nature elle même revêtue de ses formes et des couleurs, mais redoute aux dimensions de l'échelle" [Mémorial topographique et militaire 1803, p. 2].
Three-dimensional representation was also a priority issue. In one of François de Dainville's papers he retraced the main steps which led, as he himself writes, "de la profondeur à l'altitude", in other words, from probes –which inspired opisometers– to the introduction of contours in maps [De Dainville 1958]. For many years mapping offices avoided the issue of the geometric representation of the morphology of the terrain and continued to use the eighteenth-century tradition of merging geometric and pictorial methods. It's not surprising that in Naples, in the year 1807 – with a reference to the *Mémorial*– oblique hatching was used in the *Atlante Geografico*, the invaluable, comprehensive map completed in 1812 by Giovanni Rizzi Zannoni [Valerio 2014] [1].
The typical categories of eighteenth-century topography were revived, strongly influenced not only by the aforementioned concepts of imitation of nature, but also geometric representation based on the projections with numerical quotas [Papa 2003, pp 303-323].
Since the overall objective was to shape the image of modern countries and territories, there was a tendency to establish which tools were best suited to specific political and military requirements.
The crucial visual changes that occurred in the nineteenth century also benefited from the close relationship which developed between photography and

cartography thanks to the critical analysis of the photo-topographical method developed by Aimé Laussedat (1819-1907) [2]. This triggered a trend that was consolidated in the following century due to the increased number of details a camera can record compared to what can be visually retained by the human mind in the short time it takes to reconnoitre an area (we are now familiar with the physiological selection mechanisms of the human mind).
At the same time, map production increased steadily not least due to the invention of lithography, initially developed in the late eighteenth century by Aleis Senefelder and perfected throughout the nineteenth century. It allowed cartographers to gradually introduce colour and photography into their works, despite the fact that traditional etching techniques continued to be used in many maps [Brotton 2018, p. 363].
These technical developments allow us to identify two kinds of approaches in nineteenth-century maps: a more strictly codified technical approach, using zenithal projection, used to control the territory, and another approach focusing on production and design in order to broaden communication. These two approaches are objectively different in their appearance and features, but interconnected as regards spatial appropriation.
Which fundamental categories and which signs have to be used to satisfy these increasingly stringent requirements regarding representation?
Since the early decades of the nineteenth century, the business world understood the importance of strict codified cartographic representation, but at the same time had different communication requirements influenced by multiple economic and expansionistic situations.
In 1823 Carl Ritter, founder of the Geographical Society in Berlin, used the term *Kartograph*; its meaning was challenged in 1839 by Manuel Francisco de Barros e Sousa Santarém who maintained he had coined the term *Cartographia*. Whatever the case may be, the two terms were extensively used in the 1880s [Brotton 2018, p. 364].
The most recent definition of Cartography by the International Cartographic Association (ICA) states that "it is the studies and scientific, artistic and technical operations performed based on the outcome of either direct observations or the use of documentation to elaborate and prepare maps, plans, and other modes of expression, in order to revive the exact image of reality" [AA.VV. 2006, p. 5].

Fig.2. Plan of Paris and its suburbs showing the water distribution network of the river Ourcq. From: Génieys 1829.

Fig.3. Map of the Italian railway system, 1885. Bibliothèque Nationale de France.



