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ECHO

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ABSTRACT

Echo is a 3D animated short film rendered within Unreal Engine from Epic Games. The story is centered around a small child named Echo who has moved to Earth with her mom. The story follows her adventures through her first days at school and what can happen when a parent suddenly disappears from a child's life against their will.

Many of the story beats take direct inspiration from personal experiences of either myself, my family members, or stories of immigrant children who come to the United States (US) with their parents in search of a better future. There has been a lot of discussion about the immigration system in the United States in recent years, but not enough discussion on the experiences immigrant children have when going through the system and its issues, therefore this film aims to help shed a light on how just a small act of kindness can help build a new world for those that find themselves lost. The main character and the film are titled Echo because it is an "echo" of the past. Be it past experiences, stories, or events.

Dedicated to Javier Beltran, Mario Sayol Beltran, Luis Sayol Nahr, and Miguel Sayol Nahr

ACKNOWLEDGMENTS

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LIST OF ACRONYMS

ACLU – American Civil Liberties Union

DCC – Digital Content Creation

DREAM Act— Development, Relief, and Education for Alien Minors Act

UE5 – Unreal Engine 5

US – United States

ARTIST STATEMENT

I was born in Caracas, Venezuela, and immigrated to the United States when I was 4 years old. Growing up in the United States, I had to quickly learn how to speak English and adapt, but oftentimes I was faced with discrimination or racism due to where I was born and what language I spoke at home. Many of the story beats take direct inspiration from personal experiences of either myself, my family members, or stories of immigrant children who come to the United States with their parents in search of a better future.

It is through Echo's story that I aim to have viewers understand what it is like to be in a child immigrant's shoes experiencing a world that oftentimes may not be as friendly as they dare to dream.

CHAPTER 1: PSYCHOLOGY AND CONTEXTUALIZATION

To understand the underlying themes and messages of *Echo*, it is imperative to discuss

the psychology of immigration and the reasoning behind why families choose to immigrate to a

new country. According to the book "Forgotten Citizens," by Luis H. Zayas, there are

approximately over four million undocumented immigrants in the United States as of 2015. Of

that population, "81 percent of the unauthorized immigrant population is from Latin America,

mostly from Mexico." Going beyond the US, "The International Organization for Migration

(IOM) estimates that 214 million of the people on the earth live in a place other than the

country they were born in, and more than half of these individuals are women" (Zayas, 28). The

act of moving from one country to another for several reasons is a trait that dates back

millennia for humanity. In today's modern era, that concept still exists, only now there are

sanctions, laws, and due process that migrants must face to start a new life.

For those that do not have a personal stake in the situation, a common question that

arises is related to why anyone would immigrate at all. Those uneducated on immigration

would argue that immigration would be illogical for anyone, as there is so much in place limiting

the movement of people between nations. In *Echo*, the underlying subject is separation from

loved ones, as it is implied that Echo's mother brought her to a new planet but now is no longer

able to be with her. A common reasoning for immigrant parents who move to a new country

despite the obstacles is because they believe the new country will provide a better future for

their children. This is even at the cost of the parents themselves possibly not making the same

journey. As Zayas states in his book when discussing the complex reasoning on why specifically

parents choose to displace their families, "Survival needs override acquiescence to laws that seem unjust when one is desperate to provide for one's family." If the way to provide is not available in the family's home country, then the only option is to move to a place in search of opportunity. For the author's parents, they chose to make that decision with her in mind, which is why in *Echo* the parallel is intentional for Echo's mother and her daughter's future.

<div align="center">**Child Immigration and its Relation to Echo**</div>

Being an immigrant is a core pillar of who the author is. It has influenced every single one of her decisions growing up and continues to be a piece of her that she displays in various situations. The United States under the Immigration Nationality Act of 1952 labels immigrants as "aliens," the more detailed definition being "any person not a citizen or national of the United States" (INA). There are different types of aliens that fall under different categories, but for the author personally this definition felt like an unwanted brand. Growing up, the term "alien" signified "not meant to be here," and common representations of it in media were little green aliens from Mars (History Channel). This kind of dialogue and association can leave a detrimental and lasting effect on the psyche.

Studies surrounding the mental state of immigrant children have proven that immigrant children are more likely to develop disorders such as anxiety, depression, and post-traumatic stress, to name a few (Collier). Fleeing a home is incredibly difficult and oftentimes is a last resort for many families. The author's own family was one of these cases, and this is also seen in the short film as the entire premise for why Echo is in a new world altogether.The fact that Echo is an alien from outer space is a direct symbol of how the United States Immigration

Nationality Act labels immigrants, only instead of green, the author chose blue as a reference to one of the colors on the Venezuelan flag.

