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THE SOCIAL LOGIC OF SPACE IN EARLY HORIZON PERU: 3D RECONSTRUCTIONS OF RESIDENTIAL COMPOUNDS AT CAYLÁN, NEPEÑA VALLEY

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THE SOCIAL LOGIC OF SPACE IN EARLY HORIZON PERU: 3D RECONSTRUCTIONS OF RESIDENTIAL COMPOUNDS AT CAYLÁN, NEPEÑA VALLEY

By

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Undergraduate honors thesis under the direction of

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Introduction

In this thesis, I explore the spatial syntax of select residential compounds documented archaeologically at the Early Horizon settlement of Caylán (~600-200 BC), Nepeña Valley, north-central coast of Peru (Figure 1). In 2009 and 2010, David Chicoine directed the first scientific excavations at this important archaeological complex (Chicoine and Ikehara 2010, 2014). Field results revealed that the site rose as a major population center during the first millennium BC at a time of heightened armed conflicts and social tensions in Nepeña. Pedestrian surveys and mapping operations indicate that Caylán was organized as a monumental core surrounded by an extensive defense system. Intensive research at the monumetal core allowed the identification of more than 40 architectural compounds currently interpreted as multi-functional residential complexes based on excavation data. In this thesis, I use SketchUp Pro to generate 3D architectural reconstructions and thus explore the spatial organization of ancient buildings at Caylán. In the remainder of this thesis, I provide background information of the Caylán research, discuss the process of rendering 2D images of the residential compounds into 3D images and animations, and discuss the broader social meanings of the Caylán buildings. The goal of this thesis is to increase our understanding of spatial syntax as it relates to the urban setting of Caylán through visual aids.

Background

Located on the north-central coast of Peru in the modern-day Department of Ancash, the archaeological complex of Caylán is one of the largest ancient settlements in the Nepeña Valley (Figure 2). The site was first reported in the 1930s and was the object of several survey

operations through the years (Proulx 1968). In 2009, David Chicoine undertook the first scientific excavations at Caylán and demonstrated that most of the architecture at the site was built during the Early Horizon (800-200 BC) (see Burger 1992). Based on radiocarbon measurements, this occupation is currently dated between 600 and 200 BC, with most dates clustering between 400 and 200 BC (Chicoine and Ikehara 2014). Caylán is characterized by a dense, urban-like layout with more than 40 stone-and-mud wall compounds agglutinated in an area of a little more than 50 hectares. As part of her master thesis, Ashley Whitten (2015), under the supervision of Chicoine, mapped in detailed most of those compounds. Her mapping efforts yielded two-dimensional maps of the compounds which she rendered in AutoCAD and a series of Adobe Illustrator plan reconstructions and drawings.

Whitten's research, which combines spatial syntax analytical techniques including access diagrams, demonstrates that compounds at Caylán were organized as neighborhoods articulated through a series of cross-cutting pathways or streets, and monumental, benched plazas. These plazas are denoted by the attached smaller patio-like rooms, colonnaded galleries, and roofed chambers. My research departs from Chicoine and Whitten's efforts by converting the two-dimensions maps and plan drawings into three-dimensional architectural reconstructions and thus helping to better visualize those important buildings. The study of the social logic of these spaces is particular interesting in the context of the emerging urbanism in coastal Peru during the first millennium BC. Those developments are quite fascinating and in many ways antecedents to better known cases of Precolumbian urbanism in Peru (e.g., Moche, Chimú [Moseley 2001]).

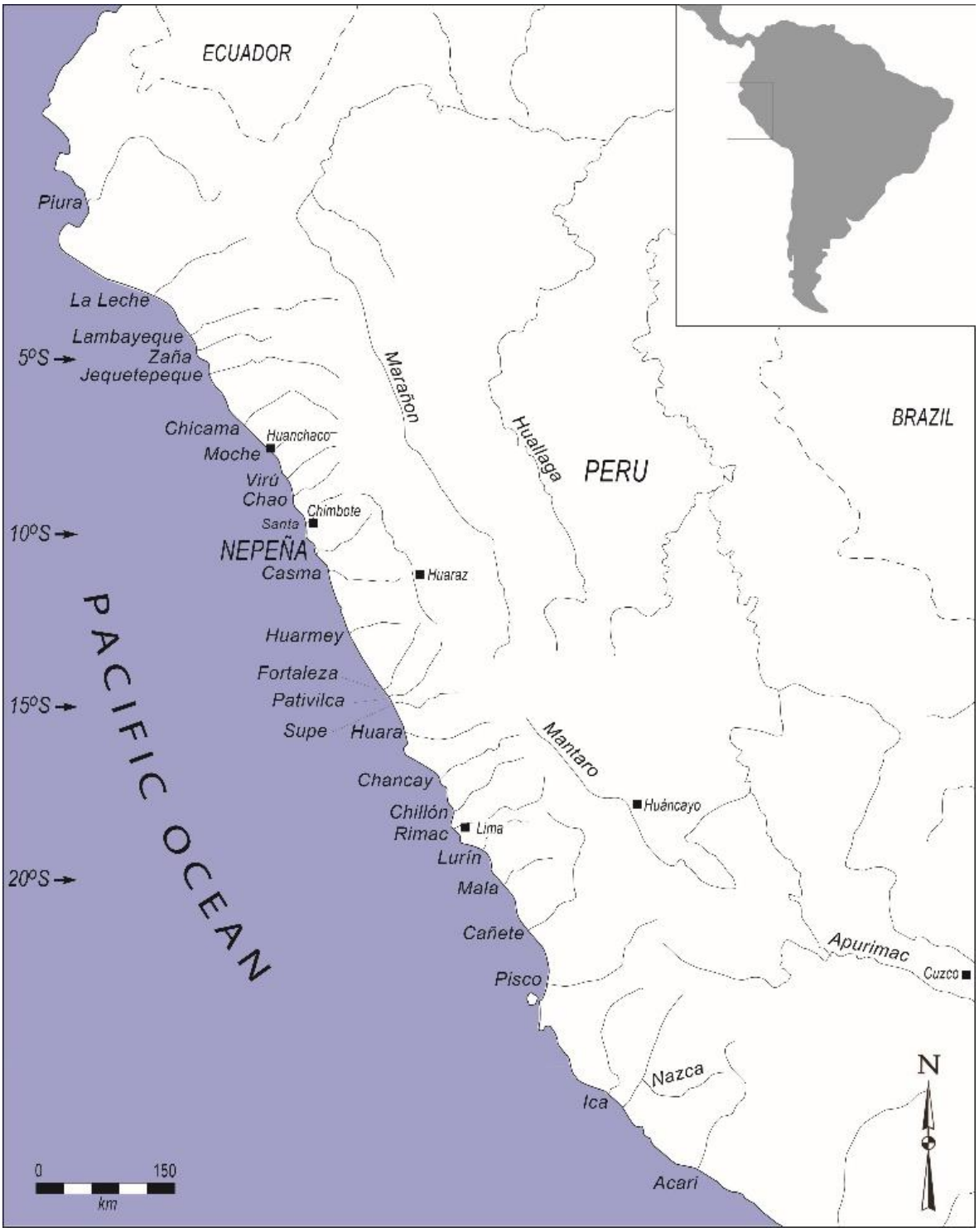

Figure 1. Map of Peru showing the location of the major rivers, including Nepeña (credit: D. Chicoine).

The Nepeña Valley and the History of Archaeological Field Research

Nepeña is a small valley of coastal Ancash located a little under 400 km north of Lima, the modern-day capital of Peru. Because of its location away from colonial cities and major contemporary urban centers, the valley did not receive much archaeological attention until recently. Archaeological investigation within the Nepeña Valley began with Julio C. Tello. In 1933, Tello conducted the first documented excavations in the Nepeña Valley at the sites Punkuri and Cerro Blanco (Tello 2005). Donald A. Proulx (1968, 1973) identified over 200 archaeological sites in the valley through surveying in 1967 and 1971. Building on Proulx's work, Richard Daggett (1984) identified an 143 additional sites. Koichiro Shibata began research in the Nepeña Valley in 2002 with the excavation of Cerro Blanco and later Huaca Partida (Shibata 2010, 2011, 2017). David Chicoine additionally conducted research in 2003 and 2004 at Huambacho (Chicoine 2006, 2010, 2011). Chicoine and Ikehara conducted excavations at Caylán in 2009 and 2010 with the *Proyecto de Investigación Arqueológica Caylán* with the goal of mapping and documenting the largest settlement in Caylán's Early Horizon. Matthew Helmer conducted research at Samanco in 2012 and 2013 (Helmer 2015). Other field research projects in the valley include Lisa Trever's excavations of Moche mural paintings at Pañamarca (Trever 2017), Carlos Rengifo's sampling of residential structures at Cerro Castillo (Rengifo 2014), and Kimberly Munro's clearing of Preceramic period ritual chambers at the upper valley center of Cosma (Munro 2018).

When combined, results of those different archaeological projects allow for a synthesis of Early Horizon societies in Nepeña. Archaeological research suggests the presence of two cultural traditions during the Early Horizon. The middle and upper valleys, also known at the Moro Pocket, was characterized by megalithic masonry with residential areas in close proximity to a

ceremonial and defensive center. Fieldwork by Hugo Ikehara (2010, 2016) indicates that the existence of more than dozen of those hilltop communities, the most famous being Kushipampa. The presence of defensive infrastructures and weaponry at those remote sites suggests endemic warfare and intense inter-community competition. The lower valley on the other hand did not typically have megalithic masonry but was rather characterized by stone-and-mud walled compounds. Here, Early Horizon settlements appear to have been organized hierarchically, with Caylán standing as the largest center in a system composed of perhaps half a dozen communities including Huambacho, Samanco, Sute Bajo and Cerro Blanco (Chicoine 2006; Chicoine et al. 2017).

Research at Caylán

Archaeological research at Caylán began with Paul Kosok's visit and description of its architecture (Kosok 1965). Two years after the publication of Kosok's survey work, Proulx visited Caylán as part of the first systematic survey of the Nepeña Valley (Proulx 1968). Daggett also visited Caylán in 1980 and made the first proposal of dating the ruins to the Early Horizon. Chicoine and Ikehara's excavations beginning in 2009 and extending to 2010 consisted of pedestrian surveying and vertical and horizontal area excavations, in addition to approximately 500 square meters of excavations of 16 test pits, six excavations units, and the clearing of one looter's pit (Chicoine and Ikehara 2010, 2014).