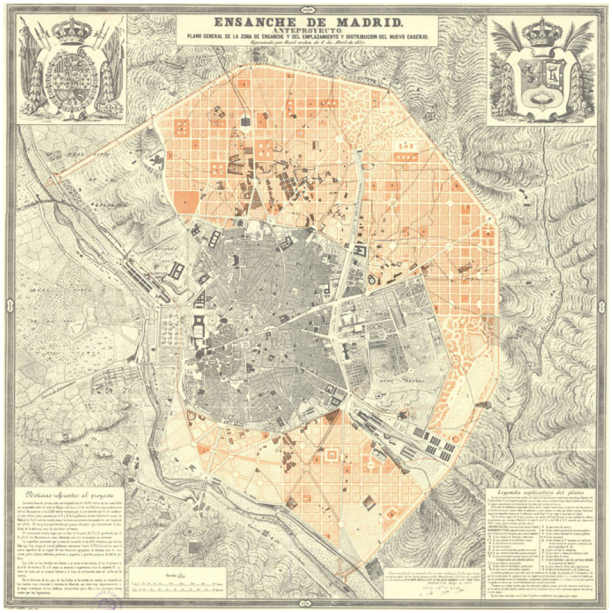


Cartography for urban expansion projects implemented internationally

The descriptive methods required to convey aspects of nineteenth-century urban expansion, construction of territorial infrastructures, and socio-economic patterns, needed to be coupled with the objective representation of places. So Europe began to move in this direction.
The images shown here reveal that cartouches, elaborate frames, and their aulic corollary all disappeared, replaced by more streamlined representation; the objective was to enhance communication which is often the synthesis of images, on different scales, explanatory legends, or statistical data. Whoever reads a map can turn a graphic image into a verbal image thanks to the legend, the point of contact between two expressive mediums.
New forms of hypertext were tested; often they simultaneously turned the maps into an image and a language, merged in a network of multilevel relationships. The following is a very appropriate definition of these complex relationships: "The map is a highly complex supersign, a sign composed of lesser signs, or, more accurately, a synthesis of signs" [Wood, Fels 1986, p. 88].
The construction of infrastructures and, more specifically, the creation of transport networks, coupled with the hygienic-sanitary problems of bigger urban centres and the development of agriculture and industry, contributed to the dissemination of new drawing types, i.e., maps that quantitatively tackled specific topics such as expertises, land and water issues, and connections between human beings and goods.
Figures 2 and 3 illustrate the different modes of expression and synthesis regarding the size of the geographical area in question.
France was the first European country to have a national topographic map with a transverse Mercador projection on a 1:86,400 scale developed under the supervision of C.F. Cassini de Thury. Territorial representation was given a new boost under Napoleon Bonaparte as part of his military control and expansion project in which men and resources were to achieve the infrastructuralization and safety of French overseas territories.
Up until the nineteenth century the most common maps in England were tithe maps, i.e., landed estate maps with differing representation scales not in line with the standardisation required by the Ordinance Survey which, from the late eighteenth century onwards, drafted the country's

Fig. 4. D.A. Donnet, Planos de población, 1857. Instituto Geográfico National de España.

Fig.5. Plano de Madrid y sus contornos, 1896. From: Chías, Abad 2016.



