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Wired! and Visualizing Venice: Scaling up Digital Art History

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Wired! and Visualizing Venice: Scaling up Digital Art History

Cover Page Footnote

This paper represents one aspect of a larger collaborative initiative, Visualizing Venice. This multi-institutional project developed since 2010 by University Iuav of Venice, Duke University, University of Padua and Nesting scrl of Venice, shows how urban space evolves over time using a common repository of shared information and digital tools to visualize our research data.

Wired! and *Visualizing Venice*: Scaling up Digital Art History

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Abstract

This article focuses on *Visualizing Venice*, an interdisciplinary, cross-cultural collaboration that engages in mapping, 3-D modeling, and multimedia representations of historical change in Venice, Italy. Through a “laboratory” approach that integrates students and faculty in multi-year research teams, we ask new questions and pursue emerging lines of inquiry about architectural monuments, their relation to the larger urban setting, and the role of sculptural and painted decoration in sacred spaces. Our practice of digital art history transforms both teaching and research and provides new means for communicating knowledge to a broad public.

Résumé

Visualizing Venice (Visualiser Venise) est un projet interdisciplinaire et transculturel d'étude et de représentation du changement historique à Venise par la cartographie, la modélisation tridimensionnelle et le multimédia. Depuis plusieurs années, le projet a réuni des équipes formées d'étudiants et d'enseignants-chercheurs dans un cadre de type "laboratoire". Nous posons de nouvelles questions sur les monuments architecturaux, leurs relations aux contextes urbains plus larges, comme sur le rôle des décorations sculpturales et picturales dans les espaces sacrés. Notre pratique numérique de l'histoire de l'art transforme nos manières d'enseigner et de chercher. Elle nous a également permis déjà de produire de nouveaux outils pour communiquer les résultats de la recherche à des publics plus larges.

* See authors' biographies at the end of the article.

The Wired! initiative at Duke University (<http://www.dukewired.org>) applies cultural and historical visualization technologies and methods to the study of material culture, art, architecture, and urban history. Through a collaborative, “laboratory” approach, we ask new questions and expand upon emerging lines of inquiry about material culture in man-made environments. Our practices in digital art history and humanities scholarship transform both teaching and research, and provide new methods for communicating knowledge to a broad public. While digital approaches have many capabilities, our own emphasis is exploring change in the built environment over time—both particular structures and the urban fabric in which they were constructed. It is our hypothesis that digital tools—and especially visualizations—prompt new questions about architectural monuments, their relation to the larger urban setting, and the role of sculptural and painted decoration, such as altarpieces, in sacred spaces. We value not only what we learn from the final research products, but also from the research and construction processes themselves.

This article will focus on one of our initiatives: *Visualizing Venice*, an interdisciplinary, multi-year, cross-cultural collaboration that supports mapping, 3-D modeling, and representations of historical change in the city of Venice (<http://www.visualizingvenice.org>).¹ It will outline several of our completed and in-process projects to demonstrate how a new approach to traditional art historical materials prompts us to think about the field in innovative ways. Aware that as scholars we have a commitment to prepare students for the future, this paper also will outline the ways in which our Wired! teaching and research group actively engages graduate and undergraduate students in new technologies as part of the larger *Visualizing Venice* research initiative. Drawing upon an interdisciplinary, lab-

based approach to humanities teaching and research, our development process is both collaborative and iterative. Finally, this article will describe our focus on public-facing scholarship through exhibitions and our development of mobile applications, one of the ways that digital practice and its dissemination has vitally transformed our work.

What is *Visualizing Venice* and who makes up the team?

Visualizing Venice is a collaborative research initiative among Duke University, Università Iuav di Venezia, and Università degli Studi di Padova. Our goal is to map and model the shaping of urban space and its monuments over time. The research team has focused on certain historically complex zones and monuments of Venice to show how social, religious and economic change transform the shape of a city over the course of centuries. Venice is a particularly rich site, not only due to the unique nature of its urban development and its key position within the medieval and early modern world as a mercantile entrepôt, but also as one of the most historically well-documented urban spaces (Fig. 1a-d).

Inspired by preceding projects such as *Hypercities* (<http://www.hypercities.com/>) and *Rome Reborn* (<http://romereborn.frischerconsulting.com/>), we interpret traditional research materials (archival documents, visual sources such as maps, prints, drawings and paintings, and on-site inspections of extant objects/monuments) through digital tools, from databases to the visualization of interactive and time-referenced maps and 3-D models. Each project team is comprised of art and architectural historians, architects, and scholars trained in visual and media studies. The participants range from senior faculty members to undergraduate students. Our extended team includes librarians and information technology specialists as well.

¹ This paper represents one aspect of a larger collaborative initiative, *Visualizing Venice*. This multi-institutional project developed since 2010 by University Iuav of Venice, Duke University, University of Padua and Nesting srl of Venice, shows how urban space evolves over time using a common repository of shared information and digital tools to visualize our research data.



Figure 1a. Jacopo de Barbari, detail of Piazza San Marco from View of Venice, ca. 1500. Courtesy of the Minneapolis Institute of Arts, The John R. Van Derlip Fund (2010.88).



Figure 1b. View of Grand Canal, Venice, Italy. Photograph: "Venise (31 sur 47)" by Juliette Gibert. <https://www.flickr.com/photos/39514698@N00/4179358448> (<https://creativecommons.org/licenses/by-sa/2.0/>).

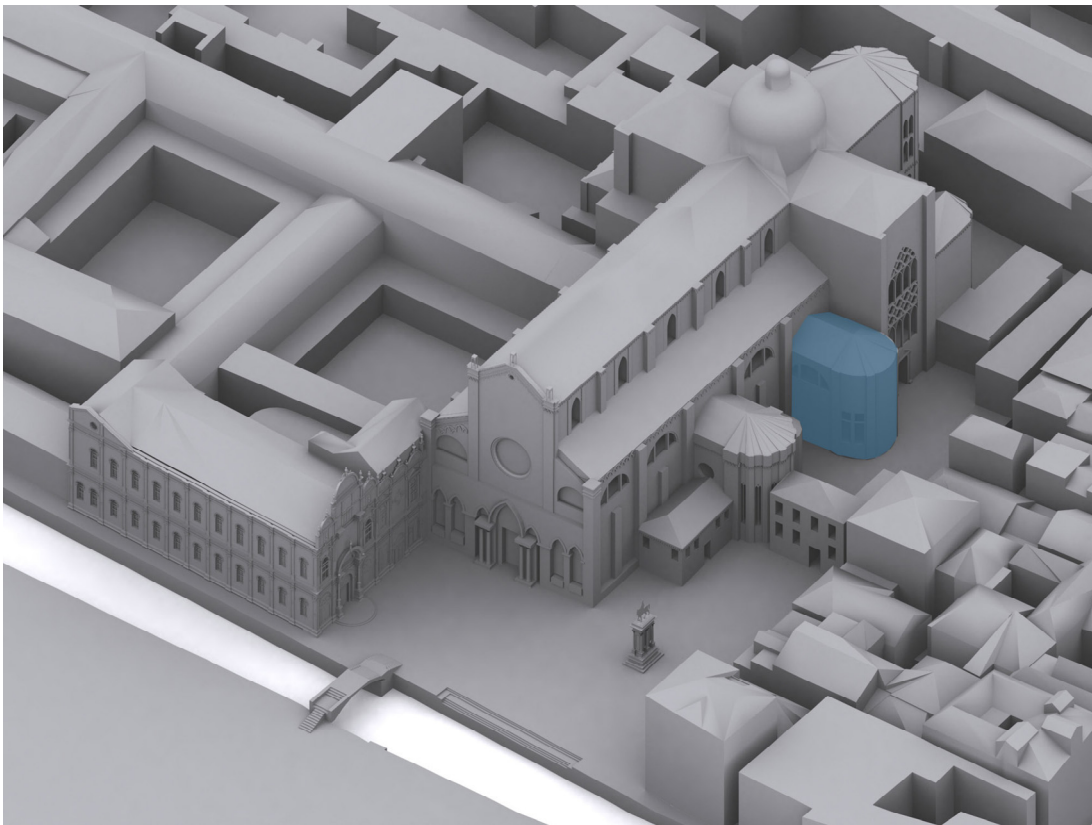


Figure 1c. Digital Reconstruction of zone around Ss. Giovanni e Paolo and the adjacent Scuola Grande di San Marco. Architect Modelers: Andrea Giordano, Cosimo Monteleone; Researchers: Alessandra Ferrighi (project coordinator), Gianmario Guidarelli (project coordinator), Alexandra Dodson, Joseph William Chandler, Isabella Friso, Mattia Grosso, Erica Sherman, Ines Tolnic, Matthew Woodworth.

