CROSSED:
STRENGTH IN UNITY AND CONNECTION

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ABSTRACT

It is only through the strength of bonds that we can overcome evil. In *Crossed,* these bonds are tested as Calum and Dmitri are forced to duel for their lives. The film explores the themes of indoctrination, belief, the power of friendship, and never giving up on the people you care about. The accompanying paper explores how these themes are integral to who we are. I then explore the process of producing animation utilizing cutting-edge mediums and how these mediums can allow us to create animation in an entirely new way.

ACKNOWLEDGMENTS

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WHY ANIMATION

I initially thought that the question of "why animation" was restrictive, as if I must change the film to suit animation. In actuality, the question of "why animation" askes the creator how they use animation to make their work better. In *Crossed*, this poses an interesting question because much of the structure of the creation process emulates live-action and stage productions. The live motion of actors on a stage drives the character animation.

While working with the fantastic combat director David Reed and the incredibly talented Joshua Goodridge, Indigo Leigh, and Jarrett Poore they created the characters' movements in the motion capture studio as I directed them through the character acting in *Crossed*. David choreographed and performed the sword fight with Joseph. Cheryl Briggs, our motion capture technician, managed everything. This entire process felt like practicing for a stage production. Animation is a slow and deliberate process, where this felt fast and spontaneous. The actors saw what the motion capture looked like after every take. We could sit together and improvise aspects of the character's performance in a way I could not in traditional 3D animation.

With the actor's performance recorded, I applied the data to the characters. Thus, with a few clicks of a mouse, I watched the characters come alive in front of me. The characters were rendered in real-time as they moved around the environment created in Unreal Engine 5. I even created the actual scene cameras in Unreal. With the real-life choreography applied to the characters, I placed the cameras wherever I wanted and had them move in any way

imaginable.

This process carries forward the spontaneity of creation that blurs the lines between animation and live-action film. The answer to the question, "Why animation?" is this: animation gives the greatest ability in shaping the world through unfettered design and looking through the cameras without constriction of gravity and physical camera structure. Working in 3D permits crafting the exact world I want while still maintaining the spontaneity of live-action.

PRE-PRODUCTION

Story

Much of the early goals and development of the film were vastly different from the final iteration. *Pirates of the Caribbean* and *Princess Bride,* with their lighthearted and adventurous sword fights, heavily inspired the film's original version. I wrote the story with little exploration of character motivation or theme. Sharing my story with my cohort and engaging in the critique process pushed me further into the development of the underlying messages.

The process of finding the underlying message and meaning was difficult. I kept changing the story but was never satisfied. Resolving the problem took encouragement and deep thought about the characters' interaction, backstory, and what they mean to me. Eventually I realized that the story never felt right because I did not believe in the story I told. Throughout this process, I discovered my personal motivation for writing this story.

I attended a Montessori magnet program at a local public elementary school when I was younger. Montessori is a system of teaching independence and self-sufficiency with kids tackling schoolwork at their own rate. This system provided a strong focus on art and science, and I cannot speak highly enough of it. It was the perfect place for my young brain with undiagnosed Attention Deficit Hyperactive Disorder. It was a school where my difference was accepted and allowed flourished. I attended that school only from first through fifth grade. From there, I

moved to Westminster Academy, a private Presbyterian school. My sixth-grade science teacher taught us that God created the earth in six days and that dinosaurs were not real, or were just another creature that did not survive the flood. They taught me about the danger of non-belief and how I would be tortured for all eternity for not believing in everything they told me. I kept rationalizing all the science that I had learned with these things that adults tasked with educating young minds were saying to me. They constantly told me that what I had learned before was wrong. After a year, my parents pulled me out of that school once they realized how bad it was there.

When developing my story, I could only think of conveying such a bigoted backward society by invoking the religious elements that terrorized me as a young boy. I remembered how even my family members tried to convincing me that Harry Potter taught kids devil worship and Pokémon was sacrilegious. The pain, frustration, and fear all came back to the surface. My experience contributed to me forming the opinion that conformity is harmful when founded in indoctrination because it can lead to actions that a person does not realize are morally wrong.

Finding my motivation for writing made re-evaluating other elements of the story easier. The characters were young men who had grown up together but are pitted against each other and forced to fight. The authoritarian society where Calum and Dmitri lived actively hunted down and killed anyone with magical power. When Calum first confronted Dmitri, he was still thoroughly indoctrinated by this society, but he struggled with maintaining his conviction as he fought against his friend. However, when revealing that Dmitri had only exposed his nature as a magic user when saving Calum's life, the final shreds of indoctrination are torn away. Dmitri

defeated Calum in combat and refused to kill him. Calum finally realized how wrong he was, and the friends reconciled with a hug.

