A Historically Authentic Digital Recreation of Holocaust Survivor Henry Friedman's Hiding Place and More Scenes from World War II

> by Casey Ward

A THESIS

submitted to

Oregon State University

Honors College

in partial fulfillment of the requirements for the degree of

Honors Baccalaureate of Fine Arts in Digital Communication Arts (Honors Scholar)

Presented June 1, 2022 Commencement June 2022

AN ABSTRACT OF THE THESIS OF

Casey Ward for the degree of <u>Honors Baccalaureate of Fine Arts in Digital Communication</u> <u>Arts</u> presented on June 1, 2022. Title: <u>A Historically Authentic Digital Recreation of</u> <u>Holocaust Survivor Henry Friedman's Hiding Place and More Scenes from World War II</u>.

Abstract approved: _____

Todd Kesterson

This project uses a variety of 3D technologies to give a deeper understanding of what it was like to live through the events of World War II. It includes three unique scenes: a Parisian Alleyway, an Underground Air Raid Shelter, and the attic where Holocaust survivor Henry Friedman and his family took refuge during the German occupation of Poland. These interactive 3D models are based on extensive research and first-hand experiences, and they will be utilized to preserve and expand knowledge in younger populations for generations to come.

Key Words: Holocaust, Henry Friedman, World War II, 3D Modeling, Texturing, Autodesk Maya, Substance Painter, Sketchfab Corresponding e-mail address: wardcas@oregonstate.edu ©Copyright by Casey Ward June 1, 2022

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I understand that my project will become part of the permanent collection of Oregon State University, Honors College. My signature below authorizes release of my project to any reader upon request.

Casey Ward, Author

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Table of Contents

1. Introduction
1.1 Inspiration2
2. Literature Review
2.1 I'm No Hero: Journeys of a Holocaust Survivor
2.2 Temple of Bagan13
3. Methodology 14
3.1 Process of Creating a 3D Piece14
3.2 Choosing the Appropriate Tools17
4. Discussion
4.1 Taking Liberties19
4.2 Limitations20
4.3 Challenges
4.3a Communicating with Henry Friedman
4.3b Historically Accurate vs. Historically Authentic23
4.3c Scale23
4.3d Bringing Depth to the Underground Air Raid Shelter24
4.3e Workflow Issues
4.4 Why Don't We See Any People? The Concept of the Uncanny Valley 26
4.5 Self-Reflection27
5. Results
5.1 Alleyway
5.2 London Underground Air Raid Shelter
5.3 The Symchuck Attic
6. Outcome and Significance
6.1 Future Work
Works Cited
Appendix: Links and Additional Pictures

1. Introduction

This project uses a variety of digital technologies to provide an intimate view of a Jewish family's experience living through World War II in German-occupied Poland. The project contains three scenes, two of which were started in a course titled New Media 3-D and were updated to fit within the parameters of this project. These were modeled after 1939 Paris and 1940-1941 London, respectively. The third piece of this project was created with help from Holocaust survivor Henry Friedman. It is a historically authentic 3D recreation of the attic where Mr. Friedman and his family hid during the German invasion of Poland. All three scenes were built from nothing using Autodesk Maya. The Alley and the attic were textured in Substance Painter and uploaded to the Internet via Sketchfab, and the Air Raid Shelter was both textured and uploaded using Sketchfab.

To get in touch with Mr. Friedman, I contacted Dr. Kara Ritzheimer, who was my professor for a course titled Holocaust in its History. When I reached out to her for help in forming ideas for my project, she urged me to reach out to Mr. Friedman, who spoke at Oregon State University during Holocaust Memorial Week in the spring of 2018. She put me in touch with another history professor, Dr. Kopperman, who referred me to Julia Thompson at the Holocaust Center for Humanity. After I explained my project to her, she reached out to Henry, and then sent me his email and phone number, saying that he would love to be contacted.

Before speaking with Mr. Friedman, I did extensive background research on him and his story. I read his memoir, watched his full video testimony, and typed up an extensive document of notes with particular emphasis on his hiding place, preparing many questions to ask him. The more I learned about him, the more reassured I was that he was the right person to contact for this project. For the last 30 years, he has dedicated his life to sharing his story and educating the world in hopes that another Holocaust-level event never occurs again. It was this dedication to education that inspired me to illustrate his story and made me feel comfortable asking for his permission and help. I have since spoken with him on the phone numerous times and asked many questions about the building he and his family spent most of the war hiding in.

A project like this is more important now than ever, especially as Holocaust awareness in youth is starting to decline and survivors begin to dwindle (Claims Conference). We cannot let their stories become lost in the age of misinformation. By working with the Holocaust Center for Humanity in Seattle, this project will be used to educate and inform those who lack an understanding of the events that occurred.

1.1 Inspiration

In starting the original two pieces of this project, I drew inspiration from my travels in Normandy, France. During my time there, I visited multiple World War II museums and saw dozens of interesting pieces of weaponry, vehicles, bombs, uniforms, pictures, and physical reconstructions of scenes from the war. I further expanded my knowledge of the war through various courses on world history and the Holocaust, and naturally gravitated toward this area when given the creative freedom to choose the setting for my projects in New Media 3-D. I settled on Paris for the Alleyway since I had been there as well, and I found the inspiration to go above and beyond the project guidelines from my online research. I knew I wanted my second project to be a continuation thematically from the first, and I stumbled upon the idea when researching unique stories from the war. I was fascinated by the images and stories I found about the London Underground air raid shelters, and I knew they would be the perfect challenge for my next project.

2. Literature Review

2.1 I'm No Hero: Journeys of a Holocaust Survivor

Henry Friedman was raised in Brody, Poland, now part of Ukraine. Jewish people settled there around 1588. He was born on May 5, 1928, and grew up amidst heavy antisemitism. The Friedmans were not necessarily well off, but more so than most in the area. Henry's father, Jacob, was a prominent and generous figure in the community. He would frequently give out loans or allow neighbors to borrow their equipment or horses. Jacob would always take in those in need, especially on religious holidays, but would never refuse a guest based on religion. The Friedmans hosted many travelers and others who needed shelter, which helped them stay informed on the happenings of the rest of the world.

