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Final Project

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**The Aquatic and Terrestrial activities of pre-Columbian Bolivian Amazon**

**Goals:**

This project’s broad goal was to understand the process of documenting pre-historic artifacts and ways of life. Representing the prehistoric culture is vital in understanding the past and studying history. In this project, we explored the role of 3D modeling in presenting pre-Columbian activities and artifacts by creating 3D models capturing the the daily activities of pre-Columbian people. Having interaction and clear representation of the past is a fun and interesting way to teach about the past and incite curiosity in those who wish to learn. This project depicts everyday tasks and actions of native wetland inhabitants in pre-Columbian Bolivia with present day ethnography. The project works to virtually depict canoeing, walking, carrying, and interacting as it was done by indigenous groups in the past.

**Introduction:**

The study of the past and contemporary structures is relevant to contemporary anthropology. These features are physical results of patterned human activities and their interactions with the environment (Erickson and Walker 2009). Our project’s main goal was to show the viewer a glimpse into the daily life of people in the past and how they interacted with each other. Our project’s process was to research, model, motion capture, and animate actions relating to pilgrimage, procession, and everyday experience. Most of which were everyday actions such as poling a canoe in pre-Columbian canals between forest islands, people walking to depict the pedestrians on causeways, which are raised earth walkways, and people socializing and interacting on their journeys to visit kin and colleagues in neighboring villages. The specific actions included aquatic movement such as poling a canoe, paddling a canoe, terrestrial movement such as walking and interactions between the people. We worked together as a team to bring these activities to life. Emiliya and Sang learned the program Autodesk Maya to create the 3D models and animations. Emiliya researched the basketry of modern and ethnographic people to aid in modelling the pre-Columbian carrying devices. Sang researched objects, including those in the Penn Museum and ethnographic accounts, for reference to create the paddle, canoe, and pole in pre-Columbian Bolivia. Tunika did research about the social interactions and day to day activity of historical, ethnographic, and pre-Columbian peoples so that they may be expressed and showed in the reconstructions of the past. She learned motion capture to animate the activities.

For the technical resources, the program Maya was used to 3D model the objects. The Autodesk Maya can be used to create 3D virtual objects by “3D modeling.” These objects can be exported and combined with a 3D virtual character rigged with motion capture movements in Motionbuilder to create an animated scenario in the multiplatform game development tool, the Unreal engine. For the Motion Capture, Tunika dressed in the motion capture suit and acted out the scripted scenarios for walking with two different types of baskets, poling and paddling a canoe and interacting with another person. The female character model provided by Professor Norman Badler was combined with the motion captured movements using Autodesk MotionBuilder. The end product hopefully will consist of short videos which have been edited and captured in Unreal engine, similar to a third person video game.

**Process:**

Initially, our group worked to depict the daily and ritualistic activities of the people on Isla del Sol. Soon we realized that the project was overly ambitious with the time constraint and the lack of knowledge about the specific locality. We broadened the scope of the project to show how the indigenous peoples of pre-Columbian Bolivian Amazon executed daily activities. After our first meeting with Professor Norman Badler, we learned the possible ways to execute and capture the motions we had in mind and in subsequent meetings with Professor Clark Erickson, the project continued to evolve. During a meeting with Professor Erickson on November 22nd that the final content of the project was fully realized. Professor Erickson helped us decide that the best course of action was in capturing the everyday activities of the pre-Columbian people: canoeing and walking, potentially depicted with tools and baskets. During the meeting, Professor Erickson explained specific information about the objects to be modelled and the motions to be captured for animation (Lee, 2016: Figure 1), and offered resources to learn more; for example, the *Handbook of South American Indians* (Métraux 1948) contained pertinent items about the canoe. The meeting helped us better understand what our project would involve in terms of research, labor, and complexity.

Keeping with the idea of depicting daily interactions, we chose to work on motion capturing and animating activities such as basic conversation and greeting, carrying objects (particularly baskets), poling and paddling a canoe. The motions to be modelled will be explained in fuller detail in the section *Motion Capture*.