Calum's character arc started with a young man indoctrinated into hate without ever realizing its harm. He needed a friend to show him the world outside of what he thinks he knows. His friend Dmitri always foiled Calum. Dimitri's character arc was where I had the most difficulty, and he went through the most changes throughout the story's development. At one point, as a somber reclusive wizard, he avoided fighting until he had no other choice. That still did not feel right. Even after he finally took shape as the runaway soldier hiding magical powers, Dmitri was still far too passive and sad. The problem was that I did not believe in Dmitri's characterization. He acted as a somber and passive mirror for Calum's rage and pain. Pleading with Calum to see the error in his ways, Dmitri desperately wanted Calum to see that his magic did not make him a monster. However, he made no attempt to fight back against the indoctrination in which his friend was still stuck.

Story Influences

Sitting down and watching a video essay on YouTube began as an unrelated experience while creating my film but soon became the most important influence on the motivation and theme behind *Crossed*.

At the encouragement of one of my friends, I watched a video essay called *Gurren Lagann and Getting It*. In this video essay the YouTuber 'Breadsword' explored his personal history and analysis of the beloved anime, *Gurren Lagann*. He talked at length about how the show pulled him out of his depression and helped him stay motivated with its ridiculous-but-wholesome pep talks and over-the-top heroic speeches.

During the video analysis, one of the most impactful elements identifies the villains in the show representing any oppressive force that people face. These villains all had noble motivations at the start of their journey but have those motivations distorted and twisted back on themselves. The villains arrive at their beliefs not because of any inherent wickedness but because they resign themselves in accepting their world as it is and believing that their course of action remains the only one they can take, given the circumstance. These once noble characters can never conceive of a world beyond their circumstance or believe that they could change their situation for the better. This same resignation to circumstance is what traps Calum. He believes that killing his friend is the only course of action he can take given his circumstance. Even though his actions are terrible, he is not a villain but needs to be challenged, thus forcing his confrontation of both the wrong in the society he is trying to uphold and the indoctrination from which he suffers. Calum can only do that because Dmitri is there breaking him out of that indoctrination. Dmitri channels the most important lesson of *Gurren Lagann* and shows Calum that we have the inherent human drive to fight against oppressive forces and break through any ceiling we find ourselves trapped under. To combat the darkness of the world we need to get mad and challenge the darkness head-on.

The idea that our anger at oppression provided the gateway of overcoming any obstacle was what my film missed. I did not believe in what I created because Dmitri did not get mad at what happened to him. I changed the story so that Dmitri would no longer be the kind of character who begged and pleaded with Calum to see the error of his ways. Instead, he would take one look at his friend and challenge him to a duel. Dmitri would be the one challenging Calum's beliefs because before he could change the conditions of his circumstance, he needed to get mad about them. Dmitri would prove to Calum that he was in the wrong and would do it by defeating him in a dual.

It is only through the connections that we make with others that we can defeat evil. It is through our companionship that we are strong.

<u>Character Motivation</u>

Gurren Lagan and Getting It posits that the show is a response to Friederick Nietzche's *The Birth of Tragedy*, specifically the dichotomy of Apollinian and Dionysian impulses. Nietzsche defines the Dionysian Impulse as the liberation of unbound instincts and the dissolution of boundaries, which directly contrasts with the Apollinian impulse signifying measure, limitation, and subjugation of everything wild and untamed. (25) In Nietzsche's *The Birth of Tragedy*, he personifies this fundamental pair of opposites in his writing about music and art. There is some debate as to whether this was Nietzsche's way of saying that the joy and beauty of life can only be found through the experience of both Apollinian and Dionysian or if the barbarism of the Dionysian impulse is what makes someone appreciate the Apollinian. However, Nietzsche describes the Dionysian impulse as this wild and untamed 'otherness' that must be subjugated by the Apollinian. To me, this description implies the subjugation of anything outside of what we deem acceptable.

The analysis of *Gurren Lagann* suggests the headstrong stupidity and heart-on-sleeve characterization in the show attempts to elevate the Dionysian impulse to the morally correct course of action when dealing with oppressive forces. *Crossed* follows the same path, taking the idea of the Dionysian impulse and recontextualizing it as the freedom of expression and the fight against oppression.

In *Crossed*, the dichotomy of the Apollinian and Dionysian is re-evaluated through the lens of authoritarian control attempting to suppress human freedom and individuality. What results is a

society that deems magic as something to stamp out and destroy, as evident by the witch-burning flashback at the beginning of the film. Exposing his magic saving his friend, Dmitri must now flee for his life, forcing Calum into acting as the hunting dog of the society that he serves when searching for Dmitri.

