Three-Dimensional Scanning

As Eyal Weizman points out in the introduction to his 2014 book Forensis, “The part or the detail becomes an entry point from which to reconstruct larger processes, events, and social relations, conjunctions of actors and practices, structures and technologies.” The detail also offers a point of entry for architectural historians to conceptualize a building through the distillation of a design concept into a small but intensely meaningful element. Historians can now capture fully scanned three-dimensional architectural details in all of their gritty materiality and insert them into larger digital models of buildings. The emerging multimedia technique of 3-D scanning offers a broad range of accessible applications for measuring and visualizing both indoor and outdoor environments with the unprecedented precision of full photorealistic imagery. The fields of architectural design, analysis, and historical research stand to be affected tremendously by this technology.

As with most technological advances over the past thirty years, the exponential improvement of 3-D scanning’s production qualities, processing speeds, and software interfaces has led to a dramatic increase in availability along with a relative decline in the price of scanners; scanning applications are now even available as cell phone software. Three-dimensional scanners assemble complex information about the relationships among objects at a single point in time. In law enforcement, for example, they allow for intensive analysis of crime scenes and bullet trajectories. They also form the basic technology that allows autonomous cars to monitor their surroundings at speed. These same cars offer the potential for constant updating of 3-D models of the inhabited world based on the continuous scans that the vehicles make while in motion.

In 2015, Autodesk, along with scanner manufacturers Leica Geosystems and FARO Technologies, sponsored REAL2015, a conference held in San Francisco that looked at how 3-D scanning, sensing, and modeling are changing the ways in which designers work. The conference brought together a broad range of constituents and manufacturers, all of them invested in how increased accuracy will change their professions or industries. The conference projected the ability to interface a scanned model with building information modeling (BIM) to create models of existing buildings that were built before it was possible to align data with lines on a drawing.

The application of this technology in the building fields allowed SHoP architects to employ laser scanning to improve the construction process of a façade they designed for the Barclays Center arena in Brooklyn, New York (2012). While the underlying structure was assembled on-site, all of the arena’s “megapanel” façade components, each measuring 3 meters by 15 meters, were prefabricated off-site. Prior to transporting the panels to the site, the fabricators scanned the structural system to verify the locations of the connection brackets. Using a technique that has clear implications for historic preservation, they developed a design model as an underlay that allowed them to verify the location of each bracket. It is possible to envision similarly precise coordination among fabricators of complex historical details captured through 3-D scanning, printed with 3-D printers, and transferred to design software that blurs the boundaries between plan, section, elevation, axonometric, and scanned historic data.

Historians and anthropologists have already developed strategies for deploying scanning devices as tools for archiving and analyzing significant architectural sites. CyArk, a nonprofit organization founded in 2003, was created “with the mission of using new technologies to create a free, 3D online library of the world’s cultural heritage sites before they are lost to natural disasters, destroyed by human aggression or ravaged by the passage of time.” CyArk is currently working to complete the scanning of its five hundredth heritage location, having already documented some sites that were later damaged or demolished, such as the Umayyad Mosque of Aleppo and the Haitian National Palace. In the future, the public accessibility of this information will be a crucial aspect of the dissemination of historical data and the historical sensitivity that such knowledge produces. As with most types of public information, open-source accessibility is essential to the democratic dissemination of such data.

How will heightened access to accurate spatial archives transform the disciplines of architectural history and architectural education? It is clear that 3-D models will become valuable teaching tools, allowing instructors to present buildings and sites by zooming in on details, material surfaces, and embedded information as though on walking tours of the sites. Additionally, the availability of maneuverable historical data should increase the value of architectural history in the design studio. Inserted
Annotations, organized chronologically and attributed, can provide historians and designers with a better sense of each layer in a given environment. If models are maintained in an open-source archive, historians can create discussions, posit hypotheses, and disseminate conclusions in the same location. In this way a high-accuracy model can become a repository for a broad array of information on a site, searchable through time, location, characteristics, or topics. Such a source could break down barriers between historians and designers, makers and scholars, old school and new school, creating spatial and temporal archives that expand text- and image-based information into a historically annotated version of the space itself.

Architectural practitioners and academics have been exploring how 3-D scanners might be employed for spatial analyses and also for creating new ways of designing, the collateral results of which offer useful material for architectural historians. One such practice, ScanLAB Projects, a UK firm founded by Matthew Shaw and William Trossell, is focused on the exploration and dissemination of 3-D scanned content from around the world. ScanLAB produced 3-D models for the 2015 BBC One program *Rome’s Invisible City*, working with the show’s producers to gain access inside and underneath some of Rome’s most iconic landmarks, including the Forum, Colosseum, tufa quarries, Baths of Caracalla, Cloaca Maxima, and catacombs. Multiple registered (relationally located) scans, above- and belowground, were used to produce virtual X-rays that enabled calibration of the relationship between Rome’s living city and the ancient one hidden below (Figure 1). The resulting model also provided access to the mysterious subterranean persona of the city, with its buried narratives dwelling among uncanny caverns. Just as such models can help expedite the planning and construction of new parts of cities, they also stand to alleviate the tabula rasa approach to architectural history that treats monuments as isolated from their larger historic contexts. This is particularly true for sites with complex stratigraphy, such as that for Line C of Rome’s subway, where excavation suffered substantial delays as salvage archaeologists documented newly discovered ruins.