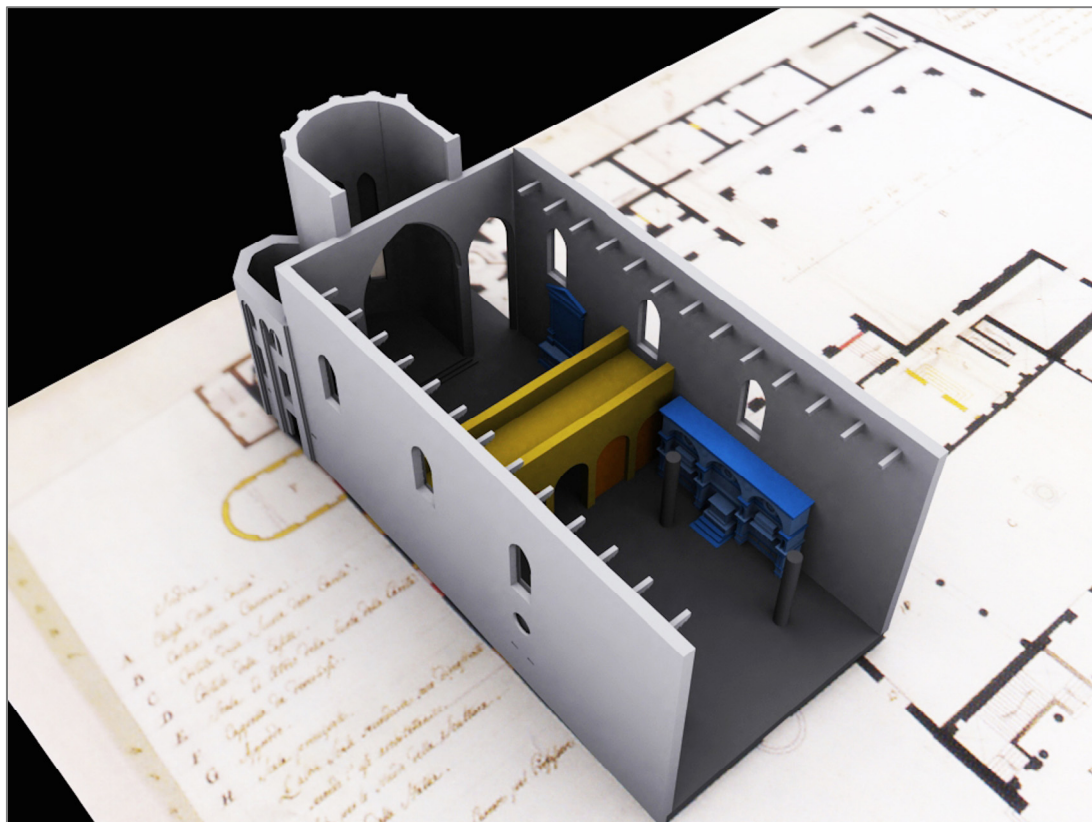


Figure 1d. Digital Reconstruction of the Church of the Carità, part of the present day Gallerie dell'Accademia. Architect Modelers: Andrea Giordano, Cosimo Monteleone, Marco Pedron; Researchers: Elena Svalduz (project coordinator), Iara Dundas, Isabella di Lenardo, Elisabeth Narkin, Joseph Williams.

What is our methodology?

Each of our initiatives begins much like any research project: with the collection of data from primary archival and secondary sources, such as manuscripts, images, and maps (Fig. 2). While we have some idea at the outset of what our final “media products” will be, we allow the nature of the data related to the research question to help determine the shape of those visualizations, as well as the underlying information systems that help us manage them. In a project focused on the movement of an object in time and space, for example, we might have a great deal of information on position and provenance, while for a stationary site the focus might be more on built additions and transformations. Each kind of visualization requires a different set of primary and supplementary materials. Over time we have evolved a complex set of metadata tailored to our unique research environment that nonetheless still draws upon standardized metadata schemes (e.g. Dublin Core) and information management best practices.

Each researcher enters the data into a set of shared, central geo-spatial databases. Our notion of “data” is broad and multimodal. The databases include images of archival records and their textual transcriptions, photographs of historic paintings, historic maps, 3-D models, and maps, terrains, and geospatial reference data. These “back end” database elements are redeployed in different “front ends” that range from research papers and presentations to public facing web-based presentations or mobile applications. Some of the *Visualizing Venice* projects are associated with specific sites or objects, while others are at a broader level of granularity and scale. What specific project data look like depends upon the nature of both the site and the historical materials associated with it.

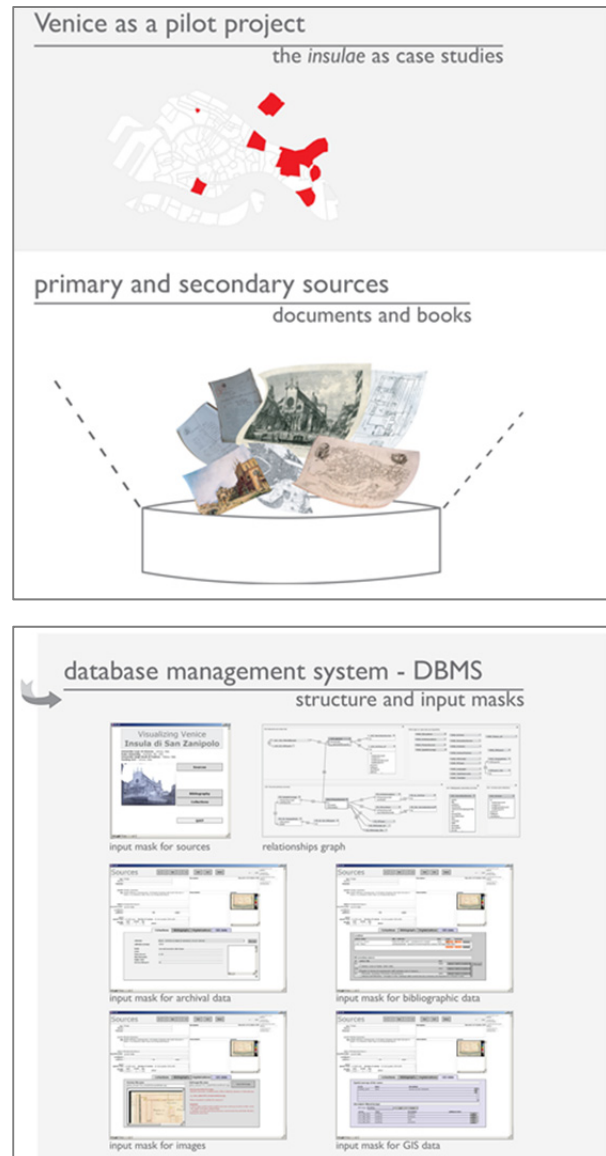


Figure 2. *Visualizing Venice* Research Methodologies and Data Collection. *Visualizing Venice* Exhibition, Durham, North Carolina, 2013. Image courtesy of Alessandra Ferrighi. <http://www.visualizingvenice.org/visu/?p=1314>

For example, projects centered on a specific *insula*, independent land formations separated by canals to form the interconnected urban fabric of Venice, rely upon Geographic Information Systems (GIS) to display the relationships between historical and contemporary map layers (Fig. 3). To this end, historical maps and cadasters are each redrawn to create illustrated map layers that can be recombined and queried. Projects that consider the city as a whole may use fewer such GIS layers and instead focus on the annotation of maps or creation of multimedia objects. Once these first

two steps are complete, we develop 3-D models of the most important structures and their complexes at key points in their history, and strategize how best to present those models to other researchers and to the wider public.

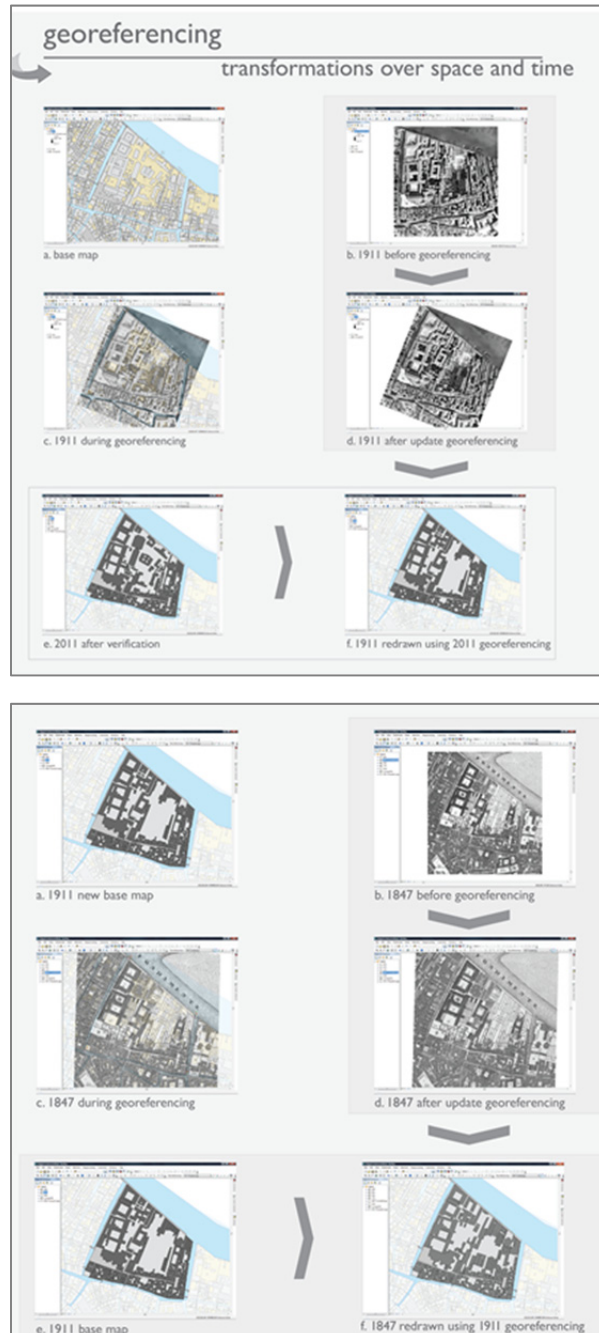


Figure 3. *Visualizing Venice* Research Methodologies and GIS Map Layers. *Visualizing Venice* Exhibition, Durham, North Carolina, 2013. Image courtesy of Alessandra Ferrighi. <http://www.visualizingvenice.org/visu/?p=1314>

Our research process is deeply collaborative, and builds upon the “lab” model prevalent in the natural and human sciences. Collaboration of this sort requires a significant commitment of time, and, ideally, a shared physical space for ongoing face-to-face and virtual interactions. The scope of these projects necessitates the division of labor both within individual projects and across the range of *Visualizing Venice* activities. These smaller groups might focus on one particular research aspect of the project, or implement a specific digital tool in order to move the work forward.² Similarly, some individuals have technical or domain expertise that can be applied to each project, while others are focused on specific historical questions and areas. As our case study examples demonstrate below, the resulting projects combine elements of original art and architectural history, engineering research, and innovative analog and digital media presentation and exhibition techniques.