Calum acts as an unwilling and indoctrinated agent of a society influenced by the Apollinian impulse. The society's Apollonian influence stems from Nietzsche's description of the Apollinian as the subjugation of anything wild and untamed and Scott Horton's analysis of the Apollinian as pushing life to an "unnatural ordering." (Horton) The authoritarian society in the story seeks to stamp out all forms of 'otherness.' The fervent goal of eliminating magic and anyone that uses it can represent any oppressive and hateful force. Calum's arc through the story is the realization that these beliefs are evil suppressions of the human will and our desire to be free. Only by losing the fight, having his indoctrination defeated, and being forgiven by Dmitri does Calum realize how incredibly misguided and brainwashed he had been.

Gurren Lagann and Breadsword's analysis heavily influences the reimagined Dionysian impulse in *Crossed*. Dmitri embodies a positive version of the Dionysian impulse as an entirely human impulse fueled by emotion and passion that demands freedom from oppression. Dmitri's magic marks him as 'other' in the society he and Calum live in. Dmitri's fight with Calum is both a fight against the system that oppresses all 'otherness' and a struggle between Calum's indoctrination and Dmitri's freedom. Dimitri actively challenges the indoctrination by fighting back against Calum. His confidence in himself and the desire of helping his friend manifests not as sadness about the circumstance but anger at the Order and Calum for still believing them. Dmitri makes

it clear he will not run away or hide from this fight but meet it head-on. The anger pushes him

forward and drives him towards helping his friend by thoroughly beating him in a fight. The

story reveals that the oppressive society's hatred is no match for Calum and Dmitri's connection

to each other.

Story Structure

The story of *Crossed* is told non-linearly through the use of flashbacks. The main events of the

short were the meeting and subsequent fight between Calum and Dmitri in the tower. Referring

to the main events as the primary timeline, at key moments throughout the primary timeline of

events, the film cuts to 2D storyboard-style animatics. These animatics are used to establish

aspects of the world, giving insight into the events leading up to the fight, and building up the

connection between the characters. Anton Chekhov coined the golden rule 'Show Don't Tell,'

which was the guiding principle for the flashbacks and their use and place in this short.

(Yarmolinsky 14) The imagery followed this principle by being immediately readable and

conveying as much information as possible in the shortest amount of time. This helped tell the

story more concisely and with greater impact.

The film opens on Dmitri sitting alone. He is clearly deep in thought and as he becomes more

agitated the scene transitions to the first flashback sequence of the film. The first flashback takes

place at an indeterminate time before the primary timeline. In this flashback, Calum, Dmitri, and

a town's worth of people are watching a witch-burning. The visual imagery of a person tied to a

stake and burning is deeply ingrained in Western cultures' visual lexicon. (Metcalfe) For

example, the opening sequences of Powerhouse Animation's *Castlevania* also opens with a

witch-burning, thus setting the stage for the events of that series. Using the shocking and strong

visuals of a witch-burning immediately conveys a wealth of information to the discerning

audience without needing an explanation of every element of the world. This sequence

establishes the society as barbaric and violent, with hatred and fear of magic.

Once again, the scene returns to Dmitri, more upset than before after remembering seeing these

people burned at the stake but the sound of footsteps pulls his attention back behind him. As

Dmitri looks to see who is coming, the scene once again transitions to a flashback. This time the

flashback is focused on the introduction of the second main character, Calum. It opens on Calum

kneeling in front of a throne with two guards standing on either side. The massive, crowned

figure on the throne orders him to hunt and kill Dmitri. He stabs and destroys the tablet with

Dmitri's face on it with the sword that we see Calum using in the fight. This establishes Calum's

reason for hunting Dmitri before the characters meet in the primary timeline. The choice of

introducing Calum first through flashbacks is essential. Calum is first seen beside Dmitri as the

only other character in the flashback with identifiable features, immediately signifying him as a

prominent character. Through his introduction with flashbacks, the audience sees Calum as

forced into hunting down Dmitri

Intercutting the fight between Calum and Dmitri are touching scenes of the two being close

friends. These flashbacks do not occur in the same flashback timeline as the other flashback

scenes. While initially worried that this would be confusing, I found that the idea of flashbacks of friendship or closeness as the two are fighting did not confuse the test audiences.

