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Visualizing the Past/Peopling the Past

Final Project

December 21, 2016

(Re)Animating the *Oikos*: Tell Billa’s Domestic Space in 3D

**Abstract**

*Near Eastern archaeologists often explore the recursive relationship between past peoples and their built environments through analyses that rely on considerations of the size and shape of buildings. The working assumption is that changes in a structure’s size and shape across space and through time reveal the shifting social interests of their inhabitants. As a result, building plans in 2D have long dominated articles and book-length studies about the archaeology of the Near East, with preference given to discussions on architectural symmetry and scale. This paper argues that an interpretation of the built environment based on these parameters alone is too simplistic; in fact, it replaces the old adage about attributing pots and people with buildings and people. Ethnographic analogy demonstrates that space in traditional Middle Eastern communities is not perceived or utilized in any absolute sense, but instead works through networks of familiarity, such as neighborhoods and households based on kinship ties. Thus, 3D computer modeling and animation offer a novel approach for ground-level (as opposed top-down) phenomenological studies. Such models can better capture the lived experience of people in the past, based on their dynamic movement through and active role in these spatially oriented networks. As a result, this paper describes a 3D model that was developed to visualize people and their movement through the Neo-Assyrian rural center of Tell Billa in the 1st millennium BCE*.

**Introduction**

This project visualizes domestic space in a Neo-Assyrian town through 3D computer modeling. Specifically, the project created a virtual workspace from the architectural plans of Tell Billa, an archaeological site in northern Iraq that served as a regional center of the Assyrian Empire during the 2nd and 1st millennia BCE (Figure 1). The residential quarter was rendered in Autodesk’s Maya and used as an analytical tool to understand how an inhabitant might have experienced domestic space at Tell Billa particularly and within the Assyrian landscape more generally. Ultimately, this work presents a phenomenological study of a Mesopotamian community, but it also encourages the use of interactive 3D environments to capture the past’s animate qualities, and thus reimagines place at the intersection of both space and time.

In the 19th and 20th centuries, before the institutionalization of Near Eastern archaeology as an academic discipline, universities sent architects to excavate sites that related in some way to the Bible (Kuklick 1996). Accordingly, Mesopotamian archaeologists have a tradition of focusing on building plans in published reports, especially as they relate to monumental architecture. Over time, scholars associated variations in buildings with archetypes: the courtyard house and the extended family; the bent-axis temple and restricted access for a privileged, priestly caste; or the massive, many-roomed palace and symbols of authoritarian power. These valuations, a priori, depend on rudimentary, Western-derived variables, such as size and shape; their emphasis in the literature has been likened to a top-down approach (McMahon 2013: 163).

However, if the inhabitants of towns, villages and cities in the early Near East were anything like their contemporaries, places were understood not in terms of “absolute space,” but “pragmatic space,” that is space experienced through the routinization and daily practice of social life (Schloen 2001: 110; Wheatley 1976). This idea has been ethnographically documented in Middle Eastern and Mediterranean communities, which express solidarity through kinship relations based on proximity within and familiarity with clan-based neighborhoods (Geertz 1979). If space is not an abstract whole but a nexus of informal social interactions, other factors, including movement through buildings, gradations in sound and light, as well as field and depth of view might have had equal or greater weight than size and shape with respect to spatial experience in the past. Their study naturally requires a ground-level or bottom-up approach.

Virtual environments, which visualize ground-level interactions, show the connection between objects, landscapes and knowledge through the dynamic representation of people; simulated interactions of the two former categories with the latter make visualizing avenues of past knowledge possible (Bogdanovych et al. 2009). Therefore, visualizing Assyrian material culture emplaced in an animated environment offers a window into past experience. Knowledge, from a phenomenological perspective, is gained through perceptual experience, so that experience is knowledge and knowledge is experience (Tilley 2008: 271). Furthermore, archaeological phenomenology assumes that the past, in its broadest sense, consisted of two experiential elements: places and the paths between places (Tilley 1994). As such, a phenomenological approach contemplates stasis and movement across space and through time (Tilley 2008: 272).

Tim Ingold has argued that moving through rather than being in a place is the primary condition of existence (2011: 12). In other words, landscapes without movement are unthinkable (Given 2013: 8). Nevertheless, archaeological scholarship remains dominated by functional and symbolic studies of built space, including empirical studies with static descriptions to reach middle-level meanings. The static view from above is privileged over movement patterns through, despite an availability of theories that deconstruct space to understand meaning, such as space syntax or access analysis (Hillier and Hanson 1984; for an example of access analysis applied to Mesopotamian domestic space, see Brusasco 2004). Giddens’ structuration theory goes further than access analysis, as it pursues a bottom-up approach starting with individual actions (Giddens 1984; Lawrence and Low 1990: 489).

Ultimately, structuration theory and spatial syntax favor people over plans. Experiential reconstructions of architecture, by incorporating ground-level views and movement, can provide a powerful counterpoint to the artificiality of plans in bird’s-eye perspective. Therefore, taking an animated 3D approach to the representation of a domestic quarter from an Assyrian rural center, with its inherent ability to introduce reflexivity among architecture, social interaction and social reproduction, offers an opportunity for the robust analysis of Tell Billa’s spatial environment.

**Challenges of Visualizing the Past**

Archaeologists working in processual traditions have long traded the specific for the general. As early as the 1960s, Kent Flannery beseeched archaeologists to focus not on the “Indian behind the artifact” but the “system behind both the Indian and the artifact” (Flannery 1967: 120). Thus, representations of people in archaeology remained and often continue to remain “shadowy to the point of nonexistence” (Bernbeck 2015: 257). This follows on a belief that historical changes and transformations occur without the explicit intervention of people, but instead result from the ineluctable nature of larger socio-natural systems. Consequently, people-less representations reify a sense that individuals lack agency; moreover, this practice contributes to a belief that only generalized images bear scientific value (Bernbeck 2015: 257).