Case Study: Ss. Giovanni e Paolo

Our first case study was a deeply experimental project. It began in early 2010 with the study and digital reconstruction of an insula that includes the significant mendicant church of Ss. Giovanni e Paolo and the Scuola Grande di San Marco, a lay confraternity conferred with special privileges as it shared the patron saint of the city. This particular location was chosen because there were several different types of institutions that could illuminate changes in social patterns of Venetian society. These included not only the Dominican complex of Ss. Giovanni e Paolo, but also one of six *scuole grandi*, residential buildings, storage structures for lumber, the civic hospital, and another church that included a small hospital for the poor, orphans, and pilgrims (the Ospedaletto). In addition to these important ecclesiastical and civic structures, the insula includes one of the largest land reclamation projects of the early

² A full listing of *Visualizing Venice* (http://www.visualizingvenice.org/?page_id=16) and Wired! Lab (<http://www.dukewired.org/research/>) research groups is available online.

modern period, the construction of the Fondamenta Nuove on the city’s northern rim.

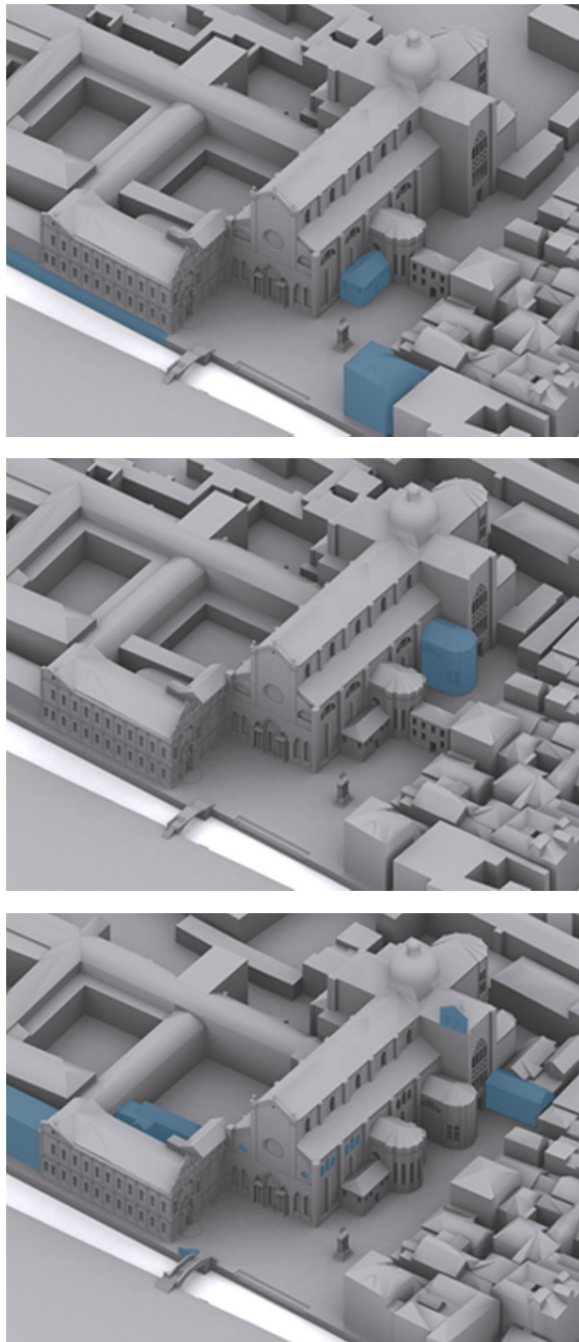


Figure 4. Transformation over time of the zone around Ss. Giovanni e Paolo and the adjacent Scuola Grande di San Marco, Venice. *Top:* 1640; *Middle:* 1723-1741; *Bottom:* 1895-1911. Architect Modelers: Andrea Giordano, Cosimo Monteleone; Researchers: Alessandra Ferrighi (project coordinator), Gianmario Guidarelli (project coordinator), Alexandra Dodson, Joseph William Chandler, Isabella Friso, Mattia Grosso, Erica Sherman, Ines Tolnic, Matthew Woodworth.

This dense and interwoven urban fabric provided an exemplary test case in which we could examine an historically complex zone of the city to show urban change as part of social and institutional history. This particular zone could therefore demonstrate transformation over time at different levels of scale (Fig. 4).

The campo facing the church of Ss. Giovanni e Paolo and the Scuola Grande di San Marco involved a secondary research phase conducted by some of our engineering colleagues in Padua. Their work explored the relationship between reality and visual representation, and the documentary value of artistic representations of urban space. They applied perspective restitution to Canaletto’s paintings and engravings of the campo in order to understand how the artist achieved the representations of the campo space and its structures and how spectators experienced these representations (Fig. 5a-b).

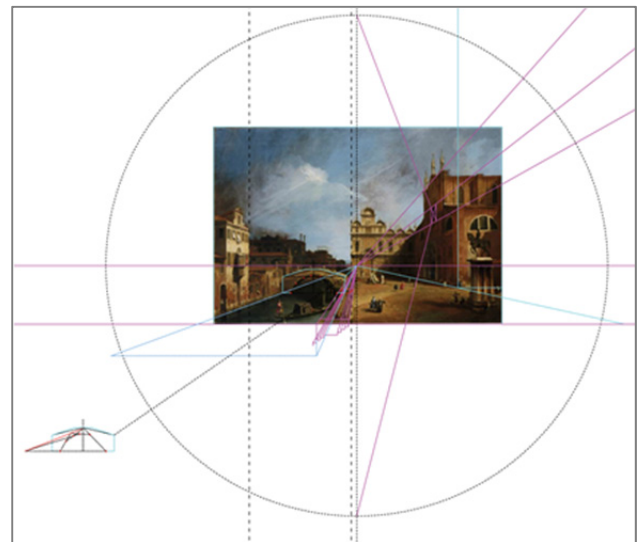


Figure 5a. Ss. Giovanni e Paolo and perspectival restitution. Courtesy of Andrea Giordano and Cosimo Monteleone.

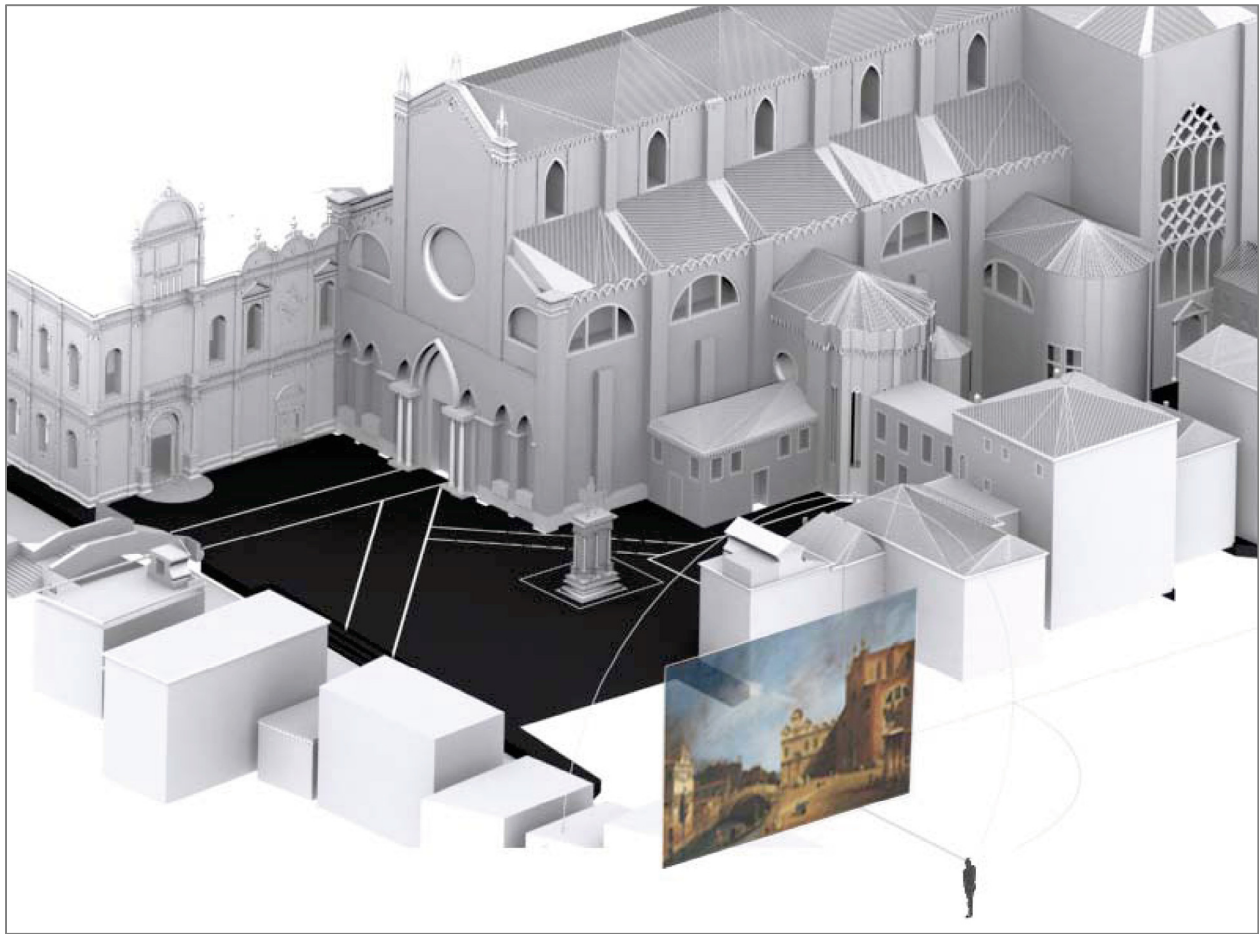


Figure 5b. Ss. Giovanni e Paolo and perspectival restitution. Courtesy of Andrea Giordano and Cosimo Monteleone.

One graduate student project examined the theoretical application of the perspectival system within the richly ornamented relief panels sculpted by Tullio Lombardo on the façade of the scuola. This study of the illusionistic perspective rendered within the two narrative reliefs demonstrated that the artist had considered the pathway of the spectator moving toward the scuola. The digital study, therefore, made possible an analysis of the ways in which the construction of architecture and its sculptural relief intersected with socio-political ritual, such as ceremonial processions, in highly meaningful ways.