The culmination of the fight and the culmination of the flashbacks happen in a match-cut sequence. Dmitri beats Calum and sends him sprawling onto the ground. The scene hard-cuts to a battle with an unnamed soldier who has bested Calum. The crowned figure from Calum's first flashback watches in front of a crowd of people. As that soldier attempts striking down Calum, Dmitri uses his magic and saves him. Dmitri sends the soldier flying with the same magic the audience sees him use on Calum in the primary timeline. Believing the fight to be over, Dmitri tosses his sword aside. Calum tries taking advantage of this but hesitates, unable to attack the unarmed but defiant Dmitri. A final flashback reveals Calum's internal conflict as his memories of friendship coincides with Dmitri's. The re-use of previous flashback images to reinforces the power of their connection. He realizes what he is doing is wrong and drops his sword to the ground.

STYLE

As the story of *Crossed* developed and changed, so did the representation of the style. Initially, the film featured an intensely graphic art style. Taking inspiration from the work of Mike Mignola and works like the short film *Yona*, the goal became creating a cell-shaded and hard-shadowed visual style with an emphasis on intense colors. This style still lives on in the 2D segments of the film, but the 3D style has shifted significantly.

Character Design

The first goal of the character development was using the concept of Western audiences' visual lexicon while establishing some visual shorthand for the characters' general personality and applicable tropes. Placing Calum as the shorter of the two with short blond hair while Dmitri is taller and slimmer with darker skin and hair relates the pair to the character dynamic established by Kirk and Spock in the nineteen-sixties Sci-Fi series, *Star Trek*. Calum shares visual cues with the hot-headed, heart-on-his-sleeve lead, and Dmitri follows suit with his design influences from the sharp, dark-haired, intellectual foil. While the characters diverge from their figurative tropes, this visual shorthand establishes the core of their relationship despite the situation of the film. Their design offers a peek into Calum and Dmitri's life outside of the events of the short.

Calum's design looks like the perfect soldier. He is square-jawed, with short blond hair, blue eyes, and a muscular build. The only significant departure is the large and soft eye shapes, a slight indication that Calum is not the hardened holy warrior his initial appearance reveals.

Calum and Dmitri are wearing the same uniform, but Dmitri's removes the undershirt, bracers, and gloves. Matching uniforms build a visual connection between the two characters, showing the history they share. The uniform's subtle visual differences highlight Dimitri's darker skin and lankier frame. The uniform incorporates a high collared vest in an eye-catching red, with a leather chest piece and boot designs referencing medieval leather armor and clothing.

The design of Calum's and Dmitri's swords are extensions of the characters' motivations. Calum's sword symbolizes his belief in the Order, representing a talisman or holy sigil he carries with him. The sword's design appears ancient and carved out of stone and is intentionally oversized for Calum's hands. The blade is broad with a flattened point, and this intentionally evokes the design of the executioner's swords. Executioners' swords have no pointed end since a sharpened point is unnecessary when executing prisoners. Calum's sword is aged and damaged, with knicks and scratches on the blade and crossguard showing its countless battles, and the aging leather wraps have almost completely fallen off. The sword is given to Calum to kill Dmitri, and Calum dropping the sword at the end of the film symbolizes his break from the Order. Dmitri's blade is comparatively longer and thinner than Calum's, much like Dmitri himself. His sword has none of the scratches and damage that Calum's blade has accumulated, and even the leather wraps are cleaner and more orderly. The design's intention shows Dimitri as heroic and unblemished, with a blade that matches him and his ideals. The colors used in the texturing of the blade are even

colors that match Dmitri. The harmony of design intentionally contrasts the ill-fitting blade Calum is forced to wield.

As the director, I instructed the motion capture actors to treat both characters as skilled fighters with years of experience throughout the fight scene. Calum's fighting style was more aggressive and reckless, while Dmitri was more defensive, collected, and competent. Dmitri is the eventual victor of the fight. Dmitri and Calum end up in the same positions as in the flashback scene where another soldier almost kills Calum. Dmitri and the flashback diverge, and Dmitri tosses his sword aside. In his mind, Calum is beaten, and there is no reason in fighting anymore. Dmitri had made his point. Calum, however, scrambles to his feet. Clutching his sword in shaking hands, he brandished it at Dmitri, but as the final flashback played, it revealed Dmitri had saved Calum's life. Calum drops his sword.

<u>2D</u>

The usage of a change in art style representing a shift in time deriving from reference films such as *The Little Prince,* where the story told by the old man is shot in a mixed media stop motion, while the primary story of the young girl is 3D animated. The 2D flashbacks of the film take inspiration from the sketchy look of concept art, heavily graphic illustrative design, and the storyboard style animation. In *Crossed*, animetism is used in the flashbacks for emulating movement and creating further contrast between the two art styles. *The Anime Machine* defines animetism as the flat multiplanar movements used primarily in anime for illustrating movement.