Brody was occupied by the Soviets following the partition in 1939 and fell to the Germans in July of 1941. Immediately after, Jews faced prosecution and murder. Henry was eleven years old when the reality of war began on September 22, 1939. He still remembers how terrified he was when the bombing started, and their family was forced to spend the night hiding in their coal shelter. The Friedmans came out of the basement to find utter chaos. Buildings burned, parts of human bodies lay in the street, and dead or wounded animals were everywhere. Jacob took the family to their farm in Suchowola as he wagered the countryside was far less likely to be bombed.

The bombing in Brody continued every night for the next two or three days. When it was over, they learned that Hitler had signed a pact ceding Brody to Stalin along with the rest of Ukraine. Though Henry doesn't mention it by name, this is likely the follow-up to the original Nonaggression Pact of August 1939, known as the German-Soviet Boundary and Friendship Treaty (History.com). This document was signed on September 29, 1939, and divided up Poland between Germany and Russia. The Russians soon came with tanks, horses, and on foot. They claimed the Friedman's textile store for their collective, along with their house in Brody and most of their possessions. As a result, the Friedmans decided to stay on the farm in Suchowola permanently. Henry began going to a Russian school where, to his surprise, he was not treated differently for being Jewish. The Russians soon started demanding more and more taxes from the local farms, but Henry's father refused to pay. Being the second-largest landowner in the area, the other farmers in the area followed his example.

In the winter of 1940, Jewish people from Brody were sent by train to Siberian labor camps by the Russians. By June of 1941, bombs began dropping once again and Brody was ablaze. In less than two weeks, the Germans invaded. Henry's father stashed all of their valuables in the ground on nearby farms. The Germans registered all of the *intelligentsia* in the area. Afterward, 250 of the Jewish people who registered were murdered. The Friedmans lost three family members, and the Germans' plan to dismantle the local Jewish community had begun. The first act of German brutality witnessed by the Friedmans was when the Germans marched the Red Army through the streets, beating the soldiers bloody and shooting them if they could no longer walk.

The *koniers*, horse dealers and the strongest of the Jews, were summoned and instructed to dig graves for the Russians and their horses. After hours of digging, the German enforcers gave a signal to Ukrainian policemen who were hiding in the trees. These policemen, hoping to align themselves with the Germans, gunned the koniers down, their bodies falling into the freshly dug graves. Some of the wounded were able to escape under nightfall and their tales reached the Friedmans.

Jewish children were soon forbidden from attending school, and Jewish teachers were no longer allowed to teach. Jacob Friedman worried that his two boys would lose their chance for education as he had during World War I, so he had their Jewish teacher, Sarah, move in with them. Sarah continued to teach Henry and his brother, Isaac, and became a part of the family over time.

The Germans were quick to take over the Friedmans' farm and made them pay to continue to live there and be able to eat. A man by the name of Herr Wolfgang, a half-German, half-Pole from Eastern Germany was put in charge of the farm. The Friedmans became unpaid laborers on their own land. At dawn on the morning of February 1942, eighteen-year-old Julia Symchuck came running up the road to warn Jacob that the Gestapo were coming for him. She worked as a maid at the police station and had overheard information about Jacob's arrest. Henry's mother had always been extremely kind to Julia, giving her extra money to help sweep the textile store or do various other tasks, and Henry's father employed Mr. Symchuck since their farm was too small to support the family. It was likely due to these reasons that Julia risked her life to warn the Friedmans of the Gestapo.

Henry's father was able to escape, as was Henry's Uncle Mosh thanks to Henry running to warn him as well. Jacob had already picked out a spot for himself to hide in a corner of their horse barn and was safe there for the next 3 weeks. During this time, Henry was certain that Herr Wolfgang would have turned them in to the Gestapo in Brody if he didn't see them as valuable. Henry's mom was able to pay off the Ukrainian chief of police, allowing Henry's father to come out of hiding. This cost them the \$3,000 USD they had saved up to flee the country. Without it, they'd likely have died lacking Jacob's guidance. When the second *aktion*, or roundup of Jews, came and the Germans needed to take 3,000 Jewish people to meet their quota, all five Friedmans went into hiding, including their teacher, Sarah. Henry hid by himself in a hayloft and had no food or water for two days. Finally, on the second night, he snuck out and sucked down six raw eggs and some sugar beets that he had found. He returned to the hayloft, where his father later found him to say he could come out of hiding. During this roundup, all of the Jewish police and leaders were taken, leaving the Jewish community in shambles. In the spring of 1942, Herr Wolfgang informed Jacob that they had received an order for all Jews in the area to go back to Brody to live in the ghetto, but Jacob convinced Wolfgang to let them stay, as their farm relied heavily on rotation farming. Only Jacob knew where each crop was planted and where it would have to be replanted next. Because of this, and the fact that there was a large harvest coming up, Herr Wolfgang allowed the Friedmans to stay.

Henry's father immediately started preparing for them to disappear. He tried to help the rest of their family members as well but ultimately had to devote all his effort to his immediate family to ensure their survival. In the middle of 1942, the Friedmans lost contact with the entire rest of their family. Henry recalls that he didn't see a single smiling Jewish face that year.

In October of 1942, orders came for the Friedmans to go to the ghetto. Henry, his mother, his brother, and Sarah went to hide with the Symchucks, who were very close with the Friedmans. This is the space that I recreated in 3D: their hiding place in the attic above the Symchuck's farm animals. The building was divided in two. One side served as the barn, and the other as the living quarters for the Symchuck family. The roof was straw, the Friedmans were surrounded by hay on two sides, and the chimney sat in the middle of the house. Their space was roughly the size of a queen mattress, and they hadn't enough room to stand. The Friedmans

barely had enough space to sit up and move around, and they slept on a bed of hay, sharing a single blanket. Henry's mother and teacher slept in one direction, and he and his brother slept the other way. When they had to go to the bathroom, they would make a hole in the hay, and Mr. Symchuck would mix their waste with that of the animals in the morning. It was dark, with the only light being that which they received through cracks in the wood panels. Henry was able to carve out a hole from one of the knots in the wood after a few days, and this became their source of light and window to the outside world. They were only allowed to speak in whispers so as to not give themselves away to the workers on the farm. Unbeknownst to Henry, his mother was three months pregnant when they went into hiding.