Caylán is denoted by its urban center organized into rectangular enclosures and contained streets, corridors, and pathways. The architectural complex consists of a flat pampa ("plain") floor encompassing most of the standing constructions at the site. The location of the complex on a flat pampa suggests a strong correlation with a need for defense in the V-shaped hills that

contain the urban sector (Chicoine and Ikehara 2014). The southern section of Caylán is posited in Cerro Cabeza de León, a ridgetop area, containing a fortress and irregular walled compounds. The southeastern portion of Caylán with its location at the end of a cultivated floor with nearby a lagoon and marshlands indicates a strong farming presence with fields located north of the marshlands.

Figure 2. Photograph of Caylán showing the stone architecture of the urban sector (credit: D. Chicoine).

Caylán's urban center comprises the ruins of at least 43 multifamily residential compounds. Each compound is centered around a monumental benched plaza, a series of colonnaded patios, and smaller roofed areas (Chicoine and Ikehara 2014) (Figure 3). Based on horizontal excavations at Compound-A (Excavation Unit 2 and 5) and Compound-E (Excavation

Unit 6), the compounds are hypothesized as functioning in an apartment-like manner with the plazas interpreted as operating as "communal courtyards" (Helmer, Chicoine and Ikehara 2012). Additionally, the plazas at Caylán hosted various platform areas that served as seated bench areas. In sum, based on spatial data, Chicoine and his colleagues interpreted the plazas at Caylán as organized around a dichotomy between an open, amphitheater-like area, and a colonnaded, roofed platform area (Chicoine and Ikehara 2014; Helmer et al. 2018).

It is important to note most plaza walls measured at least 10 meters high making activities inside the plaza exclusive to the individuals inside. Experimental acoustic testing indicates that the plazas might have contributed to the creation of special soundscapes tied to musical performance and the ritual life of the ancient urban dwellers (Helmer and Chicoine 2013). Additionally, navigation within the plaza can be categorized as almost maze-like in the way the plazas layout was set up. Overall, excavations at Caylán suggest plazas functioned in a semi-public setting with open and closed spaces to denote categories of exclusivity within a residential compound.

Materials and Methods

Using previous mapping and excavation data from Caylán, my thesis focuses on rendering 2D maps of residential compounds into 3D architectural models. I depart from architectural data and measurements collated by Chicoine and Whitten and shared with me in the form of plan reconstructions and an AutoCAD architectural database. The CAD – or Computer Aided Design – maps allowed me to measure with a high level of precision the different features of the Caylán buildings. The structures themselves had been previously recorded and mapped by Chicoine and his team using a Topcon GTS-725 total station. The coordinates collected with the theodolite state were converted through Surfer and then imported into AutoCAD for the drawing of the

different architectural features. The AutoCAD map is georeferenced and very detailed. Yet, one limitation is that elevation data were not included in the final drawing. This is mainly due to the fact that the ancient buildings at Caylán have been abandoned for more than 2200 years. The stone and mud walls have collapsed and are thus found at different elevation levels. For the sake of time and efficacy, Chicoine and his team thus decided to produce a three-dimensional topographical map, superimpose the architectural map onto it, but not to record the elevation of each wall or floors. Alternately, each compound was carefully walked, surveyed and drawn in the field. The field drawings were transferred in AutoCAD, printed and then corrected through additional visual testing. When necessary, wall abutments and debris were cleared in order to reveal entrances, columns and other buried architectural features. Elevations were recorded by hand on each compound drawing, focusing on the raised platforms. That information was subsequently entered in the AutoCAD map of each of the compound.

Based on this mapping and drawing, the residential compounds at Caylán were separated into one of four arbitrary categories depending on the overall size of the compound: small (650-2000 sq m), medium (2000-4000 sq m), large (4000-6000 sq m), or miscellaneous (more than 7400 sq m) (see Whitten 2015 for details on the methodology and size ranks). The small, medium and large compounds range in size between 650 and 5990 (n=40, mean=2734, standard deviation=1392) (see Chicoine and Whitten 2019). For my thesis work, I have rendered five compounds: one small (Compound-Q), one medium (Compound-N), and three large (Compound-A, Compund-B, Compound-H). The compounds were selected by Chicoine based on their relatively high level of integrity and conservation, as well as with the objective of providing a cross-section sampling of the size categories.

Once familiar with the map of Caylán, the location of the compounds, and their spatial organization, the first step of my analysis was to extract dimensions from the AutoCAD map. Using the measuring tool in AutoCAD, I was able to determine the length and width of the particular compounds I was rendering into 3D models. To create 3D renders, I used SketchUp Pro which is a 3D modeling program that can be utilized for a wide range of drawing functions and is relatively user friendly and easy to learn. The remainder of this thesis describes each of the compounds, their modeling, as well as animations. I conclude with a brief discussion of the anthropological implications of the study for understanding the social logic of space in Early Horizon Peru.

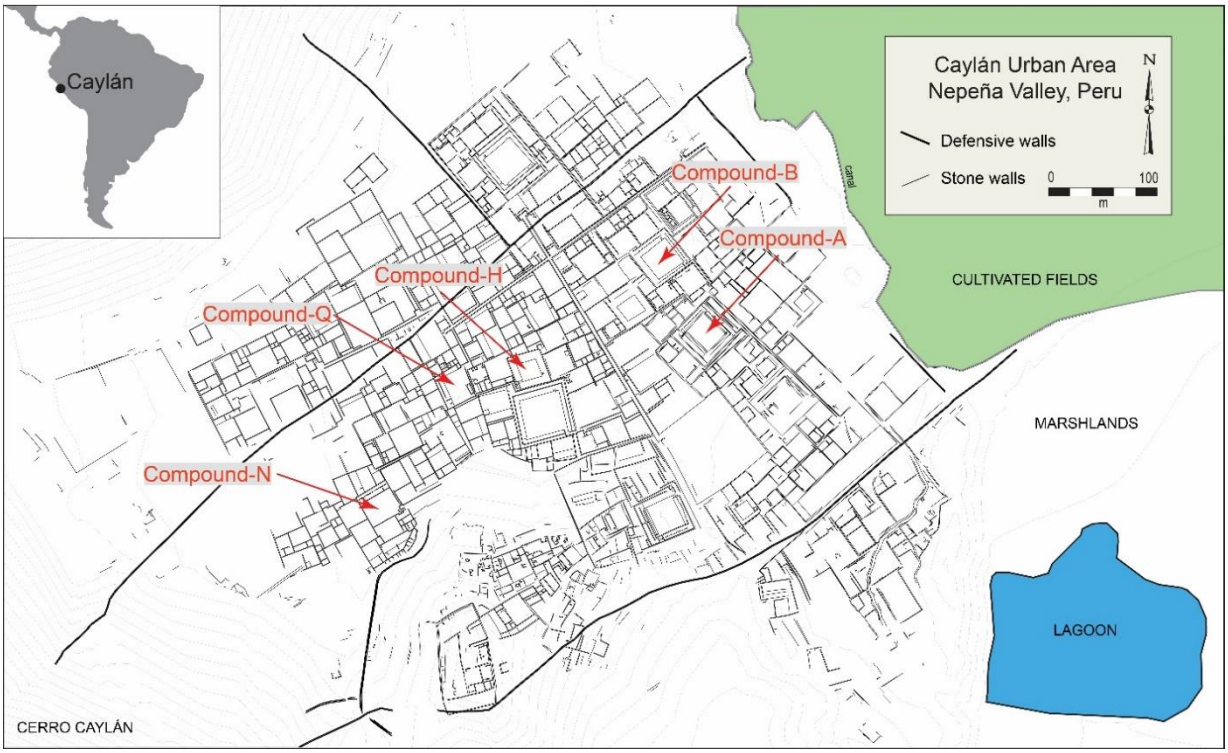

Figure 3. Plan reconstruction of the urban sector at Caylán showing the location of the residential compounds modeled in this thesis (credit: D. Chicoine).

Results and Outputs

Between January 2018 and February 2019, I have spent an average of two hours per week extracting measurements from the AutoCAD map of Caylán, sketching the different compounds and measurements, and then modeling them into SketchUp Pro. After a few tutorial sessions under David Chicoine's guidance, as well as watching some Youtube tutorial videos, I was able to work relatively independently. My efforts yielded five model compounds. I describe them below in dimensional order – which also happens to be to order in which I drew them. The rational was to begin with smaller compounds in order to learn the software and later move onto larger and more complex compounds.

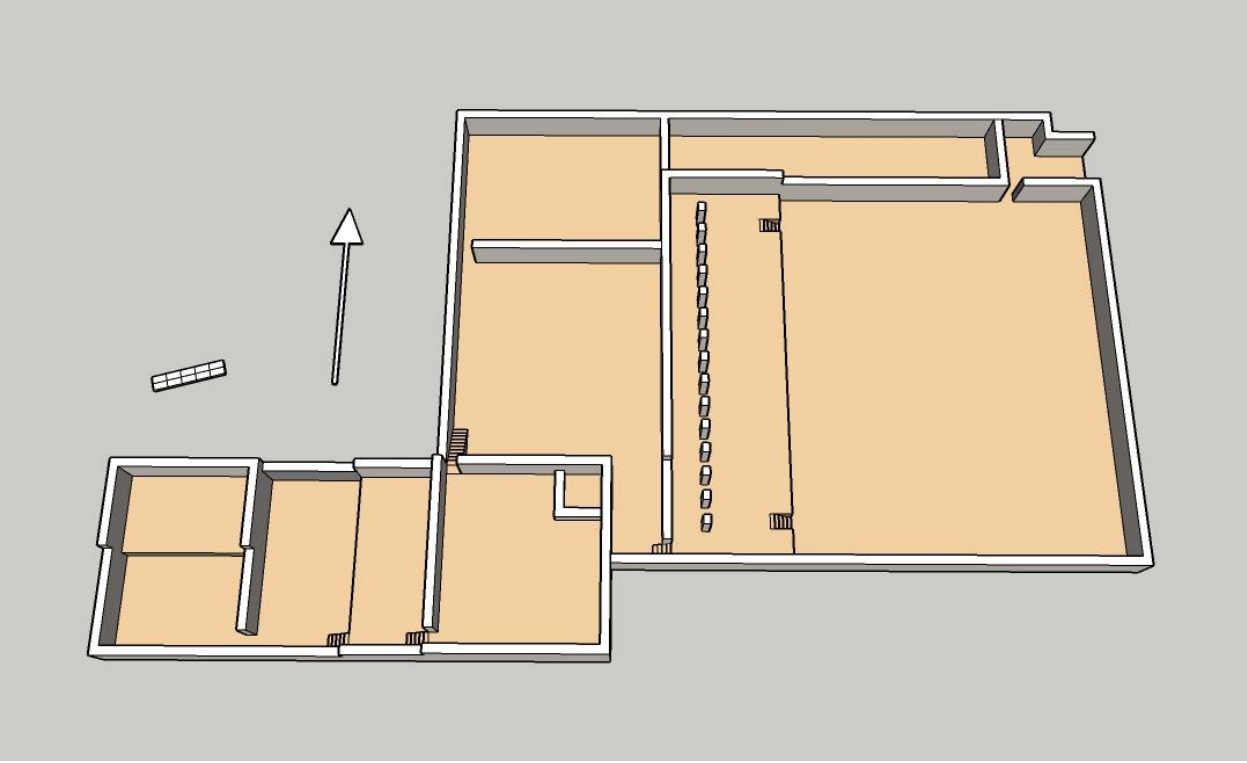

Figure 4. 2D image capture of the SketchUp Pro architectural model of Compound-Q (scale = 5 m, arrow points North) (credit: A. Passafume).

