# Entomo3D and the Student Experience in Developing Organizational Capacity

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The Virginia Tech Insect Collection (VTEC), founded in 1888, is the oldest and largest entomological collection in Virginia and a historical collection representing Appalachia's insect biodiversity. Its more than half-million specimens represent the rich diversity of the eastern United States. VTEC is an exceptional repository of pollinators, endangered and native species, once common but now disappearing due to habitat loss. VTEC was underfunded and hidden from view since discontinuation of state support in 1992. Revitalization began in 2015 with a National Science Foundation grant to fund conservation infrastructure and stabilization through storage upgrades and preliminary digitization for approximately 3 percent of its holdings. Since VTEC is too large to digitize within the scope of a single Hidden Collections grant, our project focuses on comprehensive digitization of ecologically and economically critical native pollinators and endangered and threatened species native to Appalachia. This two-year project digitizes, describes, and provides access to 15,000 pinned insect specimens through high resolution photos and 400 high resolution 3D models.

The specialized technical skills necessary for the 3D modeling in this project come from students in the Creative Technologies program in the Virginia Tech School of Visual Arts. This program trains students in 3D modeling as it is taught in video game design and animation. Graduate students were solicited through a stipend (paid by the grant) and full tuition (paid by the University Libraries and the School of Visual Arts) for a graduate degree to qualified applicants. We also hired undergraduate students as wage employees. Students are engaged in technology processes throughout the project and learn complex curatorial tasks, digitization protocols, catalog structure, technical metadata, and documentation. Participation provided the students with a professional portfolio to help them in their search for future employment.

This project also presented the University Libraries' digital library development, digital imaging, and preservation teams with new technical challenges that are unique across the spectrum of academic libraries. In the absence of firmly established best practices for managing 3D data across disciplines, we developed a technical plan adopted from established reference models such as OAIS, and based on research stemming from the IMLS-funded 2018 LIB3DVR project. Entomo3D presents a real-world test of our findings.

In navigating the challenges of the past few years, the students who contributed to the project helped increase capacity at Virginia Tech for future large scale 3D projects and have also developed a unique and marketable set of skills and experiences. Our paper includes a collection of their personal narratives as well as a discussion of challenges in building institutional capacity during this period.

### Introduction/Background: Student Employees

Whereas some academic libraries hire contingent labor heavily from an i-school or library school on campus, Virginia Tech does not have one. We were, however, able to use the same strategy by collaborating with the Creative Technologies program in the Virginia Tech School of Visual Arts (SOVA). We were therefore able to leverage student labor and providing experiential learning opportunities for students.

While the CLIR grant paid for stipends for two graduate students in SOVA and one graduate student in Entomology for two years, tuition and fees are disallowed costs. The dean of Libraries, the director of SOVA, and the head of the Entomology Department each paid for one tuition and fee waiver via cost share, and in return we hired graduate students from the SOVA and Entomology programs.

The grant solicitation encourages the participation of people with diverse perspectives in project activities. Since there was limited opportunity to provide diverse perspectives or narratives for a scientific collection, we decided to address this recommendation by prioritizing hiring personnel from underrepresented minorities. During the grant application process however we did not think the institution would allow more than a commitment to just advertising with community and cultural centers on campus, so that was our initial plan. Our hiring advertisement was scheduled to go out in March 2020. As a result of the COVID lockdown, we were not sure how many potential applicants would see it or what the following academic year would even look like.

Over the summer, we discussed these positions with the Creative Technologies program director. Jointly we were able to prioritize recruitment of students who were able to do the work and who were excited and interested in the project and additionally who were from underrepresented minorities in their program in order to diversify the pipeline and create debt-free educational opportunities for this demographic. Throughout the duration of the project, Virginia Tech University Libraries has been able to hire one Indian American woman, one Chinese man, one Korean woman, two Filipino American women, one Latvian woman, one white American woman, one white American man, one Korean American woman, one Okinawan American woman, and one Afghan American woman. In the Department of Entomology, co-PI Paul Marek hired a Colombian woman.