Henry's father went to hide with Maria Bazalchik, a disabled woman to whom the Friedmans had always been extremely kind. However, her family were Ukrainians who were part of the Russian Orthodox religion: "Her brother was a Jew-hater, and her brother's son was the leader of the Banderas, a Ukrainian terrorist group of the region" (Friedman 21). The Banderas and the Germans had come to an agreement on their occupation. The Germans were in control during the day, and the Banderas were allowed to hunt and terrorize Jewish people at night. Only Maria knew that Jacob was hiding in their home.

Henry's father had paid the Symchucks well to keep his family hidden and supplied them with enough food to feed the Friedmans for 6 months. Henry soon became frustrated that he was cooped up with two women and his brother, believing that he could fend for himself just fine on the outside because of his Christian looks. He wanted to escape but was too afraid to try. He would spend his time looking out the dollar-sized opening he'd created at the storks nesting on roofs, becoming envious of them. Sometimes he would just lay on his back and count the straws on the roof for hours. Other times, he would find solace in prayer. For the first three months, they received two meals a day: soup, a slice of bread each, and a piece of meat occasionally. These meals were passed up to them through a secret opening. After six months in hiding, they were reduced to one meal per day, given to them late at night. The Friedmans would save it underneath the blanket, keeping it warm until the next day when they would eat it for breakfast, lunch, and dinner. Henry would lick every pot clean "with a vengeance" (25).

In the winter, temperatures would reach 20 below zero, and they would wake up with a layer of ice on the quilt, their hair frozen over. Henry mentions that the dirt and oils from their unbathed bodies kept them warm.

"It came time for Mother to have her baby, and we faced a major crisis. How would Mother give birth? Even if there were a doctor nearby, we could not call him. And how could we control the infant's crying? We argued back and forth what to do. If the baby were allowed to live, our lives would be endangered. Mother had two boys and a third male baby was stillborn in 1938. She desperately wanted to have a girl. We decided to vote, and the decision we made has haunted me ever since. I wake in the middle of the night, crying. My brother still denies that he voted. The baby would be suffocated by Sarah, who assisted with the birth.

There was little room for Sarah to do much of anything except catch the baby. Mrs. Symchuck sent up a bucket of hot water. She also brought a burlap potato sack to hold the dead infant. Then she went quickly away. Mother could not scream or allow herself to utter even a sound. I remember only that I saw her biting the quilt, white-faced. Isaac and I turned our backs. We never heard or saw a thing. Later we learned that the baby was a girl.

We had asked the Symchucks to bury the baby on our land. Mr. and Mrs. Symchuck that night took the body to be buried, but they had a hard time digging a hole deep enough because the ground was frozen. The month of March is still icy winter in Poland. And even though the night was pitch dark, they were afraid that someone might see them. They had to cover their tracks in the snow, and they were in a hurry to get home.

It was a miracle that my mother survived the birth process in our little hideaway. There was no medication for her, and we all slept in filth, infested with lice and fleas. How she escaped infection, I wonder to this day. It is hard to imagine what my mother and Sarah must have endured, and the Symchucks with their sad and terrible task. What would have happened if we had let the baby live, if we had taken a chance instead of having her suffocated? What would it have been like to have a sister? But as I remember the situation, I do not think my mother had any breast milk to feed the newborn. The baby would have starved, or if she did not starve, the lice would have eaten her up. Yet, when I think of that part of my life in 1943, the pain comes back to haunt me and I can never forgive the Nazis for what I was forced to be a part of at the age of fifteen-to take a life, just so I could survive. I have a problem when analyzing myself. Was I so terribly selfish then?" (26-27)

The body of the baby was later dug up by dogs, alerting the Banderas that the Friedmans were likely still alive and nearby. Henry said he vomited when he found out, picturing the dogs dragging his baby sister around. The Banderas began desperately hunting Jacob and his family as he was one of the last important Jewish figures unaccounted for in the area.

In June of 1943, Brody was declared to be *Judenfrei*, thought to be free of any Jews in the town or surrounding villages. Any Jew or family caught harboring a Jew was to be shot on site. After 11 months of hiding, the Friedmans were reduced to one slice of bread each per day. One night, Henry overheard Mr. Symchuck speak of poisoning them when he'd had too much to drink. He was sick of risking the lives of his family for the Friedmans, especially after witnessing a terrible event. A Jewish family had been caught hiding in the forest, and they were brutally murdered in the streets as a display to the whole town. It was made clear that those caught hiding or aiding Jews in any way would meet the same fate. Mrs. Friedman said they couldn't kill the Friedmans because Jacob was still alive elsewhere and would hunt them down and kill them. The Friedmans decided it was no longer safe for them there, and they left to go hide with Jacob just a kilometer away. They snuck out at night, but Henry's legs gave out from under him while walking. He had been either lying down or sitting up for 11 months, and his muscles had atrophied. His mother had to carry him the rest of the way.

Jacob was angry at first that they had risked their lives to get to him, but he was very happy to see them alive. His space was about the size of a single bed, and he only received food on five days of the week. The five of them slept sitting up, crammed in that space for a week until they determined it simply wasn't feasible. Jacob sent Henry's mother and Sarah back to the Symchucks with Jacob's last valuable possession, his boots, as a gift. If found, they were to pretend to be Mr. Symchuck's sisters since, without the boys, there was no way to prove they were Jewish (boys and men could be easily identified because of Jewish circumcision practices). Henry, Isaac, and Jacob remained in the Bazalchik household for the next six months, surviving off scraps of food meant for just one person.