Compound-Q

The first compound and plaza that I rendered was Compound-Q (Figure 4), a small compound. Compound-Q was comprised of a main plaza and bench, seven rooms, and a hallway/corridor (Figure 5). When I initially began my rendering, I used the rectangular tool to draw the plaza with the according measurements in meters. Using the compound's plaza as a starting point, I was then able to draw the rest of the connecting rooms accordingly which are denoted in the AutoCAD file as R-1, R-2, R-3, etc., in which the "R" stands for "Recinto" or room in Spanish.

After creating the floor plan, I then used the Offset tool to make the walls of compound 60 cm thick. The walls were then raised using the Push/Pull tool to 2.5 m unless a particular room was indicated as being elevated; if this was the case, then the walls would be raised 2.5 m in addition to the particular elevation of said room. In the case of Compound-Q, the bench, the structure with multiple columns, was raised 1 m, the mound 2 m, R-4 1 m, and R-6 1 m.

After raising the walls and various rooms, I then constructed five sets of staircases. Two were placed on either end of the bench, one from room two to three, another from room three to four, and from room four to room five. Both sets of staircases on the bench had the same measurements and are as follows: 1 m wide, 1 m high, and 1.5 m deep. One individual stair was .20 cm high and 30 cm wide with there being five individual stairs in a staircase. The staircase from R-3 to R-2 comprised of ten individual stairs also measuring 20 cm high and 30 cm wide. The staircase from R-3 to R-4 and the staircase from R-5 to R-7 also had five individual stairs each measuring 20 cm high and 30 cm wide

To create a staircase, I first had to begin by using the Measuring tool to determine how far away it would be from the wall – 2 m. Continuing to use the measuring tool, I measured how wide the staircase would have to be (1 m wide) and how deep (1.5 m). After making this

measurement and using the Drawing tool to denote the measurements, I then used the Push/Pull tool to push back the space I had measured in order to create the individual stairs. The stairs were built through the repetitive motion of measuring and drawing a line 30 cm deep and then raising the rest of the space by 20 cm high using the Push/Pull tool.

After constructing the staircases, I then made the columns that lined the bench. There are fifteen columns in total on the bench. The columns measure 60 by 50 cm wide at 2.50 m tall. There is one meter of space in between each columns. The columns closest to the sides of the wall are also approximately 2 m away from the wall as well as all of the columns are 2 m aways from the back end of the wall. After using the measuring tool to determine how far the columns were away from all ends of the walls, the rectangular shape tool was used to draw the original measurement of the column and then the Push/Pull tool was used to elongate the column. After I made one column, I then copied and pasted the columns one meter apart.

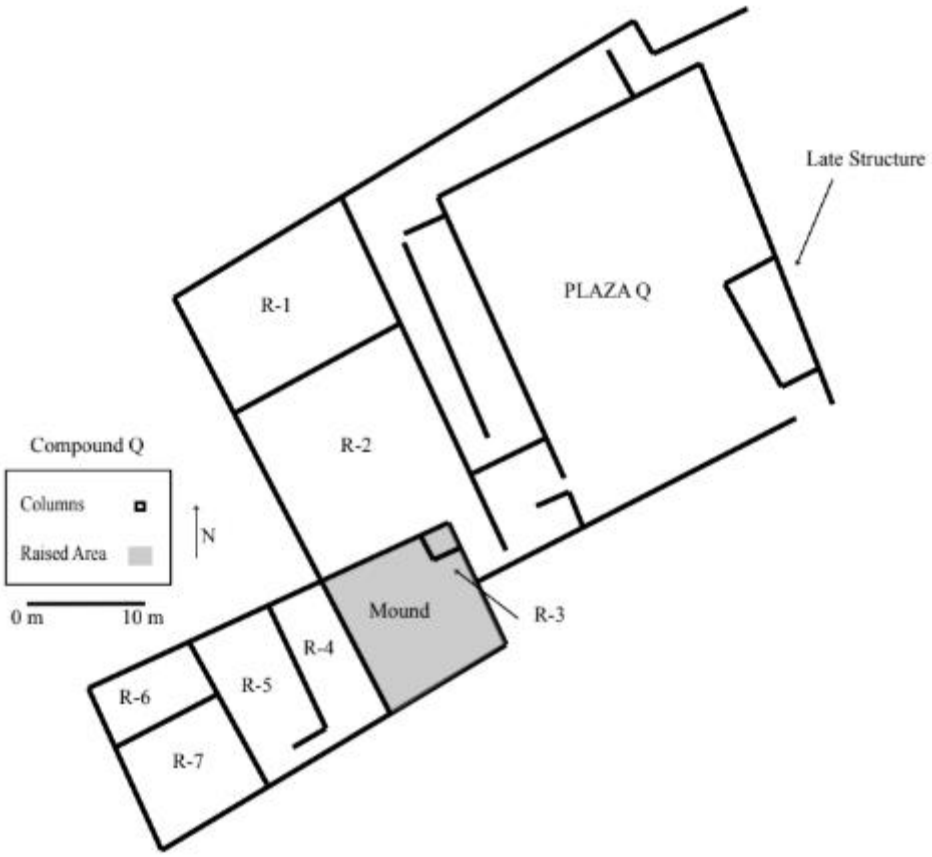

Figure 5. 2D map drawing of Compound-Q (scale = 10 m, arrow points North) (credit: A. Whitten).

Navigating Space at Compound-Q

Located in the southeastern portion of Caylán, Compound-Q is accessed through a baffled entryway into the northern corner of Plaza-Q. From the southern corner of the plaza, Room 2 is accessed. Room 1 is also most likely accessed through Room 2 and the plaza but there in no clear pathway. Extending from Room 2 is a mound structure standing at 2 meters and a succession of connecting rooms (Rooms 4-7) which are accessed entering from the mound structure.

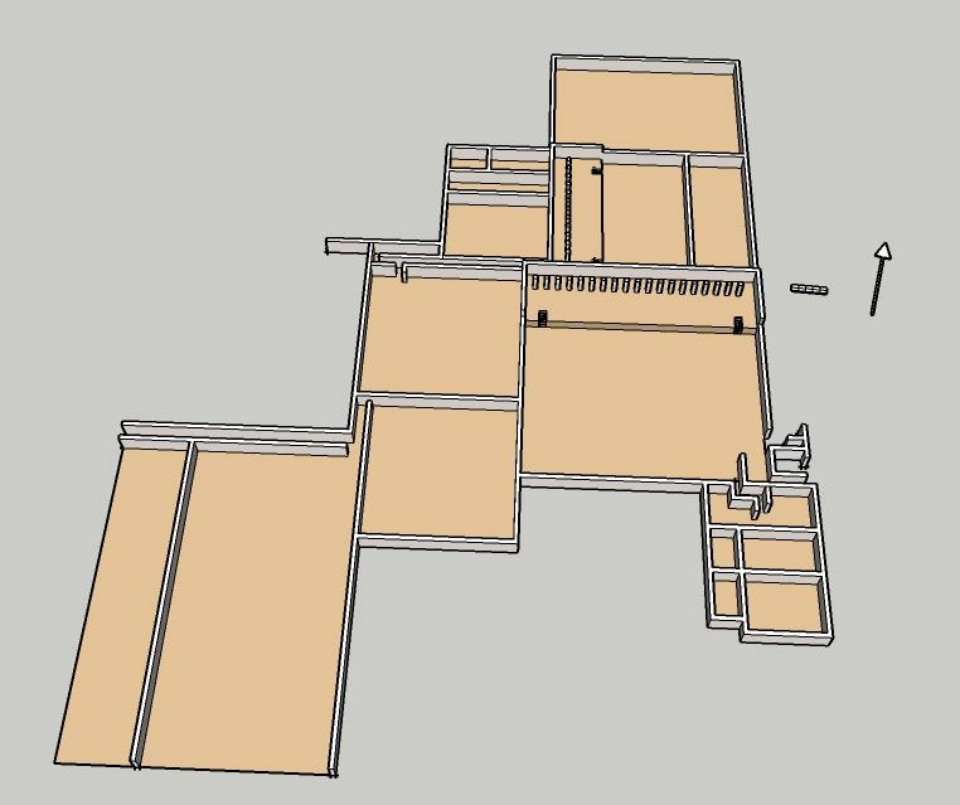

Figure 6. 2D image capture of the SketchUp Pro architectural model of Compound-N (scale = 5 m, arrow points North) (credit: A. Passafume).

Compound-N

The second compound I rendered was Compound N, a medium compound (Figure 6). Compound-N is comprised of a main plaza, Plaza N, fourteen rooms, two benches, and several small hallways/corridors (Figure 7). After using AutoCAD to determine the measurements of Compound-N and using the rectangular shape tool, I drew the plaza as a starting point and the subsequent rooms and benches.

After creating the floor plan, I then used the Offset tool to make the walls of compound 60 cm thick. The walls were then raised using the Push/Pull tool to 2.5 m unless a particular room was indicated as being elevated; if this was the case, then the walls would be raised 2.5 m

in addition to the particular elevation of said room. Bench One was raised an additional 1.5 m tall and Bench Two was raised 1 m high.

After raising the walls and various rooms, I then constructed four sets of staircases. Two were placed on either end of Bench One leading to Plaza N and the remaining two were placed on either end of Bench Two leading to R-1. All sets of staircases were created in the same manner. All staircases were measured 2 m away from their respective wall. All staircases were also measured 1 meter wide; however, the staircases on Bench Two were 1.5 m tall and 1.80 m deep in comparison to the staircases on Bench One that were 1 meter tall and 1.50 m deep. All individual stairs were 20 cm high and 30 cm wide. The staircases on Bench One had six individual stairs and the staircases on Bench Two have five individual stairs. The methods to create the stairs using the Push/Pull tool were the same in the case of creating the stairs in Compound-Q.