### Student Experience

The specialized technical skills necessary for the 3D modeling in this project come from students in the Creative Technologies program in the Virginia Tech School of Visual Arts (SOVA). This program trains students in 3D modeling as it is taught in video game design and animation industries. As mentioned above, graduate students were solicited through a stipend (paid by the grant) and full tuition (paid by the University Libraries and SOVA) for a graduate degree to qualified applicants. Undergraduate students were also hired as wage employees for production. Students are engaged in technology processes throughout the project and learn complex curatorial tasks, digitization protocols, catalog structure, technical metadata, and documentation. Participation provided the students with a professional portfolio to help them in their search for future employment. The University Libraries' relationship with SOVA is similar to the relationships between many LIS programs and academic libraries—the library provides work

experience and funding for students, and the academic program provides a talent pipeline. In the following sections, four of the students who were on the project over the course of last year each provide a narrative about how their academic work intersects with their work on Entomo3D and their professional goals.

### Younghee "Erin" Chung

I am a graduate student of Creative Technologies at Virginia Tech. My specialty is visualizing stories on storyboards, but also I can do 3D modeling and animation. I had an experience in game development as well where I produced many different 3D characters, assets, and animations, as well as optimizing those 3D assets; therefore, this project with Nathan was a perfect fit for me.
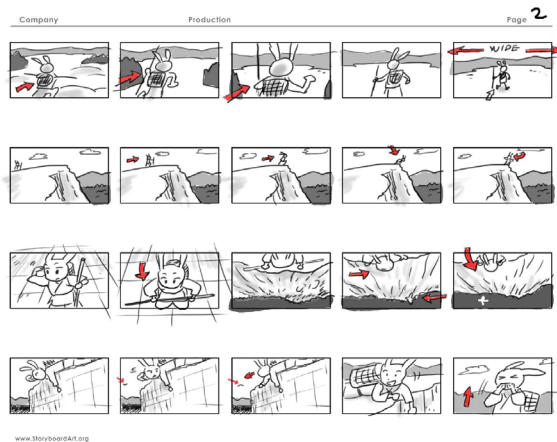


**FIGURE 1:** Storyboard by Erin Chung.

Although the workflow was quite familiar to me, this project made me understand how archiving was an important process and solidified my skills in other areas of 3D, along with being cooperative and improving communication with other members while working remotely. For my ideal future profession, I always dreamed of being a story artist since I was very young. I love writing stories, drawing characters, and expressing them through visual images like animation and films. (see fig. 1)

A storyboard is a 2D image work—it has less focus on 3D, but I want to work at 3D animation studios so my 3D skills and the experience from this project built a great foundation for me as a story artist. They broadened my perspective and knowledge so I have confidence in communicating with future colleagues who do 3D work. Most importantly, I can get bigger inspiration for writing stories.

### Katrina Enriquez

I'm a recent graduate of Virginia Tech where I received my BFA for Creative Technologies. I concentrated in 3D modeling and animation. Before anything else, I would describe myself as a storyteller. As someone who creates 3D environments for personal projects, the image in figure 2 for example, and for work, I genuinely love the idea of being able to conceptualize spaces that usually only exist in my imagination and being able to share that with others through my art. Being a part of this project has expanded my technical skills, where I am able to switch styles—in this case, I was able to learn more photorealistic practices which I can apply to my future art.

Most of my pieces are emotional. I am a highly sensitive person so I am able to draw a lot of feelings and inspiration out of the mundane, some through nature, music, and memories. For this particular piece, I was inspired by my childhood home in the Philippines. I grew up playing piano and I wanted to capture the kind of solemn feeling I would have every time I would play it.

In terms of future goals, I hope to pursue a career that involves 3D environments. This can range from positions in the gaming industry, for research, animation studios, as well as exhibit design

**FIGURE 2:** Space design concept by Katrina Enriquez.



**FIGURE 3:** Materiality study by Jillian Sy.

spaces for museums or events. I hope to learn and grow as an artist to my fullest potential and hopefully be able to inspire others through my work.