**Gender Roles in Pre-Columbian Bolivia:**

In indigenous societies of the Matto Grosso, the women are the “authoritative persons” in the village (Petrullo 1932:169). Succession and inheritance is matrilineal. The men consult their women in everything and refuse to do anything unless they agree (Petrullo 1932).

The making of farina (processed manioc flour) and biiju (manioc bread) is the responsibility of the women; while, the gathering of wood, packing of the farina for storage, making of baskets, and other occupations were done by the men (Petrullo 1932). Fishing and hunting were considered a “man's job,” and the women assisted in steering the canoe and light paddling but were never seen poling (Petrullo 1932). When actually travelling, the man always paddled in the stern, and the woman never paddled if two men were in the canoe. When travelling on foot, the loads were shared by the men and the women in proportion to their physical prowess. In short, men, women and children mutually helped one-another (Petrullo 1932; Métraux 1948).

**Basketry, Backpacks and Visualization (Emiliya Al Yafei):**

Throughout the indigenous groups of Bolivian Amazon, various materials and uses for woven baskets have existed. Materials used in weaving tended to differ by group as well as purpose - for example, the Yalawapiti made the framework of their carrying baskets out of wicker, as well as of grass, palm leaves and splints. For temporary purposes, baskets were quickly made from a single palm leaf by braiding the leaflets together. These baskets were made in all sizes, some of the larger ones measuring over a meter in length, and were carried on the back, with a tumpline, also made of bark fiber, across the chest and upper arms (Pertrullo 1932: 150), as can be seen in figures 5 (Englebert, 2014) and 7 (Erickson).

The Moré made a type of basket which was constructed by intertwining the leaflets of a palm leaf on either side of the woody leaf-stalk, producing something which somewhat resembled a mat. The woody portion running down the middle of the leaf stalk is then cut away and the mat doubled, whereupon, along the line where the edges meet, the leaflets are interwoven so that a cylindrical basket is formed. The bottom of the basket forms a raised ring (Métraux 1948: 402).

The Mojo on the other hand made boxes of reeds twined together with cotton. Modern Mojo, as well as the Guarayu, make flat circular trays and round baskets with overlapping lids in twilled basketry. Large carrying baskets with a lattice-type hexagonal weave are also made (Métraux 1948: 412). Much like the Yalawapiti, the Sirionó produced carrying and storage baskets of a temporary kind which were plaited from the leaves of the motacu palm.

The Chacobo also used arrow-grass as basket weaving material (as well as for making arrow-shafts). However, this type of grass was in low quantity, or at least rare, on the Rio Guapore. Other materials used for basket weaving also included palms with pinnate leaves Motacu, Cusi, Chonta, and many more (Nordenskiold 1924: 5).

Woven baskets were extremely versatile as they could be made of a variety of materials and formed into many shapes. In most cases, baskets were made for transporting goods, such as farmed crops and wood. Baskets made of motacu palm would be used to hold crops after harvest for longer-term storage. The Chiquitos-Mojos groups often settled in one location and thus gathered a large portion of their resources through farming - as a result, they used baskets for both collecting and storing resources. Baskets were also made for fishing - for example, the Mojo made them in a conical shape, open at both ends, and would throw the baskets over the fish to catch them (Métraux 1948: 412).

Baskets were, however, also used outside of storing and collecting resources and as a method of transportation. For example, the Arikem used special three-legged, feather-trimmed baskets to hold the skulls of famous chiefs (whilst the skeleton was enclosed in a bark-cloth bag). These relics were decorated with feathers and shells and were hung in a hammock under a jaguar skin. Other baskets contained charred human bones (Métraux 1948: 407).

When initially starting on the project, I looked at resources which were most specific to both the location we were working on and the topic. My first source was a basket made by the Ultimas (Erickson: Figure 2), provided to us by our instructor, Clark Erickson. As seen in the image, the basket was made into a cylindrical shape with a flat bottom using dried palm leaves. Such a basket would have most probably been used for either storing or collecting resources.