Figure 1: S_002 in Echo highlighting the stark color difference between Echo's skin and the world

The physical absence of Echo's mother in the film demonstrates that Echo has become an unaccompanied minor in a new world, a reality many child immigrants have faced particularly in the last decade and during the COVID-19 era. A latest study stipulated that nearly 150,000 unaccompanied minors were either at or near the United States' Mexican border in 2021 with nearly three quarters of those in federal care being fifteen or older (Cheatham). Though Echo is meant to represent a younger child in the five to eight-year age range, these are disturbing numbers and are still a portion of detained children.

While there are statutes that have been enacted to help unaccompanied minors in the event of human trafficking or separation from their families, the litigations and concerns of child welfare continue to be an ongoing issue. In a 2007 study done by Caps, Castañeda, Chaudry, and Santos that is referenced in Luis Zayas's book, "For every two undocumented immigrants deported, one citizen child is directly affected…The child is separated from one or

both parents suddenly for what could be several days to several months" (Caps et al, Zayas 19).

Oftentimes, a child's immigrant status differs from their parents and the child immigrant may not be aware of the legal ramifications of their status. Therefore, children who have been entrusted into the hands of federal housing are not aware of their rights or how they should be treated, and previous administrations have only hindered the process in understanding how children eighteen and under can go about either returning to their home countries free of persecution or living as asylum seekers within the United States under the care of the government (ACLU). These various states of children being orphaned because of detained parents, moving to an unfamiliar environment potentially without a stable family situation, or being presented with discrimination they were not prepared for mentally affects children in ways that may not be completely understood until the children grow up to be adults working within the workforce of a new country.

Many initiatives, such as the Development, Relief, and Education for Alien Minors (DREAM) Act first introduced in 2001, have tried to become law in an effort to help immigrants that came to the United States as children have a path to legal status, but unfortunately at the time of this writing, none of the iterations of the DREAM Act that have gone to vote have been passed into law. There has been a total of eleven versions of the act over the past twenty years, each with minor changes in an attempt to garner bipartisan support, but none have been fully approved (American Immigration Council). With that said, there is still a version of the DREAM Act proposal currently going through Congress, which would give "Dreamers," undocumented children that have been applying over the past 20 years to attain citizenship, the ability to gain legal status, therefore the fight is not over. (American Immigration Council).

Child Immigration in Pop Culture

While there has been a little content created to highlight children in the immigration system specifically in the world of pop culture, there are a few stories that have been written and published by notable Latin American actors detailing their struggles with the immigration system in the United States. One of these actors is Diane Guerrero, who has documented her experiences as a child whose parents were deported in her book, *My Family Divided.* The entire book speaks of her dealing with her parents' issues and journey throughout the immigration process as well as how she herself reacted to all the struggles that ensued as a result. Guerrero's trials are common, which is why books like *My Family Divided* are vital to understanding the psyche of a child going through the traumatic stress that immigration is and the constant fear of having their family separated. These similar emotions and feelings can be seen in *Echo,* as Echo herself deals with the mental ramifications and realization that her mother is on an entirely different planet while Echo is alone.

Figure 2: Echo stares at the polaroid of her mother and her longingly

One of the experiences Guerrero highlights is her time in school throughout the chaos of her mother's deportation. Guerrero writes: "In school, I did my best to focus. My grades slid, though. I couldn't bring myself to pay attention in class. My only instinct was to rest my head on the desk and concentrate on not crying." (Guerrero, pg. 74). In the short film, Echo has similar feelings as she pensively stares at her desk with no intention of paying attention. It is only when the teacher taps her board and steps in to help that Echo begins to see other sides of her situation.

Another showcasing of undocumented child immigrants can be found in the 2021 film *In the Heights,* which focuses on a community in Washington Heights and their struggles as a Latin population in New York City. Based off the Broadway production of the same title, the movie adaptation introduces the character of Sonny as an undocumented child whose dreams are shattered upon realizing that he cannot attend college without legal immigration papers. This becomes a recurring plot point for the main character, Usnavi, as he begins to pay for Sonny's papers to begin the immigration process and give Sonny a better future (Chu). Sonny and Echo,

as a result, are similar, as both characters are placed in situations beyond their control. It is only

through external help from those around them that the possibility of a brighter future

manifests.

