

ALESSANDRA FERRIGHI

VISUALIZING VENICE: A SERIES OF CASE STUDIES AND A MUSEUM ON THE ARSENALE'S VIRTUAL HISTORY

This paper introduces *Visualizing Venice*,¹ a project conceived to test the application of new information technologies to urban history with two purposes in mind. On the one hand, it seeks to provide scholars with new knowledge and research tools that are different from traditional means, such as primary and secondary sources. On the other, it hopes to create new forms of communication through which historians can help non-specialists or a general public of different ages and backgrounds understand research on urban history. Using 2D or 3D drawings of the city to highlight phenomena over time such as urbanisation patterns, the impact of new road networks or the location of different uses in the urban fabric (markets/storage space, residential/manufacturing areas, and so on) makes it possible to integrate two forms of communication – word and image – by translating the first with the second². This alone, however, is not enough. Images conceived in the technological age are also entrusted with time and movement. Adding the attribute of time to the

¹ *Visualizing Venice* is an international, interdisciplinary, collaborative research project. It brings together various research groups in Italy (Università Iuav di Venezia, principal investigator, Prof. D. Calabi, and Università degli Studi di Padova, principal investigator, Prof. A. Giordano) and abroad (Duke University in Durham - NC, USA, principal investigator, Prof. C. Bruzelius), and Nesting srl, a think tank in Venice (President, Prof. G. Toniolo; CEO, L. Bonadimani). Each research group brings their own skills and specificities into play, enriching the project and providing different approaches and ways of looking at the issues under investigation. The research was carried out in brief but intense work sessions held in July 2010, 2011 and 2012. Since late 2011, there have also been increasingly frequent opportunities to discuss the research methodology, goals, case studies and expected results, despite a lack of funding for all the researchers' work.

² F. ANTINUCCI, *Parola e immagine. Storia di due tecnologie*, Roma, Laterza, 2011.

object under investigation makes it possible to visualise transformations over the years. The dynamic nature of phenomena can be shown through videos³.

Venice: a perfect testing ground

VV's field of investigation is the city of Venice. More specifically, it deals with the historic centre represented by the 125 islands (fig. 1) pivoting around Rialto, rather than the entire municipality as it is now defined from an administrative point of view.

Venice is a unique city, a city that embodies and is the symbol of its political and administrative history, its trade, and, last but not least, its beauty. It is a city that developed in a unique setting, on land surfacing in a lagoon protected from the sea and on the mainland, to which it was linked exclusively by water until the mid-nineteenth century. One might imagine Venice as an isolated city, a city built on unstable marshland. Yet all of this is actually what created its singularity in so many different ways, such as special construction techniques and protection from salt water, to cite just a few.

Venice has a long history. It is an old city but, contrary to what one might imagine, it is a city that has continued to change over time. But how can such a unique city become a testing ground for a model for analysing urban transformation? Can it actually represent fertile terrain for study? We found the answer to these questions in the following reasons.

The first is linked to sources. In Venice, there is an extraordinary wealth of information on the city. The vast number of documents left by the *Magistrature* or civil authorities of the Venetian Republic, the many images, which include early city maps, expert drawings and topographical surveys from the eighteenth century on, and the French and Austrian cadastres, to name just a few, led us to believe we had a good starting point. Many well-preserved archival sources on the city are available to scholars. There are also many finished and already published studies. In short, there is a multitude of both primary and secondary sources.

The second relates to the continuous transformation the city has undergone over time and continues to undergo today. Many people think that Venice has

³ These issues are also addressed in *Visualizing Venice. Il caso dell'insula dei SS. Giovanni e Paolo*, in L. Galeazzo, E. Mandelli, E. Pellegrini (eds.), *New Perspectives New Technologies*, Venice, Ca' Foscari University Press (forthcoming).