This project also served as one of our first mobile application development experiments. We engaged a staff graphic designer to help create interfaces and partnered with undergraduate computer science students to develop a preliminary codebase for the Apple iOS (Fig. 6). We created some excellent prototypes for future work on our project, but realized this approach was not scalable as it involved too much customization of novice code. Our mobile application projects have focused since more on standardized eBook formats, and on responsive web design, where web-based presentations are viewable on multiple mobile platforms, not merely iOS.

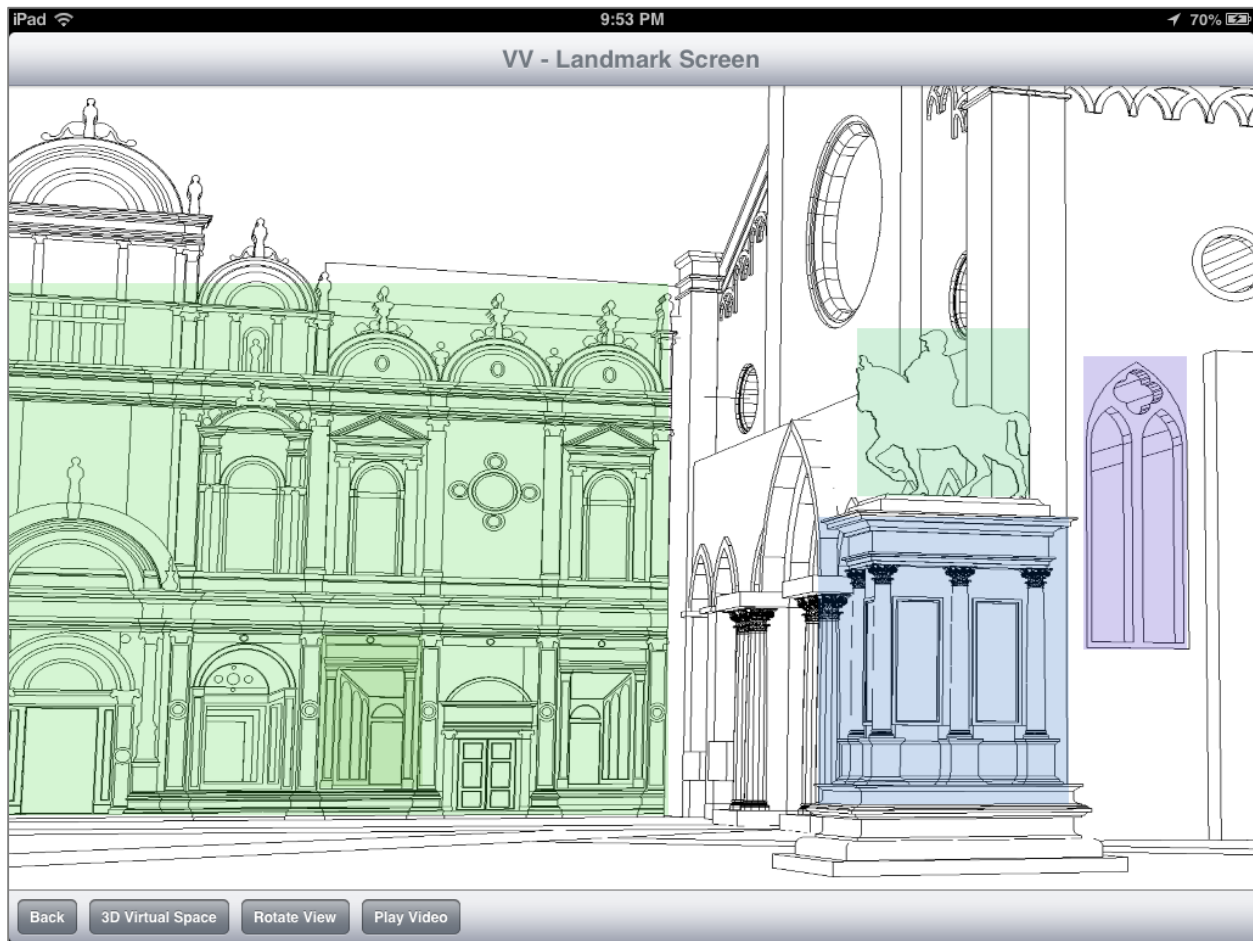


Figure 6. Ss. Giovanni e Paolo Mobile App for iOS. Interface Designer: Sarah Goetz; Researcher: Alexandra Dodson; Architectural Modelers: Andrea Giordano, Cosimo Monteleone.

In addition, we have identified augmented reality applications as a key future area for our “digital city” work in Venice, as they allow us to share scholarly research data *in situ*, in the context of the city itself, and as part of cultural heritage applications. We elaborate these ideas in the section on Public Facing Scholarship, below.

Second Case Study: Accademia Project

The second project we would like to highlight enables us to represent the “lives of things” – one of our central research themes – as works of art and other objects of material culture are relocated, repositioned, re-negotiated, or sometimes removed altogether, from or within interior and

across exterior spaces. Like the insula of Ss. Giovanni e Paolo, the Accademia zone includes a variety of architectural structures, including a mendicant church and adjacent scuola building. The team chose this zone in part because the Italian Ministry of Cultural Heritage requested a larger study of it to visualize the history of the current Gallerie delle Accademia, formerly part of the Scuola della Carità, and the relationship of the museum to its adjacent buildings within the insula. Most importantly, the team wanted to study and visualize the arrangement of paintings within the space: first as they appeared in the scuola; and second as this arrangement changed with the re-purposed history of the building and the early acquisition of the museum’s collection following Napoleon’s request (Fig. 7).

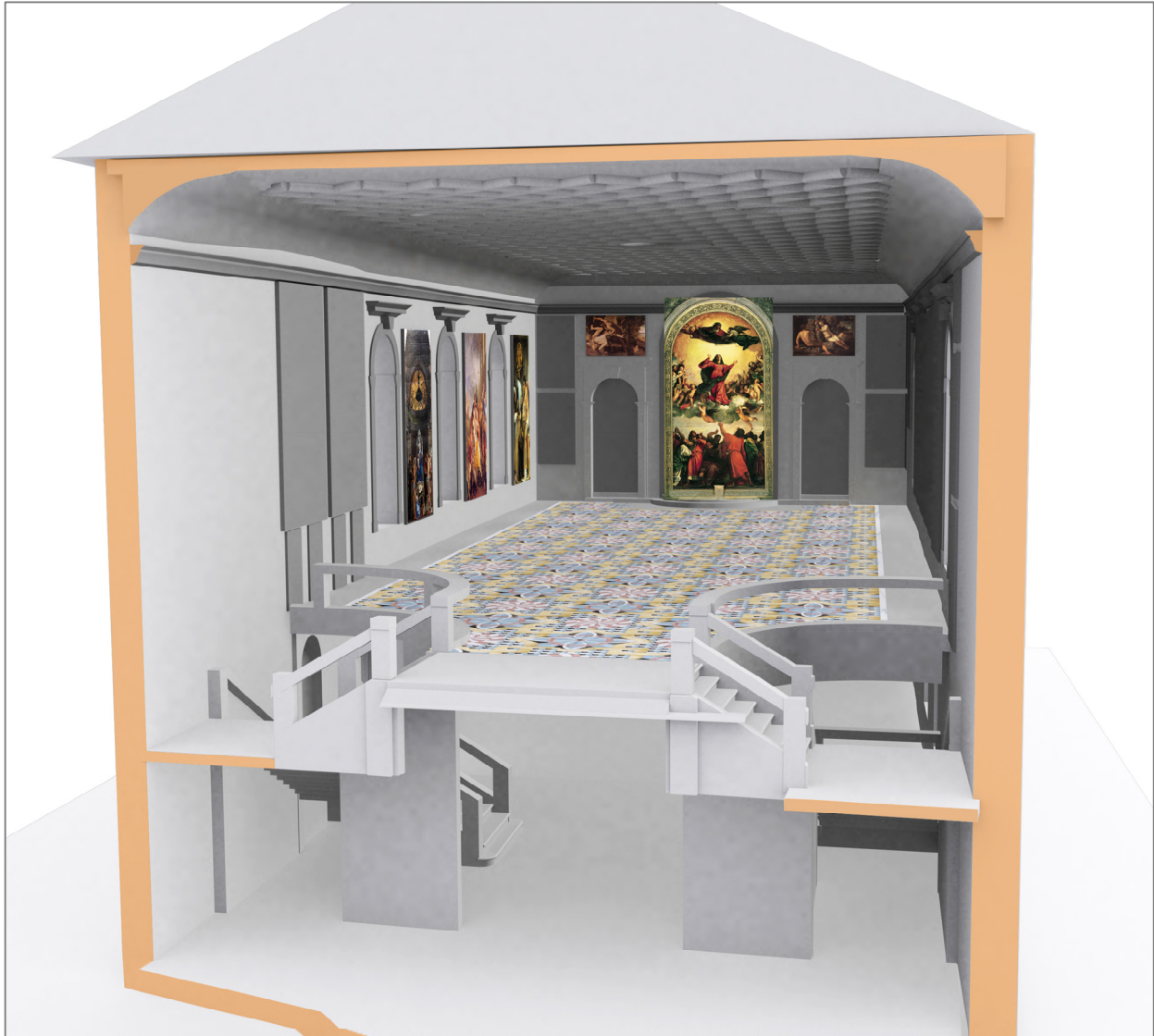


Figure 7. Model of the Accademia with Reconfigured Painting Installation, ca. 1817. Architect Modelers: Andrea Giordano, Cosimo Monteleone, Marco Pedron; Researchers: Elena Svalduz (project coordinator), Iara Dundas, Isabella di Lenardo, Elisabeth Narkin, Joseph Williams.

For example, Titian's *Assumption of the Virgin*, 1516-1518, moved from its original site - as the high altar in Santa Maria Gloriosa dei Frari - to the Accademia museum in 1817, generating new relational meanings with works of art there.³ Visualizations of original re-configurations of displayed paintings within this space have led to new understandings of intended thematic constructions among the works of art, especially as some are left *in situ* and take on new meanings

³ Note that the painting moved back to the Frari in 1918.

when recontextualized within specific reconfigurations.