Provided with a close up image of the basket texture, I started by cropping and editing the photograph using Photoshop, to remove cast shadows and light created by the flash photography. Once I had my texture set up, I began working on modeling the basket.

My initial method for building the basket was to outline the edge of the basket in Maya and then use the revolve tool to turn the outlined edge into a 3D shape. Although the shape seemed perfect at first, I soon realized that no matter which texture I added , the basket object would become translucent. After contacting the teaching assistants about this problem, I learned that this issue occurred because using the revolve tool to create the shape inverted the normals in the object. Although I tried fixing this problem, it persisted, and I was instructed to rebuild the shape from a cube or rectangular prism.

to create the same curved shape of the basket, I used a rectangular prism which I extruded inwards and then smoothed out to create a concave object. When viewed inside of the basket, the texture stretches out and deforms (Figure 3). This occurred as a result of the fact that the basket is a more complex shape and cannot unfold as a simple rectangle - despite this, the UV (Figure 4) was similar to that of a cube, and thus certain sides compressed or stretched out. The TAs recommended that the best option would be to fill the baskets with farmed crops such as manioc, sweet potato, and maize, which were all staple foods of the area.

Some groups, such as the Yanomami, would create larger baskets which they would carry on their backs, similar to “backpacks.” I used a photograph of a Yanomami woman which shows a kind of basket that resembles a more solid backpack, with a tight weave for stronger hold, arm bands, and a head-strap for better balance (Englebert, 1982:Figure 5). The first backpack-like basket that I made was inspired by this image. The making of this basket was similar to that of the previous one, with a similar shape, but deeper and larger (Figure 6). I gave the basket a more conical shape (narrower at the top than at the bottom), and used the same texture as I used in the previous basket, since the two seemed to have similar right weaving. in the future, I would like to try to edit the UV so that I can draw on the patterns shown on the basket in the image.

The third basket I made references a provided image (Erickson: Figure 7). This backpack appears as more of a basket with arm handles, and requires the objects inside of it to be tied together. to properly show the loose weaving, I tried to make a transparent mesh in Photoshop (Figure 8). In Maya, the transparency of the texture renders the entire object transparent (Figure 9). At first, I thought this was a problem with texture layering, and tried to fix it in Hypershade, without success. However, I later learned that when rendered, the basket came out perfectly solid (Figure 10). Unlike with the other two, I managed to fix the stretching of the inside of the basket by creating a separate UV for each of the inner planes.

**Visualization of the Canoe, the Paddle, and the Pole (Sang Lee):**

*Significance of causeways and canals in pre-Columbian Bolivia:*

The notion that the Amazonia is a pristine and natural environment appeared after the European conquest of 1492. In the centuries beforehand, pre-Columbian Amazon natives transformed the natural wetlands of the Amazon into productive landscapes through anthropogenic means (Erickson i.p.). The wetlands had raised fields, fish weirs, water management structures, settlements, causeways, canals, artificial river meander cut offs and inter-river channels. Some of which are still used by the locals. In this sense, the native Amazonians domesticated the environment through landscape engineering and cultivation which lead to changes in the animal, plants and ecotones of the region (Erickson 2006). The flooded savannahs had both causeways for pedestrians and canals or “canoe paths” for transportation. The canals were helpful in moving people, harvest and distant resources such as timber and firewood as the forest islands were relatively treeless (Erickson i.p.). Canoes were the main form of transportation in pre-Columbian Bolivian Amazon for this reason. Interestingly, contemporary Amazonian indigenous people are “canoe cultures,” preferring to live close to bodies of water that provide transportation and resources. They travel long distances in canoes because they are efficient in time and load capacity. (Erickson i.p.).

In addition to form of local and inter-regional transportation, the causeways and canals were also used as hydraulic structures. A causeway would impound water to keep water level consistent while a canal would distribute water for drainage or store water for irrigation. The pre-Columbian Bolivian natives used raised fields as platforms for crops and canals for platform water drainage and water storage (Erickson i.p.).

