



Virtual Tour of the Palace of Nineveh: Using Modern Technology to Preserve Antiquities in Danger

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■ I. Introduction

There have been occasions throughout history when the intentions and grand scheming of one distant nation have caused repercussions across a wide adjoining region. Such was the case, for example, when the city states across the Northern and Southern Kingdoms of the Levant suffered at the hands of the expanding ancient Assyrian sphere of influence. We first learn about these encounters in 1 and 2 Kings of the Bible with corresponding and mostly corroborating discussions in inscriptions on monuments attributed to King Shalmaneser III (859-824 BCE; on the Kurkh Stela from Üçtepe, Turkey, and the Black Obelisk from Nimrud, Iraq). While the westward incursions of the Assyrians continue throughout the 8th century BCE, the actions came to a head in the late 8th century BCE,



fig. 1. Map showing Assyrian expansion.

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when King Sennacherib's army swept across all cities in its path right up to the doors of Jerusalem, where the destructive wave was stopped (fig. 1). Here again, we are provided with stirring biblical accounts and matching Assyrian evidence from Sennacherib's prism tablets and inscriptions and graphic depictions on the walls of his *Palace Without Rival*, at Nineveh (Iraq).

With an ironic stroke of misfortune, fate has decreed that the historically and culturally important remnants of that ancient Assyrian power shall now itself be purposefully targeted for demolition, with the sole purpose of wiping the sculpture and architecture of that people from archaeological records--and thus from the pages of history. Fortunately, we now have the ability to document and preserve digitally archaeological evidence so that future generations can continue to study, learn from, and revisit the past in unprecedented detail and precision. The Institute for the Visualization of History and Learning Sites have been working for twenty years on innovative ways to understand, teach, display, broadcast, and publish information about the past for schools, museums, individual scholars, television, antiquities services, foreign governments, and local tourism. Our 3D computer modeling of the Assyrian sites of Nimrud and Nineveh have become eerily relevant lately not only for understanding the empire's capital cities, but also for envisioning the biblical stories that were turned into historical realities by the 19th-century discovery of the Assyrian inscriptions.

This paper will review how those digital models help tell vital stories in light of both recent events and the ancient interactions between the kings of Assyria and the people of ancient Israel and Judea. First, a brief introduction--figuring out what happened in the distant past is not easy primarily because we were not there. All historians have are lots of jumbled clues and missing parts, and no instruction manual. Our goal is to interpret the evidence as best we can to take into account both what was found and what was not found. Evaluating this incomplete record is difficult when relying only on static 2D photographs or plans, as has been the norm. To improve our knowledge, the discipline of Virtual Heritage, far from generating mere pretty pictures, allows us to cope with fragmented evidence by positing that the past, like life today, happened in color, in 3D, and as a sequence of real-time events. This approach repeatedly demonstrates how studying the past using interactive, 3D, computer-generated visualizations inevitably leads to new and often unexpected insight into the past. We have been using those tools to better understand the connections between the ancient kingdoms of the Levant and those of Assyria.

■ II. Assyrian Expansion and the Impact on the Northern & Southern Kingdoms

During the 1st millennium BCE, interactions between the Northern and Southern Kingdoms and the kings of Assyria are known to us from several nicely corresponding bits of evidence (see e.g., Vaughn & Killebrew 2003; Millard 1985). We now take much of this history for granted, but until the archaeological discoveries of the mid-19th century, the Bible was our only source, often presenting stories from a single point of view. Without chronicling in detail the unfolding of the extraordinary events that transformed our understanding of the specific locational contexts to the biblical narratives, a few of the major bits of evidence most relevant to the topic at hand can stand as a backdrop to later discussion of specific sites and buildings.