Developing Projects: VIVA and Acqua e Cibo

Two projects currently in development are *VIVA* (Venice Interactive Visual Atlas) and *Acqua e Cibo: Storie della Laguna e della Città* (Water and Food: History of the Lagoon and City). These broadly conceived research projects, both of which

consider the built and natural environment of the city and its lagoon as a whole, are intended to complement *Visualizing Venice* projects that focus on specific zones of the city. *VIVA* is an emerging web-accessible project that will provide access to information about Venice through interactive historical views, maps, and surveys of Venice, drawn from centuries of archival materials. Because of its remarkable and renowned archives, Venice is one of the best documented cities in Europe, with extensive material, primary and secondary sources, written and visual, on the history of the city, its monuments, and its institutions. These archives are just beginning to be made more accessible through digitization, and at times the digitized materials are still only available on-site in the Venetian archives. The website, then, is conceived as a vehicle that brings the history of the city to scholars, students, and the general public by visualizing data spatially on historic maps and cadasters. This digital atlas, unlike traditional atlases, permits the dynamic visualization of information about transformation and change of the city as part of the presentation of the historical material. Moreover, web-delivery enables a greater democracy of access.

In the first phase of this project, teams have begun enriching Jacopo De Barbari's *View of Venice*, ca. 1500, by annotating it with histories and images of major Venetian institutions and administrative buildings, such as churches, monasteries, convents, palaces, and lay confraternities (Fig. 8). Each of these is highlighted on the map with information about its origins and function, the people whose lives intersected with it, and associated imagery that helps bring the historical materials to life. The long-term goal of the research team is to produce a dynamic site that will reflect interconnections between institutions as they changed over time, and how they affected the lives of people in the community.

Acqua e Cibo is a major exhibition to be held in the Doge's Apartments of the Ducal Palace in 2015. It considers how Venice harnessed its natural resources to become one of the largest and most thriving metropolises in early modern Europe (<http://www.visualizingvenice.org/visu/?p=258>). As a city built on the brackish waters of a lagoon, it required unique forms of water management and provisioning for the vast number of residents.

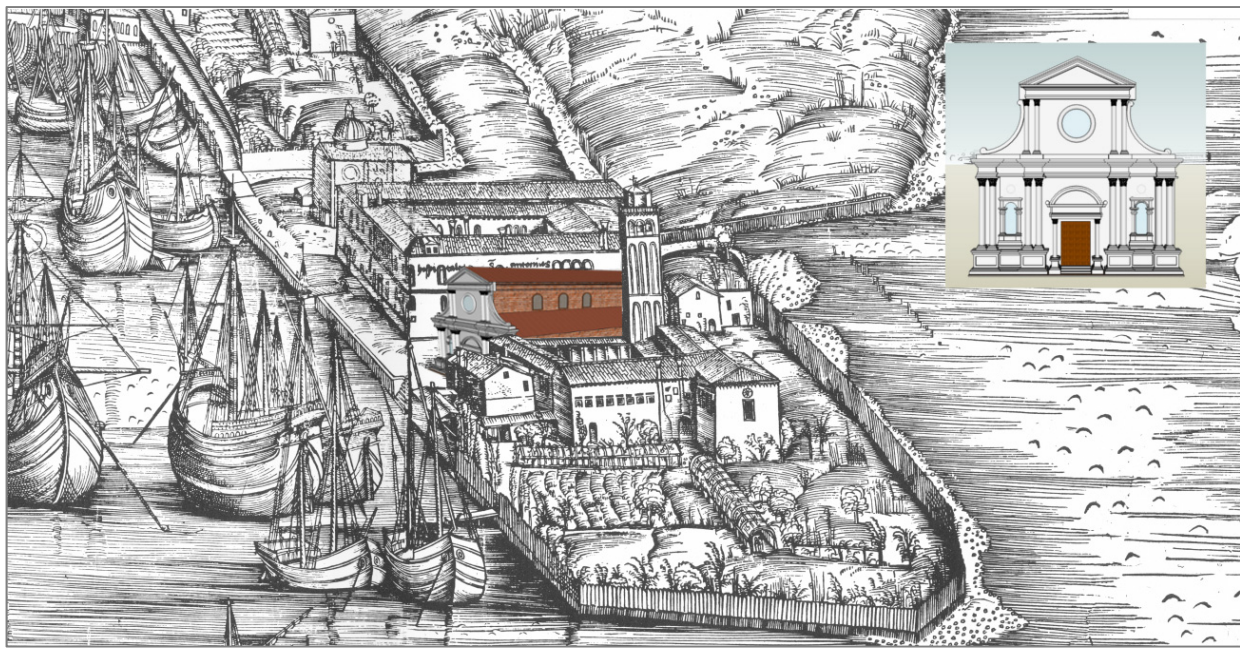


Figure 8. *Venice Interactive Virtual Atlas (VIVA)*. Model of Sant'Antonio di Castello placed on the Barbari View, ca. 1500. Modelers: Matthew Heinlein and Julia Huang; *VIVA* Researcher: Iara Dundas.

By the mid-sixteenth century the city's population totaled between 100,000 and 180,000, not including the large movements of itinerant people who resided temporarily due to mercantile or pilgrimage activity.

The purpose of the exhibition is to show the dynamic movement of food and water within Venice proper and among its islands of the lagoon and mainland possessions. The curators have chosen a variety of objects (maps, paintings, sculptures) that celebrate this theme. The exhibition is divided into five sections, each of which has digital components that animate life in Venice over the centuries. The first section will consider the morphological transformation of the lagoon with a particular focus on the rich cartographic history of the city. Accompanying the rare maps from Venetian archives and libraries will be interactive models and videos of the changing hydrography of the lagoon. The next three sections of the exhibit will be devoted to the farming of various foodstuffs, water production through its local cistern network, and water provisioning from the mainland; Venice's banquets, festivals, recreational sports and games that involved unique ceremonies and rituals; and finally architectural types, such as monastic complexes and taverns, that provisioned food and beverages. The fifth and final section will focus on state-sponsored mechanisms that enabled Venice both to harness the movement of water within the lagoon to maximum effect and to lessen the destruction of its forces. For each of the five sections there will be digital visualizations including animations and reconstructions of lost aspects of the city, where the public can view the stories in greater detail. These will include an installation evoking an historically important tavern, and interactive touchscreens that will enable users to create their own version of an historic banquet.

Pedagogical Initiatives

Both the Wired! group at Duke and the international *Visualizing Venice* team are committed to preparing students for the scholarly use of digital tools. We therefore integrate students at all levels into our research projects (Fig. 9). Wired! and the *Visualizing Venice* project—and indeed the city itself—function as laboratories for new forms of scholarly authorship that rely upon digital mapping, 3-D modeling, time-based media, network analysis, historical GIS, and virtual world elements. This work is deeply interdisciplinary, and combines both quantitative and qualitative approaches to arts and humanities research and its expression. The Wired! lab at Duke and its affiliates currently have several ongoing projects that link to *Visualizing Venice*: freshman seminars, upper-level courses in art and architectural history, two long-term research projects, a semester-long experience for students enrolled in the Duke-in-Venice program at Venice International University, and a two-week summer training session for graduate students at Venice International University.

We decided that we should target first-year students so that we could encourage them to build on their training to achieve more sophisticated projects as they proceed through their studies at Duke. To that end, we introduced a freshman seminar entitled Mapping and Modeling Early Modern Venice. By combining digital technologies with research materials (plans, sections, elevations, maps, paintings and prints) students have reconstructed the appearance of Venetian Renaissance churches in virtual, three-dimensional models prior to their later transformation or demolition (Fig. 10).



Figure 9. Wired! Lab in Action, Duke University, Smith Warehouse, Bay 11. Photograph courtesy of Caroline Bruzelius.



Figure 10. San Giacomo della Giudecca. Modelers: Xirui Liu, Ruolei Wang, Grant Shorin. Mapping and Modeling Early Modern Venice, Duke University, 2013.

Students also used primary sources (visual and written) to reconstruct interior features such as altarpieces, choir screens, and nun’s choirs. The goal of this type of pedagogy is to shift the learning process from a traditional and passive mode to more active engagement with and questioning of original materials. The creation of 3-D digital models necessitates critical thinking and problem solving, and students understand built spaces as dynamic entities that change over time. As one student aptly put it, “The model argues back!” Finally, by setting these digitally rendered buildings onto historical and contemporary maps, students address broader questions on the relationship of individual structures to the fabric of the city and the natural environment of the Venetian lagoon.

The Wired! lab also engages a team of undergraduate students in developing a *Venice Virtual World*. The purpose is to recreate the life of early eighteenth-century Venice and construct an interactive, educational game (Fig. 11).

This project uses OpenSimulator (<http://opensimulator.org>) to recreate an area in the district of Cannaregio. Students have reconstructed buildings, bridges, gardens, thoroughfares and waterways, both extant and demolished. This particular zone of the city experienced significant change in the post-Napoleonic period due to the construction of the train station, which adopted the name of the Augustinian church and convent demolished in 1861: Santa Lucia. Using the Ughi map of 1729 and a Napoleonic cadaster, students have re-created the terrain and carved out the waterways.

In addition, students have used both textual and visual sources to begin creating avatars that not only represent the average height and size of a Venetian in the eighteenth century, but also are suitably costumed in period garments. Ultimately, the game will be organized around a class “quest” structure, encouraging players to explore historical facts and research annotations embedded within the OpenSimulator platform via Neatline (<http://neatline.org/>).