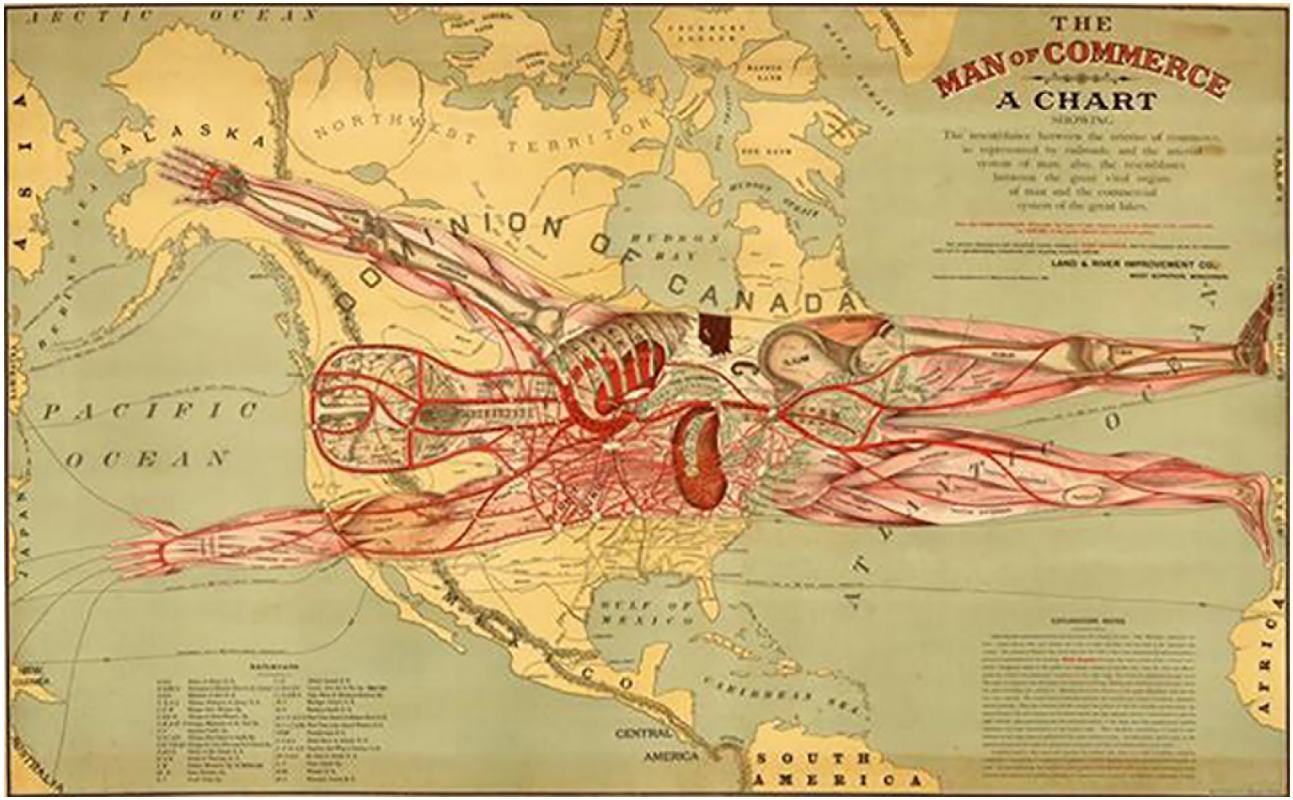


Fig.6. The Man of Commerce, 1889. University of Wisconsin Milwaukee Libraries. The outline map of North America is superimposed, with metaphorical objectives, by a cutaway diagram of the human body. <https://www.wdl.org/en/search/?collection=american-geographical-society-library-digital-map-collection#15658> (accessed 2019, August 8).

maps. Between 1842 and 1895, roughly 400 cities were mapped in various representation scales using inches and feet as their units of measurement.
During that period commercial requirements appeared to be a priority in the colonies, so while the Ordinance Survey used a complex, well-established system of land ownership and management, in the late eighteenth century the West India Company launched a systematic survey culminating in the Great Trigonometrical Survey. The undertaking was considered complete in 1843, but work continued for decades and, like Cassini's, never came to a well-defined end.

In Spain work on the compilation and publication of the Topographical Map of Spain was performed by a civil rather than military mapping organisation that based its work on the surveys performed in 1809 by Joseph Charles Marie Bentabole [Chias, Abad 2016, p. 279].
Unlike other western countries, this map was initially intended to be part of a much bigger mapping project that involved drafting a topographical map and general cadastre of Spain. The first sheet, number 599, corresponds to the city of Madrid and was published in 1875.
In the early nineteenth century Madrid had roughly 220,000 inhabitants; by the end of the century the figure

Fig. 7. Giovanni Amenduni 1884. General plan of the beach along the coast including the reclaimable districts of Ostia, Isola Sacra, the harbour, Camposalino, Maccarese and Pagliete. <http://www.luniversoeluomo.org/storia/maps-storiaRM.htm> (accessed 2019, September 4).

Fig.8. Carta topografica ed idrografica dei contorni di Napoli levata per ordine di S.M. Ferdinando 1°. Re del Regno delle Due Sicilie dagli ufficiali dello Stato Maggiore e dagl'ingegneri topografi negli anni 1817.1818.1819. Ministry of Public works, Reclamation, I series, f. 75.

had risen to 300,000. Since urban expansion was physically limited by the city walls, an enlargement project was drafted in 1860 and entrusted to architect Carlos Maria de Castro.
Based on the plan of Barcelona, the one for Madrid increased the surface area of the city from 800 to 2,300 hectares and envisaged the addition of an area around the original nucleus. This area was zoned according to its use: residential, industrial, military, recreational, and agricultural. The conventional colours used in the graphic image were then consolidated to highlight the pre-existing parts of the project.
During the second half of the nineteenth century modernisation speeded up in the Atlantic world and reached the apex of its ideological, cultural and political expansion. The divergent elements now intertwined with centuries-old elements of integration created a solid union between different communities and continents. The countries that still had enduring remains of the old regime borrowed strategies from former imperial establishments and, albeit with different rhythms and intentions, embarked on a policy of power, one which also exploited cartography [Leonhard, von Hirschhausen 2014].
The long cycle of Italian emigration to the New Continent ended in the late nineteenth century [Devoto 2007, p. 88]. In South America, and especially in Argentina, we can consider the knowledge-gathering process to have ended at the dawn of the twentieth century after long exploratory missions and scientific expeditions performed by several technical professionals who collected data and drew maps. At that time the Jesuits were also working on gathering data in less well-known areas of Latin America.
When the war of independence ended in Spain the Argentine government sponsored several exploratory missions in order to improve their knowledge of the nature and morphology of the country.
This project was further promoted in roughly 1870 when the National Academy of Sciences was founded in Córdoba; one of its objectives was to systematically explore and represent the country [Tognetti 2005, pp. 91-95]. Many Italians worked on this project, for example the en-

