FACIAL RECONSTRUCTION OF AN ANCIENT MYCENAEAN SKULL

by

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CHAPTER 1 : Introduction

Abstract

I performed a facial reconstruction on an ancient Mycenaean person to create a visual connection to these people and their experiences in the past. While facial reconstruction is most often used in forensic science to identify a recently deceased person, it can also be a useful tool for anthropologists and historians (Snow et al. 1970). Giving the people of the past a face allows the general public to empathize with the forgotten and can lead to more support for the work of anthropologists (Klimecki et al. 2016). I worked at a field school in Aidonia, Greece excavating a chamber tomb in a Bronze Age cemetery. The well preserved skull of a man, dubbed “Burial 4,” was found in the tomb. I took photos of the skull, used photogrammetry, the process which pieces 2D photos together to create a 3D image, and printed the skull out to scale. Onto the skull, I applied flesh depth markers and laid clay over it to recreate muscles and the full anatomy of the face. The finished product of this process is a complete bust of Burial 4. I used the specific features of the skull to determine how the completed face might have looked when Burial 4 was alive, using only a minimal amount of artistic interpretation. In this thesis I explore the entire process of the reconstruction from the discovery of the skull to the completion of the bust.

Background

In the summer of 2018, I spent the month of July at a field school with the Nemea Center for Classical Archaeology run by UC Berkeley. The field school sponsors the excavation of a Mycenaean cemetery from the Late Bronze Age in Aidonia, Greece. The Mycenaean people had a thriving culture, which resulted in a rich array of burial practices (Wardle and Wardle, 1998). The skull of a Mycenaean man, classified as "Burial 4," was found in Tomb 104 of the cemetery, and the skull is the subject of this thesis.

Mycenaean Civilization

The Mycenaean civilization flourished between c. 1600 BCE and c. 1050 BCE and occupied Greece prior to the reign of Alexander the Great, who established what is known as "Hellenistic Greece." The civilization was spread across the area we now know of as Greece and had contact through trading with places as far away as Spain and Macedonia (Wardle and Wardle, 1998). The Mycenaeans spoke Greek and had a collective religion, but the civilization was split up into many city-states, each with a different king. Weapons were made of bronze, which is why this time period is called the Bronze Age (Schofield, 2007). It is said that Homer's *Iliad* and *Odyssey* took place during the Mycenaean civilization, a golden age of wealth, culture, and heroes (Castleden, 2005).

Most of the archeology in the region is "salvage archeology" because of the pervasive looting that has taken place over the years. Salvage archeology involves an

attempt to excavate a site very quickly to save it from destruction or theft. Because of this, most of the publications about the discoveries there are just descriptive analyses of the physical ruins, the tombs, and the contents thereof. More research needs to be done on the items discovered and the excavated sites themselves with the goal of providing insight into the culture and identity of the Mycenaeans. There has been some research beginning to explore how Mycenaean mortuary behavior reflects their culture; it shows how Mycenaeans reuse the tombs, highlighting a deep connection between the living and dead, and how the underrepresentation of women and certain ethnicities in tombs reflects social inequalities in the living (Burke, 2019).

There were three large socioeconomic groups in the Mycenaean civilization: (i) the wealthy elite, who shaped the cultural identity of being Mycenaean as we know it, (ii) the middle to lower class and the shepherds, and (iii) the slaves. The general population may not have been extensively involved in the Mycenaean culture that has been expressed in the art and ruins left by the wealthy (Feuer, 2011). The tomb in Aidonia was very large and the family who owned it was probably wealthy, making it likely that they identified with the Mycenaean culture. Appearance and facial features are an important part of Mycenaean identity; this is reflected by their use of death masks which are portraits of the deceased left with the remains (Hristova, 2010). Because of this, creating a facial reconstruction of a deceased Mycenaean person would be culturally appropriate for reflecting identity.

Burial Practices

A defining aspect of the ancient Mycenaean culture is their diverse array of burial practices. The different practices evolved over time, creating an interesting accumulation of shaft graves, large mounds called tumuli, and chamber tombs (Wardle and Wardle, 1998). The cemetery at Aidonia consists of many chamber tombs. The process of building these tombs was very intensive and strenuous. The “dromos,” a walkway to a tomb, was cut into the rock of a hillside and had no ceiling. The chamber created at the end of the dromos could be rectangular or circular in shape with a ceiling made of the stone of the hillside and would contain one or more shallow graves, called “cists” covered by stone slabs. The cist graves could hold multiple bodies along with any grave goods left for them by their families. Once a body was buried, the entrance to the chamber, called the “stomian,” would be closed off and the dromos filled with soil until another body needed to be buried (Wardle and Wardle, 1998). A cemetery would contain many different chamber tombs for the different families in the village. Mycenaean tombs for the wealthy contained grave goods such as jewelry, weapons, and pottery (Schofield, 2007).