Fig. 1 - The entire Municipality of Venice (upper left); the historic center and its 125 islands (in the circle).

remained unchanged over the years and do not know that the Venetians actually conquered their land, reclaiming it from the sea, that many islands were expanded, that many others were built artificially, that many canals were dug out to make them navigable, that the islands are linked by bridges and that these bridges are a relatively recent institution. In some respects, it can be said that Venice is an entirely artificial city, a wholly manmade work starting from the foundations of the houses, palazzos and churches, structures that were made possible by the Venetians' ability to build foundations with wooden piles. Even the supply of fresh drinking water required the Venetians to adopt systems suited to a place surrounded by water, that was undrinkable, brackish water: fresh water had to be collected and distributed through cisterns and wells that channelled rainwater from the roofs of the city's buildings.

The borders of Venice are constantly changing, not only those between the land and the sea, but also those of the city proper, the city sitting on the sea. Take Piazza San Marco, a place that is visited by more than a million tourists each year. It too has been enlarged; its urban structure altered by the reconstruction of new buildings throughout the nineteenth century and by the demolition of the church of San Geremia and the construction of the Ala Napoleonica. The face of Venice has changed over time.

The third but by no means less important aspect is the city's social and economic history and the specialised uses many of its areas have had: just think of the shipyards, of the Arsenale, of the Giudecca, which at first provided the space for growing the city's produce and for food production and was later industrialised through the construction of large buildings for transforming raw materials. Or think about the movement and stocking of goods. Venice is a city in which manufacturing has been concentrated in a few areas and has been centred on just a few products. It is a city in which the autonomy of the districts has been consolidated and reinforced over time, in which each district is an organized microcosm for the trade of essential goods (bakers, butchers, greengrocers, and so on) and for water supply. It is a city whose margins are constantly shifting and whose outskirts change in relation to the social and economic transformation provoked by new links or new destinations. The flow of goods and people has also fluctuated over time.



Fig. 2 - The location of the case studies (the *cantieri*): [1] SS. Giovanni e Paolo, [2] S. Agnese, [3] Biennale, [4] Arsenal.

A series of case studies

Within the dense and complex tissue of the city of Venice, we identified certain places, case studies through which to experiment with and test a research methodology using new technological tools for urban history. We call these areas '*cantieri*' adopting the Italian term that means a building or work site (fig. 2).

The '*cantieri*' are areas whose characteristics still arouse interest from the point of view of the contemporary city, as they are places that are still undergoing transformation. They are abandoned areas, areas in the process of conversion, or areas at the margins of the city, far from the nuclei of the city's power centres.

During the first year of research (July 2010), we chose the *insula* of SS. Giovanni e Paolo, an island facing north, towards the island of San Michele (Venice's cemetery). It is an island that opened various avenues of research because it houses several institutions from the twelfth and thirteenth centuries, such as the complex of the Dominican Order. It is an island on which various uses developed, such as the lumber works that gave the name 'Barbaria de le Tole' to the artery crossing it longitudinally and health and charitable institutions including the Scuola Grande di San Marco and Santa Maria dei Derelitti.

The second '*cantiere*' is the *insula* of S. Agnese, the island that is home to the complex of the Gallerie dell'Accademia, one of the most important museums in Italy. This study was conceived in collaboration with Renata Codello, the Superintendent of Venice, who is an architect and the director of the museum's expansion. After the relocation of the Accademia di Belle Arti and the opening of the newly expanded and renovated museum, the complex is now seeking to establish its relationship with the rest of the city. To this end, the research group was asked to investigate how, over time, the various uses of the convent had led, first, to it being opened to the outside and then to its gradual closure.

The last two '*cantieri*' – the Giardini of the Biennale and the Arsenale – do not refer to specific *insulae* but to areas that have been designated for special uses.

The history of the area allocated to the Biennale is recent and is linked to the public gardens created in the Napoleonic era and, later on, to the

construction of pavilions for exhibiting art. The island itself, the island of S. Giuseppe, is located in the furthestmost part of the city on land that was reclaimed and expanded to create a large public green space arranged in geometrical blocks and planted with rows of trees.