It is difficult to say which revelation came first, because the sequence of events from initial discovery, through interpretation of the finds, until their first publication, and final acknowledgment by an initially skeptical but eventually wildly breathless public mean that there are several stages until the evidence becomes widely accepted (e.g., Larsen 1996). In any case, the credit for most of the major early discoveries goes to a 28-year old British adventurer and part-time lawyer named Austen Henry Layard who, during the 1840s, traipsed across Mesopotamia specifically looking for cities mentioned in the Bible. Eventually, he began excavations at two sites in northeastern Iraq: at Kuyunjik, the citadel mound of the ancient city of Nineveh (now engulfed by the modern city of Mosul, as we painfully know from recent news) and on the citadel mound at Nimrud, the ancient biblical city of Kalhu (and also the target of recent wanton demolition).

Perhaps assignment of the first major breakthrough would be Layard's work at Nineveh between 1847 and 1851 (e.g., Layard 1853, 1949). There he first uncovered a human-headed colossal bull (now in the British Museum) guarding the entry facade to the throne room of the Southwest Palace. Across the sculpture was a lengthy text recounting King Sennacherib's siege of Jerusalem and King Hezekiah's eventual payment of tribute. This provided the first independent archaeological evidence corroborating an event mentioned in the Bible, including specific mention of the 30 talents of gold paid by Hezekiah to the Assyrians. The famous Lachish battle room in the Southwest Palace was excavated by Layard in 1850, but not published with identifications of the narrative and the inscriptions until 1853 (fig. 2). The wall reliefs depicting the full scale of the destruction of Lachish and the accompanying short wall inscriptions unmistakably gave dramatic visualization to a key story mentioned several times in the Bible. The

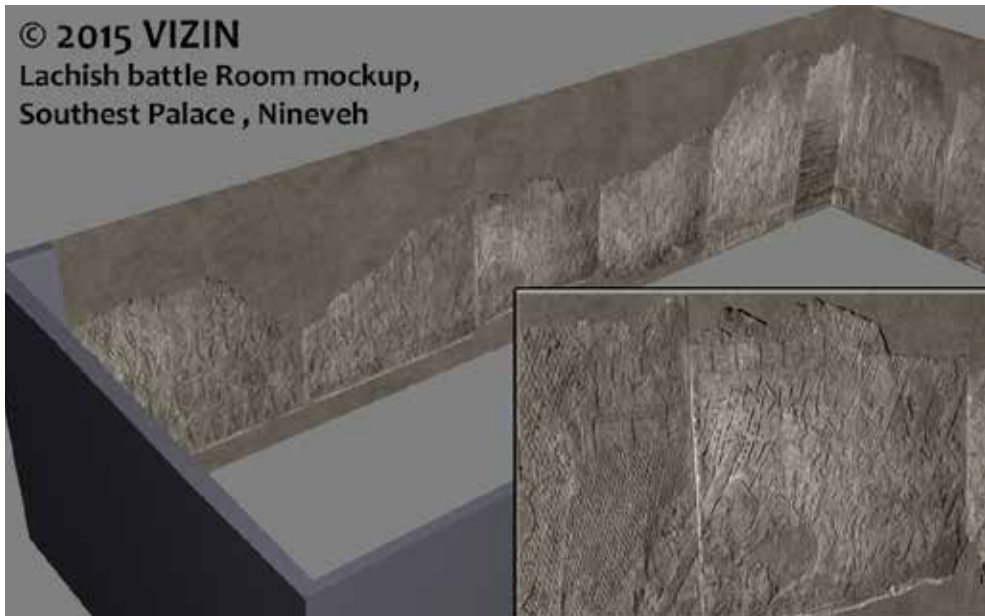


Fig. 2. Rendering from an interactive 3D model showing a mockup of the Lachish battle room, Southwest Palace, Nineveh.

Fig. 3. Rendering from the interactive 3D computer model of the citadel of Nimrud showing the context of the Black Obelisk in front of the Shalmaneser Building.

remarkable level of detail in the Assyrian depiction of the event is unique among ancient carvings. The accuracy of the scenes was further underscored upon the identification and excavation of the ancient mound at Lachish, which provided stunning tangible evidence of the Assyrian attack.