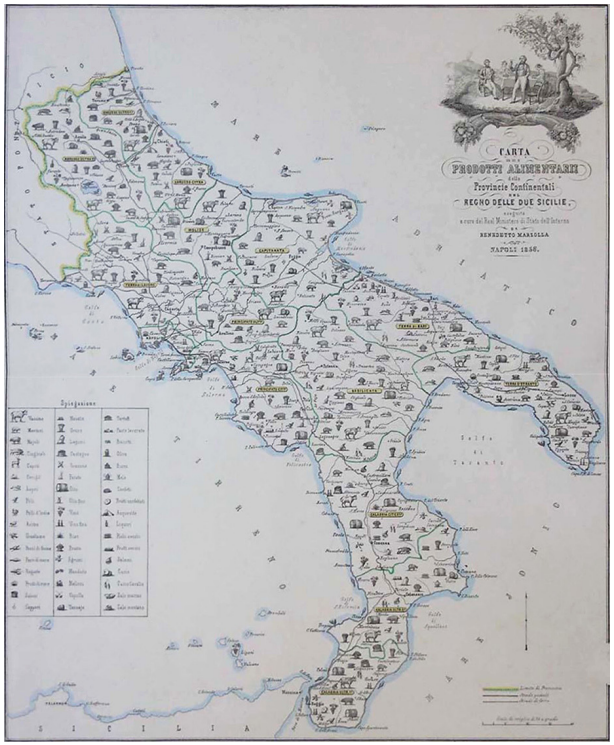


Fig. 9. Benedetto Marzolla. Map of the Food Products in the Continental Provinces of the Kingdom of the Two Sicilies, 1856. Naples, State Archive.

gineer Nicola Descalzi who was entrusted by the dictator Rosas to explore, amongst other things, the Colorado river along the border between Patagonia and the Pampas, an area where the Argentine army was fighting the Indios [Nocco 2014].
To integrate and subjugate men and places you first have to understand them, and to do so requires the use of statistical studies to test new descriptive methods.
The production of maps in Italy increasingly focused more specifically on the country's environmental problems: the flow of internal waterways and the associated problem of the formation of swamps in vast areas of the country. Reclamation was deemed to be the most important project to not only jumpstart agricultural and industrial economic growth, but also revive agriculture in what were considered unproductive areas, as well as clear land for potential urban expansion.
Given the importance of reclamation, in 1865 the Ministry of Agriculture commissioned the engineer Raffaele Pareto [3] to prepare a comprehensive report about the state of the country's agriculture prior to drafting ad hoc land drying projects. The study was to census and represent wetlands and swamps considered unproductive and harmful to public health (estimated at roughly one million hectares) [Pareto 1855, p. 57]. The study led to the promulgation of the Baccarini Law (1882) entitled *Regulations for the reclamation of wetlands and swamps* to which numerous thematic maps were attached.
The Map of productive resources drafted by Benedetto Marzolla was also dictated by the need to produce a description of food products. Marzolla was one of the most committed figures of that period, although very few studies have focused on his works. He exemplifies the dynamic activities performed throughout the nineteenth century in which men and machines were employed to not only tackle the new need for topographical or thematic information about places, but also draft design projects to improve people's living conditions, including experiments involving linguistic hybridisation and visualisation methods [Cardone 1993].
Benedetto Marzolla (1801-1858) was also a member of the Statistics Commission of the Kingdom of Naples set up by the Ministry of the Interior. This gave him access to an enormous amount of geographical data and territorial, economic and administrative information which he used to draft maps of the province of the Kingdom of Naples and elsewhere [Conti 2008]. The Map in figure 9 shows a very detailed view of the "natural" resources of the Kingdom using figurative symbols that were rather unusual for that period; they include realistic images of animals and food products, almost an anticipation of the descriptive, tourist-informative method that was to become widespread in the twentieth century.
The map provides an important instructive contribution, indicating crops no longer present in some areas of the country.
In the mid-nineteenth century maps of archaeological finds also became popular; their interesting expressive modes combined geometric rigour with attention to the landscape and variations of scale. In many cases this method produced effective, concise, thematic images, as in figures 10 and 11.