It is the idea that the space between the planes of the image conveys the sense of movement and space.

In *The Anime Machine*, Thomas Lamarre defines animatism in this passage.

> "Nevertheless, the train sequence with its diorama effects introduces another perceptual logic that apparently arises alongside cinematism. It is a perceptual logic in which our eyes do not turn from the window in order to align themselves with, or to identify with, the speeding locomotive. Rather the eyes remain intent on looking at the effects of speed laterally, sideways or crossways, rather than racing along the trajectory of motion. This is what I will call "animetism." Characteristic of animetism is the separation of the image into multiple planes. The result is a multiplanar image." (6)

The usage of flat, planar translation adds movement and depth to the illustrated frames and follows the benefits of the multiplanar image in *The Anime Machine*. The flat movement of the image planes combines with cross-fade transitions of character poses simulating the movement in a storyboard-like way. The bloom, vignette, and blur effects give the flashbacks a memory-like quality.

The usage of this helps immerse the audience in the flashbacks, breathing movement and life into simply flat images.

The 2D sequences are a vast departure from the primary 3D animations soft shadows and saturated color. This split between art and animation styles immediately lets the audience know that what they are viewing is something different from the previous scene. Creating the flashbacks with a strongly graphic 2D art style with a limited color palette, heavy linework, and deep shadows better differentiate the flashbacks from 3D art. The overall effect evokes the idea of old photographs or fading memories.

<u>3D</u>

Popular trends in video game art influenced the 3D style. The environment featured exaggerated and simplified forms accentuated by sculpted detail and painterly textures. This style de-emphasized the realism of physically-based rendered materials while still taking advantage of physically-based soft-shadowed lighting. The texturing featured minimal metallics, reflective surfaces, and no surface bump details.

The characters followed a similar modeling and texturing style, with exaggerated and simplified features but overall realistic proportions and painterly textures for their bodies and clothes. Calum and Dmitri featured chunky, sculpted hair and a simple costume design that used solid, readable shapes and painted textures for generating appeal.

The stylized art felt particularly appropriate for the medieval fantasy and magic of the story. The environment was an ancient watchtower lifted even higher into the air by the magically enhanced

trees. The man-made structures were oversized, indicating the builder's sense of grandeur and desire while making individuals feel small and insignificant. The overgrown natural environment subtly indicated the validity of Dimitri's magic as a natural aspect of the world. The attempts in creating an ordered and structured world that controls and dominates nature would eventually be overtaken by nature.

The art style of the open-world puzzle game *The Witness* inspired my foliage design for the environment. I achieved this style using a combination of densely packed 2D planes, transferred normal orientation, and unreal engine material blueprints. The look this created featured soft and impressionistic foliage that relied on the simplified silhouettes with limited detail of individual elements.

The environment palette featured saturated greens, blues, and purples to complement the warm orange-red evening light. I took particular care to use variations of value and hue instead of layers of tans and browns for representing the dirt and distress of the characters and environment color. This use of color was particularly evident in the environment stonework being primarily shades of blue and green with the occasional tans and purples. The cool-toned stonework accentuated the color contrast between the tree root, slowly enveloping the stone structure, and contrasted with the warm lighting.

PRODUCTION

Working in Unreal Engine

Game engines are the powerful software frameworks used when creating video games. Creating a video game is a complicated process that requires many different interconnected systems to work together. All of the core functionalities of creating a game are built into the game engine, which speeds up development and makes the creation process easier.

Modern game engines include significantly more than the bare essentials for making games. Unreal Engine, created by Epic Games and in its fifth major release version, focuses on giving developers powerful tools for creating massive and intricate video games more efficiently. These tools built into the engine are also incredibly effective for creating smaller products. However, despite the tools and systems developed in Unreal Engine, there are still limits to what can be done in a game engine compared to traditional animation pipelines.

While the quality of rendering in games is constantly improving, certain aspects of rendering take significantly longer and therefore are difficult including when striving for the same visual polish as blockbuster action films or big-budget animated films. Simulation can require absurd resources and time to calculate correctly, eliminating much of the heavier and more accurate simulated data for real-time rendering in game engines. Similarly, there is a limit to the complexity of rigs that can be easily implemented into a game engine. More complex rigs allow for finer control over character movement. However, due to engine limitations, some of the more

complex ways of rigging characters cannot be implemented into the game. Rigs for games must have all the bones connected and anchored to a 'root' joint. The balance of quality versus efficiency dictates most aspects of the game engine's achievable level of detail. This balance extends to visual effects and model complexity as well. Simulated or not, any visual effect puts a higher strain on the system as it becomes more complex, and the same goes for higher detailed models. When creating *Crossed,* I obtained an understanding of these limitations and ensured my design choices avoided them and the resulting negative impact on the film. The entire production process was an experiment on creating animated film in Unreal Engine.