Henry harbored no ill will toward the Symchucks following this incident: "One has to understand Mr. Symchuck's dilemma. When he originally took us in, it was for humane reasons: a good human being should help another human being who has been kind to him and his family for so many years. Mr. Symchuck was also getting financial rewards, so he was getting double the good fortune for doing the right thing. But after he saw with his own eyes the brutality of the police in killing some helpless Jews, he realized that he was jeopardizing the lives of his own family. The Symchucks were God-fearing people and kind Christians, but the liquor Mr. Symchuck drank influenced him badly, pushing forward evil thoughts. These, combined with fear, made him consider poisoning us. But the fact that, a few days later, he let the women return showed that Mr. Symchuck had, in the end, a good heart" (33).

Henry's memoir is filled with similarly terrifying stories from their months in hiding. Once, at the Bazalchik household, Henry, his father, and his brother nearly slit their own throats amidst a nearby raid by the Banderas, and when Jacob Friedman trudged through the snow carrying Henry back to the Symchucks, they escaped a Nazi patrol by mere seconds. In February of 1944, a German caravan came to town with a hundred soldiers ransacking homes and hunting for Jews on their path of retreat. The Symchucks fled to the woods, fearing they would be killed if found. Three separate groups of German soldiers came banging on the door, and all left thinking someone important lived in the home. At one point, a soldier started climbing into the attic looking for eggs, and his bayonet came within inches of Henry's face before the soldier was called back down.

On March 13, 1944, the Germans were pushed out of Suchowola by the Russians. Mrs. Symchuck came back to give the Friedmans some goulash from the abandoned German kitchen that had been set up on the front lawn. The Friedmans begged for water as the salty meal had made them unbearably thirsty, but Mrs. Symchuck was unable to safely fetch them any. That night, the Friedmans heard German voices and became terrified, thinking that the Germans had pushed the Russians back once again. Henry wanted to run for the rifles that had been left behind and fight off the German soldiers, but Sarah stopped him. He was too weak to even run or pick up a rifle, let alone use one to fight. Between the overwhelming thirst and the uncertainty of German forces in the area, Henry describes this as the longest night of his life. In the morning, they heard Russian voices. Russian soldiers had discovered the Germans hiding in the barn and were about to execute Mr. Symchuck for harboring German soldiers when Mrs. Symchuck yelled out to the Friedmans to come down.

They hastily jumped down from the attic, and Sarah explained the situation to them in Russian: "In the end, we saved the poor farmer's life. The Russian commander of the battalion that took Suchowola was called into the barn.

'Jews!' the commander said. 'I can hardly believe my eyes. I've seen no Jews in months, not since leaving Stalingrad.'

'What's the big deal?' one of his men remarked. 'Why should we honor Jews?'

'What unit are you from?' the commander shot back.

'I'm far from my unit' the soldier said.

'Arrest him,' the commander told two of his bodyguards.

We were astonished to see such action taken on our behalf.

The commander, who also happened to be Jewish, had his orderly bring bread and sardines to us and his men to celebrate our liberation" (39-40).

Henry, his mother, and his teacher were able to find Jacob and Isaac hiding under a bridge nearby. Their family was finally reunited and, miraculously, all but the newborn baby girl survived. Eventually, Henry relocated to the United States in 1949. He is still alive, and gives interviews and speeches about his experiences during the war. Henry's gripping memoir contains many more harrowing tales that could not be included here, and describes the family's escape from Poland and Henry's life post-war.

Before the war, Brody was home to almost 15,000 Jews. After, less than 100 remained. Ultimately, Henry attributed the survival of his family to the generosity and kindness of his father.

2.2 Temple of Bagan

The virtual tour of Bagan is a project that starts with a video providing background information on the earthquakes that regularly occur in Myanmar and the impact they have on the many temples scouring the region. This provides useful context for the project and gives the virtual environment a sense of importance, as it may be the only way to save the temples. After the video, the user is dropped into the first virtual space, Ananda Ok Kyaung, one of the temples scanned using lidar and photogrammetric data. The level of detail included is astonishing. It seems as if CyArk, the nonprofit company that captured the scans, was able to retain every bit of detail from the original temple down to the last scratch on the walls despite the limitations of having everything function through a web browser.

Another interesting part of the virtual tour was the inclusion of links to higher-quality versions of the murals. They say in one of the included videos that the quality they can capture with their scans is almost the same resolution as the human eye. They also mention that in order to get to one of the areas, members of the crew had to hunch down to climb up a very narrow staircase; then, after passing by a nest of hatchling birds awaiting their mother's return, they emerged onto a balcony area with a view of dozens more temples scattered across the horizon. These interviews prefaced a 360-degree viewing experience and provided some background information on the viewable area. It created a much more immersive environment to be able to hear exactly how the area is accessed. I found the entire experience incredibly inspiring.

The last temple on the tour, Eim Ya Kyaung, had been heavily damaged by an earthquake. The team was able to get scans of the structure both before and after the damage occurred, meaning they were able to construct two different versions of the temple. This allowed them to analyze not only which parts of the building were damaged, but also how the damage occurred. It was evident that the steeple had tumbled down, taking large chunks of brick out of the roof and one of the archways by the entrance. On the tour, users can examine the before and after models, layered one on top of the other with a slider revealing the damaged areas. This, in part, inspired me to take advantage of Sketchfab's annotation feature since it functions similarly to a slider in terms of interactivity and user engagement. Users are able to click on small indicators throughout the scene, which help to guide them through the space and view it from predetermined angles. These annotations also allowed for additional descriptions of the objects to be included in the attic as users click through.

CyArk was also able to create engineering drawings and maps that allow them to produce 3D architectural drawings. These drawings made it possible to study the buildings on a level that was not possible before. They could examine the relationship of certain parts of the building to one another, and help specialists determine how to stabilize the structures to prevent further damage. Their methods proved to be extremely effective at historically preserving Bagan's temples.