The Arsenale, instead, has a long history that is closely bound to the history of Venice. It too is an area at the margins of the city, an area that is so extensive that, at the end of the eighteenth century, it actually comprised one-tenth of the city. The Arsenale is a national, secret place where ships are built. From its very foundation it was enclosed with high embattled walls, a dock, and the *tese acque*, large buildings fronting the water basin. This study of the history of the Arsenale's transformation responds to a request by Società Arsenale S.p.A, a joint-venture founded in 2003 between the Italian Public Property Agency and the Municipality of Venice to develop and manage projects for the Arsenale's reuse (Second Chance Project). Among these projects is the redevelopment of the Torre di Porta Nuova, which has made it possible to create an exhibition space conceived not only for temporary exhibitions but also as a site in which to create a museum on the Arsenale's virtual history. The goal of the research is to collect data on the history of the Arsenale and to create new ways of disseminating this information through new forms of storytelling by making use of still and moving images.

Space and time in urban history

The city is the result of human intervention that, through long-term processes, has determined its form. The history of the city can only be constructed by investigating these processes, through research and by studying the sources, interpretations and their analyses. The places or events that are part of the city and its history are characterised by the two concepts of *space* and *time*. Every place was created in a given space and at a given time; every event took place at a precise historical moment and in a specific place. The protagonists of history – be they illustrious or part of the work force – lived in a particular time span and helped mark that moment with acts that are recognisable as traces in history.

To cite just one well-known example in Italy's history, the French occupation (Napoleon Bonaparte and the measures he took) and later that of the Austrians radically changed the face of Venice. They changed the way the

state was organised and contributed to the reuse of many parts of the city by converting entire neighbourhoods. In the first half of the nineteenth century, the history of Venice was marked by political decisions that placed primary emphasis on the beauty, salubrity and reorganisation of the city by making it 'modern' and giving it all the services that mainland cities were setting up. All of this entailed demolition, new construction, additions, reuse, new connections and so forth, which changed many areas of the city. Even if we do not realize it, the city we see today is the result of these measures.

When scholars recount the history of the city, they are referring – even if not explicitly – to the two themes of space and time, because every act takes place in defined or circumscribed moments and places.

The most appropriate tool for managing information regarding the concepts of space and time is GIS (Geographical Information System) because it relies on spatial, qualitative and quantitative and, last but not least, temporal data. It is software that has already been widely tested and adopted in other humanistic disciplines, such as archaeology for example, but it is struggling to find its place in historical research due to the mistrust of scholars themselves. For more than ten years now, GIS has already played a major role in historical research in the humanities, as evidenced by the literature of this field. The main feature of GIS is that of connecting the data collected in databases to maps or of relating geographic information to non-spatial data. GIS 'provides a toolkit that enables the historian to structure, integrate, manipulate, analyse and display data in ways that are either completely new or are made significantly easier.'⁴ The possibility of visualising qualitative and quantitative data on a map, for example, makes it possible to formulate new questions or to give circularity to the formula question / answer / new question. It can trigger a virtuous mechanism for the growth of knowledge or discovery that is not only concerned with finding and publishing a previously unpublished document but also with its public dissemination through unconventional and easily accessed means.

Comparing spatial data is the only thing that allows us to say that space is not static: it changes over time! This becomes evident by comparing different historical maps.

⁴ Cf. I.N. GREGORY-P.S. ELL, *Historical GIS. Technologies, Methodologies and Scholarship*, New York, Cambridge University Press, 2007, p. 1.

Data and methodology

The research of Visualizing Venice grew out of the idea of finding other, different ways to communicate research and, in particular, research on the history of the city of Venice. The first question we asked was *what* to communicate and then, immediately after, *how* to communicate it. *What* and *how* to communicate became VV's two keywords.