On the one hand, an overly interpreted image, including unverified assumptions or best-guess features, is akin to fiction and fantasy. The use of “gratuitous detail” (and its rhetorical power) can prime the viewer to buy into the plausibility of a representation through the contribution of “cognitive context,” a known fact or idea that makes the surrounding facts and ideas less open to question (Gifford-Gonzalez 1993). On the other hand, reconstructions that are entirely factual but aesthetically unpleasing risk social meaninglessness (Koepfer 2003). Consequently, archaeologists are increasingly aware of and willing to compromise between these two extremes.

Past people were not passive agents at the will of cultural fitness. Admittedly, however, the archaeological record does not often reflect unitary and rapid moments in time, creating an enormous challenge in locating individuals and their associated lifeways (Wright 2006). Therefore, even after the post-processual critique of the 1980s and 90s, the large-scale (system) still takes precedence over the small-scale (individual) in archaeological narratives. As such, the understanding of variability through time and space—archaeology’s chief aim—is reduced to mere trend and noise (Hodder 2000: 26). More recently, to provide a meaningful impression of the past and add form to the noise, archaeologists have begun to emphasize the people behind artifacts as much as or more than the artifacts themselves. Some scholars have referred to this process as “peopling the past” (Erickson 2014: 22).

Visualizing or telling stories about past people is difficult, since artists’ representations risk reinforcing cultural stereotypes of men, women and children in antiquity, especially as they pertain to notions of gender and labor relations (Gifford-Gonzalez 1993). Non-academic discourses about the past, such as print media and museum displays, are particularly powerful modes of representation, since they reach the largest and most diverse audience (Moser 2001). They are influential precisely because they mix science with accepted or expected portrayals, making them easy to absorb and, especially with respect to historical reconstruction, less quick to question.

Therefore, artistic representations are powerful and possibly dangerous if not carefully planned, since visual narratives carry equal or greater weight to written reports, particularly for laypersons and casual consumers. This medium can even influence scientists, as the wide use of images in museums and popular media can recursively influence teaching practices and research design, whereby the status quo becomes normalized. By recycling iconography and pictorial motifs, we risk ‘averaging’ the past – that is, difference and distinguishing features are lost or downplayed only to be replaced by the familiar. Some scholars have even argued that the sluggishness in which explanatory themes have changed in archaeological ideas about the past has perhaps most to do with visual images. The powerful nature of recurring imagery has trapped our interpretations, essentially freezing them in time (Moser and Gamble 1997).

If meaning is generated through symbolic content, and symbolic content is inherently visual, visual content a priori creates meaning (Moser 2001). But people consume representations differently, and thus come away with different meanings. To the passive reader, a representation might stand for reality, while to the active reader, a representation is one claim among many (Houston 2013: 70-71). Representations are choices involving more or less complexity of detail; the reception making of these choices differ depending on individual idiosyncrasies in perception Ankersmit 2001: 16; Favro 2006: 321).

Archaeological data, even if accepted as facts, are theoretically ordered into meaningful

narratives (Johnson 2010). That process, subjective in every respect, tells a story;

archaeological writing is constitutive of the discipline and therefore constitutive of the

past (Joyce 2002: 2). The past is thus created, represented and reproduced through

archaeological writing (Fagan 2016). In addition, writing often includes visual representations, including pictorial or artistic reconstructions. images, like texts, are theory laden (Moser and Gamble 1997). Therefore, every representation is like a “window with reflective glass,” offering an interpretation of the past as well as an understanding into its creator’s knowledge, theoretical background, and broader worldview (Favro 2006: 321).

Many practitioners in today’s field recognize that archaeology is accountable to a range of publics and actively seek out alternative forms of communication or represent their data through alternative narratives (Van Dyke and Bernbeck 2015; Zimmerman 2003: 8). These might take the form of fiction, creative nonfiction, the visual arts, as well as other platforms for storytelling, to make archaeology meaningful to the non-specialist. Ultimately, archeologists do not have a monopoly over understandings of the past. Moreover, repositories of public knowledge find their way to and have an influence on scientists themselves. This has a profound influence on research design and scholarly intervention.

To successfully reconstruct the past, one needs a solid understanding of the functional aspects of the relevant time period, since its minutiae constitute the believability of a representation. Therefore, academics who often disregard less cerebral matters, such as the physical properties of materials or the structural necessities of a building, are forced to pay attention to the obvious but less theoretically interesting aspects of the past. Previously overlooked characteristics or undervalued factors not only become known but also result in new understandings. Thus, informed visual reconstruction can not only teach but also advance research (James 1996: 27).

Furthermore, large scale models and reconstructions in museums present another opportunity to visualize or re-present past narratives (Fash 2013: 92). Realistic representations of the past increasingly employ 3D assets for use in television, film, game development and scholarship, for both research and education. In fact, interactive engagement with the past through technology is best achieved through virtual environments. They can connect us to a time and place that would otherwise be impossible to experience firsthand, or a site and artifactual assemblage that is too fragile to observe in person (Champion 2011: 4-5). Moreover, they present opportunities to preserve cultural heritage with visual fidelity when circumstances prohibit physical preservation (Champion 2011: 65).

**Visualization and Tell Billa**

The site of Tell Billa, situated in Nineveh Governorate, lies just outside of Mosul, Iraq in a conflict zone. Today, the “tell” or archaeological mound appears on satellite imagery to be heavily eroded from the cumulative effects of mechanized agriculture and modern military fortifications (Figure 2). Like much cultural heritage in Iraq, Tell Billa has been compromised by decades of war. Scholars and the public have been unable to engage with the site for a long time; because of landmines and chemical agents, archaeological work or cultural tourism is unlikely to take place at the site or in its vicinity in the future. Therefore, rendering Tell Billa’s preexisting datasets in 3D is one of few options in making its archaeology widely available and therefore meaningful to various communities.