### Jillian Sy

From the start of my undergraduate program, I was drawn to 3D modeling and it became the primary medium of my work. While I was learning the basics of modeling, I realized that I really enjoyed making environments whether they were regular rooms or surreal landscapes. It wasn't until I took a class in my junior year that I discovered texturing with Substance 3D Painter. Substance is a program from Adobe and it allows you to make photorealistic or stylized textures. This became a new way of storytelling for me because when I textured something, I felt like I could add so many more details about an object, like how old or how used it was, through adding layers of dust or signs of wear. With history being one of my favorite subjects, texturing also allowed me to explore the history of an object and make intentional choices based on that.

The image in figure 3 is a model of my memory box, which was the focus of my senior project. I'm a very sentimental person and I've kept mementos and trinkets since childhood. Some call it hoarding, but I consider it as collecting and it brings my path to full circle because I've gone from collecting all these material objects to looking at the materiality of an object. I hope to pursue work that allows me to be excited over textures—over the details that I think really elevate storytelling or reveal a lot about a piece.

### Eva Deisa

I'm currently pursuing my MFA in Creative Technologies at Virginia Tech. I am an interdisciplinary 3D artist, which kind of means that I do a little bit of everything when it comes to 3D. I do 3D modeling, 3D texturing, 3D animation, and environment creation. The main software I use is Maya, ZBrush, and Substance 3D Painter. I would say that the greatest challenge that I've overcome doing this project is different software integration and troubleshooting. It's been hard doing all of that by myself. Here (https://www.youtube.com/watch?v=1kd-sg3EHsg) you can see one animation that I have created during my time at Virginia Tech. In recent years I've been fascinated by virtual reality installations so that is what I am exploring right now.

Fall 2022 was my last semester, which means that I was really focused on my thesis. My thesis involves creating a production pipeline for virtual reality installations that is centered around a humanoid character animation. The skills I'm perfecting besides the ones I mentioned earlier are

recording motion capture animations of myself, creating realistic virtual environments, and combining all these skills into a game engine for a virtual reality experience.

The conceptual framework of my thesis is analysis and critique of modern-day routine and how we get stuck in a loop and then we sometimes snap out of it. An example that I use often to illustrate this is the feeling of when you drive home from work sometimes and you just have no idea how you got there. The main question that I'm trying to explore is where is our mind when it's not present?

As for why I even got into the 3D realm and chose that to be my career path, the main reason is because I just think that there are infinite possibilities of creation when it comes to 3D because you have this infinite space, right? You have no limitations of physics, no gravity, no restrictions at all. The 3D realm is not occupied by anybody else; that is yours and you can do whatever you want and you can go as weird as you want. Nobody's going to say anything because it's only you and your infinite world and you just create. It's very liberating but sometimes a little bit overwhelming because you know when somebody tells you that you could do anything you want or you can draw anything you want, we kind of get stuck sometimes, at least I do. Sometimes I want to be told what to make and I'll use my skills to do it.

So the unlimited possibilities is what drew me into 3D, and unlimited possibilities is what drew me to this project as well. When I learned that we can use the skills, that we have to do such a big service to the community, to make all of these bugs that are sitting in boxes in our entomology collection available for anyone in the world to see and interact with—it was really exciting because for the first time I had the opportunity to work on something that is serving a purpose outside of myself, as my personal practice is so internal, and so self-analyzing, and just purely artistic.

But the Entomo3D project is something that we do for other people and that feels very purposeful. This has also been the first time that I worked with a team of people, which is sometimes scary because we've all had really bad group projects in school that give us nightmares. At first I was a bit nervous but this has honestly been one of the best teams I've ever worked with because of the way that we troubleshoot and help each other out, working though the many problems we have and improving our workflow. It's all pretty amazing. It is such a big contrast from working alone because of having other people who all contribute their great ideas and solutions.

This experience is something that I will hold on to for a long time because it was so new and fresh and I learned so much from this. The main takeaway is that the 3D realm can be used in infinite different ways and not only for animation creation—because usually when people find out what I do the first question they ask is if I'm going to work for Disney or Pixar. For the longest time I was under the impression that those would be among my options but the Entomo3D project and the Digitizing Hidden Collections conference have opened my perspective to other possibilities.