The best example of studied causeways and canals is the Baures Hydraulic Complex of the Llanos de Mojos located in northeast Bolivia. The landscape of Llanos de Mojos consists of seasonally inundated grassland savannahs, rivers, wetlands, lakes, palm, gallery forests, forest islands and canopy forests (Erickson 2006, 2009). The region is naturally covered with shallow floodwater during wet season. During dry seasons, water becomes scarce. The lack of nutritious soil and alternating water levels make farming difficult (Erickson 2006). The pre-Columbian inhabitants changed this landscape to fit their needs. They built settlements, ring ditches of different shapes (Erickson 2009), gardens, orchards, and farms on forest islands, which were high grounds produced by eroded parts of the Brazilian Shield (Erickson i.p.) which rise a meter or two above the surrounding land (Erickson 2009). They had networks of causeways and canals, most straight and radiating from a common destination, through savannahs and wetlands to connect the forest islands. Both Nordenskiold (1916) and Denevan (1966) write about the use of canals to cut across the mouth of meander rivers to save time in making way down a river. Since the rivers of the central Llanos de Mojos tended to flow south to north, the inhabitants created channels between rivers and other natural water bodies to make east-west travel easier (Denevan 1966; Nordenskiold 1916).

The Major Causeways and Canals range in width from 1 to 10 m and range from 0.5 to 3m tall. Most extend up to 7.5 km (Erickson 2009). The construction was done using wooden digging sticks and baskets or carrying cloths that were used to move earth. Since the canoes were used to move heavy agricultural produce from field to settlement and allow people to move with game, fish, construction materials and firewood, the canoe paths had to be direct. The radial patterns is most likely a result of the cultural beliefs of the region. For example, circular plaza villages dedicated to rituals are at the center axis of straight roads (Erickson 2009).

The overabundance of Major Causeways-Canals are a testament to massive community labor and pride which may have been driven by competitiveness between communities. The social, political, economic and ritual aspect of the Bolivian societies was based on alliances, feasting, labor, trade, raiding and warfare. The causeways and canals was an efficient way to facilitate social processes (Erickson 2009).

The Minor Causeways and Canals are laid out straight and short. Most consisted of shallow canal with low causeways alongside. These were most likely used as canoe paths, for paddling or poling large canoes across shallow savanna during the wet season. During the dry season, these shallow channels could have been used as routes for pedestrians through the savannah (Erickson 2009). The dragging of large canoe through the shallow water of the savannah could have aided in creating these minor causeways and canals.

The majority of the Major and Minor Causeways-Canals do not cross or intersect but when they do, one stops at the juncture as there is already a pre-existing structure (Erickson 2009). There are cases where the Major Causeways-Canals intersect the Minor ones, indicating that the Major Causeways-Canals were built after the establishment of many Minor Causeways-Canals (Erickson 2009). The landesque capital most likely formed through accumulation over many generations (Erickson i.p.).

Canoes were also used for hunting during the wet season. Animals fleeing into water were easily taken by being surrounded by canoes (Erickson i.p.). In other cases, a hunter would simply paddle up to game animals such as peccaries, tapirs, deer and agoutis that are attracted to the palms, and kill them with a blow to the head (Erickson 2006). Canoes were also used for fishing. The Mojo would attach a cow skin to the gunwale of a canoe and, by striking the water with poles, they made the fish jump against the hide and fall into the canoe. One person would mind the paddle and steer while another would fish (Métraux 1948).

*Types of canoes:*

A variety of canoes were used by different groups of people. The types of canoes varied in size and material.

The dugout canoe is a canoe carved out of a log, either cedar or cottonwood, either a felled one or a driftwood. The inside of the canoe is made by softening the inside with fire and then carving with an adze-like tool, most likely made from stone, bones or teeth of animals. The Moré and Huanyam had agouti incisors hafted to a stick, with piranha teeth or with bird bones. The Mansi carved wood with piranha teeth (Métraux 1948). The large dugout canoes, often more than 30 feet long, were able to carry more than 30 men and were used for crop transportation, long voyages and warfare. The smaller ones, dugouts or bark, were used by fisherman or was used to navigate the rapids (Métraux 1948).