After constructing the staircases, I then made the columns on both benches. Bench One has a total of 19 columns; Bench Two has 12 columns. All columns measure 60 by 50 cm wide and 2.50 m tall. Additionally, all columns measure 2 meters away from the back of their respective bench, and the columns closest to the sides of their respective bench's walls are also approximately 2 m away. There is also 1 m of space in between each column. The columns were created in the same manner discussed in the description of Compound-Q using the measuring tool and rectangular shape tool to construct the initial measurements and then using the Push/Pull to elongate the column as well as copying and pasting the columns 1 m apart.

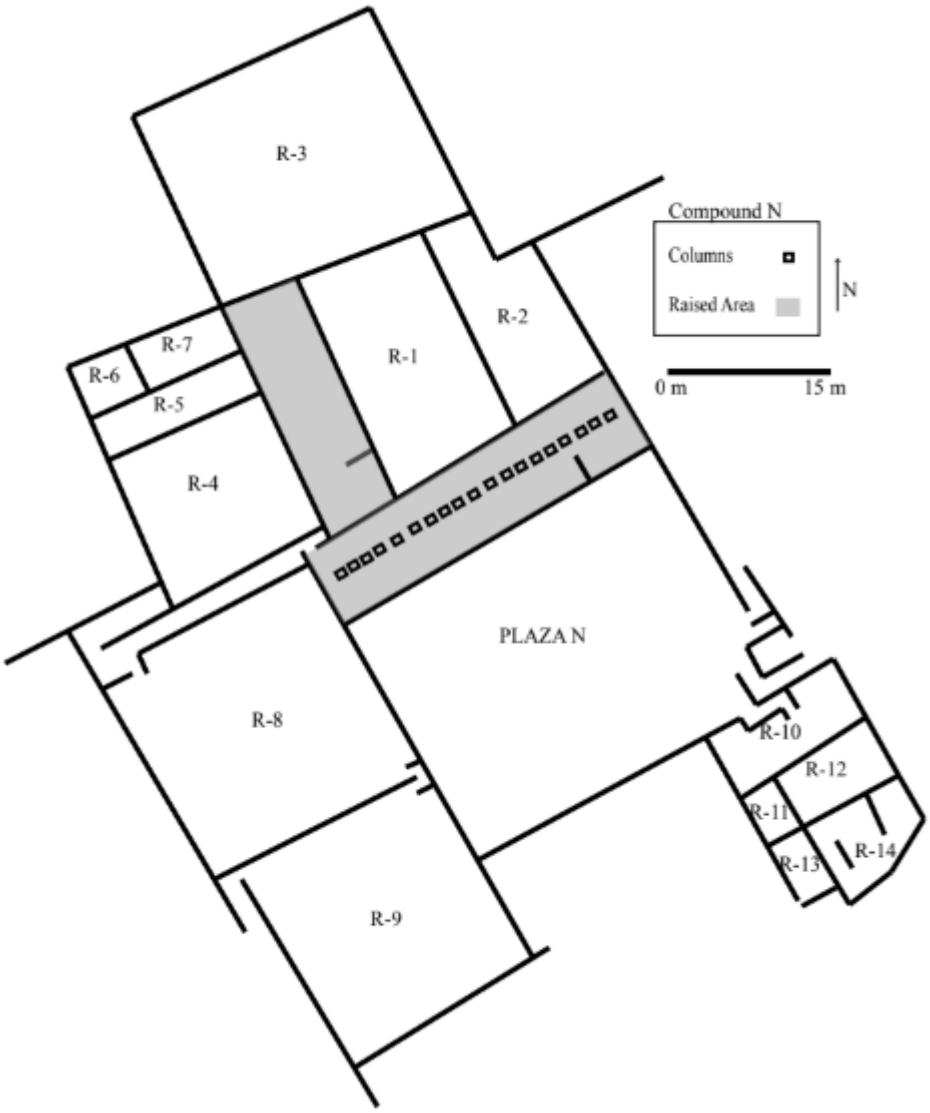

Figure 7. 2D map drawing of Compound-N (scale = 10 m, arrow points North) (credit: A. Whitten).

Navigating Space at Compound-N

Compound-N is located in the southwestern section of Caylán and is accessed through the southeastern corner of the main plaza through a baffled entryway from the street. Compound-N appears to have three main groupings or subdivisions. Extending from the plaza in the

northwestern corner is a corridor that can be used to access Room 8 and subsequently Room 9, which comprises one subdivision.

There are no clear entryways into Rooms 1-7 but, there were mostly likely accessed either from the corridor into Room 4 or from the other side of the main plaza leading into Room 2. Within the groupings of Rooms 1-7 is a raised bench; this bench functions as a central area for these particular rooms. Once entering Room 4, Room 5 is stacked behind it with Rooms 6 and 7 next to each other stacked behind Room 5. Next to these groupings of rooms is the second bench which transitions into Room 1 and then Room 2. Behind the bench, Room 1, and Room 2 is Room 3.

The third subdivision within Compound-N comprises Rooms 10-14. These rooms are accessed through an entryway from southeastern corner of the main plaza. Rooms 10-14 are also comparably smaller than the rest of the rooms within the compound. After accessing Room 10, Rooms 11 and 12 are stacked next to each other behind Room 10. Behind Room 11 is Room 13 and behind 12 is Room 14.

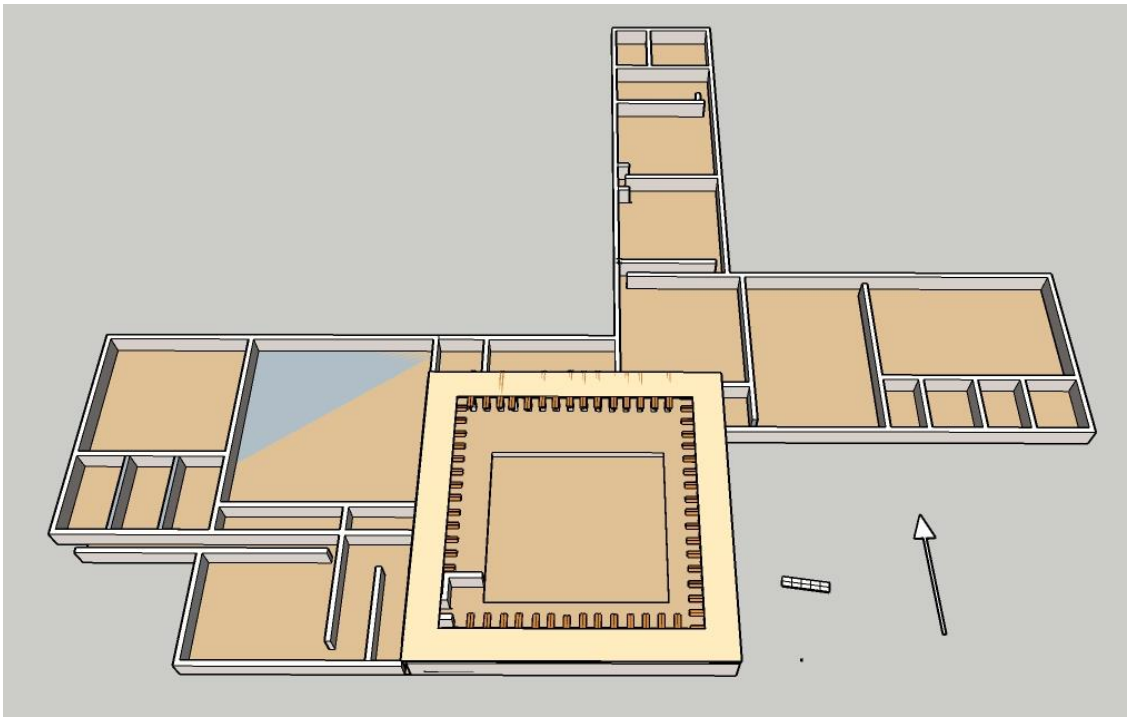

Figure 8. 2D image capture of the SketchUp Pro architectural model of Compound-H (scale = 5 m, arrow points North)

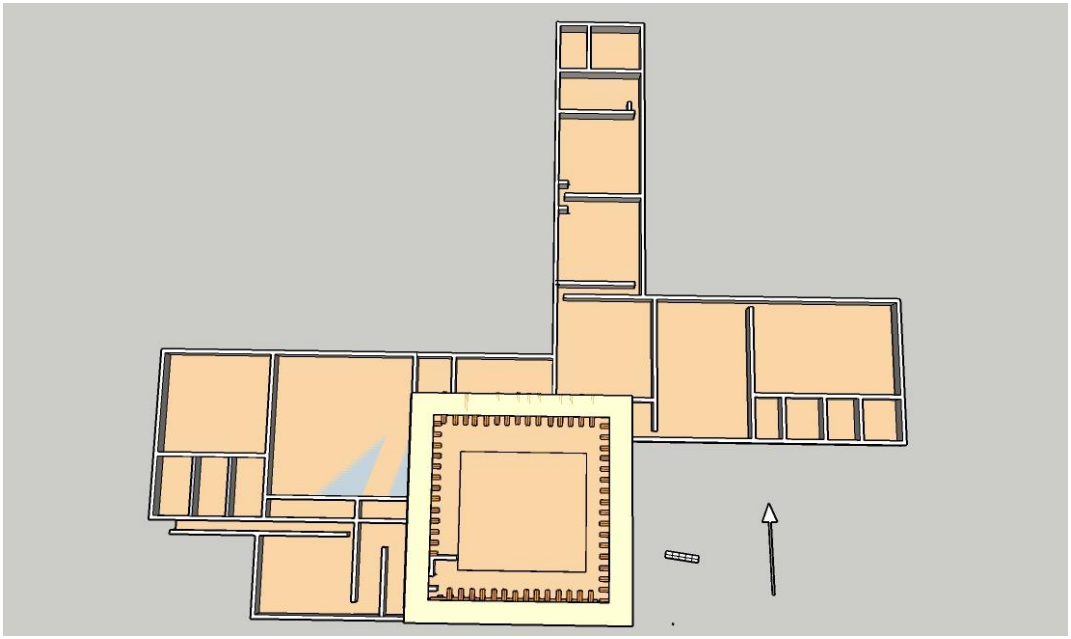

Figure 9. 2D image capture of the SketchUp Pro architectural model of Compound-H (scale = 5 m, arrow points North) (credit: A. Passafume).

Compound-H

The third compound I rendered was Compound-H, a large compound (Figure 8). Compound-H comprises a plaza framed by four benches, eighteen rooms, and several small hallways/corridors (Figure 9). After using AutoCAD to determine the measurements of Compound-H and using the rectangular shape tool, I drew the plaza as a starting point and the subsequent rooms and benches.