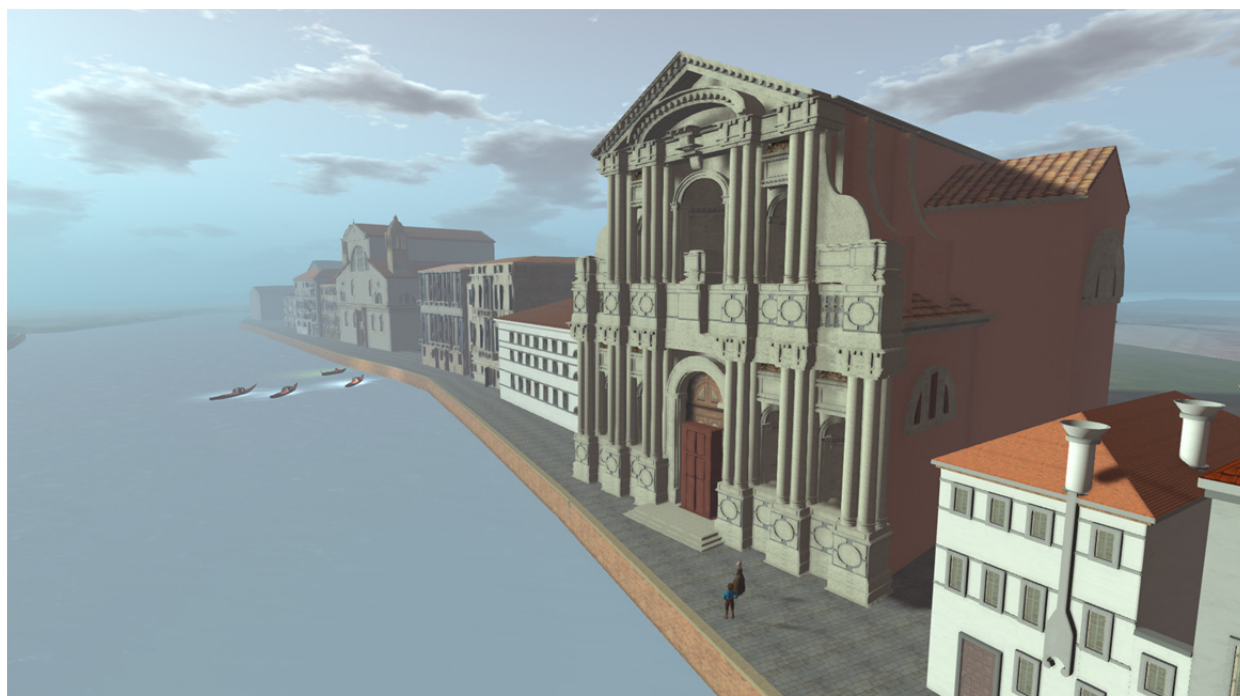


Figure 11. *Venice Virtual World*. View of Cannaregio with a focus on the Scalzi Church. Project Coordinators: Nicola Lercari and Kristin Huffman Lanzoni; Modelers: Xirui Lui, Franklin Morgan, Alexandra Orvis, Zeren Zhang; Programmers: Meng-En Huang, Sherry Lui, and Nick Pan.

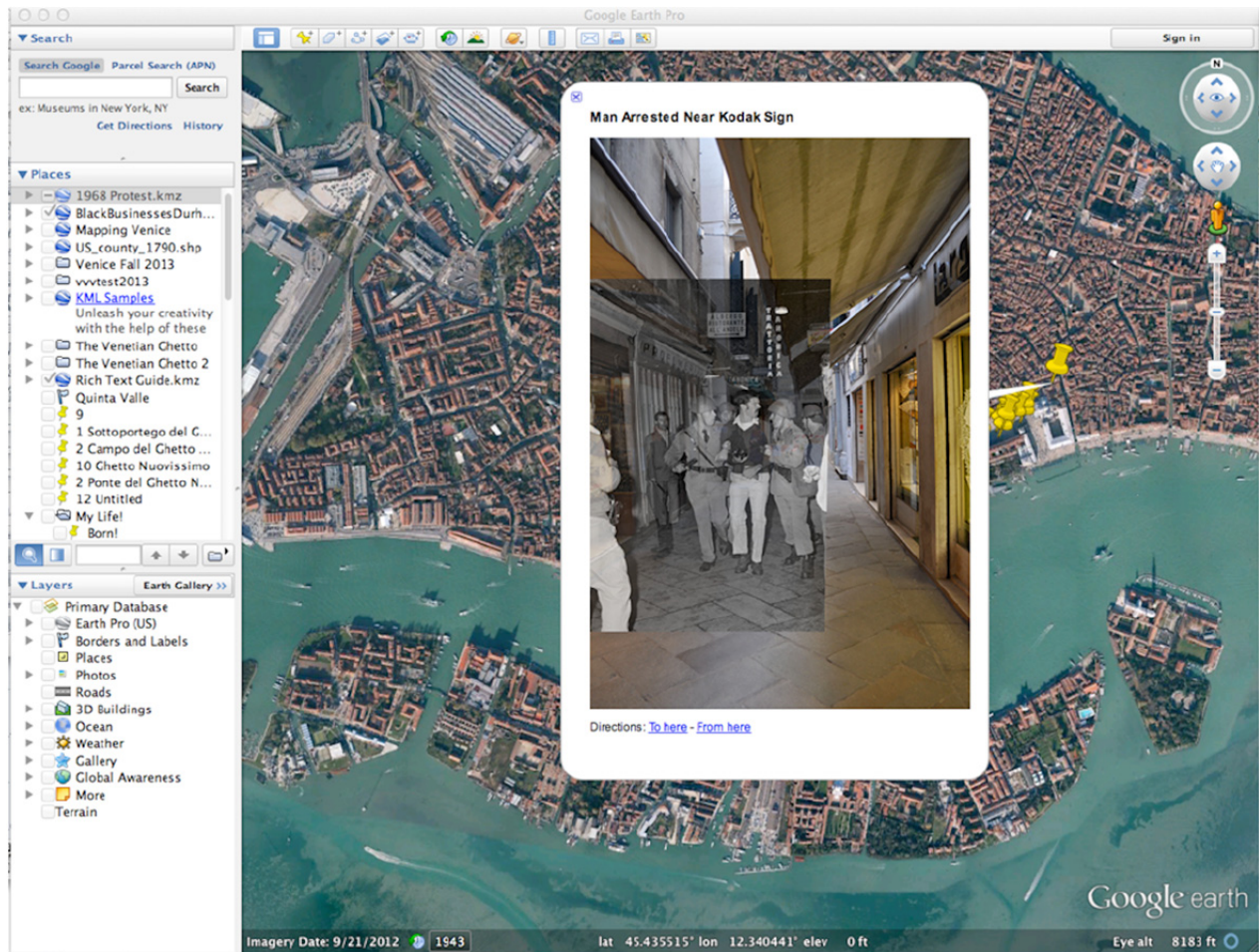


Figure 12. Student project - 1968 Venice Biennale Protests. Courtesy of Sophia Sennett.

In Fall 2014 we taught two Wired-related courses in the Venice International University (VIU) Mac Lab. The Mac Lab at VIU was modeled on Duke’s Wired! lab, and contains 16 workstations preloaded with software for 3-D modeling, digital mapping, photogrammetry, and other relevant techniques. Students at VIU come from all over the world, hailing from 16 partner institutions.

One course, Digital Cities and the Cartographic Imagination, used Venice as the case study for understanding the nature of urban experience of the city as defined in the digital age through remediation of historical mapping techniques. The second course, Web-Based Multimedia Communications, taught students hands-on web and multimedia production skills. One Duke student’s final Digital Cities project, a multimodal digital mapping project on the history of the 1968

Venice Biennale protests (Fig. 12), went on to win second place in the annual Duke University Visualization contest that year, standing out as a cultural history project amidst a field of engineering, medical visualization, and global health projects.

Another student, an Italian from the Web class, began a digital museum exhibition project focused on the collection of the Museo d’Arte Moderna Mario Rimoldi in Cortina, Italy (Fig. 13). She went on to earn a two-month fellowship to work in Durham at Duke to continue her project. She subsequently turned over her work to the museum’s technology developer for full-scale implementation as a permanent resource.

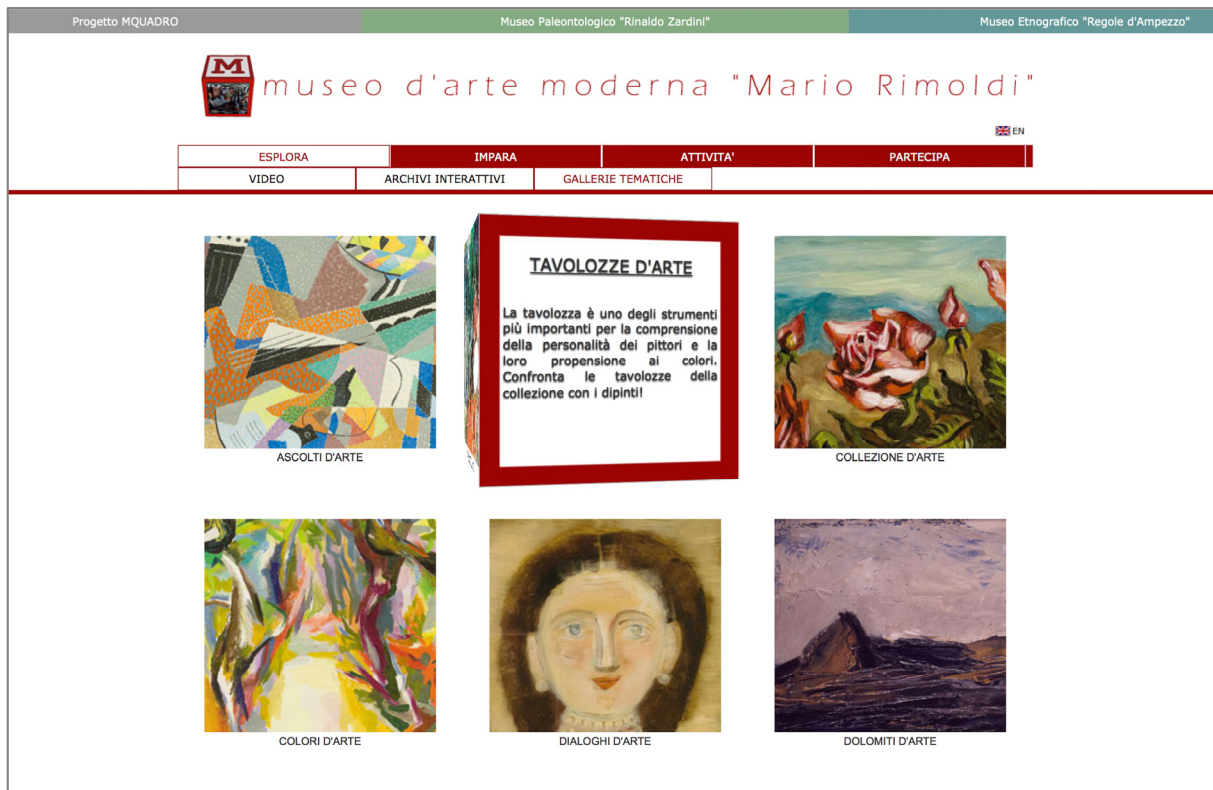


Figure 13. Student project - MQADRO exhibition project for the Museo d'Arte Moderna Mario Rimoldi Regole d'Ampezzo. Courtesy of Stefania Zardini Lacedelli.