While on the one hand the first question may seem easy to answer because the field of inquiry, and thus the content and the objects to be visualised are clear, the *how* – the interface – proved a little more difficult. In the end, we chose two ways of visualising data. The first is two-dimensional, through simple schematic representations on maps, with informative layers chosen a priori (more simply known as 2D maps). The second, which derives from the first, corresponds to the three-dimensional representation of the elevations on two different scales, one urban with more or less defined volumes, the other architectural with the possibility of reading the transformations of the façades (3D modelling). The outputs of these two products can be drawings, thematic maps, 3D models and videos for use in virtual museums, apps, on the Web and so on (fig. 3).

The basic data

To produce the *what* – the content, the objects of communication –, different mechanisms that are part of a fairly elaborate process were identified. In what follows, I will try to outline the guidelines of this process.

The first issue is related to the acquisition of the spatial data. For the city of Venice, there is a great deal of spatial data available as open sources. The Municipality of Venice gave us the CTCs (the city's technical maps) for the entire municipality. Of the many (more than 70) layers, we only selected those that were relevant to our research, which numbered about ten. They included the layers related to the building stock, place names, the land surfacing above the water, 'streets' and so forth, or rather all of the objects that are needed to visualise the present state of the city's fabric so as to compare it with the transformation over time. For all the operations that followed, we used Esri's ArcGis software version 10.1. We analysed these layers to determine what attributes were to be associated to them. For the canals inside the historic centre, for example, we needed to know if the attribute regarding the different