Tomb 104

The skull used in this project was found in Tomb 104 during the excavation in Aidonia. The research for this tomb is still underway, and a full description will likely be published in later years. It is known that Tomb 104 contains many valuable burial goods compared to other tombs in the cemetery and was likely one of the earlier tombs created there (Dr. Price, personal communication, February, 2020). Many of the tombs

in this cemetery were raided by looters. However, Tomb 104 was well hidden and was not robbed until after the excavation started, at which time the looters dug into the backfilled tomb between excavation seasons; luckily, they did not find the cists, so the grave goods and burials remained intact when excavation continued.

Based on information collected in Tomb 104, the skeletal remains of the man known as Burial 4 were in the east cist along with the bones of several other people, called “burials,” located in numerous layers within the cist. This suggests that they were deposited at different times. Burial 4 was found in a supine position in the southern half of the cist, well preserved under the stone slabs covering it. His sex was determined using metric and non-metric indicators of the cranium and pelvis. His age, middle adult, was determined through the examination of a combination of tooth eruption, epiphyseal closure, cranial sutural closure, and dental attrition. He was determined as caucasian using non-metric indicators of the cranium (Dr. Price, personal communication, May, 2020). There were no grave goods found in association with Burial 4. The lack of grave goods is very interesting since other burials in the tomb contained very valuable grave goods such as weapons, beads, gold, and other metals.

Also found in the east cist with Burial 4 were Burials 6 and 8, both of which appear to be “secondary burials,” meaning they were moved from where they were originally deposited. In some cases, the Mycenaeans would lay a recently deceased person in the center of the chamber and then push them to the side when another person died, which may be the explanation for these other burials (Cline, 2010). Because Burials 4, 6, and 8 were in the same cist, it is possible that they were all relatives.

Ethics

Facial reconstructions are the attempt to work backwards from skeletal features to a complete face by laying down clay muscle and skin over a skull. They work to put a face to someone whose body has long since decomposed and whose features are lost as a way to study the past and through them, ourselves. Facial reconstructions require some artistic interpretation and best guesses when it comes to how someone looked. Because they are not usually 100% accurate, there are some ethical concerns about making facial reconstructions at all (Wilkinson, 2005). It can be difficult in some cases for people to see where science-based interpretation ends and imagination begins, which is always a concern when humanizing people of the past. This is also a concern when creating osteonarratives, which are stories based on some archeological or bioarchaeological evidence (Boutin, 2019). Anthropologists use both facial reconstructions and osteonarratives to bring to life people from the past so that the public can empathize with them; this helps in reducing prejudices between people and raises curiosity about the history and archeology of the people being studied (Klimecki et al. 2016). However, as there are some details that archeologists and anthropologists cannot deduce from human remains, some imagination is used to fill in these gaps. Sometimes, this is seen as misleading and disrespectful to those who died and to their descendants. There is also the fear that if people of the past are too easy to visualize and are made too relatable, people can fall into the trap of “mirroring.” Mirroring is when a person sees themself in another person without acknowledging that the other person lived a different life in a different culture. Therefore, they should be empathised with, but

also accepted for the differences that cannot be fully understood by someone who did not experience them (Boutin, 2019). These are valid ethical concerns, but they need to be weighed against the opportunity to create empathy and curiosity for past people. There are ways to minimize ethical concerns while mixing science with interpretation.

Inaccuracies in Facial Reconstructions and their Implications

Facial reconstructions are more often utilized by forensic anthropologists for identifying remains than for giving a face to a person from the past (Nelson, 1998). These reconstructions tend to be used as a last resort by law enforcement officers, but with only a skull to reference, there can be misinterpretation of the soft tissue leading to inaccuraccies (Stephan, 2003). Because these cases require almost completely accurate facial reconstructions, the use of the technique has been widely criticised (Nelson and Michael, 1998). However, such accuracy is not as crucial for anthropologists whose goals are to simply help people of today connect with people of the past. While anthropologists should seek to create reconstructions that are as accurate as possible, the end goal of the reconstruction, to promote empathy and public involvement in the exploration of the past, does not require the same kind of complete accuracy as forensic reconstructions do. Like osteonarratives, which are used to fill in the holes in the past to create a more relatable picture, facial reconstructions are used to create a face for the past, despite possible artistic interpretations.