During Layard's work at nearby Nimrud, in 1846, he uncovered the so-called Black Obelisk lying on its side near the facade of what we now call the Shalmaneser building (fig. 3). The name of Jehu inscribed on the obelisk, however, although correctly read by 1850, was only recognized as the biblical king of the same name in 1851 in a letter written among philologists. The public acceptance of the connection came only years later.

Another significant discovery that helps us understand the events of the 9th and 8th centuries BCE from multiple perspectives is the Kurkh stela, found by Consul John Taylor in modern Üçtepe in southern Turkey and then shipped from Baghdad in 1861 to reach England and the British Museum by 1862. The information on the stela was eventually published by Sir Henry Rawlinson in 1870. Here we learn about King Shalmaneser III's campaigns across the Northern Kingdoms and his interaction with Ahab of Israel. This is also one of only a handful of ancient monuments that mentions the term "Israel." Although there is still some uncertainty about the person called Ahab on the stela, there is no uncertainty about the role of Shalmaneser and his intentions.

Soon after Rawlinson's publications, in 1872, George Smith, a young Assyriologist working at the British Museum, was hand copying the inscriptions found at Nineveh when he came upon a fragment of a tablet that seemed to mention the biblical Flood. This reading raised such a stir that he was immediately dispatched to Nineveh to see if he could find more of such texts. Through sheer luck he did indeed find another fragmentary tablet that completed the Flood narrative. From the moment that discovery became known, the focus of Assyriological studies shifted from palaces and wall reliefs characteristic of the early 19th century to translating inscriptions on tablets, as it quickly became clear how much of the Bible might also be found among cuneiform texts at any site across the ancient Near East.

Parenthetically, there are still hundreds of thousands of these cuneiform texts languishing untranslated in archaeological site storage rooms and museums around the world. Who knows what crucial bits of history they may hold. There are just too few experts and too many inscriptions for us to keep up with the backlog and the thousands still being

excavated every year. One of the projects we are working on, to help many more texts to be read more quickly, is a smartphone app called CUNAT (www.translation-engine.com) that hopefully will automatically translate the cuneiform and allow inquisitive minds to discover the now hidden stories (fig. 4).

Over time, as the historical pieces of evidence finally became assembled and compared, historians and the general public began to obtain a fuller picture of the chronology of events that touched the Assyrian cities of Nimrud and Nineveh and the kingdoms of Israel and Judea. It also became clear just how closely biblical and Assyrian narratives meshed.

The results of the 19th-century discoveries had later to be rearranged into chronological order and, as a whole picture, then compared with episodes recounted in the Bible. Many, many books have been published reviewing the evidence and the ways in which the ancient inscriptions do or do not jive well with biblical writings. It is not my intention to overstep my own expertise and dwell further on the correspondences, other than to say that the monuments of the Assyrian kings help inform our judgments of their intentions,



Fig. 4. Screen grabs from the Android app CUNAT, developed by Learning Sites.

their successes, and their heritage. The architectural and sculptural contexts in which they chose to depict or discuss their exploits are as much a part of the larger story as are the nuances of the events themselves.

Our work building 3D models of the Assyrian capitals includes new interpretations of the so-called Central Building of Ashurnasirpal II (critical to understanding the architectural scope of the Nimrud citadel) and the so-called Shalmaneser building at Nimrud. Our explorations of the building history at Nimrud has also led us to discover the whereabouts of the “missing” palace of Tiglath-pileser III. At Nineveh, our investigations into the architectural context of the Lachish battle reliefs has allowed us new insight into Sennacherib’s Palace without Rival and his city, now increasingly threatened by the urban sprawl of Mosul and the destructive tendencies of the Islamic State.

■ III. Visualizations of Nimrud and Nineveh

The discoveries of the 19th century sparked decades of excavations at the major ancient Assyrian capitals of Nimrud and Nineveh, which continued up to the fighting of the first two Gulf Wars and the dismantling of the Iraqi antiquities service. Archaeologists have learned much about these two cities, but it was not until we built detailed 3D models of the architecture and its contexts that previously misunderstood structures there became better appreciated, vast sculptural programs came to life, and now-destroyed buildings could be revisualized and digitally preserved. We were even able to discover the location and design of a palace long conjectured to be part of the Nimrud citadel but heretofore never found.

