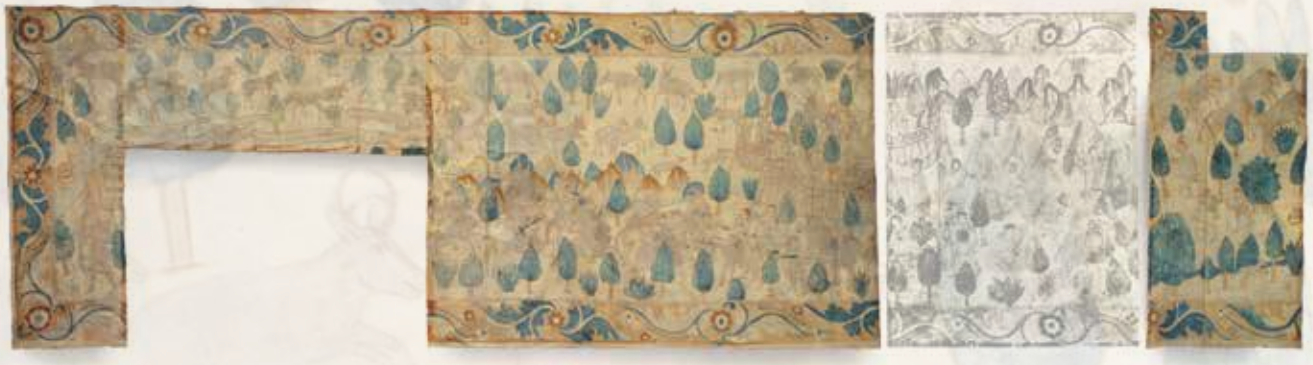
Hide and



Everything about

IN A PLEASANTLY CHAOTIC room near the Stewart L. Udall Center's maintenance office, Mark MacKenzie, the Conservation Lab's chief conservator, is figuring out how to photograph the Segesser Hides in near microscopic detail, in eighteen wavelengths and three spectra, only one of which we can see. While not an everyday task, it's something that's deep in MacKenzie's bones and the culture of his tiny, albeit world-class, four-person lab.

The Segesser Hides—there are two of them, identified helpfully as "I" and "II"—are among New Mexico's greatest treasures and have been exhibited at the Palace of the Governors for the last twenty years.

Both depict battles. Segesser I portrays a conflict between two unknown armies of Native Americans with, perhaps, a lone Spaniard advising one side. Where this battle happened, who it was between, and what it might mean for the history of anybody is only a matter of speculation, one compounded by the absence of two large pieces of the work. Theories run the gamut from Pueblo raiders attacking Plains Apaches somewhere in the Four Corners region to a confederation of Manso, Opata, Pima, and Suma Indians working with the Spanish to root out rival Sumas or Apaches somewhere around El Paso.