Mirroring

A problem can arise when people of the past are made too relatable and the public over empathizes with them. The past can be an extremely important lens for

examining our cultures today and how we have changed over time. However, people sometimes forego the lens and use the past as a mirror instead. They see themselves in the past and ignore the important cultural differences and struggles these people went through. We cannot fully relate to them with our current cultural biases. This is called mirroring and can lead to cultural appropriation and large, biased misinterpretations of the past (Boutin, 2019). Cultural appropriation can sensationalize cultures and disrespect the people in it. There is less of a problem with cultural appropriation when dealing with cultures from the past that have changed considerably over time; however, misinterpretation can still have a negative effect. This can be seen with the “Lovers of Modena,” two skeletons who were found to be holding hands when excavated. There was an immediate assumption that they were a male and female couple since the current cultural bias suggests that, but in reality, this was a misinterpretation because they could have been holding hands for many different reasons and the skeletons were actually two males (Lugli et al, 2019).

Mirroring can be exacerbated by modern political debates and the media. Politicians have been known to use the presence or absence of certain “identities” in past cultures as evidence for the validity or invalidity of that identity in present day societies. The media can sensationalize past people, painting them as representing the fundamental nature of their descendants today. They can also latch onto present day identities that past people seem to fit into (Meskell, 2002). For example, the media might characterize as transgender an ancient person whose skeleton was found buried with grave goods that modern society would not normally associate with the known gender of the skeleton, when there is otherwise no evidence that the person identified

that way, or was treated by their own society as such. The misuse of anthropology is rampant in today's social and political discussions, and having more consideration for cultural context needs to be expressed in the analysis of past people's identities.

Ethics and Involving the General Public

To bring the general public into the field of anthropology, to promote empathy for the people being unearthed by the archaeologist, and to create a visual for the work being done to study the past, anthropologists use facial reconstructions, osteonarratives, interactive websites, museum exhibits, documentaries, and movies depicting past events. An experiential system process, like feeling empathy, has been seen as more effective for problem-solving and decision-making than a rational system, such as reading a paper about the facts of an archeological site (Epstein, 1994). It is also shown that when trying to appeal to people's empathy, having a visual of a person and speaking specifically about their life has more of an impact than stating statistics about a group of people (Slovic, 2007). This would suggest that providing a face for an archeological site or for an important past event would catch more people's attention and support for the project.

Boutin, a bioarcheologist and associate professor at Sonoma State University, has found through her research that osteonarratives are a positive way to promote empathy and are especially useful when trying to decrease prejudices towards certain groups of people. She has also worked with facial reconstructions and considers them to be another form of visual imagery that can connect people to cultures which are geographically or temporally far away (Boutin and Callahan, 2019; Boutin et al. 2012).

Boutin acknowledges that in the past the study of bioarchaeology has been filtered through a western lens. For this reason she created the “Bioarchaeology of Personhood” model, which emphasizes the different ways we can study people while minimizing biases. This technique allows scientists to create a more accurate, multidimensional construction of someone’s identity that can be used to analyze their greater culture and community. People are not independent of their environment and connections to others but are shaped by them, and their actions shape others. Aspects of someone’s identity might have resulted in different life experiences in the past than they would today, and we must be able to appreciate that difference when studying them. The fifth tenet of the model encourages the adoption of new methods of interpretation that do not discourage the public from interacting in the discipline. Boutin includes this tenet because the most common form for accessing research is through journal articles tailored for western audiences, specifically those with a higher education in the field of bioarchaeology. Without a diverse audience, science could end up being interpreted the same way by everyone who reads it, limiting the scope of what could be discovered. Public involvement could lead to questions that a bioarchaeologist with certain biases and expectations would not have asked (Boutin, 2016). Boutin explains how displays such as facial reconstructions provide the information found by the researcher to the audience in a way that is open-ended so they can come to their own conclusions on what it means and why it is important (Boutin, 2012).

Minimizing Negative Effects

An anthropologist or historian recreating the past should always explain the scientific bases for any details depicted and artistic interpretations that were made (Boutin and Porter, 2014). It should always be noted when artistic interpretation is utilized and why it was necessary. Facial reconstructions and osteonarratives should reference cultural contexts, and all people from the past should be represented as unique individuals in order to minimize the risk of mirroring. Providing the faces of past humans to the public can connect them to their ancestors and create empathy for people of cultures long forgotten. It can also be important for the archeologists as it can remind them that the skulls they are handling were once living people who deserve respect, and that being human goes beyond just having bones and their research should acknowledge that.

CHAPTER 2: The 3D Component of the Skulls

3D in Anthropology

3D technology is a new frontier for anthropologists who can use it for research as well as for creating public interest in their work (Checker, 2009). There are countless museums and documentaries exploring ancient civilizations with the goal of helping the public step back into the past (Murray, 1904). I once visited a museum in York, England dedicated to the Vikings who had settled there. The front of the museum had displays of artifacts and a glass floor revealing the remains of the houses below. People glanced at the walls and the little mounds that had been so carefully excavated without much interest or amazement. However, the back of the museum included a reconstructed Viking village, and people were conveyed through it on gondolas. There were houses and objects, such as baskets and tools, placed where they were excavated; there were animatronic figures whose faces were reconstructed from skeletons actually found on the site. My friends and I spent the rest of the trip talking about Vikings, the history of York, and what it would have been like to live during that time period, completely inspired by the museum (Jorvik Viking Center). While anthropologists are trained to be able to look at a piece of stone or divots in the ground and discern what it looked like in the past, most people cannot do this. Having a display that brings it to life by adding

color and details allows people to see what amazes anthropologists and helps people appreciate the work being done.

