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Visualizing the Past/Peopling the Past
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Peopling the (Common) Past Through Agricultural Practice Near Pachacamac

Introduction

Historical records favor the powerful and the extravagant. Detailed accounts of empires, rulers, and the nobility of a civilization are plentiful, yet the common people are often overlooked and undervalued. The search for the "hidden treasures" of a lost empire that periodicals like *National Geographic* pursue renders these people invisible or unimportant to what is considered "history" (Gero and Root 1990). Thus, any historical record should consider what history it upholds: is it only interested in documenting those who once held power, or does it center the people who populate civilizations?

This project centers depictions of the past around these commoners, specifically the farming communities around the site of Pachacamac, Peru. Using the 3D graphics software Maya, I worked on constructing a hoe used in Andean agricultural, the rawkana, and applied the model to a scene of agricultural development to incorporate the people of the past as well as the objects they used. These tasks proved cumbersome due to a lack of familiarity with the software, but the work that has been done can prove a solid foundation for further work on depicting agricultural life around the site of Pachacamac.

Historical Context: Motivation for the Project

Located on the coast of Peru, the site of Pachacamac is notable for its use as a ceremonial and religious site for numerous Andean cultures (including the Lima, Wari, Ychsma, and Inca), as well as its persistence and continual use over 1,000 years through multiple societal and environmental upheavals (Eeckhout 2013). Dedicated to the coastal god Pachacamac, the ceremonial center was a site of pilgrimage, temples, public plazas, and elite palaces, bringing in countless pilgrims to make offerings and consult oracles (Eeckhout 2013). While many projects

for this course work within the site itself, my ideals for this project in documenting a history of common people led me to consult literature focusing more on other aspects of Andean life carried out by those who were not directly connected to Pachacamac as a seat of power: farmers. With so many people making pilgrimages to Pachacamac, the site would need a food network to sustain its population. In my research, I was struck by a passage by Terence N. D'Altroy (2015) describing farming culture during the time of the Incas. Describing the social and communal aspects of agriculture, D'Altroy depicts the following scene:

> Typically, a team of seven or eight men from a family or neighborhood group would work in a line to prepare the fields. Each man used a plow to break the soil and the women followed in another row, breaking the clods and planting the seeds. By teaming up, the work group could share the labor and lighten their burdens. While they worked, they sang and chanted, striking the earth in unison (2015:312).

Such a scene was exactly what I wanted to depict: cultural practices from a "typical" community in the area around Pachacamac during this time period. I also found inspiration in an article published by Dr. Erickson (2006) discussing the importance of a "landscape approach" of examining factors like the intensification of agriculture and the organization of labor to generate better understandings of the rural past (2006:335), which grounded my interest specifically in agricultural practice among the farming communities surrounding Pachacamac. In discussing my interest in agricultural practice, Dr. Erickson directed me to a set of tools that would have been used: the *chakitaqlla*, a footplow used to cut through the soil; the *rawkana*, an all-purpose hoe that served a variety of uses during the planting and harvesting cycles; and the *waqtana*, a clod buster used to break up the soil (Figure 1). Further resources provided to me demonstrated the use of these tools, such as a set of educational documents in comic book 'zine format by Dr.

Erickson, Ignacio Garaycochea, and Dan Brinkmeier (1986a; 1986b) that show the three tools being used in the construction of raised, irrigated fields called waru waru. These depictions emphasized the community efforts in agricultural practice and helped me to solidify my project, which I will now discuss in detail.

Goals for this Project

The original proposal for this project was as follows: I would use Maya to create 3D models of both a rawkana and a waqtana, two of the farming implements commonly used in Andean agriculture. Bearing in mind the materials that communities in the region around Pachacamac would have access to, I would produce accurate models to then be placed into an active scene of agricultural development using human models, depicting the planting or harvesting of crops as shown in many of the reference images that Dr. Erickson provided me (Figures 2-4). I would theoretically implement models produced by classmates, such as Regina Fairbanks's chakitaqlla or models of crops like maize, to liven up the scene and, depending on how much time I had left, I would potentially set about doing a simple animation of this scene. These goals were, admittedly, extremely ambitious given my proficiency with the software being used.

Andean Agricultural Tools and Their Use

Andean agriculture involves the cultivation of a variety of crops, including maize, tubers such as potatoes, and legumes (Gade and Rios 1972). The wide variety of crops also requires a variety of tools and agricultural practices to support them. Agricultural practice in the Andes before the arrival of Europeans would have relied primarily on hand and foot tools (Donkin 1970:505). The chakitaqlla (also known as the *taclla*) is among the most well-known of these

implements, a footplow with countless uses from breaking compacted earth for potatoes to planting, harvesting, cutting sod, and digging irrigation canals (Denevan 2001:31). The rawkana (also known as the *raucana*, *liucana*, or *azadón*) shares similar versatility to the chakitaqlla and could be used as a mattock for working the soil, weeding, and harvesting (Denevan 2001:33-34). The geographical spread of these tools depended upon land fallow in the Andes; the chakitaqlla was used for soil that compacted from resting, while the rawkana could be found in irrigated, continuously farmed regions (Gade and Rios 1972).