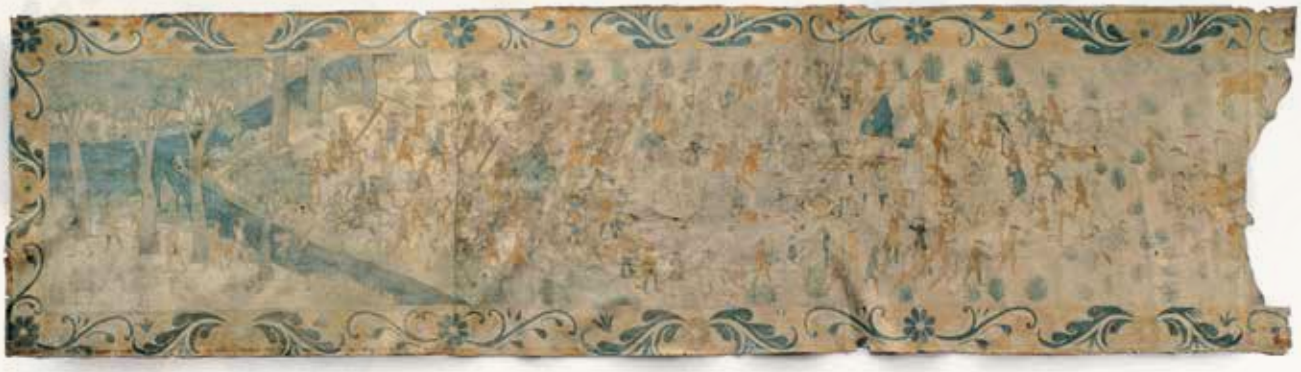
Segesser II, however, is more than just a fascinating example of colonial history and power politics in the greater Spanish empire. Yes, it depicts the battle between Plains Indians and forces led by Lieutenant-General Pedro de Villasur, on August 13, 1720, in modern-day Nebraska, which cost Santa Fe a third of the province's best soldiers and arguably marked the end of Bourbon pretensions to an empire east of the Mississippi. But it also captures the faces of individual participants, ancestors to contemporary New Mexicans. Former head of the Palace of the Governors Thomas Chávez reminded readers in a 1990 article in *Great Plains Quarterly* that this is extremely rare, not only because of who the piece captures, but that it exists at all. Contemporary or near-contemporary pictorial representations of historical events are few and far between in early American history.

"The hides are a portal to an archetypal story: clashes of culture, and cultural assimilation," said Andrew Wulf, director of the New Mexico History Museum, of two themes essential to understanding the history of the state and its peoples. "The hides will help us tell that story better."

The Jesuit priest Philipp von Segesser von Brunegg bought the hides in Sonora, Mexico, sometime between 1732 and 1758, from the Anzas, a family prominent in both New Mexico and Sonora. According to New Mexico History Museum curator

Seek

by Peter BG Shoemaker



the Conservation Lab's latest project is equal parts complicated and fascinating.

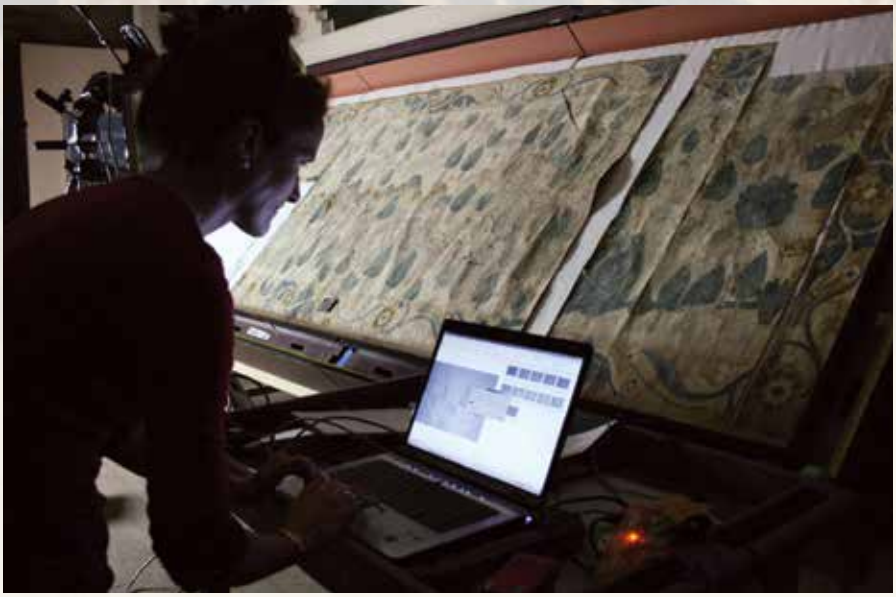
Josef Díaz, they were painted in New Mexico between 1693 and 1730. He then sent them on to his family's home in Switzerland. There they were treated as curiosities and wall hangings until Gottfried Hotz—a curator at the North American Indian Museum, in Zurich—"discovered" them in 1945. While both hides have pieces missing, Segesser I took the brunt of heavy use by the Segesser family. A large section in the lower left was cut away to allow the tapestry to fit around a door or a window. Another smaller section—featuring a tepee village—was given to a distant member of the family, who later sold it. There is a chance it may still be recovered.