Venice: case study

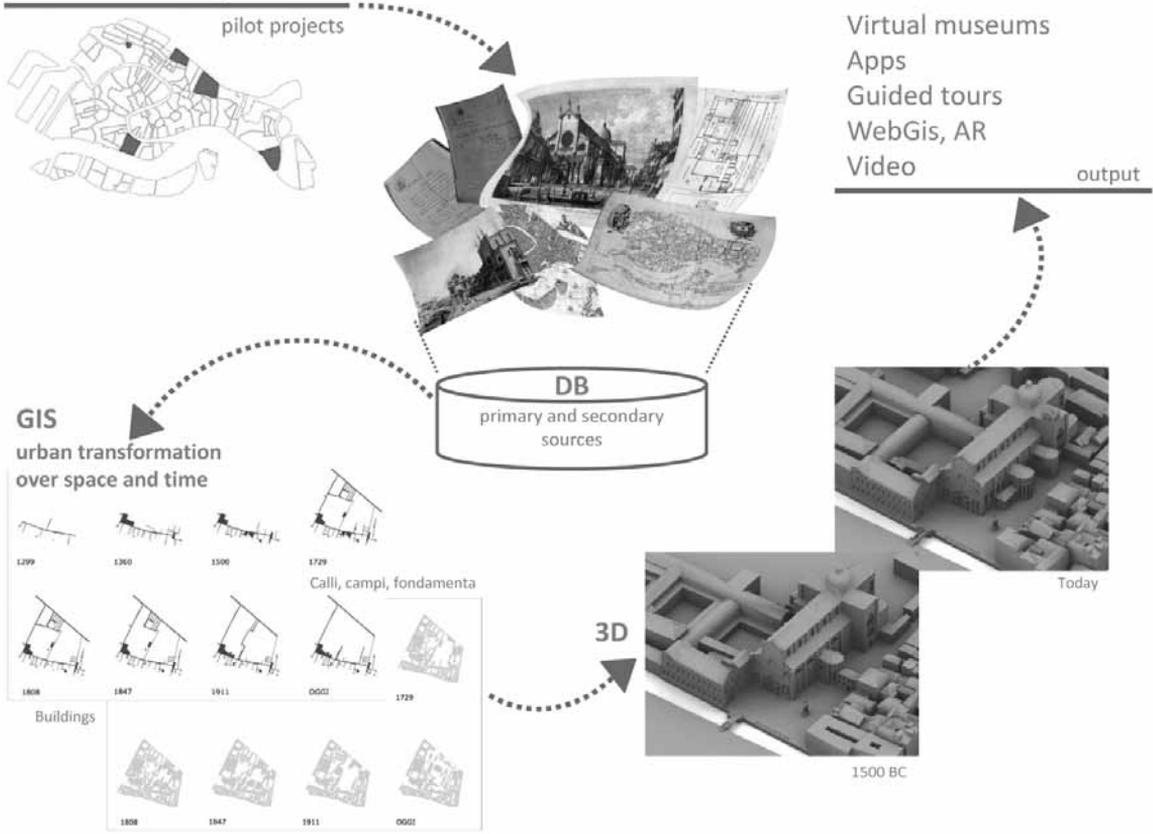


Fig. 3 - Concept or scheme of VV's research methodology.

types (Species) and the naming of waterways had been compiled so that we could track the data regarding time. The same can be said for the pedestrian streets and spaces of the historic centre, the so-called *Calli, Fondamenta*, etc., where the data regarding place names were found. For the building stock, we chose to use different layers from the CTCs because the buildings were subdivided into buildings and volume units. The first can include the second when a single building is represented by multiple volumes, as in the case of the church of SS. Giovanni e Paolo, which is tripartite with side chapels. Analysis of the data revealed an attribute in the CTCs that is fundamental in our research: the height of the eaves and the building tops, which are useful in developing 3D models.

Some corrections were made to resolve some of the problems described above and to be able to go ahead with the successive scans. The second step

involved eliminating the attributes that were not required and creating the ones that were necessary for the subsequent analyses, such as the two new attributes related to space and time. 'Start' and 'End' define the objects' time limits.

This data was used to generate a GeoDB, relying on Traverse-Mercator projections and Monte Mario / Italy 2 coordinates. The main feature of the GeoDB is that it contains vector, raster and tabular data (including non geographic data) as well as topological rules, which are essential for future digitising. This is how we prepared the basic material with which to start.

In order to track changes over time, we collected all the historical maps representing the city and all of the archival drawings that could delineate buildings, urban spaces, and so on. These documents were digitised either in raster format or with a high definition scanner. The images were manipulated to make the information legible and then geo-referenced with the same system of coordinates as our base map. The new images were interpreted and, every time a difference was found (by overlaying the GeoDB on the CTC), new shapes were drawn giving new values to the attributes. We found a lot of *calli* that had originally been canals (the name that is currently used for these landfills is Rio Terà). In this case a new object was created at the Canal layer and, in that exact moment of history, the shape became part of the Street layer.

The digitalising of the new objects was accompanied by the implementation of the attribute dataset linked to them, forming a *Feature dataset* with as many shapes as the objects transformed over time.

Database

This work was paralleled by the structuring of a database. The purpose of the DB is to collate (textual and iconographic) data on urban or building transformations and to link it, through code, to the shapes that define them.

The relational DB was created in FileMaker 11 and deposited in a server so that all researchers could store data simultaneously. Every record corresponds to an event or a source, both of which are linked to the sites under investigation. Accompanying each of these are subforms that report archival data, bibliographic data for what has already been published, image data for iconographic sources and the link to the geographical data. This will make it possible to identify the document or event linked to the transformation of the urban spaces and buildings (fig. 4).

The screenshot shows a web application interface for entering data into a database. The main window is titled "Sources" and contains several input fields and sections:

- Title:** "Mapa de la zona comprendida en el P.O. de Santa Cruz de los Baños de San Juan de los Rios, en la Barandia de Toluca y Parícutero de la..."
- Author:** "Herrera, Lorenzo"
- Date:** "1873" (year), "1" (month), "10" (day), "Mexico" (place).
- Preview:** A small image of a scanned document page with handwritten text and a map-like layout.
- Navigation:** Buttons for "Collections", "Bibliography", "Digitalizations", and "GIS data".
- Right Sidebar:** A list of records with columns for "id", "year", "month", "day", "place", and "image". The first record is highlighted.