The format of the asset creation process changes when working within a game engine. The standard progression flow for animation filmmaking is from Maya to Zbrush to Marmoset Toolbag to Substance Painter to Unreal. Once each process step is completed, the asset is exported out of that program and into the next program. Once the asset is finalized it is added to the content repository imported into Unreal Engine. This visualization of finalized content is a significant upgrade over referencing or importing assets into different Maya files. In Unreal, the model, material, and textures are imported separately. Thus, all aspects of an asset can be updated and managed separately. An important distinction is that the models displayed in the environment are instances of the imported model in the content browser. If the model needs changes, it is one click when re-importing the updated version of the model.

This level of modularity and flexibility extends to many of the critical tools available to artists working in Unreal Engine. In addition to the powerful and easy-to-use content browser, the viewport lighting is identical to the final lighting, so the artist gets immediate feedback on any

lighting changes they make. The material nodes are a potent tool that has allowed me to add rustle to my leaves and sway to my grass without simulation. Additionally, there are many prebuilt assets available, from camera and gameplay tools, models, visual effects, and lighting systems. These free pre-made assets were an instrumental tool in the pre-production and concept phases and continued giving me access to tools and assets that are outside of my reach as an environment artist.

There was no real benefit to leveraging the power of traditional rendering engines like Renderman or Redshift with this short film. While Unreal had a slightly modified workflow, it was a workflow that focused on optimization of the process and made things easier for developers. As the style of my film relied on clean, sculpted detail and simple painted textures with limited use of any form of visual effect or simulation, there was no benefit to pre-rendering my animation. Unreal's real-time approach allowed me to treat the project as if it were a stage production where my characters were performing, and that workflow was highly appealing and enjoyable.

Given the adoption of Unreal Engine in film, tv, and commercial work, Unreal Engine has many tools that make it ideal for my production and an excellent choice for animated productions overall. The tools help developers make complex and sprawling video games easier and also directly benefit any creator to organize, streamline, and speed up their smaller production.

For *Crossed*, the character rigs, meshes, shaders and textures, dynamic, and animations are all separate components. There is a script node within the character blueprints that calls animations from an array. The character blueprint allows the characters to transition between different

motion capture sequences seamlessly without manually timing out these sequences in the sequence editor.

Fundamentally, Unreal Engine and Motion Capture animation allowed me to approach my role of director more like a film director than an animation one. Actors could improvise and have a unique personal flair for the character's movements. With Unreal's real-time rendering, I was able to set multiple cameras from any angle and rendered them all out, thus creating a more freeing editing experience as well. Every shot did not have to be figured out perfectly ahead of time but could naturally develop and improve over time like live-action work. The entire process offers the spontaneity and freedom of live-action while still leveraging powerful and precise animation tools as the artist and director.

The Asset Creation Process

While much of the 3D asset creation process is a ubiquitous scaling system of tools and concepts, there are specific considerations when creating props, characters, or environments for game engines.

Within game engines, poly-count is significantly more important than in pre-rendered media. With this understanding, the more polys a single 3D model contains, the more information must be stored and calculated when working with that object. While this is less of a concern for an

animated feature or blockbuster movie, video games need efficiency because games and game engine renders are designed and optimized at real-time speeds.

The speed and flexibility available are critical in developing games, and my film leverages the same flexibility and speed. Within Unreal Engine, the primary interactive viewport displaying the scene renders at the same quality as that scene would look in a final release of the game. Thus, the artists and designers can immediately know what their work will look like.

The goal is to develop my film as close to industry standards and industry quality as possible. As a result, I had to follow a similar set of rules. For this film, most of the props and environment were modeled and UVed before beginning the sculpting process. The majority of sculpted detail in the environment is rough, worn-down stone. Achieving the stylized look did not necessitate heavy alteration to the silhouette or overall form of the structure. Thus, assets moved through the pipeline more efficiently.

I start with a simple body form in Maya for the characters, following the character T-pose concept art. At this point, I can quickly rough out the general shape of the characters in Maya. Once the rough model is then imported into Zbrush, it is just a process of adding clay and refining repeatedly until achieving the desired look.

The model is then sent back into Maya for re-topologizing. The re-topology process ensures good deformation while animating. For nice deformation of the character's mesh, both the body and face need a specific grid of polygon faces with enough edge loops and flow around joints and facial features. After completing the re-topology, the characters were sent back to Zbrush for

even finer detail. This time, maintaining the topology did not require DynaMeshing the characters at all. Thus, all the sculpted detail added in the highest subdivision level affects the lowest subdivision layer, which is the base re-topologized mesh. The final aspect of the characters is the hair, a combination of various hairbrush chunks laid out and positioned by hand.