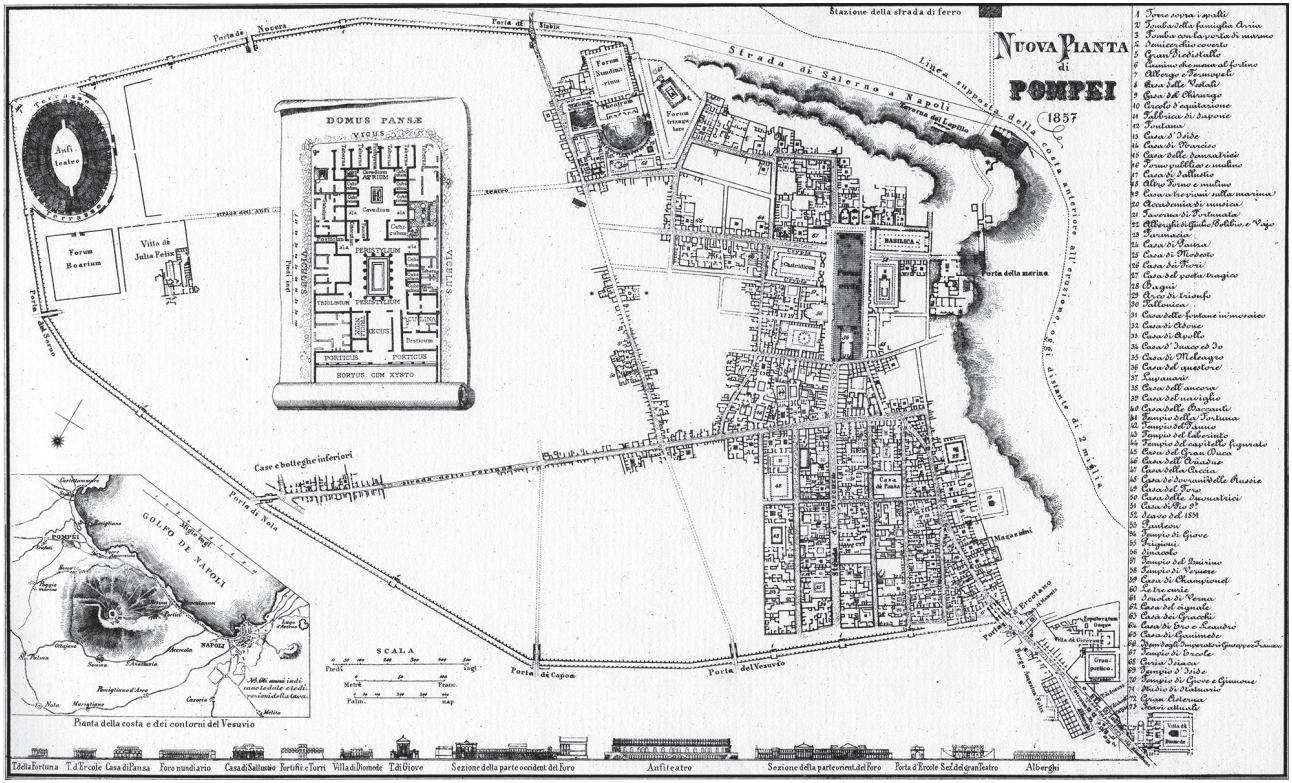


Fig. 10. New plan of Pompeii, 1857. In Atlante della Storia dei monumenti di Napoli e degli architetti che li edificavano, dal 1801 al 1851, by Camillo Napoleone Sas:so, Naples, 1858. Tab. XXII.

The future of memory

Of all the studies on old maps recently performed in various disciplinary fields, I find the ones illustrated in the book *The New Nature of Maps* by John Brian Harley [Harley 2001] to be particularly inspiring. In his book Harley also outlines what could be considered a new way of interpreting and deconstructing maps. He starts by criticising the concept of cartography as the expression of gradual technical abstraction; instead he states it is the product of social history and discusses the problem of power as an explanation for the map and its internal logic.
Cartography is undoubtedly a field in which the links between theories and the transmission of knowledge are expressed in forms that help describe the space of man and its transformations; this is achieved by using previously unexpressed communicative methods and by exploring the possibilities to coordinate, systemise and manage the different forms of data gleaned from the analysis and knowledge of places – the indispensable imperative basis behind a project.
In the last few decades the approach to urban and territorial representation has gradually evolved; it is currently possible to access families of data for every requirement and express functions exposed by the interactive potential of digital technologies and the web, so much so that a user can autonomously create an interactive map using a cartographic database. By interacting with the latter a user becomes part creator/inventor/designer. [Mingucci et al. 2013]