Bark canoes are made from a strong and large piece of bark (Métraux 1948: Figure 56). A procured bark is stretched and molded with fire and poles to keep it in shape.

According to Petrullo (1932), the Bakairi children are taught to paddle from a young age. The paddler uses his paddle from one side to the other every two strokes but steering is accomplished more by the bowman. The stern paddle came to navigate the canoe when the the bowman had to pole the canoe when going up the stream (Petrullo 1932). The paddle was often used to navigate rapids while the pole was also used to navigate the canoe through shallow and slow waters. For example, the artificial canals in cross-sections were narrow and shallow, which led to using long poles in standing position to propel the canoe (Erickson i.p.).

The Bakiri used Jatoba trees for their bark canoes. These canoes are flexible and sturdy enough to withstand capsizing and perforation. The men do not eat anything before searching for the tree because they believe if they were to eat, they would never find the tree and even if he did, the bark would not be appropriate for a canoe (Petrullo 1932). The procured bark is formed into a canoe by a fire on its inside and using poles to wedge the canoe. Cross pieces prevent the sides from bending inwards. The canoe is shallow and flat bottomed. The bow is open and clay is used along the edges to keep out water. The stern is raised but water enters easily (Petrullo 1932).

The Moré dugouts are about 33 feet long and are paddled with narrow paddles without a crutch at the handle. The modern craft of the Mojo have a sharp bow and a flat stern. Paddles are 5 feet long and have a crotch at the handle. They also have the pelota or the bull-boat made of reeds or rods and ox hide. The Pacaguara traveled in bark canoes or in dugouts big enough to accommodate eight people. The Yamiaca use both dugouts and rafts. The Móvima had dugout canoes about 30 feet long which they propelled with narrow paddles. The Tiatinagya dugouts are 33 to 50 feet long and 15 to 28 inches wide. The Chimane have both rafts and dugouts but usually travel on rivers in dugouts which are poled, and paddled only when navigating rapids. The canoes are staked to the sand by a stick through a hole in the bow (Métraux 1948). Tacana have both rafts and dugouts. Tiatinagua dugouts are 33 to 50 feet long and 15 to 28 inches wide. They also have balsas consisting of two logs fastened together by chonta-palm pins (Métraux 1948).

*Process of making the 3D model of the canoe, the paddle and the pole:*

Since canals were a large part of pre-Columbian Bolivia, I chose to create 3D models of the dugout canoe, which is ubiquitous for its variety of uses. The inspiration for this 3D model of the Chimane canoe came from the photograph of a local dugout canoe provided by Professor Erickson (Erickson: Figure 11). I used Autodesk Maya for the 3D modeling. For my first attempt, I tried to make a long and narrow canoe that fit the length of a Chimane canoe (Figure 12). I was able to create a low step at one end of the canoe on which a person can stand and pole the canoe forward. However, this first attempt was not successful in capturing the curve expected of a canoe carved out of a tree log. The prototype 3D canoe needed a curve to the underside and at the end like a cylinder cut in half. I attempted several times to recreate the curve. I succeeded on the fifth try by working from a orthographic side view of the 3D model. I used an illustration of a Chimane canoe from the Handbook of South American Indians as a reference for the steepness of the curve (Métraux 1948: Figure 67). I superimposed the illustration on the 3D model and inserted five edge loops to divide the underside into sections (Figure 13). From the side, I could select the vertex points of each section and move them in a stair-like manner to create a rough arc. For the texture of the canoe, I selected gray wood to show the discolouration of the wood after long periods of exposure to the elements.