ScanLAB’s founders argue that when the digital double can be more readily available, digestible and accessible, the future of real archaeological ruins may be replaced by an immersive flythrough. When this information becomes so accurate that the archaeologists themselves find it easier and more successful to study remotely, this challenges the necessity and relevance of conservation.

While ScanLAB Projects’ work contributes positively to the field of historical inquiry, Shaw and Trossell’s premise that a highly accurate virtual model could replace the need to get one’s shoes dirty at an actual site switches the valence of this critique. It suggests a scenario in which modeling significant archaeological sites (such as the caves at Lascaux, for which a simulated double has already been created) helps to eliminate some of the thousands of footprints left behind by tourists accessing these sites physically. In this way, 3-D models reinforce and accommodate conservation.

Weizman reminds us that the word “forensis is Latin for ‘pertaining to the forum’ and is the origin of the term forensics. The Roman forum to which forensics pertained was a multidimensional space of politics, law, and economy.” He goes on to...
note that while “the field is the site of investigation, the forum is the place where results of an investigation are presented and contested.” Weizman’s observations suggest a working understanding of how we might consider 3-D scanned models not as simple representations of space but instead as places where ideas can be “presented and contested.”

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Notes

Timescape
http://www.timescape.io, free

In recent years, the global perspective has gained ground in the humanities, challenging the prominence of Eurocentric histories and creating a demand for non-Western content to enter, populate, and reform previous normative narratives. Mark Jarzombek and Vikramaditya Prakash’s pioneering 2007 textbook A Global History of Architecture, with drawings by Francis Ching, made possible new fields of historical interrogation and foregrounded previously marginal histories of architectural production. Universities and other educational institutions have since embraced the call for a more inclusive architectural history, issuing new curriculum requirements and offering funding opportunities for research that expands beyond what is known and documented about the Anglo-Saxon world. The new mandate for world cultures courses published by the National Architectural Accrediting Board (NAAB) in 2009 only reiterated the need for a global perspective to inform teaching and research. Institutions such as the Andrew W. Mellon Foundation stepped in to provide financial support, advancing the objectives of initiatives such as the Society of Architectural Historians’ SAHARA Travel Fellowships and MIT’s Global Architectural History Teaching Collaborative (GAHTC).

In architectural history, this turn toward a world history has revealed the limitations of current survey course offerings and research when they are presented to an increasingly global student body, pointing to the methodological constraints of nation- and empire-based historiographies that reinforce the centrality of the West. However, digital humanities tools such as databases and visualization platforms increasingly simplify the task of admitting previously marginalized non-Western actors into architectural history. In fact, scholars can augment their narratives and diversify their teaching with stories of cultural connections, appropriations, tensions, and ruptures that move beyond the geopolitical realm of the West.

Timescape, initially developed by Somnath Ray and Vaibhav Bhawas as an online platform for transmedia storytelling, constitutes such an aid for writing and teaching architectural history. Following a step-by-step process, the open platform guides scholars and educators through the creation and sharing of online maps. Once the user logs in, the interface prompts the addition of “events”—either manually or automatically through Excel sheets. Each new event generates a separate window for information entry: location, date, title and description, images and videos. The platform visualizes the imported events as dots on the centrally featured map on the right while aggregating the events in a scrollable timeline column on the left (Figure 1). Each time the user hovers the cursor over a marked point, the imported information is displayed.

Timescape’s compelling visuals and design aesthetic separate it from other online tools. To the satellite views of Google Maps Timescape adds a new three-dimensional option of a rotating, scrollable globe that can potentially expand to multiple layers, revealing the geographic and chronological positions of each event. In combination with the tagging function, the three-dimensional map helps the scholar or teacher to organize networks of items, buildings, institutions, and people thematically and visualize them both temporally and spatially. By clicking on a tag, the user can group all relevant entries in networks that cut across geographic boundaries and historical times, shifting attention from buildings as distinct objects to the connections and crossings that condition them and that they reciprocally condition.

As a tool, Timescape encourages scholars to approach writing and teaching global architectural histories in terms of networks and events dynamically deployed in time and space. In Being and Event, Alain Badiou defines an event as a “point of a situation” and not a solid representation of a system—but it harnemeneutic or analytic. In placing those events on the map, Timescape promises to render visible the multiplicity of situations that they inhabit without being reductive. For example, a user can visualize the routes through which material and builders traveled, revealing the geopolitical constituents in the production of the built environment. This process requires the researcher to approach the relationship between data sets and master narratives critically, which poses methodological questions pertinent to quantitative historical studies since the time of the Annales group. Departing from this framework, Timescape maintains the visual and structural integrity of each entry, bringing individual objects into productive dialogues with each other and the larger theoretical/thematic frameworks that organize them. In doing so, the platform provides the scholar with a tool for focusing on details while being attentive to the bigger frame—in short, a tool for combining the micro and the macro in the study of architectural history.

The tool, however, does not determine the results. While teaching a 200-level survey course, I assigned a mapping exercise with the aim of encouraging students to illuminate the global elements of architectural projects, compare and contrast them...