Getting the high poly sculpted detail onto the low poly re-topologized mesh requires the use of the Marmoset Toolbag for the baking process. Marmoset takes the real light and shading from the more detailed mesh and creates a normal map, a set of images that generate fake lighting detail. This high level of detail created in Zbrush can then port efficiently into the game engine using this process. Specifically using Marmoset Toolbag provides a more interactive baking system in Substance Painter while generating better normal maps.

Importing the textures into Substance Painter, I then focus on creating simple, stylized textures. In this instance, "stylized" means textures focusing on color, light, and shadow more than material quality, giving the film a clean and slightly painterly aesthetic. This aesthetic choice is explored in the pre-production segment of the paper, but from a technical standpoint, achieving realism is much more challenging than solid stylization. The creation of high-detail realistic characters and assets takes significantly longer, and if the realism misses the mark, it is far more apparent than if the stylization is not at the desired level.

Practically, this focuses the Substance Painter texturing on appealing color choices, high-detail normal maps, and prominent highlights and shadows. I break this down into three distinct layers of texture: the color layer starts with a flat base color. I then introduce slight tone and saturation

variations through soft procedural maps. The normal map detail emphasizes using curvature highlights and ambient occlusion shadows. Final details include stylized and soft, warm color variations of any dust or wear. Structuring the texturing as this three-step process ensures the workflow stays efficient even when dealing with large environment assets

Building a World

The environment concept started as a crumbling wizard's tower at the edge of civilization, a hideout where Dmitri took refuge. The massive looming shapes of brutalist architecture slightly inspired the tower's design, however, I wanted the environment more natural and overgrown, thereby reinforcing the idea of magic as an aspect of nature. I therefore incorporated trees and vines into the setting.

The environment had several focuses that were all tackled differently. The environmental design focused on building a stylized stage as a performance space for the characters. Keeping the environment and character designs unified meant using the same general creation process for both because of the importance in ensuring stylistic consistency between the characters and environments. I considered the structures of the environment as anything inorganic or anything created by hand. The structure is the tower itself and any floors, stairs, pillars, and manufactured objects. These structures were modeled very low poly, then imported into Zbrush for adding sculpted detail. Unlike the characters, I took full advantage of the DynaMesh process ensuring a high enough density for sculpting. The Dynamesh process is when Zbrush automatically

generates an even grid of polygonal mesh for the asset to make it better to sculpt on. When using this tool, I kept the sculpted asset as close to the same general shape as the low poly so the normal map bake worked as intended.

The environment structures were textured individually in Substance Painter. However, they used the same base material I created and much of the same Substance Painter generators and procedural textures, therefore keeping the assets consistent while still allowing for variations in color and texture between the different parts of the structure.

The twisting roots and tree trunk that wrap their way around the structure were all created using Zspheres to map out the general shape of the vines. These basic shapes were sculpted using Zbrush's Sculptris mode. These were then duplicated and divided into different masks so the roots could be UVed in Zbrush. I used Zbrush when UV mapping the roots because of how complex the shapes were, but this ended up causing a problem with the normals.

For the environment, the material node system was crucial in getting the look of the foliage correct. Within the material node for the grass and leaves were systems which created movement based on manipulating the normals, color variation through gradients, and a Fresnel edge fade that stopped rendering the individual planes that made up the leaves as the camera approached their Fresnel edge. This effect was shockingly simple to create and implement on a large scale throughout the environment. It is easy to add different multiply nodes with parameters to reduce metallic shine, increase roughness, or swap out alphas, even in simple materials.

Using Unreal's landscape sculpting tools, I created the wider world seen in the film's background entirely in Unreal. Unreal's landscaping tool also allows for asset placement, so I took my grass variations and the free-use trees downloaded from LucenDev and painted them across the landscape.

Lighting was easily one of the most complex aspects of the environment design. Unreal Engine 5 introduced Lumen as the new real-time ray-traced lighting solution, but I had difficulty tuning and achieving the warm sunset lighting. Using the directional light source in combination with the sky atmosphere and volumetric clouds gave a solid result for the visual look of the sky. It had the added benefit of producing in-camera God rays. Importantly, using an ambient light cube map as part of the post-processing volume allowed for the deep blue shadows of the environment.