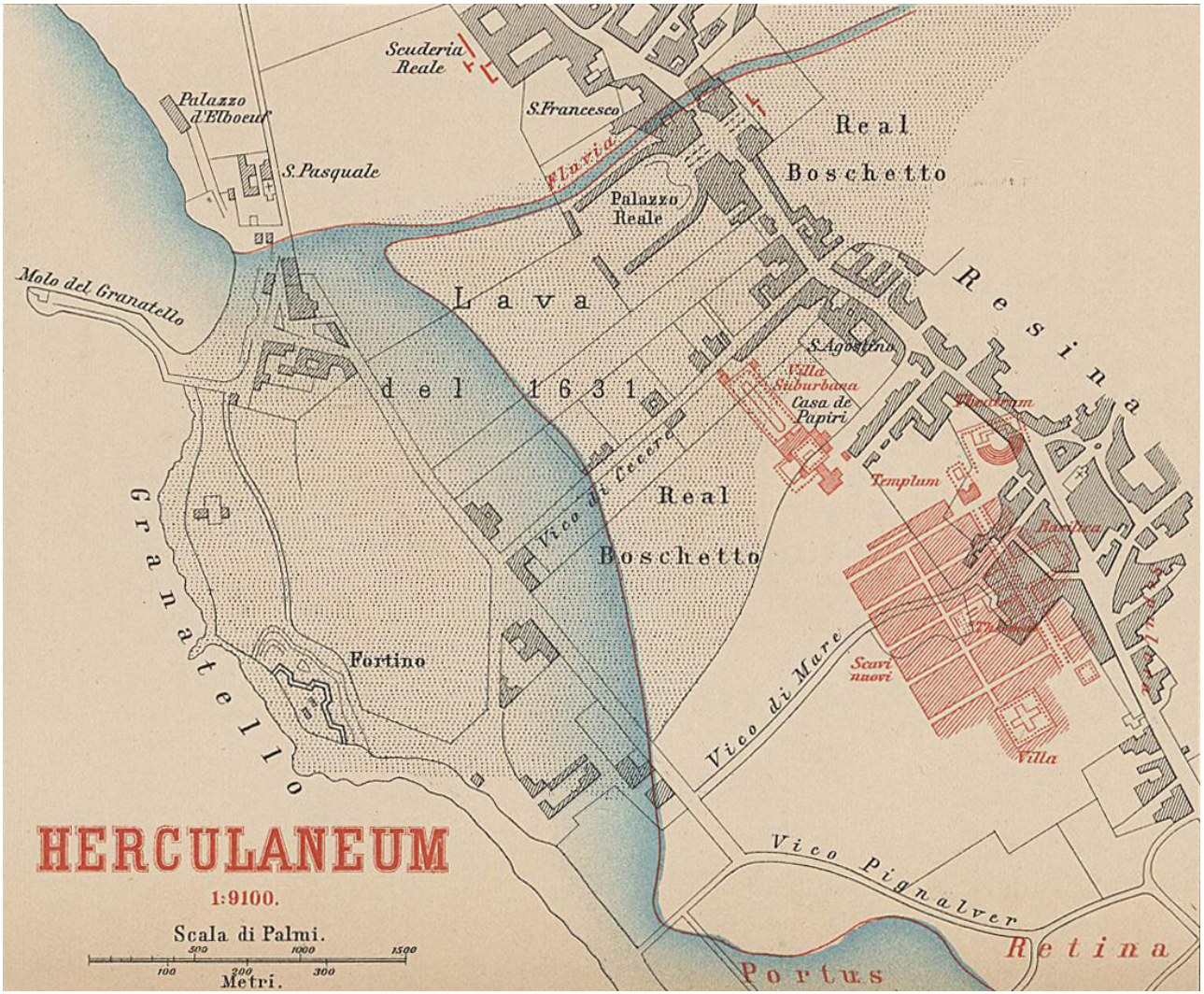


Fig. 11. Plan of Herculaneum. From: Beloch 1879.