The use of 3D technology is an important tool for reconstructing the past and can be used to make physical as well as virtual reconstructions. The Lascaux cave in France is filled with incredible palaeolithic paintings but has been closed to the public for conservation. To allow people to still be able to experience the cave, a mold was made of the walls, and the paintings were copied onto it so people could walk through the reconstruction and feel like they were visiting the actual Lascaux cave. The cave was also scanned so you can tour it virtually online. Casts have been used for many years to duplicate the skeletons of early hominid remains, but now they are also being scanned so people can print the bones themselves on 3D printers and do their own research with these very rare specimens (Hublin, 2013). Old bones are very fragile and can be destroyed by handling and by exposure and can be lost. Having casts and 3D images allows them to be preserved so that the findings can be replicated in the future for further study. The Smithsonian is planning to scan every artifact in their collection to make them accessible to anyone who is interested in studying them (Crouch, 2010). Facial reconstruction is a 3D technique that has gained popularity as more people in history have been reconstructed, such as the Mummy of Harwa (Cesarani et al. 2004). In addition to historical figures, many early hominids have also been reconstructed (Balter, 2009). Inspired by anthropology's infatuation with 3D technologies and its desire to help people visualize the past, I used photogrammetry to create a 3D image of a skull and create a facial reconstruction from it.

Photogrammetry

Photogrammetry is the process in which photos are taken of every part of an object, so that a 3D image can be created by stitching the 2D photos together (Yilmaz et al. 2007). Photogrammetry is used less often than scanning, which is easier but requires access to a 3D scanner (Lerma et al. 2010). Photogrammetry allows you to create 3D images with only a basic camera and computer; however, the process takes a considerable amount of time if you are working with a large number of photographs and are trying to achieve a high level of detail.

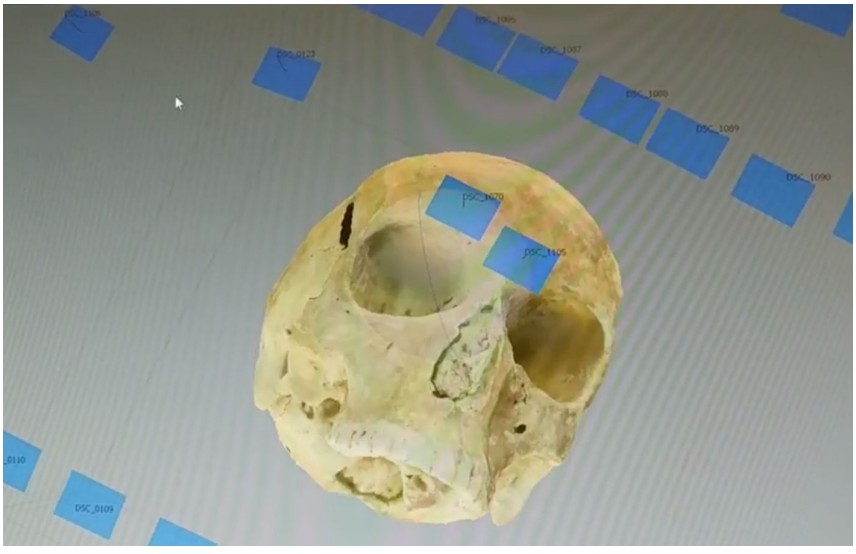
To create the 3D image of Burial 4, I placed the cranium on protective paper to avoid damage to the fragile bone and placed it on a plate with a hole in the center. The plate was pinned in the center to a circular piece of paper that was marked every 10 degrees around the edge. The plate holding the cranium had a mark in one spot which I lined up with each of the 10 degree markers on the paper when taking the pictures. I took pictures from three different camera angles. First I lined the camera up straight on and took a picture every 10 degrees all the way around the circle; then, I adjusted the angle of the camera to 45 degrees up and repeated the process; finally, I adjusted the camera to looking straight down on the cranium and again repeated the process. Once I had taken pictures of the cranium from all three angles, I flipped it over and repeated the process.