The Motion Capture Animation Pipeline

Motion Capture required a massive overhaul of my workflow, and I lost a significant amount of work because I could no longer use the control rigs created by my rigger. I relied on an entirely new system. The new pipeline recorded my actors and processed the data in Shogun. Cheryl Briggs acted as my motion capture technician and managed the system's setup, calibration of motion capture suits, and cleanup of all the motion capture data. We would then clean up the Motion Builder data and apply the modified T-pose characters to the motion capture data.

Generally, from here, it would be as simple as creating an animation layer and tweaking the animation while smoothing out any issues with the mocap. However, the rig joints for the swords

were not bound to the human inverse kinematic rig in Motion Builder. That animation did not transfer over to the character swords despite being recorded. Because of this, the characters were sent to Maya for binding the swords to the palm joints and orienting them correctly. The correct option added the swords to the character Human IK rig so that it would bind to the actor's skeleton, but I was unaware of this option at the time. Since then, I learned that it probably is possible to create a custom character map in motion builder, but as it was my first time using the software, someone else handled preparing the character for mocap.

The sword orientation needed to match the movements of the mocap data by getting the base joint rotation of the sword mocap locators. Once achieved, point and orient constraints were created between the sword joint and a locator placed in the character's palm. Finally, orient constraints were created between this locator and the mocap joint. This locator was then placed in a folder with a second locator inside, and the folder was parented to the palm joints. This process ensured that the mocap sword joint was nondestructively passing information to the sword joint through the group. If I needed to animate any changes to the sword, there was a separate animation locator that could be manipulated and keyed.

After finalizing the cleanup animation in Motion Builder, the characters were passed back to Maya and had their animations exported and baked onto their joints. That information was copied onto a new version of the characters with improved skinning and face controls. During this copy and paste, I also deleted the translation keyframes on both characters as it was unnecessary and caused some issues with the transfer.

With the body animation applied and the faces animation matched, this final animation was baked and exported into Unreal Engine. I then encountered another problem. My skinning artist had made some changes to the rig, and as a result, the animation behaved differently in Unreal. After setting up an animation retarget using a custom skeleton and retargeting my animations from the original rigs to the updated ones, the animation was finally imported into Unreal and added to the scene.

This would have been significantly easier if a few things had been done differently:

1. Matching all of the joint names on the character rig to the Unreal Engine default rig and having better joint placement, specifically for the clavicle and head joints.

2. Rigging the character in T-pose for motion capture. Despite more difficulty when modeling and sculpting, this change makes it easier to move from Motion Builder to Unreal.

3. Including the sword joint in the Motion Builder rig. While there were still issues with the orientation of the motion capture joint not matching the motion capture locators, this would have been a more straightforward fix if the sword joint were matched to the characters in the rig.

CONCLUSION

Crossed represents my core beliefs in people and the bonds that we share. We cannot hope to defeat the worst elements of oppression without the connections we forge with those close to us. Without my friends, I would not have created this piece or be where I am today.

The friendship between Calum and Dmitri is the reason Calum breaks out of his indoctrination. His blind faith without understanding the amorality of his actions leads him to try to kill his friend. It is only through the important connection they share that Calum overcame any organization, structure, or authority trying to control him. Dmitri is not a passive catalyst for Calum's change but actively challenges his friend and fights to break his indoctrination. It is his moral obligation to not plead passively for his friend's understanding, but to fight back against any oppressive force, even if it was his friend. Despite Calum's indoctrination, Dmitri fights to save Calum, never punishing him for making the wrong choice. Together, they are stronger than if they are separate. The same goes for the blend of live-action and animation techniques used for the character action. The art of creation does not need to be defined by a single genre or divided by professions. Through unifying theatre staging, live-action camera techniques, and animated design I create a stronger visual telling of this story.

Overall, the film's visuals achieve the intended art style through the process of reworking and refining. The story feels genuine and honest and presents believable characters. Gaining a wealth of knowledge in the entire pipeline for creating cinematic animation in Unreal Engine 5 and honing my professional skills, I achieve my initial goal of creating a fight scene. The usage of

actual motion-captured combat choreography is an invaluable asset in completing that goal. The combination of 3D and 2D animation make the film significantly stronger and the communication of the story more concise and impactful. Using Unreal Engine and Motion Capture allows me to experience an entirely new way of creating animation. The experiment of blending live-action and animation techniques make *Crossed* better than if using only one or the other. An exciting and heartfelt story combines with a unique and powerful blend of tools and techniques then culminates into something beautiful. Through the process of making this film I recognize the need in reconciling aspirations of resources and time constraints. Overwhelming myself at times while learning and implementing a number of new skills, I am proud of the work and collaboration that helped me produce this film. Moving forward, I now have the knowledge and experience to better design the overall production of future projects.

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