Related Works: *Lilo & Stitch*

The film *Lilo & Stitch* premiered in 2002 and became one of the most personal

identifiers of the author in part because of its underlying themes of location displacement,

struggles with abandonment and identity, and the concept of making a new "ohana" with those

that have chosen to accept Stitch on a new planet. As a result, there are a substantial number

of parallels that can be drawn between *Lilo & Stitch* and *Echo*, the most apparent of which

being that both stories center around a little blue alien from outer space. While there are

additional reasons as to the specific character design of Echo that pertain more to the definition

of alien by the Immigration Nationality Act, the character Stitch and what he represents in the

film was a direct inspiration for key shots of *Echo's* narrative, namely the scale of Echo in

relation to the world around her and the use of polaroids telling the story of being far from

home and connecting homes at the end.

In the Disney animated film, Stitch's mental state can be related to the same age as that

of a five-to-eight-year-old child as he experiences a world he does not understand. His

communication skills and interactions with the other characters in the film often result in fear

from others or ostracization from events, locations, or people. Psychologically speaking, Stitch

presents many of the symptoms that would be used to diagnose Abandoned Child Syndrome

and separation anxiety in young children. Lilo herself also deals with this disorder as she

recently lost her parents and acts out against Nani, her older sister. These same disorders are extremely common within child immigrants and as such are represented through Echo's lack of communication and isolation in my short film.

Abandoned Child Syndrome is the result of a child losing one or more of their parents at a young age (Psychiatry Open Access). It can develop physically or emotionally and may result in behaviors such as acting out in school, malnutrition or picky eating, or lack of communication entirely. In both Lilo, Stitch, and Echo, all three titular characters display the ramifications of loss at an early age. Lilo and Stitch deal with it by finding each other and making their own family while Echo learns to deal with it through her teacher helping her bring a piece of her home to the classroom in the form of a paper planet.

In *Lilo & Stitch,* closer to the emotional climax of the film, Stitch finds himself lost in a forest with a book in his hands recounting the story of the Ugly Duckling. During that sequence, Stitch comes to terms with the realization that, upon leaving the makeshift world he had just begun to form with Lilo and Nani, he is not only now lost in a new world, but he is also lost in how to move forward. The emotional impact this scene had on the author as a child is exceedingly difficult to put into words, but it is a direct representation of what it felt to be a child in a new world. That emotional thread is also present in Echo, as she is waiting outside of her school well into the hours of the night in an attempt to see if her mother will come to pick her up. As she looks at the photograph of her and her mother that Echo carries with her and then looks up at the planet where she originally comes from, Echo comes to a similar conclusion as Stitch: she is just as lost in more ways than one and has no clear path to go forward.

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The last shots of both films deal with showing the newfound families the respective

children now live with. In *Lilo & Stitch*, the final shot shows the burned picture of Lilo's parents

that is intentionally cut out to also fit a picture of Stitch at the beach, effectively connecting

that he is now a part of her family. In *Echo*, the premise is the same as the last shot of the film

shows Echo in her new environment, happy and alive. The photo of Echo and her mother is

superimposed on top to note that even while Echo's mother is no longer there, she still is a part

of Echo's story.

Figure 3: Two Pictures placed side by side to show the completion of Echo's journey

CHAPTER 2: FILM

Synopsis

Echo is an alien that comes to a new planet with her mother and must deal with the hardships and obstacles of going to a new school unfamiliar to her. The story draws from various personal experiences from myself and my family growing up in the United States and acts as symbolism for how children experience immigration. The film is purposely devoid of dialogue to further make the message and experiences of Echo universal across cultures and regions.

Identity and Character Design

The United States immigration system classifies immigrants as aliens, meaning, "any person who is not a citizen or a national of the United States. There are different categories of aliens: resident and nonresident, immigrant and nonimmigrant, asylee and refugee, documented and undocumented ("illegal")" (Cornell Law). Because of this reason, choosing to design and model an actual alien for this story was both poignant and purposeful to denote how one feels when they enter a new world and how one is viewed by others when they think the alien does not belong. Designing Echo extrapolates upon this principle. Her shape language is meant to showcase her as a star, though all her features are softened to not denote anger and sharpness. Echo's name, though never explicitly mentioned in the film apart from the title, is in and of itself an influence as well: it is an echo of the past memories that children like the author has experienced when dealing with the identity of family and love in a world that does not wish for them to be there on the basis of who they are.