### Institutional Capacity

The grant program solicitation emphasizes development of local institutional capacity, including the professional development of all staff involved. Jillian Sy, Eva Deisa, Erin Chung, and Katrina Enriquez all attended the 2022 Digitizing Hidden Collections Symposium and presented a poster and as a panel. This travel was partially funded by the University and partly by grant funds. The poster covered technical processes and workflows while the panel was what led to this paper. This

was the first professional conference for any of the students and they were excited to find people who were interested in their skill sets and to find new ways that their skills could be applied.

One challenge is with skill retention. After spending a year on the project, students learn a lot, but these skills and experiences are lost when they graduate or take another campus position. This revolving door of skills is somewhat mitigated by an evolving set of documentation which includes videos and written guides to support training. The students continuously add to this documentation as they learn new methods or find ways to clarify instruction. Maintaining relationships with the SOVA faculty has also been helpful, as they sometimes tutor the students in the required technical skills for the position. However, the skill retention issue was exacerbated when the faculty 3D texture artist who supervised the students left the university to pursue an exciting opportunity in the gaming industry. Due to the number of faculty lines concurrently open, filling the position took more than a year, during which I supervised the students myself. This was not ideal since I do not have the 3D technical skills, thus the best I could do was to facilitate their group problem-solving.

In spite of this challenge, the students formed a good team and engaged in group problem-solving and peer mentoring. Throughout the project, students have identified problems and offered solutions and efficiencies. One former graduate student, Tianyu Ge, was particularly invested in automating as many steps as possible. All of the students have identified and remediated gaps in training and process documentation.

Maureen Saverot, a former wage employee who worked her way up to a faculty position, discovered that turning specimens upside down to photograph them essentially ruined the data because the photogrammetry software detected the bend in the wings caused by gravity pulling them in the opposite direction, and the stitching was therefore impossible. This issue was addressed by adjusting the camera setup to shoot from below.

Another challenge was with acquisition of software and hardware. While we have sufficient funding to provide computers, and while allocated space for the photogrammetry, much of the work evolved to be remote due to the pandemic. Therefore, the students often worked from personal computers on shared drives because it was more accessible. Some of the software that the students can use on their personal computers, however, is not yet approved for use on university computers. Students have had access to free academic licenses for classes, but this is problematic after they graduate and the license expires. We try to identify the software they use and have it installed on a lab computer which they can remotely access through Splashtop. This is important in order to sustain production in spite of attrition. The challenge is that the students come and go and have different favorite tools.

While we have sufficient funds to purchase any technology required, we are often delayed by university procurement processes. IT Procurement and Licensing Solutions will not allow the purchase or installation of software until the end-user license agreement has been approved by the Office of University Legal Counsel and until the vendor completes the Higher Education Community Vendor Assessment Toolkit (HEVCAT). Each of these processes can take multiple years to complete, which has been a significant source of delay for the project. After several years we learned that the University Libraries administration can agree to accept risk, which is a simpler process, but still less than ideal.

## Conclusion

In spite of challenges with attrition, procurement, and the pandemic, the partnership between the University Libraries, the School of Visual Arts, and the Department of Entomology was a highly successful collaboration in terms of developing an innovative fundable project, and in creating experiential opportunities for undergraduate and graduate student employees. It is still too early to understand the educational opportunities and differences of the 3D models themselves relative to the traditional study of pinned physical specimens. Understanding this difference will be essential to long-term value and continuation of funding. ●

## Author Bios

**ERIN CHUNG** Is an MFA candidate in Creative Technologies, with a graduation date of May 2023. She is a graduate assistant on the Entomo3D project.

**EVA DEISA** completed her MFA in Creative Technologies at Virginia Tech in December 2022. She is a former graduate assistant on the Entomo3D project.

**KATRINA ENRIQUEZ** completed her BFA in December 2021. She worked on the Entomo3D project from 2021 until 2023.

**NATHAN HALL** is a co-PI on the Entomo3D project. He was director of digital imaging and preservation at Virginia Tech until March 2023. As of April 2023 he is the associate dean for distinctive collections and digital strategies at Penn State University Libraries.

**JILL SY** completed her BFA in Creative Technologies at Virginia Tech in December 2021. She has worked on the Entomo3D project since 2021.