(Image 1: Burial 4 Cranium)

This process does not have to be exact; it is more of a guideline for making sure you have enough photos to create an accurate image. I repeated this same process for the mandible. In all, I took about 500 photographs of the Burial 4 skull. The number of photos you need depends on how much detail and accuracy you want. As long as you photograph every part of the object, you can likely make an average 3D image. However, because I wanted as much accuracy and detail as possible, I made sure to get as many photographs as was reasonable. To ensure that the photos themselves were quality enough to capture all the details, I used a Canon DSLR camera and took the photographs in a diffusing light box used specifically for photographing artifacts.

(Image 2: Burial 4 Mandible)

After taking the pictures, I imported them into a program called “Agisoft PhotoScan Professional.” The program went through every picture and compared points of interests until it created a point cloud with the entire object represented. I then added the “mesh,” which



(Image 3: 3D image of a skull with detail in Agisoft Photoscan Professional)

basically put a blanket over the point cloud to make the object solid. After that, the details, which include the color and texture, were added to the image. After the program has analyzed the collection of photographs, you then need to delete from the image floating points not associated with the object that were picked up from the background of the photographs. The resulting 3D image can be saved and moved into a 3D editing program, such as 3D Builder, in order to be able to manipulate the image. I used this process to combine the cranium and mandible so I could print the whole skull.

Printing

Before printing the life-sized 3D image of the skull, I first did a small test print to ensure that the image would print correctly. I used a Formlabs 1+ 3D printer to make this first print. This printer uses a laser to harden a liquid resin, layer by layer, into the object that was downloaded to the printer (Formlabs, 2019). A life-sized print was then produced with the larger Ultimaker s5 printer in the Appalachian State University Belk Library Inspire Maker Lab. This printer lays down plastic layer by layer until it builds up the object from the bottom to the top (Jani, 2018). The printing process for the life-sized skull took approximately 48 continuous hours. The printed skull of Burial 4 was within 3 millimeters of the original skull dimensions.

CHAPTER 3: Burial 4

The Reconstruction

Preparation

To begin the process of the facial reconstruction I made a base to hold up the 3D print of the skull. I glued wooden popsicle sticks together to build a shape that generally resembled shoulders and a neck. I made a “pillar” in the neck to provide extra stability to support the weight of the skull after the clay is added. The shoulders and neck are not built from the actual measurements taken from the Burial 4 skeleton but are only intended to serve as a base for the skull, which is the focus of the reconstruction. Paper mache was then applied to the wooden structure to create a surface for the clay. The only anatomical details included on the neck and shoulder structure were the trapezius muscle, the clavicle, stemocleidomastoid muscle, and the laryngeal prominence on the thyroid cartilage (Adam’s Apple). These features are very noticeable when looking at a person and were therefore included to seem realistic.

The clay used was white Craftsmart Natural Air-Dry clay. This type of clay is great for hand-modelling and does not require firing in a kiln. However, I did have a

problem with the clay shrinking as it dried, creating cracks which needed to be filled in as they appeared.

The Setup

Once the base was completed I began the actual process of the facial reconstruction. The first step was to make and attach the flesh markers. Over the years forensic anthropologists have been creating charts of “mean facial depth measurements” for people of different regions, genders, and ages. I used measurements provided by Helmer (1984), which were developed with an ultrasonic technique. Ultrasonic measurements are considered more accurate than older measurements taken by pushing knives or pins into the face of a cadaver since the depth of facial features starts to change relatively soon after death. For Burial 4 I used the mean measurements for White European Males aged 30 to 39.

vertex	5	Orbitale	5
Trichion	4.7	Canine Fossa	19.7
Metopion	5	Upper First Molar	22
Ophryon	5.8	Lower First Molar	18.5
Glabella	6.2	Mandibular	10.1
Nasion	7.3	Frontotemporale	5.3
End of Nasal	2.5	Lateral Orbit	5.2
Lateral Nasal	7.4	Lateral Zygomatic	7.6
Alare	11.7	Zygomaxillare	9.9
Subnasale	14.6	Midmandible	11.9
Upper Lip	12.3	Euryon	6.7
Lower Lip	14.9	Temporalis	16.3
Labiomental	12.1	Zygomatic Arch	5.3
Pogonion	10.3	Midmasseter	21.3
Gnathion	8.3	Gonion	13.2
Mid-supraorbital	7.3	Opisthocranium	5.5

(Table 1: Helmer, 1984. Facial Depths for Adult White European Male aged 30 to 39. Units in mm.)

Facial reconstructions are an interesting mix of forensic science and bioarchaeology. However, they are not always compatible. In bioarchaeology, race is considered a social construct and only holds weight in cultural contexts and not biological contexts (Blom, 2005). However, in forensic science race is still recognized as a biological description and is used when determining average facial depth measurements for different racial groups. However, you cannot make a bioarchaeological facial reconstruction without the forensic depth markers. With the increased use of facial reconstructions in bioarchaeology, it would be beneficial for the technique to be modified for the field by finding a way to determine facial depth without dividing people into groups based on race. This would also be beneficial since politicians and nonscientists try to use forensic determination of race and ethnicity to support racism and intolerance towards certain ethnic groups.