**Tell Billa’s Historical Background**

From October 1930 until the spring of 1935, the American Schools of Oriental

Research in Baghdad and the Penn Museum excavated Tell Billa in what was referred to as the

“Joint Assyrian Expedition.” The 30-hectare earthen mound, as seen in this Corona image, lies

immediately south of the Jabal Ba in northern Iraq, sitting less than half a day’s journey

by foot from the then capital city of Nineveh (Figure 3). Ephraim Speiser served as general

director throughout the project and as field director for the first two seasons. The Joint

Expedition excavated Tepe Gawra at the same time, thirteen kilometers to Tell Billa’s

northwest.

Unlike Tepe Gawra, Tell Billa remains poorly published; only two brief *University Museum Journal* articles have been published, in addition to basic summaries in the *University Museum Bulletin* and stock reports in *BASOR*. Limited work undertaken in the 1935/36 season was never reported. Speiser (1939), Finkelstein (1953), and Postgate (2013) have discussed the Tell Billa textual corpus, most of which dates to the end of the second millennium BCE. Matthews analyzed Middle Assyrian glyptic from Tell Billa (1991). Otherwise little else has been written.

The unavailability of Tell Billa’s data is regrettable, since ibaniba—Tell Billa’s Akkadian name—served as capital and collection point of ibaniba province during the Middle Assyrian period, if not thereafter (Pedersén 1998: 90). Based on a contextual analysis of the Middle Assyrian cuneiform material recovered from the site, Nicholas Postgate likened the town’s bureaucracy to a country manor set within a rural landscape (2013: 277). Therefore, Billa represents a local center at a time when the Assyrian state was rapidly expanding and forming an international identity (Feldman 2006). A consideration of Tell Billa and its material remains thus adds to our provincial perspective of this developmental process.

**Limitations of the Tell Billa Dataset**

At the time of the Tell Billa campaigns, field records were distributed among various members of the excavation team, with the understanding that each member would publish their own part. Unfortunately, the lion’s share of the documentation was left incomplete or became lost. Moreover, the records often intermix notes from Tell Billa and Tepe Gawra; the two sites are often confused in the field ledgers, since the projects shared personnel and notebooks for several seasons. Tell Billa’s accounts therefore remain scattered and fragmentary.

More recently, records from Tell Billa’s third campaign (1932/33) were returned to the Penn Museum. Specifically, Penn Museum Archives received building plans, an object catalogue, most of the object photographs and the site notes for 78 burials. Work from 1932/33 initially overlapped with and eventually became adjacent to several of Speiser’s trenches from the preceding season of 1931/32. Therefore, these newly recovered records, which include several preliminary plans and burial cards from later campaigns, make possible a general if cursory reevaluation of Tell Billa’s stratigraphy, particularly for the residential district excavated to the south-west in the second and third seasons.

**Archaeological Background, Settlement and Architectural Plans of Tell Billa**

The Joint Expedition divided Tell Billa into twenty meter squares labeled by letters running north-south and east-west (Figure 4). During the first campaign, excavations sounded the north-east corner of the mound and identified seven strata with cultural materials. Published reports noted modest stone buildings throughout the first level, with mud brick structures throughout the second and third levels (Speiser 1930: 12). Speiser attributed an Assyrian date to the earlier levels, and a Persian date to the latest. Tombs described as invasive were found throughout the upper strata, leading Speiser to conclude that the mound’s north-east area served as a necropolis during the Achaemenid occupation of the site. Thus, the excavation team was quick to believe that the Assyrian footprint in this section was insignificant, despite substantial architecture in levels 2 and 3 and inscribed bricks with the names of Ashurnasirpal II and Shalmaneser III on the surface.

For the second season, work in the north-east corner continued (now referred to as the “Hurrian section”), while new squares were opened to the south-west, particularly squares R – S / 3 – 5. Specifically, the Tell Billa team probed a deep ravine about 400-meters south-west of the first season’s work (Speiser 1931: 4). Early accounts described this new section as having had a longer Assyrian occupation than the north-west (Speiser 1931: 5). Neo-Assyrian architectural remains were traced, including the foundations of an Ishtar temple (Speiser 1932: 32). Based on a trove of cuneiform documents uncovered, two Assyrian strata were confidently identified. Unlike Tell Billa’s north-west corner, however, only two strata were assigned level numbers: the first Assyrian level, Level 1, was dated to the 9th century BCE, and the second level to the 14th and 13th centuries BCE (Speiser 1939: 144). Later cuts, although stratigraphically noted as Achaemenid in date, were not assigned stratum numbers.

Work throughout the third season continued to focus on the site’s south-west corner. Charles Bache, taking over as field director, returned to Speiser’s exact same trenches from the previous season, hoping to uncover additional cuneiform documents. In addition, he would open new trenches immediately to the south, primarily in squares V – X/6 – 8. Along with surface finds, these trenches revealed two major occupation levels of a residential quarter. At the time of excavation, Bache labeled the upper level “Persian” and the lower level “Assyrian,” without assigning specific stratum numbers. As the season progressed, the Assyrian stratum was further subdivided into a later and earlier period, and was now called “Assyrian I (IA)” for the later material and “Assyrian II” for the earlier material. The latest or “Persian” level remained numberless.