After much study, including trips to the United States and Mexico, Hotz made contact with a curator at the Museum of International Folk Art in Santa Fe. And although both felt that the hides would have a fine place in New Mexico, nothing came of it then. It wasn't until 1984 that staff at the Palace of the Governors made contact with Dr. André von Segesser, and negotiations began. Both parties wanted the hides to come to New Mexico, and after two years they arrived—to great press fanfare and a flurry of academic activity.

In the 1980s the Segesser family no longer knew, if their ancestor ever had, who had painted the hides, or where and on what occasion they were painted. Not surprisingly, the hides have been meticulously studied since their return. Scholars have constructed, deconstructed, and reconstructed possible narratives —mostly but not entirely through visual inspection and historical research—to explain what's happening in each of the paintings.

Theories abound. The hides were painted in Santa Fe ateliers; they were painted elsewhere; they were overseen by European craftsmen; they were directed by master painters; they were painted by European-trained locals; the Spaniards were present at both battles, or only in Segesser II; and so on. Everything from facial expressions on individual characters to the stylistic elements like the painting's border has been subjected to analysis to find out how and where they were painted, by whom, and why. By and large, this visual and historical analysis hasn't provided definitive answers.

Enter science. Frequently, this deeper analysis is done through liquid chromatography and its associated techniques, exploiting chemical properties to reveal the presence of cer-



Dr. Fenella France examines a captured multi-spectral image stack, taken while the protective plexiglass was temporarily removed from the Segesser display case. The camera is behind her. Photograph by Natalie Baca.

tain kinds of pigment, or types of composition, or even hidden images. The lab has used these methods, most notably in the last few years with their pathbreaking work on cochineal. The drawback? They require a physical sample of the artifact being studied. Practically, this means scraping or cutting off a piece of the original. In either case, the analysis destroys the sample: do that too many times and there's nothing left.

A powerful alternative is a relatively new technology (pioneered in the 1960s during the Vietnam War) called multispectral imaging—taking photographs under a variety of types of electromagnetic radiation. This is a big deal because different wavelengths of light, like ultraviolet and infrared, reveal characteristics of objects that might be entirely invisible to the naked eye under day-to-day circumstances.

Humans see the world only within a very small band of electromagnetic radiation, where each light wave is between 740 nanometers and 380 nanometers, peak to peak (a nanometer is one-billionth of a meter—about the distance a fingernail grows every second). Other animals see different spectra, which in many cases means that they see a different world. Cameras fitted with lenses that filter out some spectra and accentuate others can do this too. But unlike living beings, they can encode the images so that researchers can adjust elements of the image to accentuate or deemphasize particular aspects like exposure, contrast, clarity, tone, and tint, all things that might enhance the available information from each photograph.

Conservation professionals and art historians have been making use of multispectral imaging for a few decades, examining everything, particularly in infrared, from paintings by Renaissance masters to (famously) a tenth-century CE manuscript of a second-century BCE Greek text, overwritten by a thirteenth-century CE Christian text called the Archimedes Palimpsest. This consists of a Byzantine prayer book with seven important works by the Greek mathematician Archimedes hidden under the text. One of the hidden documents no longer existed in Greek anywhere in the world before its discovery, and two of them—*The Method of Mechanical Theorems* and the *Stomachion*—were entirely unknown in any language. (For the history of the Palimpsest, extensive images, and information on the research techniques themselves, visit archimedespalimpsest.org.)

It is the use of multispectral imaging to see through or under an existing painting that has most captured the imagination of scholars and scientists. To understand why, imagine how some paintings get made. Artists from the Renaissance onward often used two typical techniques as they were preparing to begin a new work. The first of these is called *spolvero*, which involved pressing powdered chalk through a pricked outline of a drawing onto an empty canvas. This created a guide picture that the artist could then follow or use as an experiment to see how something else might look.