Because flesh markers are still essential for making facial reconstructions, I used them in my reconstruction. I made them by measuring and cutting thin wooden skewers to the designated lengths. I initially used hot glue to attach the markers to the skull, but the water from the clay caused them to fall off, so I reglued them all with superglue.

Given that the skull size is within 3 mm of the actual size of the skull for Burial 4 and the flesh markers are measured up to one one-hundredth of a mm, there could be some inaccuracy using the markers. However, these are averages of the depths, so there is some flexibility. This means that if the skull is 3 mm too small, the markers wouldn't cause obvious irregularities. There is also debate on whether using flesh markers is useful at all since there can be considerable variation among populations (Wilkinson, 2004). However, they do create a useful guide to follow to avoid laying too

much clay on the bottom as you are building outward. Room is left at the ends of the flesh markers for the skin to be laid over top.

The Method

In her book “Forensic Facial Reconstruction (2004),” Caroline Wilkinson describes in detail several different methods for doing a facial reconstruction. I followed her instructions for the Manchester Method for the reconstruction of the skull of Burial 4. This method includes building the face outwards by recreating the muscles and other features of the face out of clay. The following description of the process I used shows how I applied her techniques to the skull of Burial 4.

The Eyes (pg 110-114; 165; 182-184; 198)

I started this reconstruction with the eyes. It was determined by Bron et al. (1997) that the mean diameter of the male eyeball is 24.6 mm so I created two eyeballs of this size out of clay. I situated them centrally in the eye orbitals, protruding to where the iris would reach out past a line that could be made between the mid-supraorbital and mid-infraorbital. I filled in around the eyes so that they would not fall out and made marks where the corners of the eyelids would need to be. The inner canthus, or inner corners of the eyes, were placed at the lacrimal crests. The outer canthus was marked 8.5 mm below the frontozygomatic suture (Fedosyutkin and Nainys, 1993) The bottom

of the pupil is marked at the line that can be made between the inner and outer canthi. Marking where the pupil should be is very helpful later when situating the eyelids around the eyeballs.

(Image 4: Reconstruction of eyes.)

I created the *orbicularis oculi* muscle from clay, covering the whole eye orbit; this forms the eyelids. The shape of the eyelids follows the shape of the supraorbital crest and the infraorbital crest. Considering Burial 4's protruding brow ridge, the folds of the upper eyelids are particularly deep into the orbit, making the eyes look slightly sunken into the face. Eye shape relies mostly on following the eye orbit and trying to mimic that shape with the rest of the features of the eye as well as using the diagonal of the two canthi to determine the slant of the eyes. In the case of Burial 4, the highest part of the open eye is slightly lateral to the pupil, and the outer canthus was slightly higher than the inner one. After completing the two eyes, I added the *procerus* and *corrugator supercilii* muscles to complete the brow.

The Side of Head (pg 179-180)

The *temporalis* and the *masseter* are two muscles that fill in the space above and below the zygomatic arch. The *temporalis* covers the temporal bone on the side of the

(Image 5: Reconstruction of the Muscles of the Side of the Head.)

head. It attaches to the zygomatic arch and the top follows the temporal line. This muscle causes the head to look more rounded. The *masseter* should fully cover the mandible until the end of the zygomatic arch. This creates some of the cheek of the face and should bow outward.

The Mouth (pg 180-182)

There are two muscles of the mouth that are made with clay, the *orbicularis oris* and the *buccinator*. The *buccinator* extends from the *masseter* muscle of the cheek to cover the molars. It is a rectangular muscle that reaches between the alveolar processes of the maxilla and mandible so it covers the molars completely. It attaches to the *orbicularis oris* which is the muscle of the lips. This is the underlying muscle and does not create the shape of the lips but does provide a guide for them. It encircles the teeth and attaches to the maxilla and mandible at the very end of the alveolar process. The corners of the mouth start in the middle of the maxillary canines, and the mouth follows the shape of the curve of the teeth while

(Image 6: Reconstruction of the Muscles of the Mouth.)

staying in the center of the maxillary teeth. Burial 4 does not have advanced maxillary prognathism resulting in the *orbicularis oris* being symmetrical in size.

There are two mathematical equations for determining the size of the lips. The equation for the top lip is 0.4 + 0.6 x (height of maxillary teeth in mm). For Burial 4 the height of the maxillary teeth was 9.9 mm so the size of the top lip is 6.3 mm. The equation for the bottom lip is 5.5 + 0.4 x (height of mandibular teeth in mm). For Burial 4 the height of the mandibular teeth was 7.8 mm so the size of the bottom lip is 8.6 mm. The split of the mouth that was created when laying the muscles of the mouth is the guide for where to place the lips. When sculpting the lips it is important to remember that they are fuller in the middle and become more level with the skin of the face closer to the corners of the mouth. The lips should be made after all the muscles of the face are laid and when the skin is being applied so that other muscles can be attached to the orbicularis oris without trouble.