3. Methodology

3.1 Process of Creating a 3D Piece

The method used to create each of these projects is the same method taught in Todd Kesterson's New Media 3-D course. It's important to start with a strong foundation and outline for what one is planning to create, starting by determining what mood will be conveyed, the amount and type of objects that will populate the scene, and how much space each piece will take up. Traditional 3D modeling methods rely heavily on reference images because they provide a strong starting point and visual guide, so it's typical to gather hundreds of reference images before starting the modeling process.

Once these images have been gathered, the scene can be laid out in 3D space using basic geometric shapes. This mockup provides a visual representation of how the space will be used and divided. It's important to keep in mind the end goal and format during this stage. For example, the scene would need to be laid out differently for a project that will be viewable from all sides versus one that will only be rendered from specific viewpoints. Once this portion is completed, the modeling process can begin. Depending on the type of object, reference images can either be directly imported into Autodesk Maya to be used as a stencil or kept nearby on a second screen or another viewing format (phones, tablets, and printed pieces of paper all work).

The Alleyway and the Air Raid Shelter were both started as class projects and came with certain starting guidelines. For the Alley project, we were tasked with creating an alleyway closed on three sides, filled with at least a trash can, a barrel, a wine bottle, a wooden pallet, a dumpster, pipes, a door with a step, and a window. Objects with complex curves like the bottle or pipes are often easiest to create using a 2D curve drawn from an imported reference image. They can then be converted into 3D objects using various tools within Maya such as the "Revolve" tool or the "Attach Brush to Curves" feature. Simpler objects such as pallets or trash cans can be created by combining and/or altering the geometry of basic cubes, cylinders, spheres, and planes. Once each object has been modeled, it can be resized, rotated, and placed in the correct position according to the mockup scene. This continues until all of the assets have been modeled.

The next step is to start texturing the scene, which can be done several ways depending on the final goal. Anything that requires more than a solid color will most likely need to be UV mapped. Because the X, Y, and Z dimensions are already present in 3D modeling programs, U and V serve as the 2D texture axes. UV mapping is typically the first step in the texturing process and determines how a 2D image will be projected onto 3D space.



Fig. 1. Wheeler, Richard. UV Mapping of a Cube. 2008.

If a project is textured using Maya, a new material must be assigned to each component that requires a unique texture. If multiple objects or components are meant to be textured similarly, they can all use the same material. Next, seamless texture images can be downloaded from the Internet or created using Photoshop and assigned to the correct material. Maya has plenty of tools to help resize or alter the texture image so that it fits the end goal, but other programs like Substance Painter streamline the process of creating complex and highly detailed textures. Substance Painter provides users with pre-made materials and "smart materials." The materials can provide color, roughness, height, and metalness to an object, while smart materials take this a step further by using additional detail from the high-poly mesh and adapting to each object specifically. This makes it possible to automatically add wear and tear to the edges of objects, add dirt specifically in dented areas, create realistic rust, and much more. From here, the scene can be exported to Sketchfab where lighting, shadows, and other effects can be added before publishing.

3.2 Choosing the Appropriate Tools

Autodesk Maya was utilized for the 3D modeling portion of the project because I had already taken the time to learn and experiment with it throughout Professor Kesterson's courses, and I had experience with it from creating both the Alleyway and the Air Raid Shelter. Other programs like Blender and 3DS Max are also quite popular, but I found it unnecessary to learn a new program for the modeling that this project required. I did, however, choose to learn the aforementioned texturing program called Substance Painter. Various issues prevented me from uploading my scenes directly from Maya to Sketchfab, but Substance Painter simultaneously provided a workaround to these issues and a way to increase the amount of detail overall. This became increasingly important with the attic because of how confined the space was and provided even more benefit to learning a completely new software program. I chose Substance Painter because my mentor, Professor Kesterson, recommended I experiment with it after it was added to the Adobe Suite.

Autodesk Recap Photo was used to 3D scan the hay because it was accessible to students and created by the same company as Maya. I imported nearly 100 pictures I had captured of some loose hay, and Recap Photo turned the images into the 3D model that I duplicated and used throughout the attic. Tutorials on YouTube made the program look friendly for new users and further encouraged me to use it for this project.

Sketchfab was chosen as the publishing platform because it's a public repository, and the controls aren't overly complicated. My mentor and I considered other programs like Unity that would potentially allow for a more immersive and programmable experience, but it would have shortened the reach of the project and made the publishing process far more difficult than it needed to be. Although Sketchfab did present its fair share of challenges, the accessibility that it brought was essential to this project.

3.3 Traditional 3D Modeling vs Photogrammetry

Traditional 3D modeling methods work great for geometric objects like wooden pallets, chimneys, and barrels, but more complex forms like hay are much more difficult to model by hand. This is where 3D scanning can be of use. There are multiple ways to scan an object, but photogrammetry was my method of choice because I already had some knowledge of the process, and it was an effective tool to accomplish the realistic look that I was aiming for. Photogrammetry is defined by the American Society for Photogrammetry and Remote Sensing as, "the art, science, and technology of obtaining reliable information about physical objects and the environment, through processes of recording, measuring, and interpreting imagery and digital representations of energy patterns derived from noncontact sensor systems." To simplify, photogrammetry is the process by which we obtain and feed key visual information to a computer to be pieced together. It allows for the translation of real-world elements to the digital realm. Photogrammetry was the perfect tool to depict the hay in the attic because of its random and organic form.

4. Discussion

4.1 Taking Liberties

One question my mentor posed was, "to what degree should liberties be taken to tell a story that isn't fully known?" Henry Friedman leaves a detailed account of the events in his book, but certain details are either missing or have been forgotten with time. Henry was just 14 years old when they went into hiding in the spring of 1942, and it is difficult for him to remember every detail of the attic now, 80 years later. Similarly, the lack of light in the attic and the physical and mental stress he was under certainly altered his perceptions and memory. He has provided very valuable information and feedback about the space, but certain details, like the shape and material of the pot, remain unknown. Even with thorough research, it was difficult to find sufficient reference images of a Polish soup pot from 1930 to 1945. Instead, I combined images of cooking pots from nearby regions and time periods to create something that I thought would have been accurate, and then verified its authenticity with Henry.