Chronologically, our computer modeling begins with the best preserved of the ancient Assyrian palaces, which has been named the Northwest Palace belonging to 9th-century BCE King Ashurnasirpal II (e.g., Paley & Sobolewski 1992, 1987; <http://www.learningsites.com/NWPalace/NWPalhome.html>). Layard worked from 1845-1851 excavating and documenting the two sites of Nimrud and Nineveh. After some sketching at each site, he and his assistants removed from the ruins the brick decoration and stone bas-reliefs that ornamented the walls of many palaces. Over the course of Layard’s and subsequent excavations and with Ottoman approval, and the support and assistance of the British representative in the area, the bas-relief carvings were distributed to friends, family members, and museums across the globe. Visitors received permission, literally, to mine the site of what were considered duplicate images, some of them among the

finest examples of 9th-century bas-relief sculpture. This is another brand of deliberate destruction of cultural property.

Tracing the buying, selling, and looting of these slabs over the last 170 years continues to be a daunting task for those interested in understanding the sites as a whole, rather than focusing on just one single isolated work of art at a time (e.g., Paley 2003). For example, we can document the whereabouts of over 320 complete and fragmentary bas-relief in over 70 museums and private collections across the world from just the Northwest Palace at Nimrud alone. Every few years, another fragment or two surfaces, more recently due to its recent willful demolition. Because of this global distribution, no one, neither scholars nor the general public, can fully comprehend the site as the Assyrians intended it be experienced, which is crucial for truly understanding the extent of the stories depicted and the rationale for their locations in the palace. This is one reason why we need interactive 3D computer models. We can put the wall reliefs back into simulations of their original contexts and study them from the point of view of the original inhabitants (figs. 5-6). And in the case of sites targeted during wartime, virtual reality offers digital surrogates as more permanent records to monitor decay and destruction, and allow access to educate future generations.



Fig. 5. Rendering of the throne room from the interactive 3D computer model of the Northwest Palace, Nimrud.



Fig. 6. Rendering of the Great Northern Courtyard throne room facade from the interactive 3D computer model of the Northwest Palace, Nimrud.

As we work our way across the citadel at Nimrud, piecing the site back together (fig. 7), we face problems that, before virtual heritage, seemed insurmountable based on the fragmentary and greatly dispersed evidence. Such conundrums solved through the use of 3D modeling included, correcting the function of the so-called Central Building and the neighboring Shalmaneser Building, fixing the position and extent of the previously missing palace of King Tiglath-pileser III, and defining how did the Assyrians get from the lower town up to the various functional destinations across the mound (Reade & Sanders forthcoming 2015). Resolving these long-standing issues, with an eye toward the Assyrian cultural interactions with the Mediterranean coast, provides valuable insight into the planning and propagandistic tendencies of the Assyrians in relation to how the same historical events were viewed and chronicled by other sources.

As we expanded our model of the Nimrud citadel, we immediately learned new things about Assyrian architecture, use of lighting, the carefully planned locational relationship between the wall reliefs and interior circulation and sightlines, and thus about the iconographic, educational, and political purposes of wall reliefs and the functions of spaces. Specifically, we were able to test new theories about how the rooms may have

been lit, about the use of sacred trees to represent the king in his absence, and how throne rooms might appear from a visitor's point of view. Our results convinced the late Assyriologist Sam Paley who told us (personal communication): "I am particularly pleased with such virtual reconstructions, because I am able to visit the site and travel through it and see things that I could not see in one image before or even see easily and quickly if I were able to visit the actual ruined site; I could appreciate spatial relationships the way the ancient Assyrians intended."