The Chin (pg 182)

Three muscles make up the chin, the *mentalis*, the *depressor labii inferioris*, and the *depressor anguli oris*. Each of these muscles connect with either the *orbicularis oris* or the *buccinator* so it is important to lay the clay for the mouth before the chin. The *mentalis* is a small oval muscle on the end of the chin with two pieces reaching up in a “v” to the *orbicularis oris*. At the inner corners of the ends that touch the *orbicularis oris* the *depressor labii inferioris* starts and extends to the inferior border of the mandible. It is angled so it creates the lateral part of the chin. The *depressor anguli oris* overlaps the

(Image 7: Reconstruction of the Muscles of the Chin.)

depressor labii inferioris at a diagonal. It is a triangular shape covering almost the entire bottom of the *depressor labii inferioris* at the inferior border of the mandible. The small tip of the muscle connects where the *buccinator* meets the *orbicularis oris*. The curvature of the mandible will impact the shape of the chin as well as the intensity of the mental protuberance. Burial 4 has a strong chin that is not protruding and is slightly rounded, but large enough to match the strong jawline.

The Nose (pg 103-110)

When creating the nose you first make the nasal projection. This will create a guide to indicate the length of the nose. The projection is made from the same wooden sticks as the flesh markers. One stick is placed at the end of the nasal spine, following its angle. Another stick is placed at the end of the nasal bones, again following their angle. Where the two sticks cross is the tip of the nose. The sticks are marked, cut, and glued onto the skull. To check that the projection is accurate the “Lebedinskaya Method” is used. A straight line is made between the nasion and the prothion (when making a

line like this on the 3D reconstruction, a thin straight object can be used to represent the line, such as a thin stick). Another straight line that is parallel to the first is placed at the end of the nasal bones. This second line should represent a line of symmetry between the edge of the piriform aperture and where the edge of the nose will extend. When the nasal projection is symmetrical it is an accurate extension.

The long triangular shape of the piriform aperture in Burial 4 suggests a straight nose. The nostrils extend a few millimeters beyond the aperture. To make the nose, clay is draped over the nasal projection and the nostrils are placed in the correct position. Then the shape of the nose is sculpted around those two main structural features. The nose will look out of proportion until the rest of the muscles and skin around it is completed.

(Image 8: Reconstruction of the Nose.)

The Cheeks (pg 184-188; 190-191)

There are different layers of muscles on the cheeks. Two muscles attach to the *orbicularis oris* and with the *orbicularis oculi*. The *levator anguli oris* muscle covers the top part of the *orbicularis oris* between the *buccinator* and the nose. It reaches up covering the canine fossa and attaches to the *orbicularis oculi*. The *levator labii superioris* is a very thin muscle that crosses over the *levator anguli oris*. It attaches to

(Image 9: Reconstruction of the Muscles of the Cheek.)

the *orbicularis oris* next the nose and to the *orbicularis oculi* just past the *levator anguli oris*. Over these muscles are the *zygomaticus minor and major*. The *zygomaticus minor* stretches from the zygomatic bone over to the *orbicularis oris* next to the nose. The *zygomaticus major* is right below the *zygomaticus minor* and reaches from the zygomatic to the *orbicularis oris* next to the *buccinator*. These two muscles create the cheek bone that is seen in the completed face. Clay is placed around them to help keep them stable since they are stretched over the face and are suspended above the muscles already laid down.

Next the *parotid gland* is made. This is a mass of clay made with little balls of clay layered under the zygomatic arch to the mandible concentrating near the ear. Finally the *risorius muscle*, which is thin like the *zygomaticus major and minor*, is stretched between the *orbicularis oris* and the *masseter*.

The Skin

This skin is made by taking thin sheets of clay and laying them over the muscles to match the height of the flesh markers. The sheets of clay create the skin but they still need to be sculpted because the face has many little divots and details. The skin needs to be carefully molded around the temple, cheekbones, chin, forehead, and jawline. At

(Image 10: Reconstruction of the Skin.)