For the paddle, we had visited the University of Pennsylvania Museum of Archaeology and Anthropology (Penn Museum) to take photographs of an Eskimo paddle from western Alaska (Onnekikami: Figure 14). However, Professor Erickson found a more suitable canoe paddle that was collected from the Kuikutl from the west bank of lower Kuluana river collected by Vincente Petrullo during the Matto Grosso Expedition (Erickson: Figure 15). I used this paddle as a model on which to create my virtual 3D paddle. The paddle was easier to virtually model than the dugout canoe. To create the blade of the paddle, I started out with a flat and wide cuboid. For the body of the paddle, I started out with a long and narrow cylinder. For the grip of the paddle, I started out with a blunt 2 x 2 x 4 cuboid. The three shapes were aligned in a straight line like a rough approximation of a paddle (Figure 16a). When I auto-smoothed the paddle to make it more rounder, the grip failed to attach to the body of the paddle. Hence, I moved the grip further inwards (Figure 16b). This time, the auto-smooth function successfully smoothed the object (Figure 17). I picked warm wood for the texture to show less elemental damage to match the provided photograph (Figure 18).

For the pole, I referenced the videos uploaded on PennBox by Professor Erickson (Erickson: Figure 19). The video is of the local people poling and paddling canoes, navigating the waters of Bolivian Amazon with Professor Erickson’s archaeological team. From this video I extrapolated how long and thin the pole was relatively to a human. I started out with the default cylinder provided by Autodesk Maya. I elongated and narrowed this cylinder to the approximate size. I added in a gray wood texture to show it was made of wood and not made of fine varnished wood.

**Motion Capture (Tunika Onnekikami):**

Motion capture (MoCap) is the digital rendering of actions performed by a human model. First, a person is dressed in a black bodysuit. Then small, white, reflective half -bulbs are placed on the suit, which are picked up by the cameras up above. Every movement is captured by the cameras and appears on the computer screen to which the entire program is running. Our goal was to capture the daily activities of Pre-Columbian because they were the realistic interactions that we felt were important to depict. Because our project was to depict the actions of the past, we chose to utilize the motion capture technology available in the Engineering department; we used the “Blaze” and “MotionBuilder” motion capture programs.

I was the one to don the motion capture suit. The first time we went into a session with Chloe Snyder, the cameras would not calibrate. During our next session, with help from Robert Zhou, we were able to calibrate the MoCap cameras (Figure 20) and capture the needed motions: poling (canoeing through waters with a long pole in a standing position), paddling (canoeing through waters with a paddle in a sitting position), walking and carrying a basket in hand (basketing) or on back (backpacking) and interacting. It was crucial that I start and finish in the ‘t-pose,’ with my arms outstretched by my side. We would later learn that the models all begin the same t-pose, so if the human model did not start in the t-pose, it would be harder for the model to ‘grasp’ the applied motion during the application process (figure 21).

The paddling motion was done while sitting on a table. The legs were bent at the knees in front instead of kneeling, but the knees could not be bent fully as to not cover the sensors in the area. The paddling and poling motions were done on both sides on the “canoe” (in our case, a table).

The next motion “acted out” the two people greeting and gesturing in one take. We decided on capturing the two people’s movements in one take. We placed tape marks on the ground to mark where I would stop and greet the other person. I pretended to greet a person at one tape mark and walked around to greet as another person at the other tape mark. We did this in one take so that we could cut the motion file into two. This would create two separate motion files with similar but different greeting movements (figure 22).

The final motions were those of basketing and backpacking (figure 24). For the basket in hand motion, I carried a small object that in no way represented an actual basket in size or shape, so I had to decide how the basket should be held. Similarly, without a physical object on my back, I had to mimic the motion in a way that I believed was similar to the way it would have been held. The backing motion was based on a photograph (figure 7). I also had to pay attention to the detail with the backing motion, so I thought it best to squat and lean slightly in order to appear as though the basket on my back had some sort of weight.

The most crucial aspect of the process was applying the motions to the models we were given. We used a model purchased for the class by Professors Badler and Erickson, but they needed to be rigged so that they could be used by the students. We chose to use the female model because that was the only one available to us at the time. We decided this was appropriate because women were just as likely to perform important societal functions as men were during this time (Steward 1948).

After Chloe emailed us the rigged female, unclothed model, we met on a Saturday to apply the motions. Using Autodesk Motionbuilder, we uploaded the mocap files (.fbx) and rigged the motions onto a skeleton character. We then uploaded the 3D female character and applied the rigged character onto the 3D female character so that it followed exactly what the rigged character was doing.