In addition, the ongoing VIU connection has led to collaboration with our Italian colleagues, of which several now teach topics such as architectural reconstruction and Venetian art history at VIU. Being on-site together has helped us forge stronger inter-institutional working relationships for our ongoing projects, including the summer workshops for graduate students, which will be in its fourth year in Summer 2015, with the generous support of the Gladys Kriebel Delmas Foundation and The Getty Foundation. These collaboratively taught ten-day summer on-site workshops at VIU for faculty and graduate students bring together visual and media studies faculty skilled in digital tools with subject-area experts focused on Venetian art, architecture, and culture. Our goals for these workshops are twofold: first, to introduce a series of technological tools to scholars whose work might benefit from visualization-based approaches to research and its expression; and second, to jump-start ideas for how new and existing *Visualizing Venice* research can be shared in various digital forms. All of the

workshops introduce principles of digital mapping, 3-D modeling, media production and digital dissemination, and feature collaborative final project production based on research materials provided by the workshop team.

Our first workshop in Summer 2012 centered on the drinking water system – the cistern network of Venice – and relied on GIS information about the city's wells as the basis for training with our digital visualization tools (Fig. 14). Professor Giorgio Gianighian of Iuav, an expert of the Venetian cistern network, collaborated on the content of the workshop. Studying and modeling the provisioning of essential urban services – such as water – serves as a model for present-day questions of sustainability.⁴ Our participants in the workshop ranged from early-stage graduate students in various historical fields, to seasoned faculty, to a local non-profit organizer.

⁴ See, for example, this student project which explicitly makes the connection to eco-sustainability in the context of contemporary Venetian tourism: <https://vimeo.com/44707343>

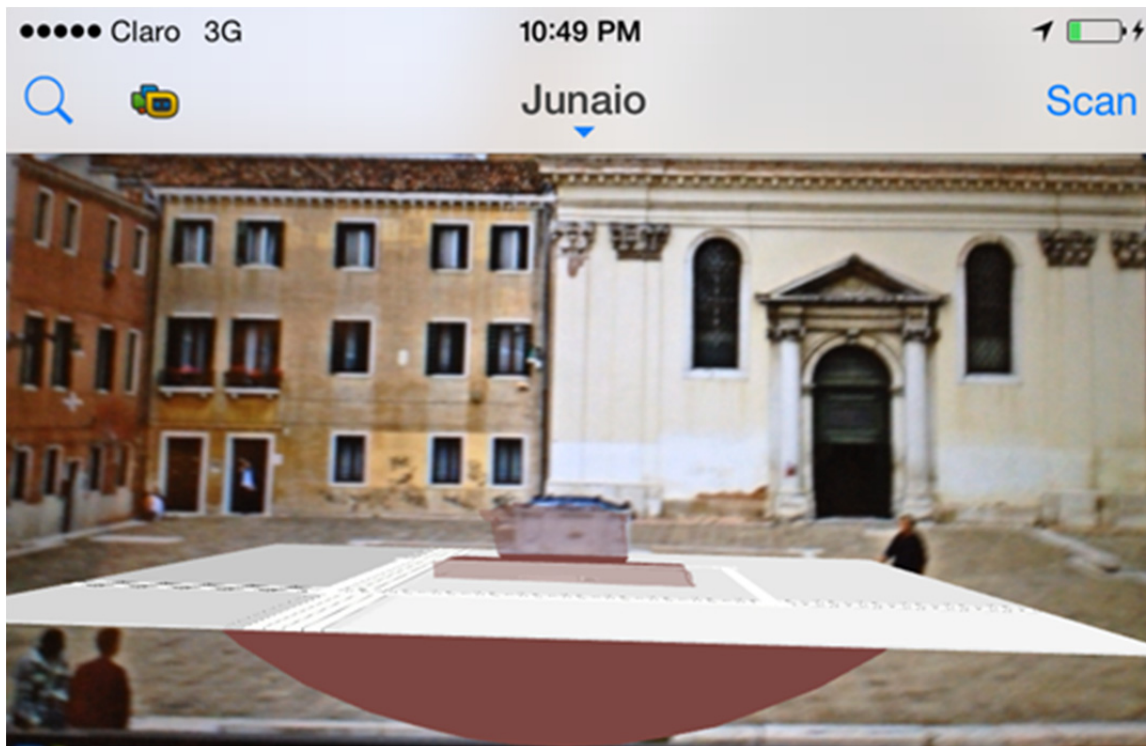


Figure 14. 3-D reconstruction of a cistern, geo-located in an augmented reality platform. Courtesy of Mark Olson and Victoria Szabo. Cistern Network, Summer Workshop 2012 at Venice International University. <http://www.dukewired.org/201206-venice-water-networks/>

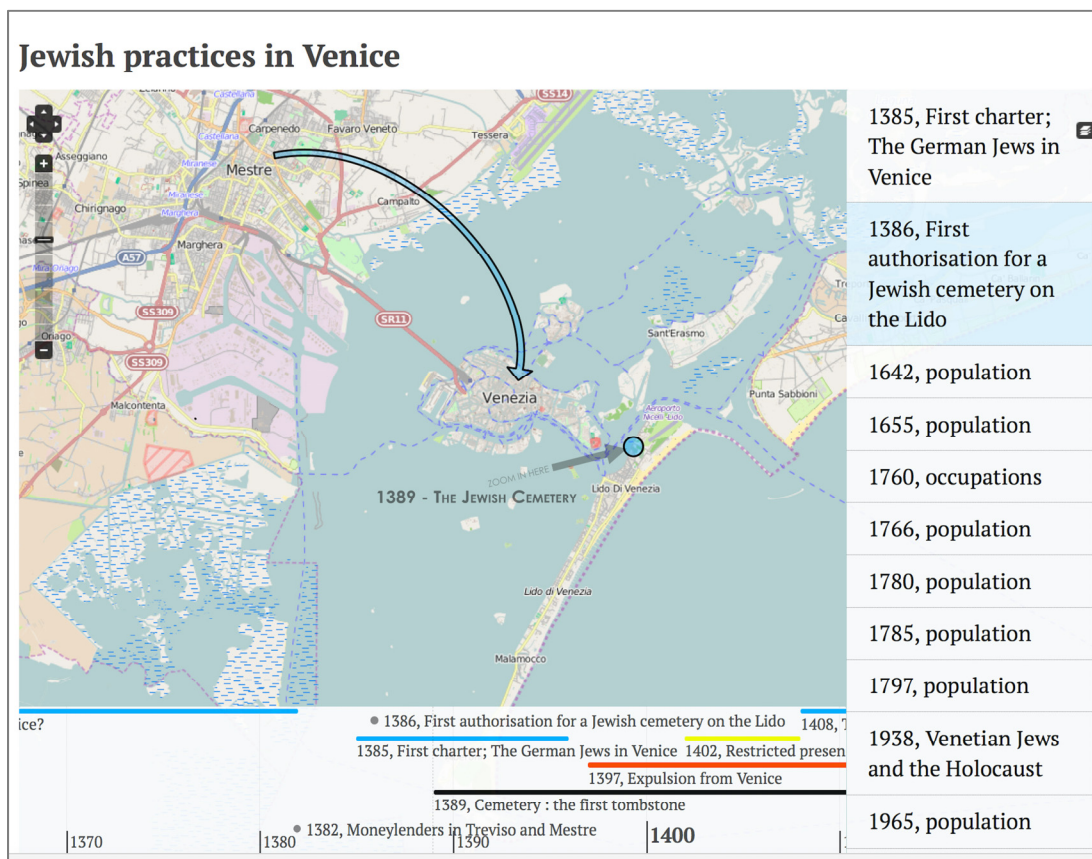


Figure 15. Interactive Neatline timeline of "Jewish Practices in Venice." Project by Isaac Cohen, Colin Dupont, Claudia Marra, and Genevieve Werner. Venetian Ghetto, Summer Workshop 2013 at Venice International University. <http://www.dukewired.org/20130604-the-ghetto-of-venice/>

The second workshop, in Summer 2013, focused on modeling change in the Venetian Ghetto, involving several local history organizations. Building upon our success in the first year, this version of the workshop set a higher bar for the scholarly content and production values of the final work, resulting in research projects focused on the changing geographic contours and makeup of the Ghetto (Fig. 15), drawing upon the scholarly research of *Visualizing Venice's* co-leader Donatella Calabi as well as other team members.

In Summer 2014 we focused on the City and the Lagoon, enlarging the scope of what is typically understood to be the city by exploring the history of several small islands in terms of their artistic, social, military, and environmental effects (Fig. 16). In Summer of 2015, we anticipate working on the Biennale, drawing directly upon the ongoing research of team members at the University of Padua, Iuav, and Duke, to concentrate on both the buildings and site of the Biennale, as well as the content of the exhibitions themselves.

Public Facing Scholarship

We have been “pushed” by our experiments to ask how visualizations can make an impact on a public that extends far beyond academic communities or even geographical boundaries. This outward-facing humanities component is a key objective for both the Wired! group and *Visualizing Venice* that we seek to accomplish through public exhibitions as well as by developing mobile applications.

