Sam Cox Spends Her Sunday Mornings with High-Tech Mummies

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While most of us rarely think of mummies unless it's Halloween, Sam Cox constantly has the cloth-wrapped creatures on her mind. A graduate student at the University of Pennsylvania, Sam is studying anthropology that uses the latest technology, like CT scans, to examine ancient specimens. She sat down with Knowledge@Wharton High School to discuss her path from high school to anthropology and how technology is changing her field. An edited transcript of the conversation is below.

Knowledge@Wharton High School: Hi. We're here today with Sam Cox, senior at the University of Pennsylvania, who has been doing research at the University of Pennsylvania Museum of Archaeology and Anthropology. Sam, as an anthropology major, you have had the opportunity to use the latest technology to examine ancient specimens. What are some of the projects you have been working on?

Sam Cox: Most recently we finished working on a project CT scanning some of the ancient heads that are now on display in the new exhibit that is in the museum. We have also been working on CT scanning the mummies that are on display as well, and I have been working on a couple of archaeology projects — one in Malvern, Pa., and another one in Central Italy.

KWHS: You said in a previous interview that people are just starting to realize how useful this kind of imaging technology can be in applications other than medicine. How does the CT scan process work exactly?

Cox: Basically, CT scanning is a three-dimensional X-ray. We take specimens from the museum on a cart and we wheel them over to the hospital of the University of Pennsylvania every Sunday morning about 7 a.m. We use their CT scanning machines that they usually use for medical purposes. That early on a Sunday morning they don't have any patients that are using them, so we get to. Basically it is a giant tube. You put the specimen onto the bed and it goes

through the machine, which has lasers that rotate around it. The lasers essentially take an X-ray image of the specimen every millimeter through the whole specimen and it goes front, back, top, bottom, left, right. And then we get all of those images on a disc and we have some special software that we use to compile them and put them back together in the right order. So you can look at them either as the individual images or you can have the computer reconstruct them into a 3-D model.

KWHS: What do you hope to learn from scanning these mummies?

Cox: The mummies are still wrapped so they have never been viewed. We are just looking for even basic things like age of the person when they died, whether they are male or female, anything that we can tell about their health — like if they have osteoporosis or signs of malnutrition. Right now, we are just [studying] the basics of these mummies and trying to find out what they tell us. And then once we find those things we can reframe our question and look more specifically at certain things. But we are still looking at the initial analysis of them.

KWHS: How long does it usually take to photograph one specimen?

Cox: The actual CT scan itself takes two to three minutes for, say, a skull or something like that. When we do the mummies it takes a little bit longer because they are much bigger. But the whole process is from CT scanning it to getting it available for an online archive for researchers around the world to use. So by the time it is CT scanned and actually gets on that archive and is available for everybody, it usually takes us about a week.

KWHS: As we advance sometimes we forget why it is important to look at the past. What would you say are some of the major reasons we should stay connected to our past? And what have you learned through working with the mummies and other specimens?

Cox: That is a good question. I think one of the biggest reasons to stay connected with the past is that humans haven't changed as much as we would like to think. Our technology has advanced but basically we are still all the same…. It is interesting to look at how people's attitudes have changed and then from there, [look at] how that defines us as being human. And how does that make us different from anything else that is on the planet. Working with the mummies has been cool because they obviously have a completely different burial custom than anything we are used to today. But you still see some basic trends. I have worked with child mummies and things like that. The way people treat their children versus the way you treat older people — men versus women — and those kinds of things — hasn't changed at all. It is interesting.

KWHS: The Internet has flattened our world by providing everyone with a server access to information. How has the CT scan technology, coupled with the Internet, enabled others from around the world to learn about what you have worked on at Penn? Are there other technologies you have worked with or see yourself working with in the near future?

Cox: As I was mentioning before, we have an online archive for all of our CT scans, which is great because anybody, anywhere in the world, can request our CT scans. And we do it for free. We just burn them onto DVDs and we send them out to whoever wants to study them. That is kind of in the spirit of collaboration — it encourages people to work together in a sense. It is also good because you don't have to come to Philadelphia now if you want to study these things. So it allows our collection to be open to a much wider range of people. Just using CT scans themselves actually has helped save our collections. It keeps them from being handled as often, which keeps them from being damaged. It helps us and it helps other people.