We were able to successfully assemble, for the first time, globally scattered sculpture so that the original decorative schemes and narrative programs could be fully appreciated in a simulation of their original scale, lighting, color, and 3D spatial complexity. In the process, archaeologists came to realize how much data are missing despite 170 years of research; and how wrong the long-accepted illustrations and interpretations of the buildings were. Testing data, and assumptions on that data, in three dimensions is crucial to verifying their validity. The Nimrud virtual world now acts also to document the on-going destruction of this World Monuments Fund endangered site and will allow teams,



Fig. 7. Rendering from the interactive 3D computer model of the citadel at Nimrud, c.800 BCE.

such as from Interpol, to more accurately track and identify stolen artwork as it reappears on the market. Virtual heritage computer models provide a solution to the long-term documentation and visual preservation of monuments critical to history.

Once we identified the Central Building, not as a temple or an isolated structure, but as really being the monumental entryway to the Northwest Palace complex, an interpretation that had eluded scholars for decades, we focused on the structure next to the Ashurnasirpal gateway which also contained a pair of colossal bulls on its facade. These so-called Center Bulls faced east and were inscribed for Shalmaneser III (Ashurnasirpal's son, who ruled from 858-824 BCE). Originally found by Layard, they were re-excavated in the mid-1970s by a Polish team who showed that the bulls had originally flanked a doorway that connected the structure with the piazza to the east. Another doorway led out of this Shalmaneser building westward, towards a courtyard. Part of a wall-panel showing a magical figure fighting a pair of lions, survived in position on the northern jamb of this inner doorway, mimicking the similar wall-panel in the equivalent doorway in Ashurnasirpal's gate building, thus helping us to model and identify this structure also as a gateway, but to a minor royal compound (Shalmaneser continued to expand, and presumably live in, his father's grand Northwest Palace during his reign). Shalmaneser's celebrated Black Obelisk was found by Layard lying on its side north of the Center Bulls and presumably would have stood in the equivalent position to that occupied by the Rassam Obelisk of Ashurnasirpal in front of his gateway (fig. 3).

Layard was also busy excavating the citadel mound of Nineveh, while he worked at Nimrud. As at Nimrud, he preferred to use vertical shafts to find key features and then tunnel along walls to expose reliefs and sculptures (fig. 8). The Southwest Palace (Russell 1998, 1991), the grand *Palace without Rival*, of Sennacherib is so large that it still to this day has not been fully excavated (which, given the current political situation in Mosul, will probably save much of the remaining building from harm). We know a substantial amount about the throne room of the palace, its colossal guardian animals, magical wall reliefs, and long narrative inscriptions. In order to more completely understand the wave of Assyrian expansion westward across the Levant during Sennacherib's third campaign, we do need the aid of the throne room texts, but equally critical are the Lachish battle reliefs.

The Lachish Room, as it has been designated, has a peculiar location in the palace, especially given the nature of the reliefs, the consequences of the actions depicted, and the duplication of discussion of the battle in the Bible. Clearly, the destruction and



Fig. 8. Examples of drawings showing Layard's excavation techniques at Nineveh.

looting of the city was a key moment of the Assyrian king's third campaign, and its timing with regard to the siege of Jerusalem makes the images that much more engaging. However, according to Sennacherib, the battle at Lachish was minor enough not to warrant mention in his annals or to be placed so as to impress visitors to his grand palace, since the battle narrative has been carved across a room deep inside the personal and administrative wing of the building, well away from public spaces. So, as far as visiting dignitaries or tribute-bearers were concerned, the battle did not exist.

Yet, among the design of the Assyrian palace, someone carefully positioned the room containing the Lachish reliefs at the end of a long corridor framed with colossal guardian animals and precisely on axis with the center of the largest inner courtyard of the building. Further, each successively inner set of colossal animals is slightly smaller than the previous accentuating the impression of perspective as one looks down the corridor toward the center relief, the one that shows the battle itself underway (fig. 9). Punctuating the view from the center of the administrative wing of the palace seems to suggest that the king was more mistrustful of his staff and family than he was of enemies from outside. He used the narrative to show off his power and might to those supposedly closest and most



Fig. 9. Rendering from the interactive 3D computer model of the Southwest Palace, Nineveh, showing the view from the inner courtyard toward the Lachish Room.

loyal to him. This is curious. Biblical chroniclers found the battle and its implications for Assyro-Judean relations important enough to discuss several times, especially in light of nearly simultaneous actions taking place in Jerusalem.