In total, Henry is confident that the Friedmans had the soup pot, four soup spoons, a pocket knife, one blanket, and the Jewish prayer book with them in the attic. The knife and prayer book both belonged to Henry. I received conflicting information about the blanket as well as the book(s) that they had with them. In his memoir, Mr. Friedman mentioned that they only had a single quilt between the four of them and just the one prayer book, but in my interviews with him, he said they had multiple blankets and educational books. I chose to model these

objects based on the original account from his memoir since it was likely fresher in his memory at the time of writing.

I also knew the rough dimensions of their space from the information in his memoir and online. Their area was roughly the size of a queen mattress, and no one could stand up except for his brother, Isaac, who was the shortest of the family. Because of the slanted roof above them, Isaac could only stand by the chimney. The Centers for Disease Control and Prevention puts the average height of an 11-year-old boy at roughly 56 inches, providing an estimate for how tall the space was at its highest point. His height could've been off by a few inches, but again, Henry confirmed the dimensions and appearance of the space when I later presented the model to him.

4.2 Limitations

One of the greatest limiting factors for what can be achieved in 3D is time. Modeling and texturing an entire scene by oneself means creating every last vertex, edge, face, object, color, light, and brushstroke.

Having a realistic timeline was a very important consideration when deciding the scope of this project. The original plan was to model the entire building in which the Friedman family hid, including the area where the Symchucks lived, the barn beneath the attic, the exterior of the building, some of the surrounding land, and of course, the attic where the Friedmans spent 18 months in hiding. After discussing with Professor Kesterson, it was decided that it would be unreasonable to undertake this amount of work, and the scope was fixed to the attic area. The goal of the project is to put the viewer in Henry Friedman's shoes, and he was only able to see the inside of the attic (with the exception of the peephole included in the Sketchfab model) for the duration of their hiding. Working with Sketchfab created its fair share of limitations as well. My mentor and I knew that audio would greatly help in creating an immersive experience, especially when it came to using the objects that Mr. Friedman and his family had with them to tell their story. Unfortunately, Sketchfab removed the ability to add sound to projects on their platform in early 2021 due to legal concerns. I wanted to insert audio clips of Henry telling his own stories at specific annotation points in the attic because his words are so very powerful, and it would have added an important sense of gravity. To still accomplish a similar version of this, I created a video of the space and added in the audio clips along with some videos of him speaking. It's still quite powerful, but it doesn't allow for the same combination of interactivity and immersion that would've been present with the inclusion of audio directly in Sketchfab.

Sketchfab also only lets users add a maximum of three lights. This became an issue with the Underground Air Raid Shelter because I modeled three light fixtures at the top of the scene, but my mentor recommended I add some light pouring in from the staircase to add realism. Deleting one of the light fixtures I had modeled would have made the ceiling look odd, so I had to remove a light source from one of the fixtures and instead use it to light the staircase. It simply looked like the light had burnt out. This decreased the overall level of light in the main area of the scene, but it did create a greater sense of realism.

4.3 Challenges

4.3a Communicating with Henry Friedman

One difficult aspect of my research was trying to obtain all the information I needed from Mr. Friedman to create an accurate representation of the building and space they were hiding in. He was very willing to help with the project, but it was difficult to communicate effectively with him both because of the language barrier and the fact that his hearing isn't so great over the phone. He understands English well having lived in the US for quite some time now, but I often had to repeat and rephrase questions multiple times to get him to understand what I was asking.

It was also clear to me that Mr. Friedman didn't understand why I needed such oddly specific information. I was asking questions he had never had to answer, like what specific material the soup pot was made of or what exactly the exterior wall looked like from the inside. The second time I spoke with him, I expressed how grateful I was for his willingness to help and tried to explain my project and the 3D design process in as much detail as possible. My explanation must have clarified things for him, as he then provided very helpful descriptions of how the space was laid out, and he was much more responsive to the rest of my questions. However, it still took several months of back-and-forth phone calls and emails to completely piece the scene together.

I was able to make another breakthrough when I emailed over some sketches of my interpretation of the layout of the Symchuck building (per Professor Kesterson's recommendation). Mr. Friedman viewed the sketches and called me the next day to inform me that the two sides of the house should be flipped, and that the "secret door" was in fact only a few pieces of wood covering a hole in the floor. I also learned through this phone call that the hay surrounding them was not in bales as I had previously thought, but in loose stacks going all the way up to the ceiling. I was also able to clarify a few more details about the soup pot and the plywood boards that served as the exterior wall.

4.3b Historically Accurate vs. Historically Authentic

Another challenging area of my research was trying to obtain photographs and information on the area of Poland where Mr. Friedman and his family lived. Because he was only 14 years of age when he and his family went into hiding, he can only remember so much. I spent a great deal of time scouring Polish databases for images and descriptions of rural Poland from 1930 to 1950, but there seemed to be a real shortage of information available. In the previous projects, I relied heavily on reference images to create all my models, but it was clear I wouldn't be able to do the same with this one. I spent roughly 60 hours in my initial research phase, and it was after this point that I realized I would be unable to find enough reference images to create something that was 100% historically accurate. Without pictures, it was nearly impossible to determine what everything in the attic would have looked like. This is ultimately what led to the shift from creating something "historically accurate" to something "historically authentic." Rather than trying to ensure every piece of the project looked exactly accurate for that time in history, my mentor and I chose to focus on creating a space that is authentic to Mr. Friedman's story.