After creating the floor plan, I then used the Offset tool to make the walls of the compound 60 cm thick. The walls were then raised using the Push/Pull tool to 2.5 m unless a particular room was indicated as being elevated; if this was the case, then the walls would be raised 2.5 m in addition to the particular elevation of said room. The benches encircling all sides of the plaza were an additional 1 m high.

After constructing the compound as a whole, I then focused on the plaza and the encompassing benches. Each bench had approximately 15 columns lining the side of each bench and measuring 60 by 50 cm wide and 2.50 m tall. After measuring and constructing the columns (using the same process as mentioned in previous discussions of the other compounds), I created four large beams that measured the length of each bench to place on top of the columns and two cylindrical beams that would then be placed on top of the large beam and each column to support the roof I would make subsequently. The four large beams measured approximately 30 m each (dependent on the length of each bench side) and the smaller groupings of two beams measured 5 m long each. All beams were constructed in the same manner by initially using the Shapes Tool to create a small circle and then using the Push/Pull Tool to extend the beam to the desired length.

After creating the support structure for the roof, I was then able to make the roof. The roof covers the entire perimeter of the benches that encircle the plaza but not the plaza itself. To make the roof I first used the Shapes Tool to create a rectangle that is the exact measurement of the length and width of the plaza plus the benches. In order to make the roof only encompass the length and width of the benches, I then measured and used the Draw Tool to make these denotations on the roof. After making the denotations, I was able to cut away the excess roof using the Erase Tool. I also made the roof 25 cm thick using the Push/Pull Tool. After the roof was complete, I then placed it on top of the columns and beams using the Move Tool to position it correctly.

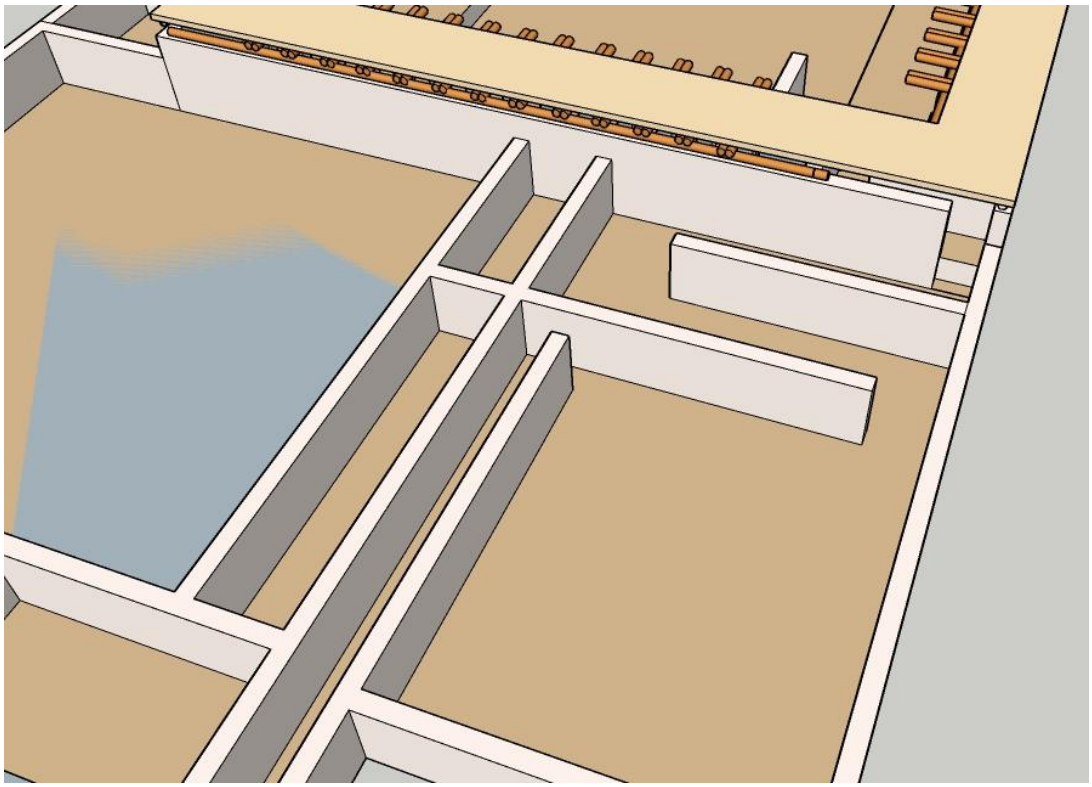

Figure 10. 2D image capture of the SketchUp Pro architectural model of Compound-H showing a baffled entryway (credit: A. Passafume).

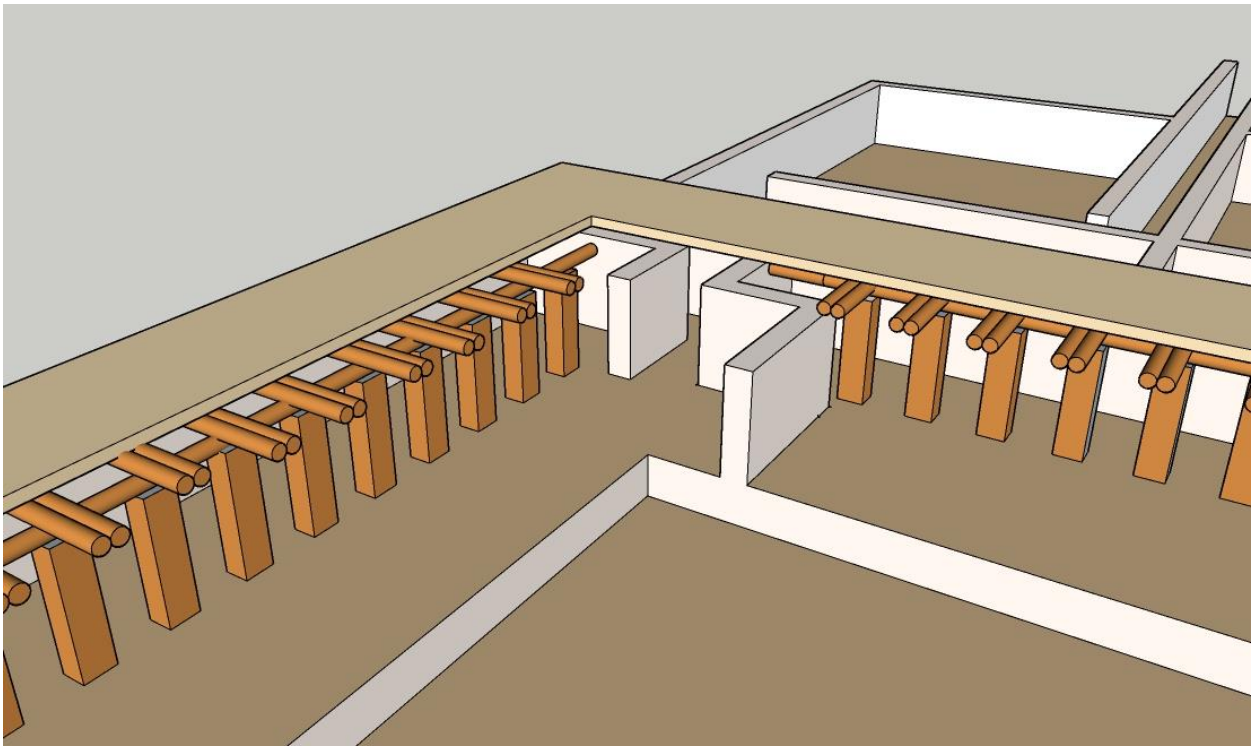

Figure 11. 2D image capture of the SketchUp Pro architectural model of Compound-H showing a baffled entryway (credit: A. Passafume).

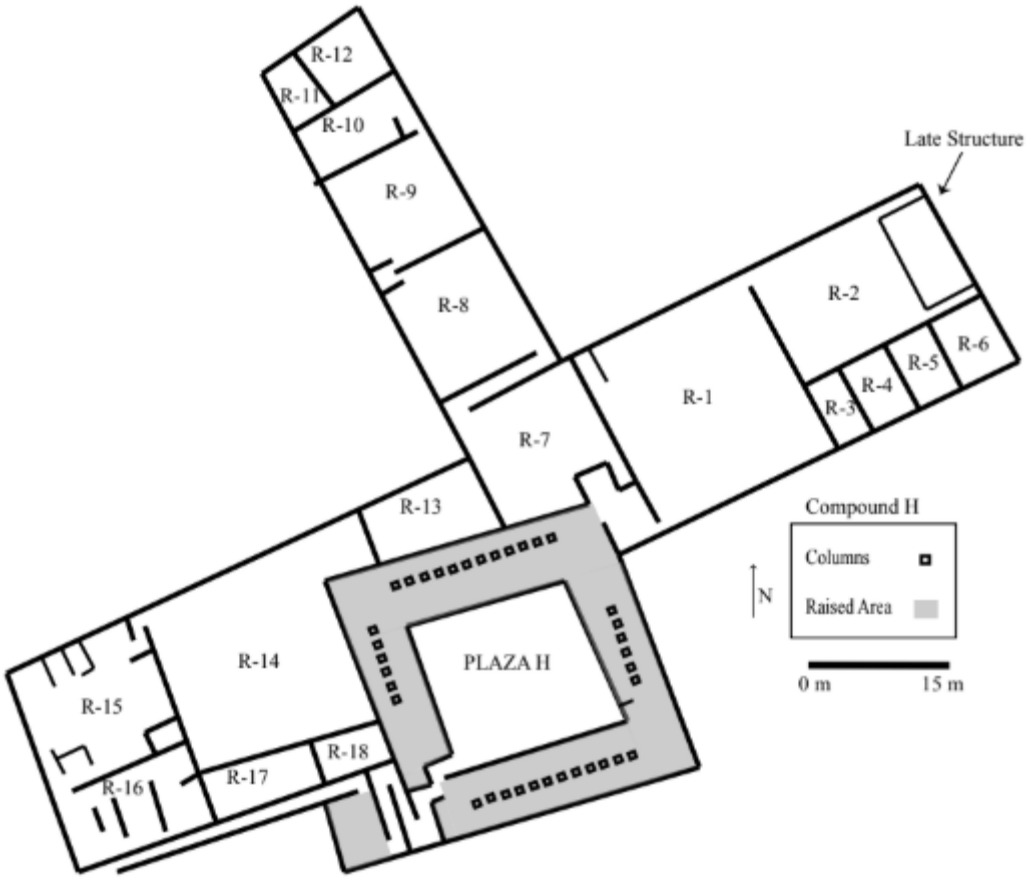

Figure 12. 2D map drawing of Compound-H (scale = 10 m, arrow points North) (credit: A. Whitten).