The findings from this area, only partially published, remain unique in scale for what is known of Neo-Assyrian domestic architecture (Bache 1935; Pedde 2012: 852). More specifically, the Level IA plan represents one of the few examples of non-urban domestic space for this time period and region, and certainly the most extensive (Figure 5). Plans of the Level I architecture remain unpublished, including substantial foundations in four of the six fully excavated squares (Figure 6). Unfortunately, the latest level lacks the additional notes and records that were available for Bache’s Level IA, while secondary walls further complicate any analysis of Level 1 structures. Therefore, Tell Billa’s Level IA, dating to the early 1st millennium BCE, and published only summarily in 1935, ought to be restudied, in light of comparative data and newer technologies.

**Near Eastern Settlement Plans and Architecture in Perspective**

In general, large portions of cities and towns in the early Near East developed organically rather than being planned from their beginning. Their arrangement of streets, houses and open spaces resulted from the daily practice of people, with incremental change over time (McMahon 2013: 167). Some of the more prominent examples from archaeological data include the southern Mesopotamian city of Ur, where large sections of neighborhoods dating to the early 2nd millennium BCE were investigated, as well as several sites in the Diyala region of Iraq, dating to the end of the 3rd millennium BCE (Frankfort 1950). These settlement areas stand in contrast to deliberately arranged sections of cities, in which palatial and temple complexes were carefully planned with a mind to controlling movement (Ristvet 2014: 57). Few examples of large-scale, horizontally exposed residential districts in sub- or non-urban contexts exist for the Neo-Assyrian period.

Public and private buildings in this region have undergone little change throughout millennia (Potts 1997). The primary material for both houses and monumental structures was, and until the very recent past continued to be, sun-dried mudbrick. Fuel-intensive and therefore more expensive baked bricks were limited to drains, damp-courses, bathroom floors and courtyard pavements. Reeds and the ribs of palm fronds formed roofs. Larger monumental buildings were distinguished by the use of gypsum revetment, divisions of buttresses and recesses, as well as surface decoration (including glazes and artistic reliefs). Conversely, private, mud-plastered houses were situated within an irregular network of narrow, winding streets leading to markets, city-gates or blind alleys (Stone and Zimansky 2004; Frankfort 1950: 99-100).

From a more regional perspective, Assyrian households and the settlements they comprised were similar to early modern Middle Eastern cities, before the functional distinction between urban and rural followed on industrialization (Schloen 2001: 102-103). People lived in “joint-family” households; at an ideal level, these units were larger than a nuclear family and based on patriarchal, patrilineal, and patrilocal social practices. The main advantage of extended family units, through real or fictive kinship co-residence, was an ability to pool risk, as a family’s main source of sustenance was agricultural landholdings beyond city walls. The poorest members of these communities would have been unable to endure the joint-family household model, from losses in land, livestock or access to labor; accordingly, they would be forced to attach themselves to wealthier joint-family households through patron-client relations or servitude. Therefore, while the joint-family household was the “conceptual norm,” increased mortality and basic economics meant that the majority of households were occupied by smaller families in the nuclear phase of a household’s lifecycle (Schloen 2001: 108).

Because most cities and large villages were situated on tells or mounds, houses were tightly packed from lack of space. These tells rise over time, through the weathering, collapse and reconstruction of mudbrick, so that in many parts of the Near East the plain is dotted with raised communities and little else (Frankfort 1950: 100). Beneath these towns lie the remains of ruins of former dwellings, often built to the exact measurements of their predecessors, so that an archaeologist can read the architectural history of one of these sites by tracing a succession of wall stubs, resting one upon another.

The narrow and winding streets of a traditional Middle Eastern city, as well as those known from archaeological studies, resulted from a community built on kinship relations, as well as a need to create shadows and block the sun (Schloen 2001: 104). Inner courtyards became necessary, therefore, to provide protection and seclusion from closely arranged residential units. Exterior windows were few, especially at street level; thus, houses were often blank and undistinguished on the outside, making it difficult to discern differences in size and wealth. The focus of activity was naturally on the inside, with the ground floor used for cooking and storage, and second floor or roof for sleeping. Flat roofs additionally provided extra space for various activities, while the inner courtyard also provided light and heat dissipation.

**Modeling Parameters**

To visualize Billa’s architecture within a dynamic environment, I created a computer model in Autodesk Maya, a graphics and animation software. The decision to use Maya was not random. While other programs, such as AutoCAD, are more popular for architectural modeling, Maya offers a number of unique features, chief among which is animation. Although the current project created a 3D model and then rendered it into 2D, future work will animate the model, introducing time and movement. Because movement and time-series changes are essential for a phenomenological study through computer modeling, it was important to generate the imagery in a native software, capable of building, rendering and animating complex scenes. Maya satisfies all three components, and is also freely available through student subscription.

The model represents Tell Billa’s Level IA (Neo-Assyrian) architecture, as it was recorded in the field during the third season of excavation (Figure 5). That season’s director, Charles Bache, noted that few restorations had been made in the plan, based on the well preserved nature of the wall foundations (Bache 1935: 33). He documented 79 domestic-use rooms within the extent of excavation, along with a major street and a plaza; the street and plaza divided the domestic quarter into 3 distinct areas. All buildings were characterized as private houses, constructed of *libn*, the Arabic term for sundried mudbrick. Floors were usually made of tamped earth. Overall, the general layout of the Billa houses can be described as a variation on the traditional courtyard house, discussed in a previous section. The courtyards themselves tended to be paved with baked-brick, as they were exposed to the elements. This same building technique held true for the kitchen areas. Smaller rooms surrounded the courtyard, and were likely used for storage and sleep during the colder months. However, most of the time household members would have slept on the roof. Because little less than one-meter remained of wall heights at the time of their excavation, it is impossible to tell if residences had a second story, or if a wall contained a window (or even the height of a window).