4.3c Scale

Because scale is so important to Mr. Friedman's story, it was very difficult to decide how to portray the attic space that I created. Sketchfab allows the user to set the Field of View (or FOV for short) of the camera. Princeton Instruments defines Field of View as "the maximum area of a sample that a camera can image" ("Field of View and Angular Field of View"). A lower FOV means a smaller viewing window, and a larger FOV stretches the space out so the viewer can see more at once. The problem with this is that while a larger FOV would make it much easier to see the cramped attic, it gives the illusion that the space is much bigger than it truly is. To remain true to the goal of creating a *historically authentic* interpretation of the attic, I chose to keep the FOV at the default, realistic value of 45.

4.3d Bringing Depth to the Underground Air Raid Shelter

Both the Alley and the Underground Air Raid Shelter were created with specific parameters in mind, but the Underground Shelter provided an especially unique challenge. For the original project in New Media 3-D, we were tasked with filling a blank rectangular space with anything of our choosing. After I had decided on my idea and was about halfway through modeling my scene, I realized that it looked incredibly flat when viewed directly from the front. To add depth, I split the space up with a pillar in the middle and pushed out the back wall on the right side to create a staircase leading into the area. I also added large objects like the beds, trash cans, and benches before I rotated the entire space about 45 degrees. This broke up the space nicely and allowed the viewer to see much more of the scene at once.

4.3e Workflow Issues

Several problems arose when trying to export the first two projects directly from Maya to Sketchfab. With the Alleyway, it was immediately clear that almost all of the models were showing up incorrectly. The flags and canvas truck cover that had gone through cloth simulations reverted back to their original forms and were showing up as rigid planes, and all of the textures were either missing or vastly different from how they were showing up in Maya. I tried for weeks to solve these issues, but it became clear that exporting directly from Maya to Sketchfab simply would not work with the Alley. To solve these issues, I retextured the entire scene using Substance Painter. This added at least two months of additional work, but it served as a valuable introduction to the program and helped familiarize me with the features and techniques associated with it. Using Substance Painter allowed me to create a much more detailed and interesting environment for the Alleyway and proved that it was the right program to use on the attic.

For the Underground Air Aid Shelter, most of the detail lay in the models themselves, and I deemed it unnecessary to put in the extra work it would have taken to UV map and retexture that entire scene. The Alleyway would serve as the technical showcase from a modeling, UV-mapping, texturing, and lighting perspective while the Underground Air Raid Shelter showed what could be achieved through cloth simulations and modeling alone. Through a process of trial and error, I had found a workaround to many of the problems that arose with the Alleyway. I discovered that I could retain all of the detail from the cloth simulations and texture the entire scene using Sketchfab, but I had to delete about 20% of the models. Each object was either given a seamless texture downloaded from the Internet or a basic color.

The general workflow going from Maya to Substance Painter to Sketchfab turned out to be enormously difficult when it came to making changes. Many issues with the projects only arose after they were uploaded to Sketchfab. If the issue was texture-related, I would have to go back to Substance Painter, determine how best to solve the problem, fix it, and then re-upload it to Sketchfab (a process that took hours by itself). If the issue was modeling-related, I would have to go back to Maya, find and fix the issue there, and then re-export the scene to Substance Painter. From there, I had to adjust each separate texture size individually, retexture the entire scene over again, export the scene to Sketchfab, adjust the background, post effects, and lighting, and then publish. This process often took days or even weeks. I would try to spot all the issues within a scene in Sketchfab before going through the arduous process of fixing it, but I would either miss small details (like one floating flower box at the back of the scene) or new problems would arise. Even the flower box, which would seemingly have a simple and easy fix, would take at least a full day to fix. Part of this was due to the load times associated with uploading massive files to Sketchfab (the Alley was almost 500 megabytes). A basic Sketchfab account is only capable of uploading a 150-megabyte project, so I had to upgrade to the highest-level account to post the Alley. The workflow that I chose added months to the completion date of this project.

4.4 Why Don't We See Any People? The Concept of the Uncanny Valley

The concept of the Uncanny Valley was introduced by a professor at the Tokyo Institute of Technology by the name of Masahiro Mori in 1970. It refers to the idea that as robots (or, more recently, animations and 3D models) become more lifelike, they become more appealing, but only up to a certain point. A robot, animation, or character that is almost lifelike gives us a strange, creepy, and uneasy feeling. The theory is about more than this uneasy feeling, however; it serves as a guideline for robotics professionals and digital creators alike.



Fig. 2. MacDorman, K. and Masahiro, M. Mori Uncanny Valley. 2007.

Christoph Bartneck, associate professor at the University of Canterbury in New Zealand, offers a different view of the Uncanny Valley, describing it as more of an uncanny cliff. He says that while there are many examples of projects falling into the realm of the uncanny, he has never seen one climb back out and make it to the other side, the side of perfect lifelikeness. This is the main reason why I did not include any characters in my scenes. Models of non-lifelike people would distract from the emotional history of Henry's story and break the immersion.

4.5 Self-Reflection

From an artistic standpoint, I'm very proud of what I accomplished with the Alley. In total, I spent more time working on it than on the other two projects. Though much of this time was spent learning Substance Painter and the workflow I had chosen, I still see the Alley as my most technically successful piece. I was able to accomplish everything I had hoped for, aside from a few minor details. The Air Raid Shelter was similar in this manner. Although I didn't add the same level of detail in the texturing phase, I was able to create something that I'm very proud of.

I also enjoyed the process of translating Henry's words and stories into a 3D environment. It was an interesting and meaningful challenge to create a space that had so much underlying history. One of the most gratifying aspects of it was making informed decisions about how the space should look and feel based on what I had read and heard from Henry. For example, Henry mentioned in his book that Mr. Symchuck was not the best carpenter when he first started working with Henry's father. Considering this information and the Symchucks' financial situation, I determined it was likely that Mr. Symchuck built the home himself without the greatest materials or expertise, so I created slightly crooked wood planks and support beams to add even more realism.

I did feel an immense sense of pressure with the attic project, however. I was intimidated to speak to and work with a real survivor of the Holocaust, and I felt a great responsibility to create something worthy of Henry and his story. I became much more reassured after speaking with him multiple times though, and I'm incredibly grateful for the experience that I had.