Wood and stone were the most common materials used in the construction of field tools, with metals such as copper or bronze becoming more popular by the time of the Europeans' arrival (Denevan 2001:28; Donkin 1970: 521). The rawkana was formed by tying together a blade of metal or chipped stone to a short, hooked stick (Denevan 2001:33). The hafting used to tie the blade and the handle was made of leather, currently from cowhide but likely made from llama leather during the time of the Inca (Gade and Rios 1972). Maintenance of a stone-bladed rawkana was simple, sharpening only requiring a hammerstone to chip off flakes or by grinding and polishing until the blade reaches the desired sharpness or the blade is exhausted (D'Altroy 2015:312). The rawkana thus functions as an all-purpose tool and relatively easy to maintain, a simple but reliable and efficient farming implement.

Crafting the Rawkana

To model the rawkana, I first needed reference images, which were provided courtesy of Dan Brinkmeier, who sent numerous scaled photographs of his rawkana from the highland Andean community of Huatta, Peru (Figures 5-7). Based on these images, I could see clearly the three distinct elements of the rawkana: a curved wooden handle, a blade, and leather hafting binding. While the material of the blade was metal in the reference photographs, I chose to

produce a rawkana blade of chipped stone that might have been in the use before the introduction of iron and steel blades.

All models I produced during this project were made using Autodesk Maya, a 3D computer graphics software. I began by importing in Brinkmeier's reference images and produced a cube, which I elongated into a rectangular prism through scaling (Figure 8). Then, I created some edge loops near the top of the object and began extruding (Figure 9). After a few tries to find the correct faces and angles to extrude to match the shape of the reference handle, but eventually my model matched its basic shape (Figure 10). Next, I made moves to begin replicating the curvature of the handle itself, and this I managed by creating more edge loops on my model and translating sets of faces back and forth as I worked my way down the length (Figures 11-12). With preliminary modeling of the handle complete, I fashioned the blade by creating another cube and then elongating and flattening it into a thin sheet, which I positioned above the handle such that it replicated the reference image (Figure 13). I tapered the bottom edges of my handle to produce the pointed shape of the reference rawkana by pulling out vertices and then used the Smooth tool to produce a much more rounded shape on my handle (Figures 14-15). Using the same tool on the blade produced an object much rounder than chipped stone would be, so I instead simulated the curvature of the blade by adding a bunch of edge loops to create more vertices to pull at (Figures 16-17).

Satisfied with the handle and blade models, in the next step I would provide colored textures for both. Unfortunately, no models of basalt or the specific wood grain of the handle were available for free, so I had to find similar but not exact textures. After trying a few textures I found online (Figures 18-19), I eventually settled on a gray stone texture for the blade and a light pine texture for the handle (Figures 20-21). These textures were not perfect but were the

closest approximation of the reference rawkana I could manage with my time and budget. When initially applying these textures, I found that the wood texture of the handle had been stretched and distorted and was completely illegible. With the help of Myles Al Yafei, one of the TAs for this course, we determined that the issue stemmed from an error in the UV map of the handle due to the way that I created and corrected the errors made in modeling (Figure 22). With some tweaking of the settings, I rectified the problem by using the "Best Plane" tool under the Create tab in the UV Editor, which automatically generated a proper UV for the handle and fixed my texture problems.

I began to think about how to produce the leather hafting of the rawkana. The numerous bands and ties created a complex shape that I had little understanding of how to replicate in Maya; from my interpretation of the reference images, the bands appeared to be comprised of only one or perhaps a few relatively thin strips of leather that were tied together to generate the tension that holds the blade to the handle. With Al Yafei's help, I developed a workaround to the complicated shape of the hafting that could be managed with my technical proficiency in the software: I generated a cylinder, positioned it aligned with the bands from the reference, and began shifting vertices around to not only flatten the cylinder to the rest of the model, but to hide the interior of the cylinder to appear as a band to the average observer (Figures 23-24). My next steps were to duplicate this band and then alter each copy until I completed the entirety of the hafting. I first textured the band so that this step would not have to be repeated for the rest of the process (Figure 25). Then, I spent an extraordinary amount of time generating band by band until I finished the hafting, flipping and rotating each duplicate, pulling at vertices one by one, then moving their UV maps around to shift textures so that they appeared to be unique bands (Figures 26-29). This process repeated over 15 times and was the most time spent modeling the rawkana

but produced satisfactory results. Then, I began work on the next step: placing the object in a scene.