This dynamic and interactive process is very different to past practices; it creates a clear-cut division between the person who produces the map and the person who reads it.
Relational multiform databases and geographical information systems –GIS– play a key role in this process: they can be used to file material, relate and analyse alphanumeric data, maps and images, as well as design and develop open access instruments that can be used to retrace the memory of places [Chias, Abad 2008].
This is the potential of geo-referencing which, associated with an analysis of the features of territories or, better still, of landscapes, exploits the representation of material and immaterial connotations.
Nevertheless, we should not ignore the construction of the data system that corroborates and substantiates not only the scientific validity of the whole process, but also the output drawings that have to transmit a coherent picture between what is physical and the cultural values that make up and define the represented contexts (fig. 12).
This is a stimulating operational and conceptual process if and when representation achieves the levels of expressivity required to spatially outline environmental and identity values which in turn delineate unexpected fields of action, also the result of certain nineteenth-century experiments.
Moreover the online dissemination of modern or old maps requires that a standard be adopted to establish these processes ranging from digitalisation to web sharing and copyright management and protection.

Conclusions

In this short and far from exhaustive article I have tried to show what old maps, especially nineteenth-century maps, can provide in terms of knowledge and how they can be used in in-depth disciplinary studies focused not only on cartographic analysis, the semiotics of representation and graphic signs, but also the interpretation-reinterpretation of the role of maps and their power of communication and persuasion.

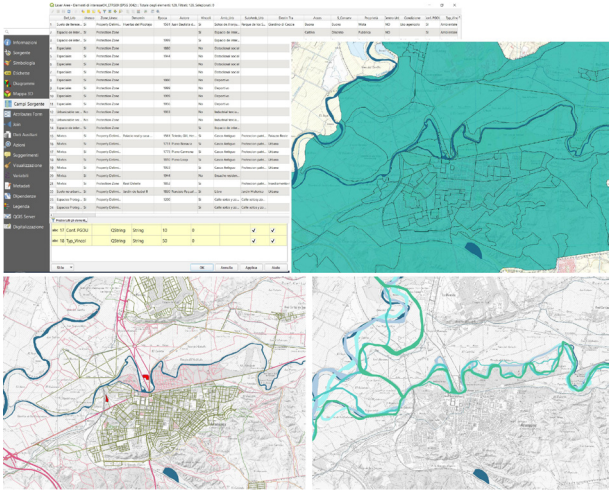


Fig. 12. Graphic output from the GIS comparing maps of the royal site of Aranjues created during different epochs. From: Fernandes 2019.

These descriptive forms undoubtedly represent a cultural reservoir which remains almost untapped and waits patiently to be understandably analysed, interpreted, compared and disseminated. The studies performed in this disciplinary area have provided systematic and internationally-acknowledged results, i.e., with more episodic, but nevertheless inspiring goals, due also to innovative management information and communication technologies that can sustain and facilitate processes and searches that concentrate on connecting man and different places, eras, and expressive forms.
These studies also constitute a consistent heritage of knowledge which deserves to be disseminated more systematically so that as the studies progress, they produce new results and original inputs.

Notes

[1] The minutes of the meeting were published in issue n. 5 of the *Mémorial topographique et militaire* [Mémorial topographique et militaire 1803], the department of the *Dépôt de la Guerre*; the attached tables of conventional signs increased the number of signs previously used in topographical manuals.

[2] The report submitted by the captain of the military engineers, Laussedat, to the *Académie des Sciences* in Paris in 1860, implied that there was a desire to turn the photograph into a map; this should be considered as part of the trend involving technological changes that took place during that period. [Gemignani 2018]

[3] In 1877 the engineer Pareto became a 1st Class inspector of the civil engineering division and in 1882 was named member of the Permanent Committee of the Civil Engineering Division. He was also confirmed as a member of the National Council of Public Works.

Author

Lia M. Papa, Department of Civil, Building and Environmental Engineering, University of Naples "Federico II", lmpapa@unina.it

Reference List

AA.VV. (2006). *Linee guida per la digitalizzazione del materiale cartografico*. A cura del Gruppo di lavoro per la digitalizzazione del materiale cartografico. Roma: ICCU, Istituto Centrale per il Catalogo Unico delle Biblioteche Italiane e per Informazioni Bibliografiche.

Beloch, J. (1879). *Campanien: Topographie, Geschichte Und Leben der Umgeburg Neapels in Alterthum*. Berlin: S. Calvary & C.

Brotton, J. (2018). *La storia del mondo in dodici mappe*. Milano: Feltrinelli.

Cardone, V. (2018). Editoriale. In *diségno*, No. 2, pp. 5-8.

Cardone, V. (1993). Un rilievo giovanile di Benedetto Marzolla. In *Disegnare. Idee, immagini*, No. 6, pp. 17-24.