We have reconstructed the palace as a 3D model and are creating several narrated videos telling the story of the Assyrian expansion and highlighting the key features of the battle reliefs and their meaning. Among the unique and archaeologically invaluable features of note are the two inscriptions carved into the battle scenes:

- (1) an inscription is placed in front of king seated on his throne overlooking the battle and his prisoners gives the kings name and identifies the city from which the booty and captured people originated and
- (2) a text placed over the king's tent, again identifies Sennacherib by name (Ussishkin 2003:209-16). Without these captions, we would not be as certain about the meaning and importance of the depictions, nor be able to so closely match the carved scenes with

the evidence found during the excavations at Lachish (Ussishkin 2014); and thus link the Assyrian accounts to the biblical accounts to the site of the actual battle. This is a remarkable set of coinciding events.

One unintended sidelight of our virtual heritage research has brought together several of our projects and once again links Jerusalem and Nineveh. Among the fateful political machinations that took place in 701 BCE was the movement, against Sennacherib's army in Judea, of Egyptian forces led by a young commander named Taharqo (also Taharqa and Tirhakah) in his support of the people of Jerusalem. Despite his defeat by the Assyrians, Taharqo later became pharaoh of the 25th

Dynasty, with religious headquarters in Jebel Barkal, Nubia (present-day Sudan; Kitchen 2003 p.22-24; Hoffmeier 2003). Besides the fact that artifacts dated to the 25th Dynasty have been found at Nineveh (Thomason 2004), it just so happens that we are also working on a 3D visualization project for the site of Jebel Barkal, including many monuments built by Taharqo (fig. 10)!

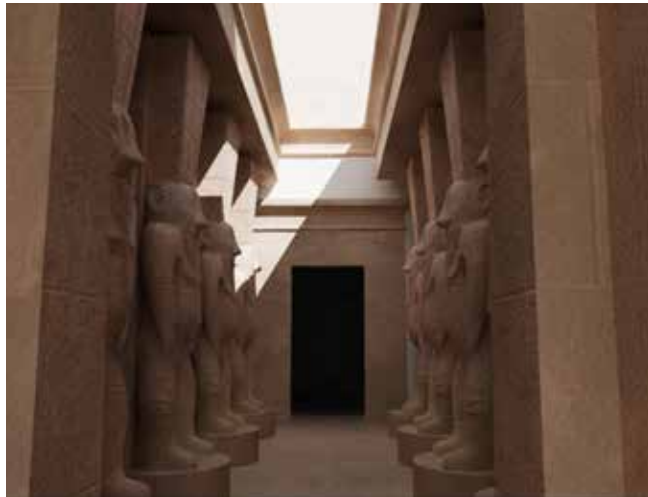


Fig. 10. Renderings from the 3D computer model of Jebel Barkal, Nubia (present-day Sudan) showing the interior and exterior of Temple B300, commissioned by the pharaoh Taharqo.

■ IV. Conclusion

After working for two decades in virtual heritage, our work has demonstrated that there is:

- no better way to test the validity of archaeological assumptions;
- no better way to test spatial, behavioral, and temporal hypotheses;
- no better way to test the accuracy of past interpretations and evidence;
- no better way to assemble globally dispersed artifacts back into a simulation of their original contexts;
- no better way to visualize intrasite change and development; and
- no better way to absorb complex datasets about the past than visually, interactively, and in 3D, just as we do in real life.

But what is really important is that we need virtual heritage these days to ensure that the past remains as the ready teacher of tomorrow, even if those remains are only recorded and envisioned digitally. The digital capture of archaeological sites and artifacts is now more crucial than ever given threats to the very survival of entire cultures and peoples by climate change, wars, and deliberate erasure. Without such evidence at our disposal, we would never have realized how accurate the biblical narratives were, how much about the stories told in the Bible were still left for us to learn, and how the events told there can seem so different when seen from other points of view. Gaps in the biblical accounts can now be filled in as a result of excavations and subsequent innovative visualizations. The interactions between the Assyrians and the kingdoms of Israel and Judea are but a small portion of the histories awaiting supplemental evidence. That evidence must be captured, disseminated, and made lasting; we cannot let more unrecorded and unstudied historical relics be destroyed. Luckily, we have the tools that allow us to do this effectively and efficiently. The technologies of the future are here now.