Stones lined either side of the central street, which sloped towards its center, to form a primary drain throughout its length. According to Bache, the street was wide enough to permit the passage of animals and wheeled carts (Bache 1935: 47). It extended into unexcavated areas to the north and to the east, while the excavators also found evidence for an additional street or passage, which would have joined the main street, in the northernmost end of the excavation limit. Bache believed that no additional architecture existed to the south of the main plaza, and that this was therefore the main exit towards Nineveh, the city that bore a gate with Billa’s name, since this area neared the limit of the tell and faced Nineveh (Bache 1935: 48).

Unfortunately, the excavators did little else for the plans than trace and illustrate architectural walls. There is neither mention of in-situ artifacts, nor precise coordinates or find-spots. Therefore, a visual reconstruction of Tell Billa’s Level IA plan for phenomenological study requires careful projection beyond the structures themselves. Moreover, critical features of the model are far from certain, such as wall heights and roofing materials, since they were not documented during excavation. Thus, various assumptions had to be made. That similar data do not exist from other nearby sites dating to the same time period further complicates the reconstruction. The only other residential areas excavated on a comparable scale at the time of the Neo-Assyrian empire were from Assur, to Tell Billa’s south (Preusser 1954, Miglus 1996). The plans for Assur, which also represent wall foundations, are similar in nature to Billa. At the same time, Assur was a large, walled city with a diversity of building types, quite different from the rural center that characterized Tell Billa. Assur was also Assyria’s religious capital for millennia, as well as a former political capital. Therefore, it remains unclear the degree to which Assur’s dataset is representative of Neo-Assyrian domestic architecture in general.

Assumptions for the Billa model included the following parameters: wall height (2-meters), number of building stories (1-story), roofing materials (tamped clay), as well as window arrangements and heights. Moreover, typical pottery types of the period were included, as well as a person, cart and livestock. While these inferences are textually or archaeologically attested for Billa, their placement in the model is purely speculative. They were included to provide scale, as well as to form a part of the animation sequences as the project moves forward. To people the model, its most critical aspect, an individual was included and assigned height (5ft), gender (female), and a task (pulling a cart). Sheep were included for livestock type, since they were amply discussed in the cuneiform documents found at Tell Billa. Altogether, the model’s assumptions were based on broad archaeological comparanda, ethnographic accounts, and reasonable deduction.

**Modeling Process**

I first created a metric-based grid in Maya (Figure 7). The Maya grid mirrored the archaeological grid established by the Billa excavation, which was laid out in 20 by 20-meter squares, so that Tell Billa’s building plan could be spatially referenced and accordingly scaled. Because the few data that the Billa plans preserved included wall thickness and arrangement, this step was critical. Next, the plan was scanned as a high-resolution tif file and brought into the Maya interface. Separate layers were created for the grid and plan, so that they could be overlaid and toggled on/off. The plan’s grid points were aligned with those in Maya, confirming spatial accuracy and setting the stage for model building.

Now that a scale was in place, it was attempted to first trace the architectural plans in AutoCAD, since it is a native drafting program (Figure 8). The plan was to then export the product as an FBX file, to be brought into Maya and referenced against the plan. This step turned out to not work well, because the movement between file types and programs resulted in over- or under-interpretation of polygonal faces, as well as a loss in the overall fidelity of UV texture surfaces (Figure 9). Thus, a polygon mesh was created in Maya, draped over the referenced building plan, and used as a starting block from which to create Billa’s domestic quarter (Figure 10).

Maya’s Multi-Cut tool was the primary means to extract building surfaces from a base mesh. To achieve this effect, the tool was used to cut polygons that followed the size and shape of the walls along the straight plane of the underlying mesh (Figure 11). The polygon slices followed the lines of the architectural plan, which could be seen beneath the modeling surface, because the base mesh was turned into a wire-frame (transparent) layer (Figure 12). Cuts strictly adhered to the plan whenever possible, so that bonded walls were left bonded, while walls that abutted but appeared to be structurally unconnected were left separate. Once the cuts were established for a given wall, its internal faces were selected and pulled out of the base mesh, using Maya’s Extrude tool. Each wall unit’s z-axis was coded for the proper height of 2-meters through the modeling toolkit panel and processed for final extrusion (Figures 13 and 14). Because roofs were not discussed in the written report or documented in the archaeological record, they were not yet incorporated into the model.

At this point, the model consisted of two elements: extruded walls, to represent architectural features, and the base mesh, to represent the ground (Figure 15). However, because both of these formed part of a single mesh, and because each needed to be separated to texture the different components, each individual polygonal face needed to be selected and grouped (Figure 16). This turned out to be one of the most time-intensive aspects of the modeling process, since the base mesh contained 10,000 polygonal faces prior to the creation of additional faces for the walls. More than two meshes (architecture versus ground) needed to be created, since the architecture bisected the ground mesh and made it impossible to differentiate the buildings and ground in one iteration. Once this was completed, the critical faces where the bottom of each wall met the extremities of both internal and external floors had to be individually inspected and assigned into one or another category (wall versus ground), to ready the different feature classes for smoothing and texturing (Figure 17).

Now that the polygonal bodies were distinct, textures were mapped onto the object surfaces. For the tamped earth of the ground, a 2D texture map was created from a Google image of a village’s soil in current day northern Iraq (Figure 18). Once it was applied, the consistency in and size of the stone inclusions caused the texture map to look unrealistic. To correct for this, the relevant faces were individually selected and then projected in Maya’s UV editor. From there, the UV shells of the ground mesh were selected and scaled until a satisfactory—and hence realistic—consistency was achieved (Figure 19). In the most basic sense, this process balanced the scale of the tamped earth texture with the size of the mesh and thus its real-world equivalent. The same process was repeated for the walls, which used a mudbrick texture map also derived from Google (Figure 20). The mudbrick texture was selected because it displayed articulated bricks (though it should be noted that these bricks would have been plastered and re-plastered with clay or mud throughout a building’s lifestyle, hiding them from view except following heavy rains). In order to represent what are a distinguishing characteristic of Near Eastern architecture, articulated bricks were chosen over mud plaster, with the understanding that the texture map can be modified at any point in the future.