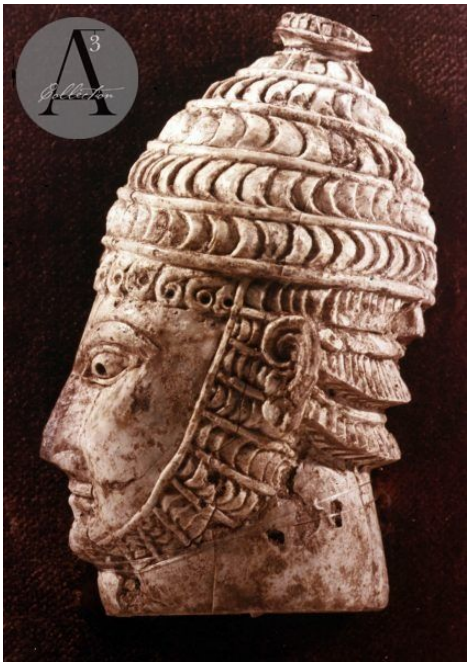
the temple, the temporal line on the skull creates a ridge so the temple should be molded inward. The cheekbones run from the zygomatic arch to the nose as well as following the *zygomaticus major* and *minor*. This creates a triangular area that is pronounced on the face. It is especially important to follow the flesh markers when sculpting the chin and jawline. The areas under the corners of the mouth curve inward then out to the chin and jawline. The mouth of Burial 4 is very close to the nose and the chin is rounded from the lips so that there is no divot under the middle of the bottom lip leading to the chin.

Artistic Interpretation

The ethical concerns surrounding facial reconstructions are discussed earlier in this paper, including problems such as mirroring and misinterpreting the past when utilizing artistic interpretation. I state that ethical problems can be minimized if the person creating the reconstruction references the scientific bases used, identifies instances of artistic interpretation, and explains how the interpretations were made within the subject's cultural context. I used widely accepted anatomical methods to recreate the face of Burial 4, but I used artistic interpretation for some of the features.

I used the Manchester method, as opposed to other techniques where you strictly follow the flesh markers instead of recreating the muscles, so that more of the

structure of the face would be anatomically based. I also used the shape of the skull to mold the facial features in order to limit my own bias for how facial features ought to look. However, there was no scientific or anthropological information as to the appearance of the ears and hair; these were created through artistic interpretation.



(Image 11: Mycenaean Ivory Warrior Head with Boar's Tusk Helmet, Antiquities History Collection, Mycenae Museum, Greece.)

There was no way to determine the appearance of the ears of Burial 4 from the shape of the skull, so they will not be accurate but at the same time cannot be left off. Therefore, I chose to make the ears symmetrical, simple, and unmemorable. It is very likely that my bias for how ears look in my time and culture influenced the shape I created.

Hair is another detail that is not determined by the skull shape, including both hair on the head and eyebrows. This detail was not completely essential in completing the reconstruction of the head of Burial 4; however, I decided to include the hair and eyebrows as a way to make the bust seem more realistic for a middle adult man. To minimize my own biases I referenced the picture of a Mycenaean man wearing a boar's tusk helmet for the texture and length of the hair as short and wavy.

As explained earlier, I created the shoulders and neck early in the reconstruction process using mostly artistic interpretation. Therefore, I covered them with a sheet draped over the shoulders. Mycenaean men would have worn loin skirts and were often depicted bare-chested, but because I did not have accurate information about the size

and shape of the neck and shoulders, a drape seemed to portray less inaccuracies (Spence, 1969).

The facial reconstruction of Burial 4 required artistic interpretations of the ears and hair, but they were done with the purpose of promoting empathy and connection with this person from the past, which is the primary reason for the reconstruction. Since I took preventative measures to limit ethical concerns, these interpretations should be acceptable.

An interesting technique that can be implemented to reduce artistic interpretation in facial reconstructions is genetic analysis. It can be used to determine certain facial features that cannot be recreated from the skull itself, such as eye color and earlobe shape. Genetics can also be used to identify closely related groups, identify widely shared characteristics, and understand how groups blended or not, which are essential questions to answer when studying people of the past. More effort needs to be made at this point to incorporate genetics into anthropology and facial reconstructions.

Chapter 4: Conclusion

The Mycenaeans, the predecessors to the Ancient Greeks, represent one step towards the development of our modern western civilization. They had a thriving culture with impressive tombs. The sponsors of archeological projects in Greece could more effectively promote public interest in their research by utilizing 3D techniques to bring the past to life. Photogrammetry, while a time consuming process, is relatively easy and can be done by anyone with a camera and access to Agisoft Photoscan Professional. Even if you do not have access to a 3D printer, having 3D images of artifacts can make them more accessible to the public. I made the facial reconstruction of Burial 4 from the Bronze Age cemetery at Aidonia as accurately as possible with minimal artistic interpretation to make it more realistic. Having a face to represent the people buried in the cemetery can promote empathy for the people buried there and increase interest, and funding for, the archeological site which has been studied and tested by Boutin throughout her research. This is especially important for this site due to the persistence of looter activity in the tombs. Hopefully this reconstruction can help people see that these 3,000 year old bones were once living people who deserve respect and can facilitate the exploration of their stories by archeologists.

(Image 12: Finished Reconstruction.)

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