As far as other technologies, I think this kind of anthropology is going more and more towards this kind of computer modeling thing because it does save our collections. And since times have changed, we don't really get any new things in our collection. We are not going to be getting any new Egyptian mummies or anything like that. So we want to

preserve what we do have. We can do that better by using things like CT scans. Anthropology in general is moving more towards technology. Some of the projects that we have been working on have been utilizing a lot of new lab technologies like isotope studies that we didn't really have access to in the past.

KWHS: Your interest in anthropology has brought you to Duffy's Cut in Pennsylvania, the site of a mass grave of Irish immigrant workers that were building a railroad in 1832. What is the story surrounding the site? And how do you and others working there piece together the workers' stories?

Cox: Duffy's Cut is an interesting place. It is, as you said, the site of a mass grave of Irish immigrant workers who all died building this specific mile of railroad in 1832. Basically what they were doing was leveling out a giant ravine in the middle of the forest so that the tracks could pass over it. So they were basically building a mountain. The official railroad story was that these men all got sick and died of cholera in 1832. The two people that are responsible for starting this whole project are Frank and Bill Watson at Immaculata College. They did a lot of research into it and found out that there is some evidence of a railroad cover-up going on at this time. They have a hypothesis that maybe all these people didn't actually die of cholera. Maybe there is something a little bit more nefarious going on. They would like to say that they were all murdered and buried in this hillside. We don't know that to be true, but that's why we have started doing the archaeology.

What we found so far from digging is that the story says that all of these people were buried on giant wooden sledges and buried like that in the hillside together. What we found so far is that they do have coffins. So that is a little bit different. It would imply that they had taken a little bit more time in the burial than what the other story would suggest.

KWHS: As field supervisor on the excavation project, what are some of your responsibilities? And how is your work on the site different from that in the museum?

Cox: Being a field supervisor is quite different from working in the museum. First of all you have to go out and get dirty — sit in the mud, sometimes the rain — for hours on end. My job out there in the field is partly to teach — to make sure that everybody out there knows the proper procedures for digging and for documenting and photographing. And then also to be able to look at the site and tell what is happening. A lot of archaeology involves very minute changes in soil color or soil composition, things like that. You have to be able to look at it and recognize that this change means something. But that change over there probably doesn't. Those kinds of things take a lot of practice out there. And you're working with shovels and picks, whereas in the museum I'm often working with artifacts and computers. It is kind of the opposite end.

KWHS: How did you become involved in these projects? Since when did you know that you wanted to study anthropology?

Cox: I decided when I was about 9 years old that I wanted to be an archaeologist. I remember my mom saying to me, "That's great, but you don't really know what archaeology is." So when I was in high school I volunteered in Connecticut with the Connecticut state archaeologist for a couple of summers doing archaeology projects with him. I thought that was the greatest thing ever. That was the first time I got to work with human remains — working with them and excavating them. That's pretty much when I decided that I wanted to do archaeology, but I really wanted to work with skeletons and mummies.

Also, in high school when I was starting to look at what college I wanted to go to my mom had a friend who worked at Penn and had mentioned to her that they had this museum. So I came by to look at it and actually ran into Janet Monge [acting curator in charge of physical anthropology] in the hallway and started talking to her. She offered me a job over the summer if I wanted it. I've been here researching ever since. I think because I've been here for a while, Janet has done a lot to help. When projects come across her desk, she usually mentions it to me and sees if I want to work on

them. I owe a lot of what I do to her.

KWHS: You touched on this a little earlier, but do you see the way anthropologists work changing in the coming years?

Cox: Yes. Mostly what I had said before is that there is an increasing movement towards technology. Some of the technology is to help conserve artifacts — using the CT scans and things help us a lot with that. Some of the technology is actually destructive also. When I mentioned doing things like isotope studies — in order to do that you have to destroy samples. So there is good and bad to those kinds of things. But we do get a lot of information from those that there is really no other way to get, which is partly why I think technology is becoming so much more important now than it has been in the past. We know all of the old techniques. People want to see what else these objects can tell us that maybe you can't necessary see or infer. It is definitely going in that direction.

Even in archaeology people are starting to use things like magnetometry and ground penetrating radar to try and map sites before you dig them…. You can figure out the most promising places. Even up in Duffy's Cut we used magnetometry to locate where we thought the burials would be — just looking for anomalies under the ground before we started digging. Even for those kinds of things where there is still a lot of manual labor and hard work we are starting to use more and more technology.