The next step was to focus on a particular building, and to project cultural elements and set them into a hypothesized domestic context. First, the building was given a flat roof (Figures 21 and 22). Based off of ethnographic analogy, the roof was textured with Maya’s native color palettes to look like a mix of tamped clay atop wooden thatch. In addition, the house was given a door and window (Figures 23 and 24). These were also based on ethnographic examples, in which few external windows adorn individual houses and doors retain a sill for flood control. The latter process involved reselecting particular faces and once again using the extrude tool, creating a physical and visual sense of depth. These same faces were assigned a dark color, to enhance their void-like appearance.

A female woman was situated in front of a house, pulling a cart that holds a ceramic vessel (Figure 25). The woman was provided by a teaching assistant and imported as an obj file. She was assigned a homogenous texture, without marking for clothing, skin-color, or distinguishing facial features. This decision was based on a wish to not bias the representation without further research of archaeologically attested time-period dress, as well as genetic and skeletal evidence, to indicate likely skin/hair color and body shape/height. A sheep was also modeled and added to the scene, as well as additional pottery vessels (Figures 26 and 27). The sheep, pottery vessels and wheelbarrow were produced through basic workflows established in class for NURBS and polygonal modeling, as well as tutorials found on Lynda.com. The pottery shapes and vessel types are well known from this region and time-period (Haller 1954, Speiser 1933). Texture maps were assigned based on the brown-buff paste known for certain Neo-Assyrian ceramic assemblages (Figure 28). A wooden wheelbarrow was depicted for two reasons: first, it indicates cultural activity through movement and, second, it can be pulled along the street during future animation (Figure 29). Its size and shape were based on the modeler’s logical inference. The wooden texture map was taken from Google. Several sheep were shown trailing the woman and cart. The basic mesh of the sheep was duplicated twice, with minor adjustments in scale for each duplicate, to achieve a realistic depiction (Figure 30). The texture map for the sheep was downloaded as a prefabricated jpeg from an online marketplace (Figure 31).

The most complicated but necessary step to achieve realism was to introduce a background sunlit sky, as well as accurate lighting and shadows. By default, inserted lights do not create shadows in Maya. Therefore, one must specify only those lights that ought to cast shadows, which is a function of visual goals and the ability of one’s hardware to render multiple lighting elements, since it is a processing-heavy task. Ultimately, specific lights and surfaces were coded to produce shadows, as well as receive sunlight, based on the sun’s azimuth and intensity. To create the sky, a NURBS sphere was projected into the model and scaled to encompass the entire scene (Figure 32). From there, the sphere was assigned a prefabricated environmental texture that could be adjusted for sunlight intensity, as well as background fog and dust cover. Once the center of the sphere was entered in Maya, it appeared that the model sat beneath a sunlit sky.

**Summary of Results**

With these elements put into place, the final step of the modeling process was to render the scene. The Mental Ray 3ds Max rendering plug-in was downloaded from the internet and used as the primary renderer in Maya. Mental Ray was chosen because it can create physically correct simulations of lighting effects. The outcome was a 2D image with reasonable shadows and lighting (Figures 33 and 34). The scene selected for rendering was the front of a house with the woman, cart, pottery and sheep. To her right is a plaza, the main entrance into this area of the domestic quarter. The image captures a time around midday, when the sun is at its highest.

In addition to the model building process in Maya, a digital elevation model (DEM) of Tell Billa was created in Esri’s ArcGIS (Figure 35). That DEM, along with the Maya model, will be imported into Esri’s CityEngine 3D software, to emplace the model onto the DEM and tie the DEM to its proper geographic setting. The result will allow a user to fly-through the model and thus view the domestic quarter within its wider landscape. To create the DEM, Billa’s original contour map was acquired from the Penn Museum Archives and digitized in ArcGIS and coded for elevation values (Figure 36). It was referenced against time-series Corona imagery from the late 1960s, to anchor the DEM in space (Figure 3). Esri’s CityEngine requires a license and will hopefully be acquired soon, so that this facet of the project can be completed.

**Discussion of Results and Future Prospects**

Now that a single Maya domestic scene was rendered, the entire domestic quarter can be populated with cultural elements, including additional women, as well as men and children. People can be represented in both households and on the street, and at different times of day (with a change in time-specific activities). Greater household variety can be introduced, with a mix of one- and two-story structures. The baked-brick of household courtyards can be visualized, as well as the stone-lined drain of the central street. In addition, projected house elements, such as furniture and cooking hearths, can be depicted; beds can be set out on roofs; and rising smoke can flow from kitchen areas. The entire quarter can be reduplicated and set into contiguous regions, to expand the overall size of the representation and thus domestic space. Most importantly for the project’s intended purpose, the scene can be animated in Maya or uploaded to a cross-platform game engine software, such as Unity. Sounds can be added, based on social activities and livestock, and cultural lifeways can be simulated.

Ultimately, the model’s near-term goal is to animate the scene, and therefore represent domestic experience at Tell Billa through studied interpretation. Experience, as has been discussed, arises through the entangled interaction sphere of people and things through time and space. To introduce time-series processes at Tell Billa, with their implications for changes in light, shadow, sound, and action (and thus movement), is to dynamically represent phenomenological parameters. From such a representation, the model can visually depict conceivable or even probable experience-related phenomena, and that depiction can be transformed into a written text about Near Eastern domestic space. Because all base data have already been incorporated into the model, and because the geographical setting is fixed through DEM creation and geo-referencing, animation and thus the project’s realization is not far off. At the same time, the ability to continually tweak and refine the model means that the process will never be complete. Indeed, 3D visualization through computer modeling lends itself to reflexive methodologies for this very reason.