The second technique, and the one that gets researchers particularly excited, is *pentimento*. In this case, artists sketch directly onto the canvas before they begin painting. Not only can pentimento give researchers insight into how a finished painting might differ from the idea and approach that the artist had at the beginning, but it can also reveal a variety of other things. For example, evidence of the use of drawn horizons and other tricks of the trade can be used to determine particular artistic traditions, teacher/student relationships, changes in a patron's direction, or even a change of model. What makes spolvero and pentimento visible in multispectral infrared-targeted imaging, and the entire process possible, is the carbon found in the charcoal of the sketch or the pinprick dusting. Carbon absorbs infrared wavelengths, making them stand out under the usually transparent paint pigments in an infrared photo.

In the case of Segesser II, evidence of pentimento or spolvero (and initial tests show plenty of the latter, at least) can contribute to a better understanding of the sort of training and tradition that existed in the Santa Fe workshops from which the hides are suspected to have come. Both or either would add credence to the prevailing belief (based specifically on stylistic conventions) that the painters of the hides benefited from European training, either originally or second-hand. But it's not just the underdrawing that is of interest. There is also the pigment and the dyes that do so much to make the paintings so compelling.

The choices (or perhaps lack of choices) that the artists had available to them about what sort of pigment to use can provide additional clues to answering the questions of who painted the hides and where, and offer confirming evidence of the timeline. For instance, Prussian blue and indigo have very different histories (the former only became commercially available in 1710, and probably quite a bit later in the Americas), and each shows up differently under infrared: Prussian blue as opaque or black, and indigo as transparent. Determining which pigment contributed the blue to the paintings can reveal hints not only about training but also about the existence and shape of trade networks, and the world of potentially competing workshops in the New World.

All of this, MacKenzie said, is about raw curiosity as much as it is about finding a way to let the artifacts illuminate answers to the universal questions of "design, process, and decision making." It helps scholars get beyond the thing itself to an understanding of not only who made it, but why they made the choices they did in making it. For instance, was something being done a certain way because it had always been done that way, or was the artist experimenting? The obvious solution, then, is for the lab to image Segesser II (and eventually Segesser I) and get some good answers.

The problem, MacKenzie explained, is that "we're trying to build the Eiffel Tower without knowing how to build a girder." Because, it turns out, Segesser II is a nightmare of an imaging problem, and there's no simple—or even proven—way to do it, despite knowing what the end result ought to be.

SEGESSER II IS BIG, measuring 17 by 4½ feet. It's floppy, which means it has to lie flat, and it's priceless. In other words, it is not the sort of thing you can just pick up and throw under a camera.

Thankfully, the world of conservation is one part tradition and established practice—there are known ways of doing things that produce results of a certain expected sort, and these are taught in academic programs and in the lab—and one part bald-faced, no-holds-barred figure-it-outness, because no one has ever done it before. Obviously, this particular combination of approaches attracts a certain sort of person, one who likes to solve problems through a combination of established, proven techniques and mad experimentation. And the lab is like a magnet for those sorts of people. As MacKenzie put it, from the midst of a collection of vials, electronics, screwdrivers, and piles of duct tape, "It's a hidden profession, and a dream job."

After looking around the marketplace and talking to colleagues across the world, MacKenzie came to the conclusion that nobody had the tools necessary to do what needed to be done with the Segesser Hides. So, he designed something. But not from scratch. Instead he went down the path of many inventors of necessity, asking the question, "What's around that's close, that can get me

Left: This detail of Segesser I represents the way museum visitors see this part of the work in normal light. Photograph by Blair Clark.

Right: The same detail in "false color," multi-spectral imaging mode clearly shows various additions, alterations, and reinforcements made to the painting during its history of use. Photograph by Mark MacKenzie.

where I want to go fast?" The answer was a tool that's been used in factories for years and is now finding its way into the do-it-yourself world as well: a computer-controlled cutting machine known as a CNC router.