Peopling the Past with the Rawkana

Before working on creating a model of the rawkana in use, I needed reference images, which I found in the previous photographs provided by Dr. Erickson (Figures 2-4). I imported an image of three people tending a field with farming implements that includes visible usage of a rawkana into my Maya project along with a male human model provided to us by the Teaching Assistants (Figure 2). My original plan was to work with a clothed model, but I found the clothed model provided to be unsatisfactory. Wearing bright fabrics and adorned with an elaborate head piece, I did not believe this model would be accurate to a farming community. I decided to work instead with a model that was not clothed with the intent that clothes would be added in the future. I made transformations on the legs, torso, and arm of the model to have it bend over and reach out to grip the model of the rawkana model (Figure 30). Then, I proceeded to adjust the model's hands so that the fingers would "naturally" grip the handle of the rawkana.

Posing the model for gripping was the most intensive, tedious, and frustrating part of this entire project (that unfortunately led me to forget to take many screenshots of the in-between steps between the start and end of posing). To move the hands and fingers, I needed to rotate the clavicle of the model, the shoulders, the elbows, the wrists, and finally the individual joints of each finger in sequence. The arm would move out, then down, then the elbow would bend slightly inward as the fingers wrapped themselves around the handle of the rawkana. My first attempts at this process were filled with dozens of small motions across the many joints of the hand, trying to wrap the left hand around the rawkana, but every attempt led to fingers passing through the handle or "breaking" them by bending them unnaturally. When working on the right

hand, I could not get a proper angle for the arm to meet the bottom of the handle without the shoulders or elbows appearing warped or sinking into other parts of the model's body. I also struggled with the positions of the thumb and each finger of the hand, since my reference images were not detailed and mimicking the poses myself was insufficient to replicate their positions in Maya. After numerous adjustments of the human model and the rawkana orientation, I achieved a position where the pose looked natural (Figure 31). At this point, the work consisted of numerous small adjustments so that the hands were "gripping" the rawkana and the individual fingers did not appear to be passing through any part of the solid model (Figures 32-34). The last adjustment I attempted was to texture the human model to incorporate an appropriate skin tone for an Andean farmer. I used an image of four farmers working with chakitaqllas as reference for the skin tone (Figure 3). Unfortunately, Maya would not assign a texture to the posed model and texturing the source model before importing to the scene darkened the model and made its features indistinguishable; the, so I was unable to produce a skin tone texture in the scene (Figures 35-36). Despite these setbacks, I produced a pose for showing the use of the rawkana featuring a male model mid-swing against the ground (Figure 37).

Results: Rendering the "Finished" Model and Looking to the Future

Unfortunately, the work of posing the rawkana and the human took most of my time spent on the entire project. I have not been able to model the waqtana or add more people to the scene. Despite the problems faced, I produced a detailed model of the rawkana and posed it in a similar environment to its use. With my modeling complete, I produced rendered images of the rawkana model without the human model against a basic plane using area lights and the standard Maya renderer (Figures 38-39). I began to create the final scene to contextualize the rawkana by finding dirt textures and a skyline image purporting to be an image of a Peruvian skyline online

(Figure 40). These images were then applied to image planes to situate the human model on top of a plowed field with an Andean skyline in the background to show a farmer working in a field (Figures 41-42). These renders provide a foundation for the depiction of agricultural life at Pachacamac and demonstrate how agricultural practices can be represented and preserved through computer graphics.

Future work on this project, whether done by myself or by someone else, could expand upon my farming scene. Using a properly modeled local landscape of a field, more models of rawkanas could be made, each with slight variations alongside other farmers holding chakitaqllas and waqtanas to produce scenes matching D'Altroy's depiction of singing farmworkers in rows preparing the fields for the planting season. In additional, more human models could be incorporated to produce gender diversity in the scene and all models could be given clothes appropriate to a farming community of the time period. Incorporating more people into this scene would center the communal aspects of these farming communities and the shared labor of maintaining the farm. The entire growing season of a field of crops could be produced using these models, including planting crops (such as maize), weeding and irrigating to maintain the fields, and harvesting crops. The ideal visualization of this project would be an animated sequence of these farmers preparing the fields, possibly with embedded audio of any traditional farming songs that might still exist in indigenous communities in Peru today.

Conclusion

Despite the challenges to 3D model their lives, incorporating common people into the historical record is important for our understanding of their culture and accomplishments. History is not just empires, the powerful, and their squabbles with other powerful people. History is also the daily life of an Andean farmer who will never have a direct hand in the running of an

empire, someone working to survive and provide for their family. Their history is a history of labor: tending fields with their community as they plant, cultivate, and harvest crops using hand-crafted implements. By depicting this history, Andean agricultural practices can be preserved, and Andean farmers' labor appreciated as just as valuable to an empire as its emperor, if not more. Common people matter as much as leaders do in maintaining communities and empires, and chronicles of the past should work tirelessly to include them as well.

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