Our exhibitions have featured videos and illustrated panels that convey the results of our research. Additionally, we have created physical models of our reconstructions using 3-D printing. These physical models lend a material quality to our digital work and allow exhibit visitors to better understand issues of relative scale. Our latest exhibit has been on display in Venice, Zagreb, Durham, and most recently, in China.

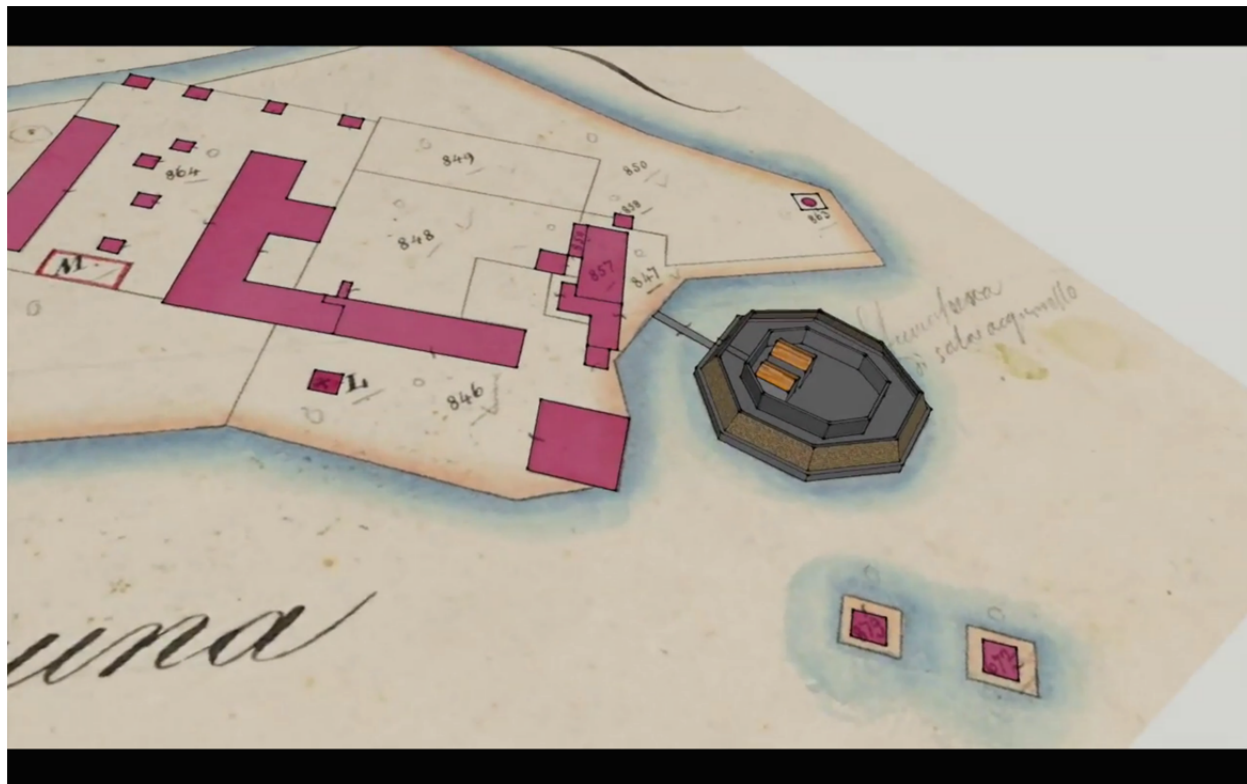


Figure 16. Fortifications in the Lagoon of Venice. Project by Lorenzo Vigotti, and Anna Sitz. City and Lagoon, Summer Workshop 2014. at Venice International University. <http://www.dukewired.org/20140603-visualizing-venice-the-city-and-the-lagoon/>

We are committed as well to complementing traditional modes of museological display and are actively developing museum exhibit installations that encourage sustained and embodied engagement with our artifacts and historical reconstructions. For example, Wired! has established a research and teaching collaboration with Duke University’s Department of Electrical and Computer Engineering to explore gesture and facial recognition algorithms as the technical core of a set of installation prototypes. One prototype (Fig. 17) leverages the Leap Motion’s (<http://www.leapmotion.com/>) ability to track hand movements and allows exhibit goes to “paint with light” on both virtual and actual statuary, drawing on historic information such as woven tapestries to explore the available pigments and fashionable colors of particular time periods.

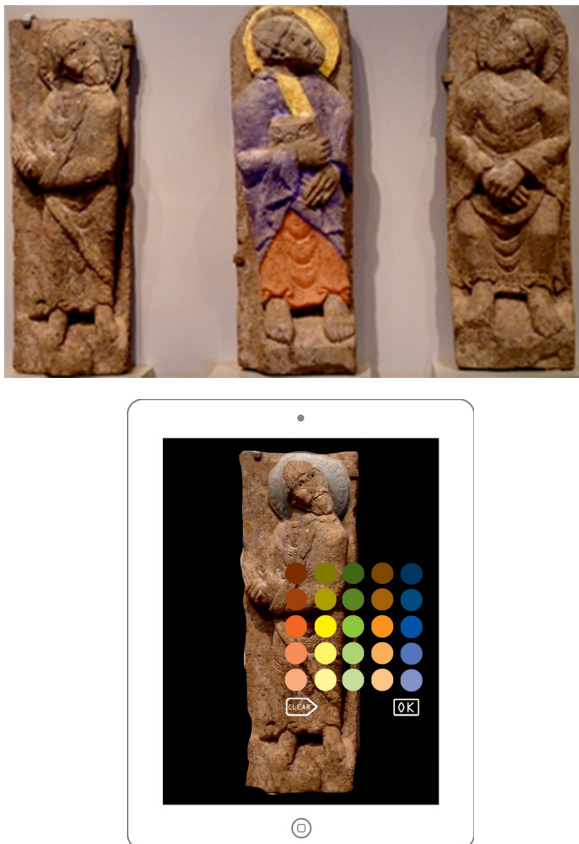


Figure 17. Lives of Things Polychromic Light Painting Application Prototype. PIs: Caroline Bruzelius, Mark Olson, Guillermo Sapiro. Project Manager: Mariano Tepper; Researchers: Alexandra Dodson, Sinan Goknur, Jordan Hashemi, Amanda Lazarus, Max Symulski, Christopher Tralie.

A second prototype (Fig. 18) leverages infrared sensors to capture and track a visitor’s face in order to keep her/his point of view in sync with an immersive 3-D reconstruction. Whereas the majority of 3-D interactive exhibit technologies require complicated and cumbersome headsets or gyrosopic tracking hardware be worn by the viewer, this set-up provides a walk-up “hands free” immersive experience. It is our hope that the combination of novel technology, playful fun, and scholarly research will generate engaged and sustained interest in the museum contexts where we display our research findings.



Figure 18. Video still from infrared head-tracking demo. Courtesy of Jordan Hashemi. https://www.youtube.com/watch?v=3_tFbBmkZZQ

Another area we continue to develop is the use of mobile applications for *in situ* exploration of historic materials. We see mobile applications as an opportunity to augment both lived experience in the city, and historic documents and exhibition spaces. As noted above, we have partnered graduate student researchers in art and urban history with computer science students in order to think through how complex historical information can be conveyed in a publicly accessible, digital form. Our prototype apps for Santi Giovanni e Paolo (see Fig. 6), the Cistern Network, and the Venetian Ghetto each draw upon these goals differently. Our hope is that the forthcoming Biennale app will enable us to mix annotation of architectural spaces in the Giardini, where the permanent exhibition structures are housed, with the “ghosts” of prior exhibitions, as well as installations around other sites in the city. Perhaps we will activate our student’s 1968 protest map as a mobile application as well. Ultimately, by

creating a mobile application tied to specific locations within the city, we will have created a research product, the *Visualizing Venice* app, that combines lived experience in contemporary urban space with deeper understandings of the complex historical fabric that frames the present moment. We see these interventions as a way to bring scholarship to life for students, visitors, and the local inhabitants of Venice, as well as to provide our graduate students with opportunities to think through how they might communicate their research using digital tools to make complex spatial and visual arguments.

Conclusion

A fascinating and surprising “by-product” of these myriad directives has been that digital technologies engage all of us (from researchers to students and public) more directly with the original works of art by probing into questions about materials and context and how these have had an impact on the built environment and affect change over time. We believe that the implementation of digital technologies transforms our understanding of art, architectural and urban history. The collaborative enterprise of *Visualizing Venice* demonstrates that our work is intimately linked to an understanding of larger systemic considerations. This is creating a new art history that engages in context, change over time, and the dynamic intersection of time and place. Digital technologies stimulate new understandings of both well-studied art historical materials and significantly altered or demolished monuments. One key understanding is the ability to visualize how someone might have experienced space in the past. We do this by modeling the spectator’s movement through the urban fabric as well as their passage through different types of architectural structures. Representing the various historical GIS layers allows us to show how the spectator’s experience changed over time. The Wired! group is involved with numerous other projects that take advantage of digital media

affordances for understanding the lives of cultural objects in context, the history and impact of exhibition practices, and the construction and representation of experience in other urban spaces, such as Paris, Athens, and our home in Durham, NC. As we have illustrated, we are deeply invested in “scaling up” digital art history. This scaling up involves not only infusing our work with new techniques and technologies, but also scaling up our collaborations: international and interdisciplinary, and involving all levels of students and scholars.

Authors’ Biographies

Kristin Huffman Lanzoni’s interest in reconstructing altered or demolished structures led her to work with *Visualizing Venice*. Her current research focuses on the uses and configurations of space for the visual arts, in particular the relationships formed in early modern Venice.

Mark J.V. Olson’s research explores the impact of new technologies on humanities scholarship. He is particularly interested in 3-D modeling techniques in the historical and cultural study of material culture. He endeavors to foster critical reflection on the epistemologies embedded in and promoted by emerging visualization practices.

Victoria E. Szabo’s primary research focus is on the critical and practical affordances of database-driven spatial media such as digital maps, virtual worlds, and mobile applications for scholarly research and public exhibition. Her current focus is on augmented reality development for cultural heritage applications in Durham, NC and Venice, Italy.