It which took us some time, but we finally figured out how to apply each motion successfully (figure 24a). Having working models and see the productions of what we had learned to do was exciting. Emiliya created videos of the motions and uploaded them to YouTube; she simply needed to ‘render’ the videos in MotionBuilder (figure 24b). Although successful, a few errors occurred; for example, due to the differences in body size between myself and the 3D human model, the poling motion causes her hand to go through her body (as she is wider than I am and would require a wider movement). Accounting for the sizes of the people we were modeling (by looking at the uploaded photographs and text) would likely have prevented this.

**Results:**

Much of the research done for this project came from resources uploaded to PennBox by Professor Clark Erickson, including textual and visual media.

Not every endeavor lead to successful results. For example, during our first meeting with Professor Erickson, we were taken into the collections room at the Penn Museum to search for an indigenous canoe paddle from Bolivia or a surrounding area. This paddle turned out to not be the most accurate representation of a paddle we could use because it was not native to our area of study, but to Alaska. We were able to use another Eastern Bolivian example from the PennBox provided by Professor Erickson.

Although our research of ethnographic literature showed that women were socially exempt from tasks such as paddling and poling the canoe, our project only uses a female model since that was all that was available at first. As mentioned previously, however, when not working together with men, women did perform traditionally masculine tasks.

**Future Plans:**

Some minor adjustments will have to be made in the models to improve their aesthetic appearance. This includes improving improving the texture by fixing the UV layout so that stretching does not occur, and possibly drawing on the textures to represent the geometrical patterns often found on Bolivian baskets.

Our hope for the future is to see the separate elements we have created for this project come together into a fuller story in the pre-Columbian Bolivian environment that Sacha and Chloe has recreated with the Unreal game engine. If revised, the female 3D model would be replaced with the fully clothed version of the female version that Chloe has created for us recently. The newly rigged 3D models will be saved as motion capture (.bvh) files. In the game engine, the 3D character will be put together with the 3D objects. To depict the canoeing activity, a canoe in a canal will have one character stand on the bow holding a pole while another sitting at the stern with a paddle. To depict social interaction, one character will be walking along a causeway and greeting another character that they encounter. To depict the walking, several characters will be shown walking on the causeway. One character will be holding a basket full of crop which we might be able to get from Estee. This character rig might be able to also hold a pot since the hand position is similar. One character will have a basket hoisted on their back. This will all be animated in the Unreal engine and filmed in short snapshots to show moments of each activity.

**Conclusion:**

The creation of reconstructions of past events, people, and places is pivotal to aid us, as humans, to understand our own history and past. Thanks to reconstructions, our understanding of the past improves and our views of it become clearer. By studying and understanding the past, we learn about cultures and societies which, although different in lifestyle, reflect modern ideals, norms, and consequences. Humans generally distance themselves from their history, and thus through reconstruction we start to appreciate our own development, both social and technological, and reflect on our own ideals. Reconstructions help us understand where our own ideals and cultural norms have stemmed from, and predict trends for the future.

By having participated in this class and having worked on this project, we have learned about the cultures of people in Eastern Bolivia; cultures which seemed very different from ours. We have become aware of their social expectations and the differences between people of different genders and ages, and have discovered that their gender roles were far less segregated than we might have originally thought. We also learned about how the different tribes of Eastern Bolivia used and manipulated the resources around them to create devices for transportation and storage. By recreating the work of Eastern Bolivians using modern technology, we also empathised with with them. Whilst creating the canoes and baskets, we experienced struggles which were similar to those of the Bolivians, such as the difficulty of building a canoe from a block/log of wood and weaving and structuring a basket. We learned to appreciate their work and their efforts, as even though we used different methods to create the same objects, we understood the time and effort put into creating each one. Even when acting out the motion capture, we had to put ourselves into the shoes of the Bolivians and not only understand them but *become* them. All in all, by working on this project, we not only learned about the past and worked with unfamiliar programs, but also managed to bridge the perceived gap between the past and present.

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