Conti, S. (2008). L'agroalimentare nel Regno delle Due Sicilie in una carta di Benedetto Marzolla. In N. Castiello (a cura di). *Scritti in onore di Carmelo Formica*, pp. 349-258. Napoli: Università degli Studi di Napoli "Federico II".

Chías, P., Abad, T. (2008). The GIS in an ancient cartography: A New Methodology for the online accessibility in the Cartographie Digital Librerie. In M. Ioannides, et al. (eds.). *VSMM 2008. Digital Heritage. Proceeding of the 14th International conference of Virtual Systems and Multimedia*, pp 125-130. Limassol, Ciprus: VSMM/CIPA/ICOMOS.

Chías, P., Abad, T. (2016). The Peninsular War 1808-1814: French and Spanish Cartography of the Guadarrama Pass and El Escorial. In E. Liebenberg, I.J. Demhardt, S. Vervust (eds.). *History of Military Cartography*. Cham: Springer.

De Dainville, F. (1959). De la profondeur à l'altitude. Des origines marines de l'expression cartographique du relief Terrestre par cotes et courbes de niveaux. In M. Mollat (éd.). *Le navire et l'économie maritime du Moyen Age au XVIIIe siècle*, pp.195-209. Paris: Sevpen.

Devoto, F.J. (2007). *Storia degli italiani in Argentina*. Roma: Donzelli.

Fernandes, V. (2019). *Siti storici e paesaggi fluviali. Strategie e strumenti per un progetto di valorizzazione: El Real sitio de Aranjuez*. Tesi di laurea magistrale in Ingegneria Edile-Architettura, relatori proff. L.M. Papa e P. Chías Navarro. Università degli Studi di Napoli "Federico II".

Gemignani, C.A. (2018). Dalla foto alla mappa: innovazioni tecnico-scientifiche, continuità e rivoluzioni visive nel secondo Ottocento. Spunti preliminari. In A. Guarducci, M. Rossi, (a cura di), *Storia della cartografia e cartografia storica*, pp. 88-94. Bologna: Patron.

Génieys, M. (1829). *Essai sur le moyens de conduire, d'elever et de distribuer les eaux*. Parigi: Carilian-Goeury.

Harley, B. (2001). *The New Nature of Maps*. Baltimore and London: The Johns Hopkins University Press.

Leonhard, J., von Hirschhausen, U. (2014). *Imperi e stati nazionali nell'Ottocento*. Bologna: Il Mulino.

Mémorial topographique et militaire (1803), *5. Topographie*. Parigi: Imprimerie de la République, pp. 1-64.

Mingucci, R. et al. (2013). Modellazione e progetto urbano: applicazioni e prospettive per i GIS. In *Disegnarecon*, Vol. 6, No. 11, pp. 11-20.

Nocco, S. (2014). Conoscenza e rappresentazione del territorio argentino tra il XVI e i XIX secolo: missionari, cartografi, esploratori. In *RiMe, Rivista dell'Istituto di Storia dell'Europa mediterranea*, No.12, pp. 181-183.

Papa, L.M. (2003). La cultura del disegno nella formazione dell'ingegnere. In A. Buccaro, S. D'Agostino (a cura di). *Dalla Scuola di Applicazione alla Facoltà di Ingegneria*, vol. I, pp. 303-327. Benevento: Hevelius.

Pareto, R. (1855). *Irrigazione e bonificazione dei terreni*. Milano: Stabilimento Saldini editore.

Rossi, L. (2018). Ancora sulla rappresentazione del rilievo. La centralità francese e un precoce caso italiano (sec. XIX). In A. Guarducci, M. Rossi, (a cura di), *Storia della cartografia e cartografia storica*, pp. 70-79. Bologna: Patron.

Tognetti, L. (2005). *Explorar, buscar, descubrir. Los Naturalistas en la Argentina de fines del siglo XIX*. Córdoba: Universidad Nacional de Córdoba.

Valerio, V. (2014). La rappresentazione della montagna nel XIX secolo tra scienza e imitazione della natura. In E. Dai Pra' (a cura di). *Approcci geo-storici e governo del territorio*, vol. 2, *Scenari nazionali e internazionali*, pp. 75-92. Milano: Franco Angeli.

Valerio, V. (1993). *Società, uomini e istituzioni cartografiche nel Mezzogiorno d'Italia*. Firenze: Istituto Geografico Militare.

Wood, D., Fels, J. (1986). Designs on signs/myth and meaning in maps. In *Cartographica. The International Journal for Geographic Information and Geovisualization*, Vol. 23, No. 3, pp. 54-103.