Narrative Influences

This film is heavily influenced by past and personal accounts of children and teenagers in the immigration system, namely the author and those in her family. While some aspects of certain stories were altered for purposes of emotional impact, the core of these stories and how the child feels remains intact. The feelings of isolation, misunderstanding, hope, and reinvention are spread throughout the story's arc as Echo learns what it means to be someone different from others in their world. There are many stories and documentaries that discuss the brutal passage that is immigration and the effects it has on a working-class family, but extraordinarily little talk about the effects immigration can have on children.

Because the film focuses primarily on Echo and her interactions, the decision was taken to model and represent the world as if it were from the point of view of a child and a child's perspective on how things work. An area that best exemplifies this is during the initial opening where the stars shine to spell out the title of the film. The stars themselves are not natural realistic stars in space, but rather a basic representation of a five-pointed star. Similarly, Echo's home planet moves at a faster rate than that of a traditional planet when viewed from far away. This is done to add more movement to the shot as well as represent how a child may view a planet upon learning that it spins. Similarly, when Echo is outside during the night and tries to reach out to her original planet, the planet moves away, an act that would not be physically possible. How Echo perceives her unfamiliar environment is vital to understanding her psyche as a child immigrant and abandoned minor. Lastly, another key moment in where this is best showcased is when the Teacher first meets Echo. Whereas the Teacher is excited to welcome a new student into her classroom and goes to meet Echo at the door, the large-scale

discrepancy between the Teacher and Echo causes Echo to perceive this reaction as twisted and

terrifying, which prompts Echo to run away to her desk.

CHAPTER 3: ART DIRECTION

Set Design Influences

The setting of the film takes place in an elementary school classroom, much of which was inspired by Celebration K-8 School, the elementary school the author attended growing up. Particular care was taken to remove blue from the environment to make Echo stand out against the background and further emphasize that she is not of the same world. Other areas of the set, however, do play with the primary colors significantly, as red, yellow, and blue are the colors of the Venezuelan flag.
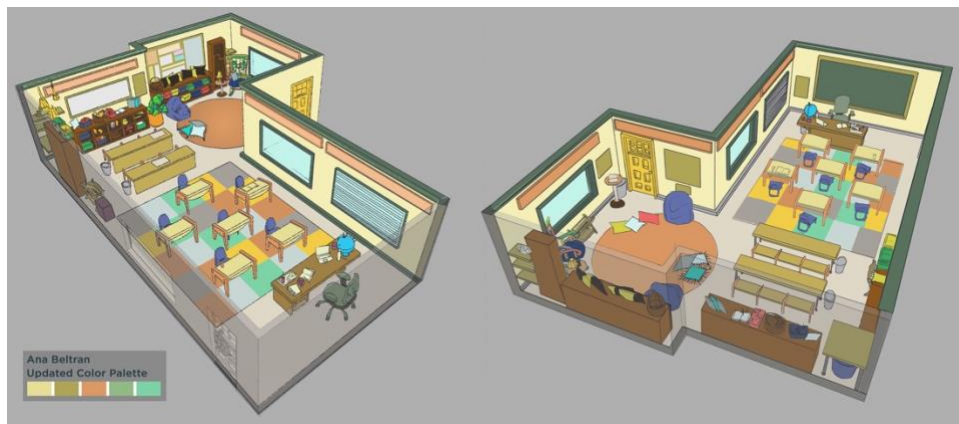

Figure 4: Classroom Color Scheme and Layout

Plot Devices

Echo carries around a photograph of her and her mother on their original planet. Very quickly, the photograph becomes Echo's only way of remembering her mother as during the film it is implied her mother has been deported and is no longer there to pick her up from school. Oftentimes as children, there is some sort of keepsake that reminds children of where they were and creates sentimental value. When they hold onto it, they remember those that they have lost. The photograph acts as this memento for the rest of the film. Towards the end

of the film, a secondary photograph is taken is taken in the classroom of Echo next to the planet she created. This is meant to show that, while the worlds are now different, the new memory will bring peace and joy in remembering who was there and where Echo was. By unifying them together in the final shot, the message is solidified that Echo is making the best of a brand-new world while still remembering where she comes from.

As a call back to the author's experiences as a child immigrant, the clock in the classroom represents the month and day when her family first moved from Venezuela to the United States. This also serves to visually represent how long Echo has been waiting for her mother on the bench that it is nighttime.