Traditional archaeological evidence--excavation notes, photographs, and sets of often conflicting or incomplete plans from old excavations--were able to provide Assyriologists with only general information about the function, design, and whereabouts of the buildings around the central part of the Nineveh and Nimrud citadels. Once interactive 3D computer modeling was introduced, researchers were able to ask different questions, test new hypotheses, and visualize the results in ways led to more definitive and insightful results.

When hypotheses are tested as interactive virtual reality worlds, we can “see” whether the assumptions might be valid, whether what is presumed in plan actually holds together

as real construction and spatial flow, and visualize the results from the ancients' point of view. Creating such virtual worlds based exactly on excavated evidence would be a desirable goal, to ensure that the resulting computer images are as accurate and precise as possible, and can be scrutinized to the highest standards of scholarship. This is not always entirely possible when relying on plans drawn 100 years ago or on incomplete field notes. Luckily, today's documentation and site recording methods can take advantage of tools that make our modeling lives a lot easier and that, in turn, promise a paradigm shift in how fieldwork, analysis, publication, teaching, and fundraising activities happen. Advances in computer vision and pattern recognition research have both taken some of the burden of creating 3D models off of our shoulders and opened up new ways to use and view the resulting virtual environments.

Archaeology is tedious. The discipline demands exactitude, copious documentation, rigorous analyses, and prompt dissemination to peers. Fieldwork becomes challenging when trying to accurately locate structures, walls, trenches, features, and artifacts in 3D space. We once simply described our finds, took measurements manually, made some drawings, and took a couple of photographs of contexts and details. That approach suffered from inaccuracies, inconsistent terminology, transcription errors, and just taking too long. And, some things or viewpoints were not recorded at all, because their significance was not recognized until it was too late. Traditional methods also do not effectively allow questioning all the collected data in real time, nor allow for adjusting field strategies while the work is underway. Often, years elapse before all the evidence has been amassed, studied, and synthesized, which is unfair to colleagues.

It would be immensely beneficial if archaeological fieldwork could rely on just one software package that would keep things digital from data acquisition to publication, integrated all datatypes together, could be used at different types of sites with minimal modification, and placed interactive 3D contexts at the heart of the operation. The goal would be to ease recording and recall for researchers of all backgrounds for all types of sites. That is exactly what our package called *REVEAL* was created to do (<http://sourceforge.net/projects/revealanalyze/>).

Compared to existing database packages, standalone GIS or 3D modeling packages, or image management software, *REVEAL* is special. It is a single piece of free and open-source software that coordinates all data types (such as, photos, drawings, 3D models, and tabular information) with semi-automated tools for documenting sites, trenches and objects, recording excavation and site-evaluation progress, researching and analyzing the

collected evidence, and automatically creating 3D models and virtual worlds. Search and retrieval, building interactive visualizations, and testing hypotheses against the recorded material can all happen in real time, as the work proceeds. That is its important advance.

When combined with augmented reality, the ability to overlay our 3D model reconstructions over the reality of incomplete excavated remains using smartphones or tablets, we can now envision fascinating ways to bring the stories of the Bible, the excavations of the Near East, and the wonders of ancient history together to make the narratives of the past come alive, remain meaningful, and ensure that cultural heritage is not forgotten or wiped from memory. To that end, the recent Cairo Declaration (<http://www.theantiquitiescoalition.org/cairo2015/>) was signed by ten countries whose antiquities have become the target of terrorists for destruction or sale on the black market. The Declaration seeks to establish guidelines, oversight committees, and independent centers with task forces to combat the war on cultural heritage.

It is clear that the questions we now ask about the past need not be constrained by traditions of the past, but only by the innovations we create to help visualize the answers.

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