Navigating Space at Compound-H

Compound-H is located in the southwestern portion of Caylán and resembles a "T" shape. Three distinct groupings of rooms comprise this compound facing from the north, east, and west of the main plaza. The main plaza is encircled by four raised benches. Compound-H is accessed through a baffled entranceway/corridor from the southwestern corner of the plaza (Figure 10, Figure 11). The entranceway comprises a long corridor followed by shorter, twisting hallways to finally access the plaza.

The eastern subdivision, Rooms 1-6, is accessed through the southwestern corner of the main plaza into the southern corner of Room 1. Room 1 leads into Room 2. Rooms 3-6 are much smaller rooms are stacked on top of the other lining the length of Room 2 (Figure 12).

Room 13 lies in between the remaining two subdivisions: Rooms 14-18 facing the west and Rooms 7-12 facing the north. Since there are no clear entrances into either compound, Room 13 could have belonged to either subdivision. Facing the western side of the plaza, Room 14 leads into Room 15 and subsequently Room 16. Stacked behind Room 14 are two small rooms: Room 17 and 18. Branching towards the norther section of the compound, Room 7 leads into Room 8 followed by Room 9 and then Room 10. Stacked behind Room 10 are Room 11 and 12, two small rooms.

Compound-A

The fourth compound I rendered was Compound-A, a large compound (Figure 13). Compound-A is comprised of a plaza encircled by a bench on all sides, twelve rooms, and various hallways/corridors (Figure 14). After using AutoCAD to determine the measurements of Compound-A and using the rectangular shape tool, I drew the plaza as a starting point and the subsequent rooms and benches.

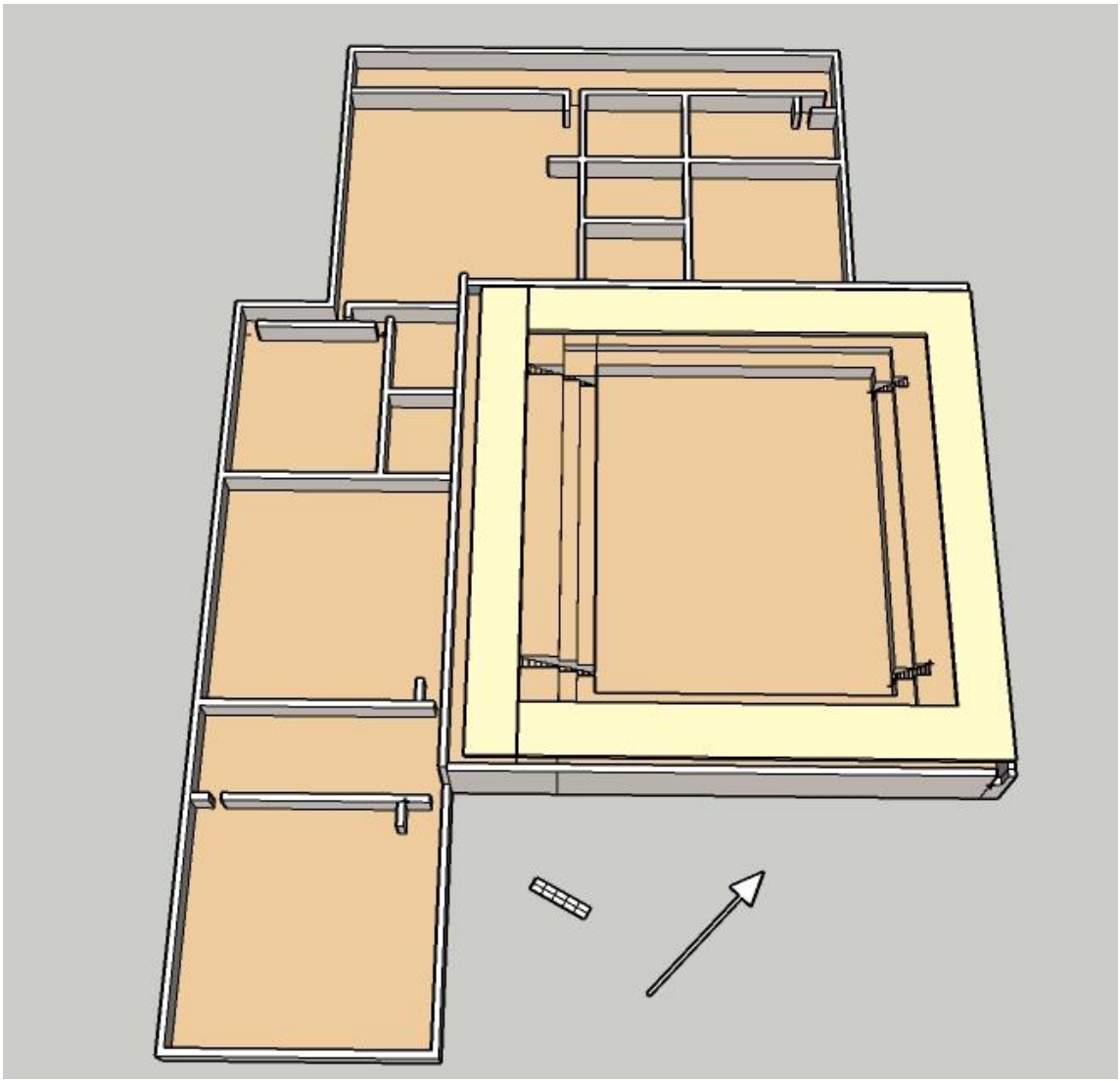

Figure 13. 2D image capture of the SketchUp Pro architectural model of Compound-A (scale = 5 m, arrow points North) (credit: A. Passafume).

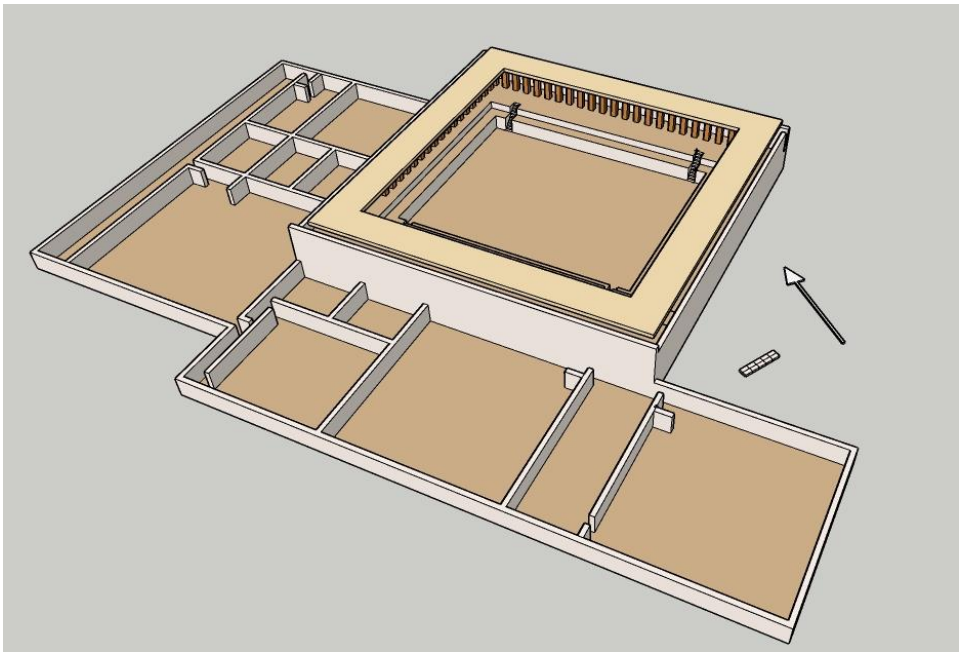

Figure 14. 2D image capture of the SketchUp Pro architectural model of Compound-A (scale = 5 m, arrow points North) (credit: A. Passafume).

After creating the floor plan, I then used the Offset tool to make the walls of compound 60 cm thick. The walls were then raised using the Push/Pull tool to 2.5 m unless a particular room was indicated as being elevated; if this was the case, then the walls would be raised 2.5 m in addition to the particular elevation of said room. The walls of the benches were raised an additional 4 meters due to the increasing elevation of the benches on the inside.

After creating the floor plan and raising the walls accordingly, I then focused on the construction of the stairs within the plaza in relation to the benches. Plaza A and its surrounding benches differ from the previously discussed compounds, because the benches were not raised at one interval but at multiple intervals depending on the specific side of the plaza. For example, the three benches that contain the columns are raised initially 2 m high and then an additional meter creating two layers to the bench. The other bench that contains no columns is raised four

times overall with it first being raised by 2 m and then again three additional times at 1 meter each time creating four layers to the bench.

There are four staircases overall in Compound-A that are located in the plaza/benches. Two staircases are located on the bench across from the bench with no columns and the remaining two staircases are on the bench with no columns. The staircases are measured 2 meters away from the end of each respective bench and were created using the same methods employed in previous discussions of staircase creation. The staircases on the bench with columns has a total of nine individual stairs that measures 1 meter wide and 30 by 30 cm wide. The staircases on the bench with no columns has a total of fifteen individual stairs per staircase that measures 1 meter wide and 40 by 50 cm wide.

After constructing the benches at the necessary heights and their respective staircases, I then created the columns. As mentioned previously, only three of the benches contained columns. The bench opposite the one without columns contains 23 columns and the other two benches has 17 columns each. All columns are 2.50 m tall and 60 by 50 cm wide. Again as mentioned in previous discussion of the construction of columns, the columns closest to the sides of the bench's wall were 2 m away and 2 m away from the back of the wall. The columns are 1 meter apart from one another and created using the Rectangular shape tool and Push/Pull tool.

After the construction of the columns, was the construction of the beams (reeds) and roof. In the case of Compound-A with there only being three benches with columns, only three long, cylindrical beams that measured the distance of each bench was created. Each beam was approximately 45 m long. The grouping of the two smaller beams that are placed on each individual column measures approximately 4 m each. Plaza-A was decorated with elaborate architectural sculptures (Figure 15).

The roof was constructed in the same manner as the roof in Compound-H by creating a rectangular shape the same size of the plaza and benches. The roof also measures 25 cm thick.

Figure 15. Photograph of architectural sculptures from Plaza-A at Caylán (credit: D. Chicoine).