**Conclusion**

If the past is about actual people, then people should be at the forefront of our stories about the past. At the same time, anthropologically trained archaeologists, who study material culture to write about that past, face a problem: their data are not direct representations of past people but correlates of past interactions between people. Whether they are categorized as ceramic cooking pots or monumental buildings, these correlates are stuff. So how do scholars bridge the divide between stuff and people? How do they engage with and write about past realities centered on people, when their empirical observations are mere “shadows on the wall,” to borrow an allegory from Plato? The answer, for better or worse, is interpretation, and, increasingly, interpretation in 3D.

Archaeologists do not discover the past but interpret its remains (Shanks and Webmoor 2013: 145). This interpretive process is not unlike the parsing of a cuneiform tablet, where often only fragments remain. One possible translation is offered, while the raw data are made available to and therefore become a part of a much larger dialogue. Of course, an expert interpretation, as an informed interpretation, retains a distinguished quality, and this is true for philology, archaeology, or any social or hard science.

More and more, archaeologists have recruited new technologies to aid in their interpretations of past peoples. Between the time that material culture enters the archaeological record and is subsequently uncovered, millennia can pass. During that interlude, material remains are necessarily disarticulated from the people who lived with them. This inherent disjunction demands that archaeology be an interpretive discipline; the material record is first and foremost a learning tool, from which the lifeways of past people can be better understood (Redknap 2002: 27).

Phenomenology and related approaches in material studies and network theory emphasize a deep appreciation of human-environment interdependencies and their loop effects, so that the landscape is people dependent while people are also landscape dependent (Snead et al. 2009). Social processes occur in space. They are enacted by and give meaning to individuals and societies. These include the daily rituals—both public and private—of gendered relationships and their specific social roles, religious and economic practices, as well as bureaucratic routines (Ristvet 2014: 43; Lefebvre 1991: 191). Such actions, situated in space, are relational and take place through movement. In archaeology, a theoretical outlook that fails to account for the movement of people anchored in space produces a narrative wherein experience is “fossilized into sites and dots on a map” (Given 2013: 8).

The 3D model reconstructed for Tell Billa is a foundation. The skeleton of the environment has been created, and the archaeologically derived architectural data have been represented. Several cultural activities were rendered, to demonstrate proof-of-concept. The next step will involve animation, including shadow and light as a function of movement and time of day, both within and outside of individual households. Using spatial syntax and structuration theories, hypothesis-driven questions on field-of-view manipulation, the interplay of light and shadow, as well as variations in sound can offer a sense of past experience, as well as a functional understanding of the material conditions of daily life in Assyria.

Many ancient buildings from the Middle East lie in ruins or are only partially preserved. This is especially true for monumental architecture, such as palaces and temples. Lesser structures, such as private residences, are rarely recognized at all in the archaeological record. Thus, we often rely on ethnographic analogy with modern communities when imagining how individuals and groups lived together in the past, to understand the social and symbolic use of space across time and place. But space is multifaceted. It includes physical space, what we think of as "experience," sensual space, or "perception," and internal projections of space, which form our "imagination.” Architecture subsumes all three. Both today and in the past, people cannot detach themselves from architecture. Buildings exist; we are forced to look at and interact with them, whether we like it or not. We therefore ought to deconstruct the underlying assumptions of how past people engaged with built space, so that we do not project the past into the future, but represent it to the best of our knowledge in the present.

References Cited

Ankersmit, Frank R.

2001 *Historical Representation*. Stanford, CA: Stanford University Press.

Bache, Charles

1935 “The First Assyrian Level at Tell Billa.” *University Museum Journal* 24: 33-48.

Bernbeck, Reinhard

2015 From Imaginations of a Peopled Past to a Recognition of Past People. In *Subjects*

*and Narratives in Archaeology*, edited by Ruth M. Van Dyke and Reinhard Bernbeck.

University Press of Colorado, Boulder.

Bogdanovych, A., J. A. Rodriguez, S. Simo, and A. Cohen

2009 *Virtual Agents and 3D Virtual Worlds for Preserving and Simulating Cultures*.

IVA09.

Erickson, Clark L.

2014 Beneath the Surface: The Excavations at Sitio Conte. Interview by Lucy Fowler

Williams. *Expedition* 56 (3): pp. 17-25. University of Pennsylvania Museum of

Archaeology and Anthropology.

Fagan, Brian

2016 *Writing Archaeology: Telling Stories About the Past*. Routledge (2nd edition).

Fash, Barbara W.

2013 Visual Time Machines: Nineteenth-Century Photographs and Museum Re-

Presentations in Maya Archaeology. In *Re-Presenting the Past: Archaeology through*

*Text and Image*, edited by Sheila Bonde and Stephen Houston. Joukowsky Institute

Publication 2, Providence.

Favro, Diane

2006 In the Eyes of the Beholder: Virtual Reality Re-creations and Academia. *Journal of*

*Roman Archaeology* 61: 321-334.

Feldman, M.

2006 “Assur Tomb 45 and the Birth of the Assyrian Empire.” *BASOR* 343: 21-43.

Finkelstein, J.

1953 “Cuneiform Texts from Tell Billa.” *Journal of Cuneiform Studies* 7: 111-176.

Frankfort, H.

1950 Town Planning in Ancient Mesopotamia. *The Town Planning Review* 21 (2): 98-115.

Geertz, Hildred

1979 The Meanings of Family Ties. In *Meaning and Order in Moroccan Society: Three*

*Essays in Cultural Analysis*, edited by C. Geertz, H. Geertz, and L. Rosen, 315-391.

Cambridge: Cambridge University Press.

Gifford-Gonzalez, Diane

1993 You Can Hide, But you Can’t Run: Representations of Women’s Work in

Illustrations of Palaeolithic Life. *Visual Anthropology Review* 9 (1): 22-41.