A CNC (computer numeric control) machine uses precise commands on three axes—X, Y, and Z—to move a cutting tool over a flat surface. CNC machines are used mostly to do intricate metal work or product prototyping, where users need to be able to cut material while controlling not only the length and width of each cut, but also the height, or depth. The cutting tool is mounted on a gantry system that permits it to move in any of the dimensions the operator dictates.

Obviously, MacKenzie had no interest in a cutting tool, but he was very intrigued with the way in which the tool moved over the surface of the cutting table. And an idea was born. What if there was a table and a gantry system constructed in such a way that the Segesser hide could lay flat and over which the camera could freely move as needed?

The lab benefits from a bequest from the Pierce family, restricted to the advancement of scientific analytical work (see sidebar). And having access to the fund allowed MacKenzie to do something that very few institutions—particularly state-run institutions—anywhere in the United States can do: he went out, found an engineer and a company that could make a CNC system to his specifications, got a bid, and okayed its production. When the assembly is complete, MacKenzie will attach the lab's multispectral imaging camera where the cutting element would have hung, and the result will be a unique tool in the world of research and museum conservation.

ASSUMING A 15-PERCENT OVERLAP for each picture (with those adjacent to it)—which MacKenzie says is important to ensure not only that the hide's image can be reconstructed in its entirety, but also as a bulwark against mistakes—the lab will capture about 5,000 photos, representing somewhere around 330 gigabytes of stored data (that's equivalent to about 580 hours of video). During the imaging process, the lab will also capture the precise coordinates of each photograph (a sort of GPS-like guide to where on the painting each picture was taken).

That latter step is particularly necessary not only to allow scholars to pinpoint particular areas for discussion, but also so that it will be possible to return to specific areas of the hide and take further pictures, either to explore additional elements of the artifact or repair errors that might have happened during the initial session. This redundancy, as well as the number of photos and their extremely high resolution, serves a secondary purpose, one that is central to the lab's role in conservation.

"What we're trying to do," said MacKenzie, "is do such a good job the first time around that we won't ever have to do it again." And this is a first principle in a lot of conservation work: capture everything, more than you need, in as wide a variety of formats as possible, so that whatever anyone needs to know about the piece in the future, the information will be available. In other words: get it once, but get it all. "Some bright light in the future may come along and run all these images through a quantum computer," said MacKenzie, talking about some of the young, talented scientists coming into the field. And indeed, early indications of quantum-assisted analysis elsewhere suggest extraordinary possibilities: from algorithms that will learn as they work, to pattern-identification based on variables we might not even think to look for.

Imaging was scheduled to begin in August and will probably take a couple of months. During that time, the Segesser Hides will not be on display at the Palace of the Governors. However, photographs of them can be seen at nmhistorymuseum.org/hides/.

Once the initial analysis begins to shape up, there are plans to enable greater access to the results. Academic papers will follow, of course, as well as the development of public interfaces for exploration or research. A documentary film featuring the lab's work on imaging the hides is planned as future accompaniment to the exhibit. The quality of the images will also allow museum officials the option to display facsimiles in lieu of the delicate originals, if needed (for instance, if the baseline assessments suggest that some time in dark storage would be a good thing).

"We don't know what we'll find," concluded MacKenzie, "but we're all going into this with as few preconceptions as possible. We'll see what we'll see." Later this year, so will everyone else.

Peter BG Shoemaker is a former historian and archaeologist turned writer and poet—little change, as it turned out. More at petershoemaker.com.

Dr. Don E. Pierce Endowment for Archaeology and Conservation

Dr. Don E. Pierce retired to Santa Fe following a long career as a pathologist. He had an intense interest in Native American arts and archaeology, and he served for years on the Board of the Museum of New Mexico Foundation's Friends of Archaeology. His appreciation for the contributions of scientific analysis to the study of material culture led him to dedicate a large share of his estate to the support of the analytic capacity of the Museums of New Mexico Conservation Department and the Center for New Mexico Archaeology.