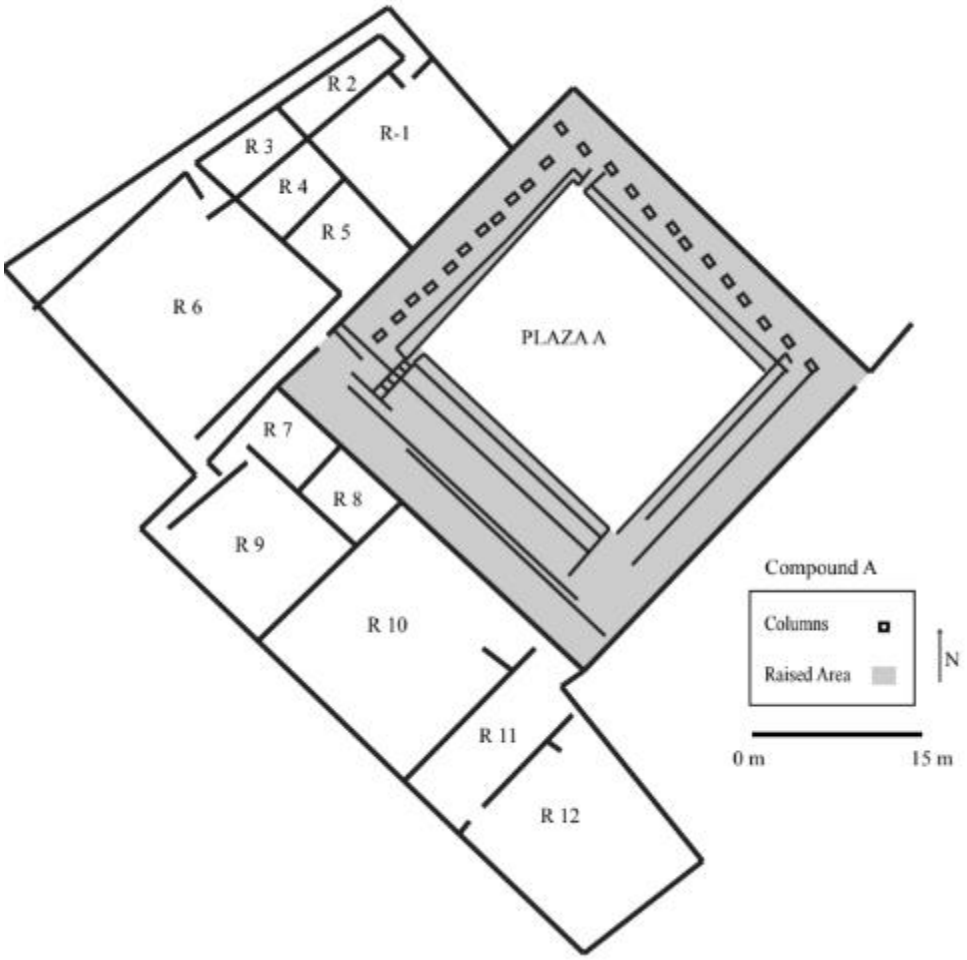

Figure 16. 2D map drawing of Compound-A (scale = 10 m, arrow points North) (credit: A. Whitten).

Navigating the Space at Compound-A

Located in the southeastern portion of Caylán, Compound-A is accessed through the eastern corner of Plaza-A. From Plaza-A, there are two delimitations of space with one living quarters comprising Rooms 1-6 and the other Rooms 7-12 (Figure 16). Exiting Plaza-A to access the northwestern portion of the compound (Rooms 1-6), one arrives in Room 5 where one moves

down a hallway to move forward to Room 6. Lining the back of Room 6 and extending to the back of Room 3 and Room 2 is a hallway used to access Room 1. Additionally, Rooms 4 and 3 are accessed through Room 5 which is significant to note since the rooms are stacked one behind the other and due to their relatively small size could have been used for storage areas. The same holds true for Room 2 located behind Room 1.

Moving from the hallway mentioned in the previous paragraph, one accesses Rooms 7-12 beginning in Room 9. Rooms 7 and 8 are smaller rooms stacked in between Room 9 and the plaza which are accessed through Room 9. Accessing the remainder of the rooms (Rooms 10, 11, and 12) are also accessed beginning in Room 9 and moving from one room to the next through designated doorways.

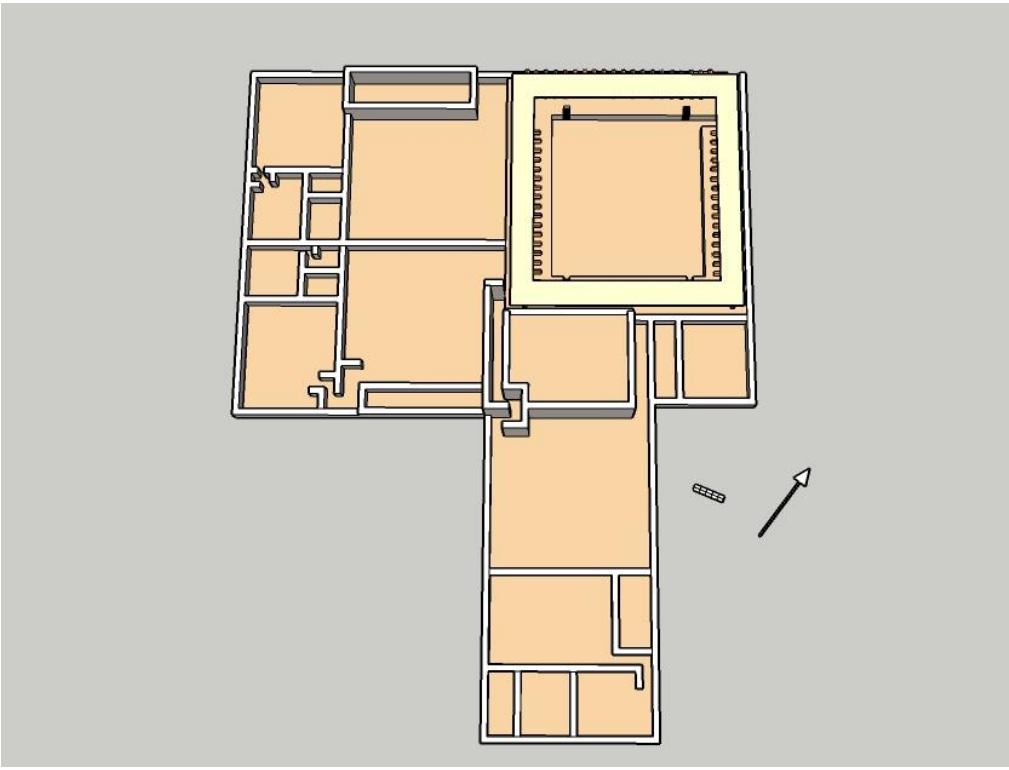

Figure 17. 2D image capture of the SketchUp Pro architectural model of Compound-B (scale = 5 m, arrow points North) (credit: A. Passafume).

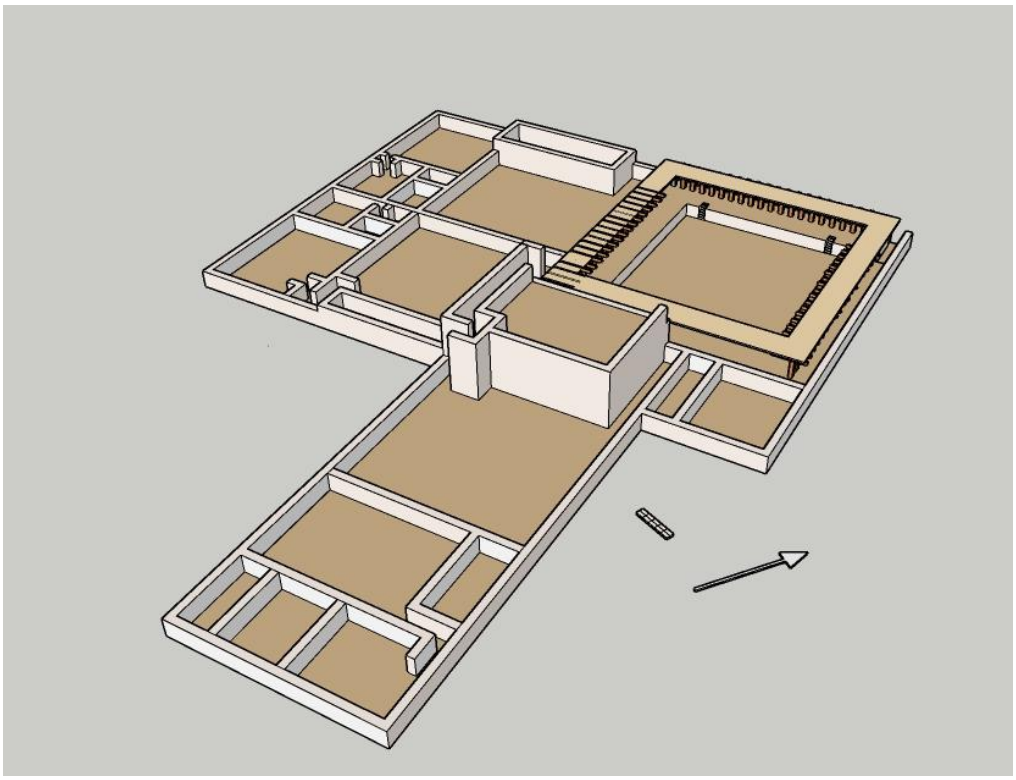

Figure 18. 2D image capture of the SketchUp Pro architectural model of Compound-B (scale = 5 m, arrow points North) (credit: A. Passafume).

Compound-B

The fifth and final compound I animated was Compound-B, a large compound (Figure 17, Figure 18). Compound-B is comprised of a main plaza, twenty rooms (including a mound), and hallways/corridors. The plaza is raised 2 meters on all four sides with three of the benches containing columns. After using AutoCAD to determine the measurements of Compound-B and

using the rectangular shape tool, I drew the plaza as a starting point and the subsequent rooms and benches.

After creating the floor plan, I then used the Offset tool to make the walls of compound 60 cm thick. The walls were then raised using the Push/Pull tool to 2.5 m unless a particular room was indicated as being elevated; if this was the case, then the walls would be raised 2.5 m in addition to the particular elevation of said room. The benches encircling the plaza were raised an additional 2 meters. Room 6 is also raised 6 meters and Rooms 9 and 10 contain a small bench raised 2 meters and 1 meter, respectively.

There are four staircases overall in Compound-B that are located in the plaza/benches. Two staircases are located on the bench across from the bench with no columns and the remaining two staircases are on the bench with no columns. The staircases are measured 2 meters away from the end of each respective bench and were created using the same methods employed in previous discussions of staircase creation. The staircases on the bench with columns has a total of nine individual stairs that measure 1 meter wide and 30 by 30 cm wide. The staircases on the bench with no columns have a total of fifteen individual stairs per staircase that measure 1 meter wide and 40 by 50 cm wide.