Below the main form, there is a section for "Full image file name" and "Full image file name" with a "Open full image" button. It also includes instructions for uploading images:

- Each image must be with a resolution of 300 pixels per inch (300 dpi) and a file size of less than 1 MB.
- Use the following naming convention: `year-month-day-place-image.jpg`
- Use the following naming convention: `year-month-day-place-image.jpg`

Fig. 4 - Form for implementing data in the DB.

Some general implementation rules were adopted for compilation. These include reference to the international method adopted in the *Dublin Core Metadata Initiative* (DCMI) for fields such as Author, Title and so on, as well as the lexicon adopted for cards by the Istituto Centrale per il Catalogo e la Documentazione (ICCD, the leading Italian institute for cataloguing and documentation), with specific cataloguing standards, especially for the fields with preconfigured lists.

3D modelling and video

The next step in the research workflow was creating the three-dimensional models for the *insula* of SS. Giovanni e Paolo, our first '*cantiere*', which were drawn on the basis of the two-dimensional data and information from other sources. For this kind of work as well, we established rules for representing the two different scales (urban and architectural) and for the distinctions to be made between the fixed data derived from sources and the interpreted data. This part of the research was initially done with Autocad (for modelling), 3D Studio Max (for rendering) and Adobe Premiere Pro (for video editing).

For the '*cantiere*' of the Arsenale we are using a parametric modelling software (Esri's City Engine) and the criteria established in the *London Charter*.

A museum on the Arsenale's virtual history

The museum on the virtual history of the Arsenale will be one of the first outputs of Visualizing Venice. It is a museum that, instead of physical objects, offers (virtual) content that can be displayed in different ways, online and offline, inside and outside. The goal of the museum is not to conserve works but rather to communicate the complex's history. The content produced through VV's methodology (2D plans, 3D models, videos, etc.) will make it possible to learn about the transformations that have occurred over time in this unique place in the history of Venice.

The museum will be housed, in part, in the exhibition space inside the Torre di Porta Nuova. This is why it will not be a virtual museum on the history of the Arsenale, but a museum of the virtual history of the Arsenale. It will be possible to consult the museum's content on mobile devices without being inside the museum. It will be possible to stand at specific points inside the complex and 'see' what has happened there over time: new construction,