Given, Michael

2013 Commotion, collaboration, conviviality: Mediterranean survey and the interpretation

of landscape. *Journal of Mediterranean Archaeology* 26 (1): pp. 3-26.

Haller, A.

1954 *Die Gräber und Grüfte von Assur* (= WVDOG 65). Berlin: Mann.

Hodder, Ian

2000 Agency and individuals in long-term processes. In *Agency in Archaeology*, edited by

M. Dobres and J. Robb, pp. 21-33, Routledge, London.

Houston, Stephen

2013 Ping-Pong, Polygons, Virgins: Graphic Representations of the Ancient Maya. In *Re-*

*Presenting the Past: Archaeology through Text and Image*, edited by Sheila Bonde and

Stephen Houston. Joukowsky Institute Publication 2, Providence.

Ingold, Tim

2011 *Being Alive: Essays on movement, knowledge and description*. London: Routledge.

James, Simon

1996 Drawing Inferences: Visual Reconstructions in Theory and Practice. In *The Cultural*

*Life of Images: Visual Representation in Archaeology*, edited by B. L. Molyneaux, pp. 22-

48, Routledge, London.

Johnson, Matthew

2010 *Archaeological Theory: An Introduction*. Wiley-Blackwell.

Joyce, Rosemary A.

2002 *The Languages of Archaeology: Dialogue, Narrative, and Writing*. Blackwell.

Koepfer, Diana L.

2003 Representation and Aesthetics in Paleo-Art: An Interview with John Gurche.

*American Anthropologist* 105 (1): 146-148.

Kuklick, Bruce

1996 *Puritans in Babylon: The Ancient Near East and American Intellectual Life, 1880-*

*1930*. Princeton: Princeton University Press.

Lefebvre, H.

1991 *The Production of Space*. Oxford: Blackwell.

Matthews, Donald

1991 “Middle Assyrian Glyptic from Tell Billa.” *British Institute for the Study of Iraq* 53:

17-42.

McMahon, Augusta

2013 Space, Sound, and Light: Toward a Sensory Experience of Ancient Monumental

Architecture. *American Journal of Archaeology* 117 (2): 163-179.

Miglus, Peter A.

1996 *Das Wohngebiet von Assur: Stratigraphie und Architektur*. Berlin: Mann.

Moser, Stephanie

2001 Archaeological Representation: The Visual Convention of Constructing Knowledge

about the Past. In *Archaeological Theory Today*, edited by Ian Hodder, pp. 262-283,

Polity Press, Cambridge.

Moser, Stephanie and Clive Gamble

1997 Revolutionary Images: The Iconic Vocabulary for Representing Human Antiquity.

In *The Cultural Life of Images: Visual Representations in Archaeology*, edited by Brian

Leigh Molyneaux, pp. 184-212, Routledge, London.

Pedde, Friedhelm

2012 “The Assyrian Heartland.” In *A Companion to the Archaeology of the Ancient Near*

*East*, edited by D. T. Potts, pp. 851-866. Somerset: Wiley.

Pedersén, O.

1998 *Archives and libraries in the ancient Near East, 1500-300 B.C.* Bethesda, MD: CDL

Press.

Postgate, N.

2013 *Bronze Age bureaucracy: writing and the practice of government in Assyria*. New

York: Cambridge University Press.

Preusser, Conrad.

1954 *Die Wohnhäuser in Assur*. Berlin: Gebr. Mann.

Redknap, Mark

2002 *Re-Creations: Visualizing Our Past*. National Museums & Galleries of Wales and

Cadw, Cardiff.

Ristvet, Lauren

2014 *Ritual, Performance and Politics in the Ancient Near East*. Cambridge University

Press.

Schloen, J. David

2001 *The House of the father as fact and symbol: patrimonialism in Ugarit and the*

*ancient Near East*. Winona Lake, Ind: Eisenbrauns.

Shanks, Michael, and Timothy Webmoor

2013 A Political Economy of Visual Media in Archaeology. In *Re-Presenting the Past:*

*Archaeology through Text and Image*, edited by Sheila Bonde and Stephen Houston.

Joukowsky Institute Publication 2, Providence.

Snead, James E., Clark L. Erickson, and J. Andrew Darling

2009 *Landscapes of Movement: Trails, Paths, and Roads in Anthropological Perspective*.

University of Pennsylvania Museum of Archaeology and Anthropology.

Speiser, E.

1930 “University of Pennsylvania Museum – Baghdad School Expedition at Billah.”

*BASOR* 40: 11-14.

1931 “Reports from our expeditions in Iraq.” *BASOR* 41: 19-24.

1933 “Pottery of Tell Billa.” *Museum Journal* 23: 249-308.

1939 “Gleanings from the Billa Texts.” In *Symbolae ad iura orientis antiqui pertinentes*

*Paulo Koschaker dedicatae quas adiuvante*, edited by Th. Folkers, J. Friedrich, J.G.

Lautner, and J. Miles, 141-150. Leiden: E.J. Brill.

Stone, Elizabeth C., and Paul E. Zimansky

2004 *The anatomy of a Mesopotamian city: survey and soundings at Mashkan-shapir*.

Winona Lake, Ind.: Eisenbrauns.

Van Dyke, Ruth M., and Reinhard Bernbeck

2015 *Subjects and Narratives in Archaeology*. University Press of Colorado, Boulder.

Wheatley, Paul

1976 Levels of Space Awareness in the Traditional Islamic City. *Ekistics* 42: 354-66.

Wright, Henry T.

2006 Early State Dynamics as Political Experiment. *Journal of Anthropological Research*

62 (3): 305-319.

Zimmerman, Larry J

2003 *Presenting the Past*. AltaMira Press. Walnut Creek, CA.