After creating the plaza benches and stairs, I then created the columns on the plaza benches as well as the columns on the small benches located in Rooms 9 and 10 (Figure 19). Only three of the benches in the plaza contained columns. The bench opposite the one without columns contains 20 columns and the other two benches have 15 columns each. Rooms 9 and 10's benches have 5 columns. All columns are 2.50 m tall and 60 by 50 cm wide. Again as mentioned in previous discussion of the construction of columns, the columns closest to the sides

of the bench's wall were 2 m away and 2 m away from the back of the wall. The columns are 1 meter apart from one another and created using the Rectangular shape tool and Push/Pull tool.

After the construction of the columns, was the construction of the beams (reeds) and roof. In the case of Compound-B with there only being three benches with columns, only three long, cylindrical beams that measured the distance of each bench was created. Each beam was approximately 45 m long. The grouping of the two smaller beams that are placed on each individual column measures approximately 4 m each.

The roof was constructed in the same manner as the roof in Compound-H and A by creating a rectangular shape the same size of the plaza and benches. The roof also measures 25 cm thick.

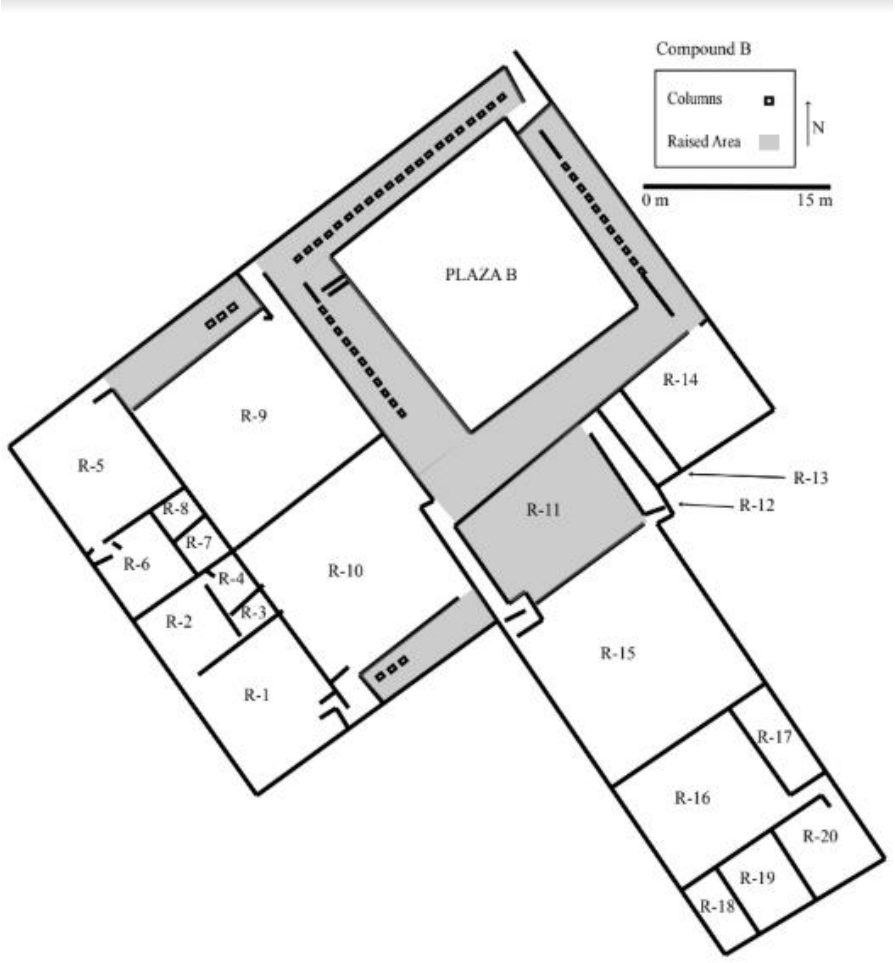

Figure 19. 2D map drawing of Compound-B (scale = 10 m, arrow points North) (credit: A. Whitten).

Navigating Space at Compound-B

Compound-B is located in the southeastern section of Caylán with the entrance to the compound accessed through the northern corner of the main plaza. Compound-B contains three subdivisions: two mirror-like subdivisions southwest of the plaza and the other south of the plaza. One of the subdivisions southwest of the plaza contains Rooms 5-9 and the other contains Rooms 1-4 and 10. The main plaza leads into the northern corner of Room 9 which contains a columned bench along its northwestern wall. The northwestern section of Room 9 connects into Room 5. From Room 5, Room 6 is accessed. Rooms 7 and 8 are stacked next to each other in between Room 6 and 9 and were most likely accessed through Room 6.

Rooms 1-4 and 10 mirror the layout of Rooms 7 and 9 but lack a clear entranceway into the subdivision. Room 10 contains a raised bench with columns along its southeastern wall. Room 10 leads into Room 1 with a baffled entryway which subsequently leads into Room 2 and Rooms 3 and 4 which are stacked behind Room 2, much like Rooms 7 and 8 behind Room 6.

The third subdivision comprised Rooms 11-20 and is accessed by a hallway extending from the main plaza into Room 15. From Room 15, Rooms 11-14 can be accessed from the northern section of the room with the remaining rooms (16-20) accessed through the southern portion of Room 15. Room 11 is a mound with Rooms 12, 13, and 14 subsequently behind it. Room 17 is a smaller room attached to Room 16 which leads into Room 20 and subsequently Room 19 and 18.

Animating the Compounds

Animating each compound utilized the same process and can be discussed as a whole. To create animations, you first begin by making different scenes from different viewpoints. Scenes are made by clicking the Windows panel and then selecting the scene option. From there, the scene option displays a plus and minus sign to either add or remove a layer. By adjusting the viewpoint using the navigation tool, a new scene can be created by then selecting the plus sign button and thus creating a new layer. The more layers there are, the more fluid the animation will be. To view the entire animation, right-click on any scene and then select "play animation". Additionally, viewpoints within an already created scene can be adjusted by clicking on the particular scene and selecting the "update" option. To create the duration of the transition between the scenes, the settings menu was selected from the animation dropdown on the "view" button. The transition time between the scenes was selected for one second.

Coloring the Compounds

All compounds being composed out of the same materials also have the same colorings. The color of the compounds was determined through excavations at Caylán conducted by David Chicoine and his team. Using the color samples from the physical compounds, the colors were then able to be matched digitally and are as follows in SketchUp: Rooftops = wheat, Walls = seashell, Reeds = Peru, Floors = Tan. The colors were determined by looking at field photographs provided by Chicoine in which the different construction materials could be observed. Using the eyedropper tool in Adobe Photoshop, we were able to closely match the colors of mud mortar, plaster, reeds, floors, and rooftops.

To color a specific item in Sketchup, the Paint Bucket tool must be first selected from which the desired color is chosen and the specific entity to be colored is then selected.

Discussion: The Social Logic of Space at Caylán

The organization of architectural space within a built environment can reveal and influence the social organization within a culture or community, and vice-versa. In the anthropology of the built environment and architecture, this approach has been called the social logic of space and studied under what scholars call "spatial syntax" or "spatial grammar" (see Hillier and Hanson 1984). Through the lens of Caylán, contemplation will be made in relation to the association of space and social organization in a residential setting and larger urban context.

Society and Space

Spatial syntax is a reflection of the relationship between social organization and community. Spatial syntax as defined by Hillier and Hanson describe the "combinatorial structures" of society that in turn become manifested in the "artificial world" (Hillier and Hanson 1984). Architecture can function as a physical indication of the values or societal organization of a community in a specific time and place with changes in architecture also being indicative of societal changes (Hillier and Hanson 1984: 48). Architecture is able to interrupt space in order to bring "meaning to the spatial dimension" (Glassie 2000:21). The study of architectural remains also proves useful in classifying groupings according to time, location, and/or societal differences.

Human societies, in a sense, function as spatial phenomena in their occupation of space on Earth and create their own distinct spatial order. Human societies operate in a spatial form

and create spatial order in two fold. First through interaction between one another generating societal organization and second by articulating these interactions through physical means---architecture (Hillier and Hanson 1984: 26-27). It is through spatial order that cultural differences can be denoted from one societal formation to another. Society and space can be so intermingled that significant change in spatial form can lead to change social order and vice-versa: "Different types of social formation, it would appear, require a characteristic spatial order just as different types of spatial order require a particular social formation to sustain them" (Hillier and Hanson 1984: 27).

Spatial Organization at Caylán

The five of forty-three compounds from Caylán that I have rendered of the excavated compounds operate with the general layout of the compounds consisting of an entrance to the main plaza with entrances then leading into the patios and then smaller rooms. The overall shape of the compounds differs as well as the size of the rooms within the compounds; room size also differs among compounds that fall into the same size category.

Within the compounds themselves, there appears to be three segregations of space. The first being the plaza which functions as the most public space within the compound due to its main entrance into the compound, benched sitting areas, and columns supporting roofs to provide shade. The second segregation of space within the compound after the plaza is the patio, the rooms succeeding the plaza of the compound. The patio operates in a less public/communal space than the plaza due to the entrance leading into patio only be able to be accessed through the plaza. It is important to note that with compounds consisting of more than one patio there was not necessarily a connecting area between the patios indicating potentially more private

spaces. These separated, more privatized areas could have been used to host more than one family unit in a compound. The third segregation of space would be the smaller rooms. In most cases, these smaller rooms were covered in some capacity.

Within Caylán's urban core, the larger the compound could correlate with the larger the social groupings residing in the compounds. Additionally, the larger the compound could also denote a higher social ranking due to the materials and resources needed to construct larger compounds; this in turn can suggest the presence of social variance among Caylán's urban core.

Concluding Thoughts and Future Directions

My thesis focused on the rendering of 2D mappings into 3D animations of select compounds that had been excavated previously at Caylán. My goal is to grant a better understanding of the layout of the compounds and the social organization of Caylán through the 3D images. Rendering 2D mappings of excavations into 3D images is beneficial because it provides a more nuanced look into how space is used in architecture and therefore a more nuanced look into the social dynamics that were in play at that particular time and location of the built environment in question. With the understanding that the built environment is indicative of social or cultural organization, values, or expectations, then taking architectural remains to create 3D renderings of sites can allow for a more in depth analysis and study of a particular community. Additionally, 3D renderings can allow for the opportunity to make cross-cultural comparisons in regards to how communities with similar societal values articulated this into their architecture or how communities with similar built environments or architectural styles articulate their societal organization.

Further research can take the form of rendering more if not all 43 of Caylán's excavated compounds to create an even more holistic understanding of the spatial organization. Additionally, renderings of the other sites in the Nepeña Valley into 3D images could be utilized to make more in depth cross cultural comparisons in reference to spatial formation and social organization.

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