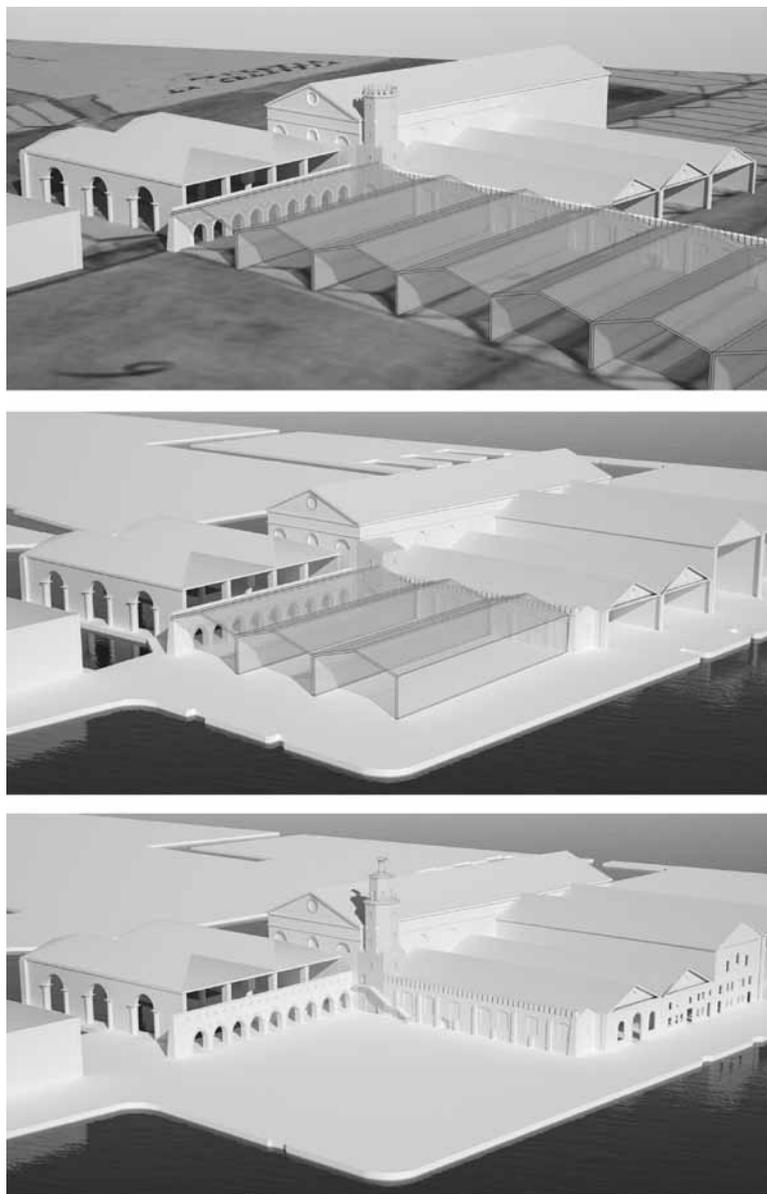


Fig. 5 - Models 3D from the panel on the history of the Arsenale, curated by Caterina Balletti and Alessandra Ferrighi for the exhibition 'Visualizing Venice, new technologies for urban history', Spazio Gino Valle, Università Iuav di Venezia (December 2012).

demolition, the building up of layers, and so on, and at the same time, to understand why all of this has happened. This new museum form will make communicating easier and more immediate through the use of interactive devices and the user's full immersion 'in the field' (fig. 5).

Visualizing Venice's research is a work in progress. We have taken small steps forward each year, increasing our team and recalibrating our tools. Our goals, however, have remained unaltered: to provide urban historians with new research and communication tools and to produce content that can be shared with a general, non-specialised audience⁵.

⁵ACKNOWLEDGMENTS: *Visualizing Venice* is the result of the work of many different people, including professors, researchers, PhD candidates and students. The project's success has depended on the varied threads everyone has known how to weave together. In alphabetical order: Rachael Brady, Caroline Bruzelius, Donatella Calabi, Francesca Castellani, Joseph Chandler Williams, Eleonora Charans, Chiara Di Stefano, Isabella di Lenardo, Alexandra Dodson, Jara Dundas, Alessandra Ferrighi, Isabella Friso, Ludovica Galeazzo, Andrea Giordano, Sarah Goetz, Mattia Grosso, Cristiano Guarneri, Gianmario Guidarelli, Cosimo Monteleone, Laura Moure Cecchini, Elizabeth Narkin, Mark Olson, Marco Pedron, Mauro Perosin, Erica Sherman, Elena Svalduz, Victoria Szabo, Ines Tolic. Special thanks go to Professors Caroline Bruzelius (Duke University) and Donatella Calabi (Università Iuav di Venezia), who conceived the idea of *Visualizing Venice*. They have both known how to instil belief in this research, and putting together ideas and skills has been a real challenge. FUNDING: This research has been possible thanks to funding received from the The Gladys Kriebel Delmas Foundation of New York, from the Fondazione di Venezia, from the Università Iuav di Venezia, from Duke University in Durham NC and from the Università degli studi di Padova. These funds have guaranteed travel stipends, some fellowships, the organization of educational seminars and participation in conferences.

This essay was translated by Marlene Klein.
Revised by Elizabeth Bevan.