5. Results

5.1 Alleyway

Sketchfab View (Textured and Lit):



Substance Painter View (Textured Only):





Autodesk Maya View (Wireframe on Shaded Mode):

This scene takes place after the fall of Paris during WWII. It is meant to show what an area might look like after seeing some light combat and a visitation by French freedom fighters. Like the other two projects, I modeled each prop from scratch and textured them all in Substance Painter. Some textures, like the posters and the flags, were taken from the Internet and further detailed in Substance Painter. In total, this scene contains over 70 unique textures, some comprised of as many as 9 or 10 different sublayers. Also included are 16 different annotations to guide the viewer through the space.

It's important to note that while I did try to get this as close to *historically accurate* as possible, this scene is not modeled after one specific place in Paris, and it didn't actually exist. It's merely my interpretation of what an alleyway would have looked like, with *historically authentic* representations of the buildings and objects.

5.2 London Underground Air Raid Shelter

Textured and Lit:



Wireframe on Shaded:



Modeled after a London Underground station used as an air raid shelter during The Blitz (1940-1941), this project originally came from the same New Media 3-D course as the Alleyway.

We were tasked with filling a blank space with anything at all and using lighting, sound, objects, and animation to convey a specific tone. Both the animation and sound had to be removed in updating the scene to work with this project, but the mood being communicated in this piece is one of survival and desperate times. The people that have been here are or were scared, but safe for the time being. The lighting is dim, but still bright enough to illuminate everything in the scene. It feels eerie and hastily abandoned.

Bombing on London was prevalent in World War I, and even as attacks were anticipated toward the beginning of World War II, authorities were reluctant in supporting the use of Underground stations as shelter due to the misconception that it would decrease morale among the public ("Shelter in Wartime"). Regardless, when bombing began in September of 1939, thousands of Londoners took shelter in the Underground network. During the first night of bombing, death tolls nearly matched the total from all of the first World War, with 430 people dead and another 1,600 injured. Understanding the severity of the threat, the city of London was forced to adapt. Systems became more organized to ensure the safety of civilians as they continued to take shelter in the stations, setting up beds for themselves and their families. New ticketing systems and better facilities were set up, and a special train cart would even stop at the stations to distribute food and water. This arrangement was functional, but the London Transport started developing several new deep-level shelters ("Shelter in Wartime").

Construction started in 1940 but was not completed until two years later ("Deep Level Shelters in London"). During this time, the deep-level shelters were not open to the public but did see some use by government officials. The tunnels were to be approximately 16 and a half feet wide and almost 1,200 feet long, slated to contain two levels each for medical stations, kitchens, sleeping quarters, and sanitation areas. They were originally meant to house around 9,600 people in each shelter, but that number ended up closer to 8,000 per shelter, and only 8 of the 10 bunkers were completed. When bombing once again started to become more prevalent in 1944 as the Allies invaded Germany, five of the shelters opened to the public. The names of these shelters are Stockwell, Belsize Park, Clapham North, Clapham South, and Camden Town. The other three were reserved for government use only ("Deep Level Shelters in London").

The station that I created is meant to be one of the public Underground stations used as a shelter before the deep-level project was completed. Temporary beds have been set up, time-appropriate advertisements can be seen along the walls, and personal belongings lay strewn about the space.

5.3 The Symchuck Attic

Textured and Lit:



Textured:



Wireframe on Shaded:



The attic project is the culmination of all the work I put in learning modeling and texturing techniques and programs from the previous projects. Although it's much smaller than

the other two, it contains far more history. This is the area of the Symchuck's attic where a 14year-old Henry, his little brother Isaac, his pregnant mother, and his teacher Sarah hid from the Nazis for almost 18 months. It shows everything they had with them in hiding aside from themselves and the clothing they wore. I added nine different annotations throughout the scene, which provide additional details on the objects and the space. It can be viewed in 3D on Sketchfab along with the other two projects. I also created a video tour of the space and added in clips of Henry talking about their experiences in hiding. Links to this video and videos of the other two projects can be found in the Appendix.

6. Outcome and Significance

This project has significantly advanced my Honors College experience and long-term goals by providing an opportunity to showcase my skills to their full potential. I've created many different multimedia projects in the past, but I've never had the time or access to the tools that would allow me to put everything I've learned up to this point together into one masterful piece. I had to do extensive research to ensure historical authenticity, I had to model and texture hundreds of objects, program in navigation tools, prepare the space for upload, create demo videos, record and mix in audio from Henry Friedman, and much more. It's important for me because I want to pursue a career in 3D modeling, design, or art. Many jobs in these fields require at least one major project that shows every step the artist goes through, putting their skills on full display. I accomplished that by working from the ground up, documenting my entire creative and design process, and ultimately producing a professional piece of work that serves as both a testament to what I've learned as an undergraduate and a stepping stone into a career. 6.1 Future Work

The next step for the attic project will be working with the Holocaust Center for Humanity in Seattle. They have expressed interest in using it in their virtual tour, or potentially with their Oculus headsets. Given the fact that the attic space is so small, my mentor and I thought it would be best to use a 360-degree image for the virtual tour. The space simply isn't big enough to view in Virtual Reality with their headsets, and scaling the viewer down would make it inauthentic. If I can, I would like to make the space interactive, with viewers being able to zoom in on certain items and get more detailed descriptions. I will have to speak further with Julia Thompson at the Holocaust Center for Humanity to determine what the best course of action is, but I am excited to continue my work and further Henry Friedman's goal of educating the world in order to prevent another Holocaust from occurring ever again.

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Appendix: Links and Additional Pictures

This link contains video tours of all the spaces, but unfortunately, the 3D models will no longer be viewable once my Sketchfab account is downgraded to the basic version:

https://linktr.ee/caseyward.

Additional Photos of the Attic:













Paris Alley:























Underground Air Raid Shelter:



