Music and Sound

Music and sound play a crucial role in this film as there is no spoken dialogue. The choice to not have "spoken" words was intentional, as the author did not want to limit the audience to language speakers and make the story only about Latin Americans coming to the United States, effectively turning the conversation into a commentary on Spanish and English countries. By having music denote the emotional impact of scenes without dialogue, it opens the door for a broader understanding of any culture and centers the idea that what creates a sense of isolation is the inability to be understood.

Character Design

When first approaching Echo's design, set design was greatly considered. Echo is meant to be extremely different from the unfamiliar environment and planet she finds herself in. Therefore, from the beginning there was always a conscious decision to have space represented

in Echo's design. With Echo being the titular character, special care was considered for her design to further emphasize the core of the story. Jonah Lobe posted a series of videos detailing the fundamentals of character design where some underlying symbols come in the form of squares, triangles, and spheres (Lobe, An Immortal Design). Each primitive shape denotes a specific feeling in the character it creates, therefore thoughtful design requires deliberate selection of the basic shapes that comprise the character.

Echo's horns and hair are meant to accentuate space, for when placed T-Pose, or in a neutral pose, her silhouette resembles that of a five-pointed star. Her body, however, is very round and blobby, mimicking that of a young child. The softer forms help offset the harder triangles so they do not read as negative.

Figure 5: Emissive map on Echo's face and hair gives an additional otherworldly glow

Echo's color palette takes from the colors of galaxies and nebulae, leaning more into the cooler and otherworldly tones that contrast with the green and earthly environment. Additionally, the freckles have an emissive map overlayed onto the material so that in low light situations, Echo's freckles reflect that of a star map. As far as texturing the hair, the UVs are laid out purposely to take advantage of gradient tools in Substance Painter to help break up the hair's forms. Playing around with the UVs and color helped sell the final look and feel of Echo's sculpted hair. The decision to give Echo pigtails as a hairstyle came from the desire to have what is an otherwise otherworldly character a sense of connection between a younger audience member and Echo. It was much later into production that the author realized when she was younger that she often had pigtails as her signature hairstyle as well.

The Teacher's character design was founded on using a capybara as direct inspiration. Capybaras are not only native to Venezuela but are often also animals that partake in the concept of alloparenting, which is the act of raising children not of their own (National Library of Medicine). Choosing an animal with this trait allowed for the Teacher to have a reason to not only instinctually have a connection to help Echo, but also be open and reactive to aiding Echo through a traumatic time in her life. The Teacher's glasses and hair are also direct inspirations from the author's kindergarten teacher, whom in many ways was the figure that helped her through similar issues of not feeling like she belonged at a young age.

CHAPTER 4: UNREAL

What is Unreal

The decision to render the film in the Unreal engine came at the onset of the project due to the author's background in game design and experimental animation. The world of real time rendering and its development has skyrocketed in the past few years as Epic Games, makers of the Unreal Engine, sought ways to diversify their assets into other markets such as film and animation. Because Unreal is a real-time renderer, one of the key benefits of using the game engine is its significant duction in render times without risking production quality. This advancement in the realm of animation has already been recognized by The National Academy of Television and Arts, which gave Epic Games an Emmy for the Unreal Engine in 2018 (Unreal Engine).

Epic Games' Unreal Engine has been at the forefront of the games industry with various studios releasing games using the engine for over 20 years. Tim Sweeney, CEO of Epic Games, has stated to cinemablend, "Unreal Engine is the only way to achieve these final, photorealistic pixels in real time. It's the only renderer that does that" (cinemablend). Most notably, it is an engine that is free to developers for game development, making it one of the most widely used engines for production companies and studios to utilize (unrealengine.com). In May of 2020, Unreal Engine's latest version, Unreal Engine 5 (UE5), was announced to the world and included updated and revitalized lighting and mesh generation systems named Lumen and Nanite, respectively. Of the two, Lumen's lighting approach refactored how the engine interpolates real time lighting data, and thus lowered the necessary computing power of content that relied

heavily on previous practices like baking light to accommodate expensive renderers (Unreal

Engine). Due to this new development, the author transferred all film production assets into

Unreal 5 upon its release for open beta in 2021.

The transfer from Unreal 4.26, the original version the film began production in, and

Unreal 5.02, was remarkably painless. The only issues that arose were the import of cameras at

times not synchronizing to their correct location and some objects having to be slightly adjusted

to fit in their new world spaces. Because lighting had only been used for quick tests up until

that point, losing the previous lighting data in favor of switching to Lumen was not a loss in

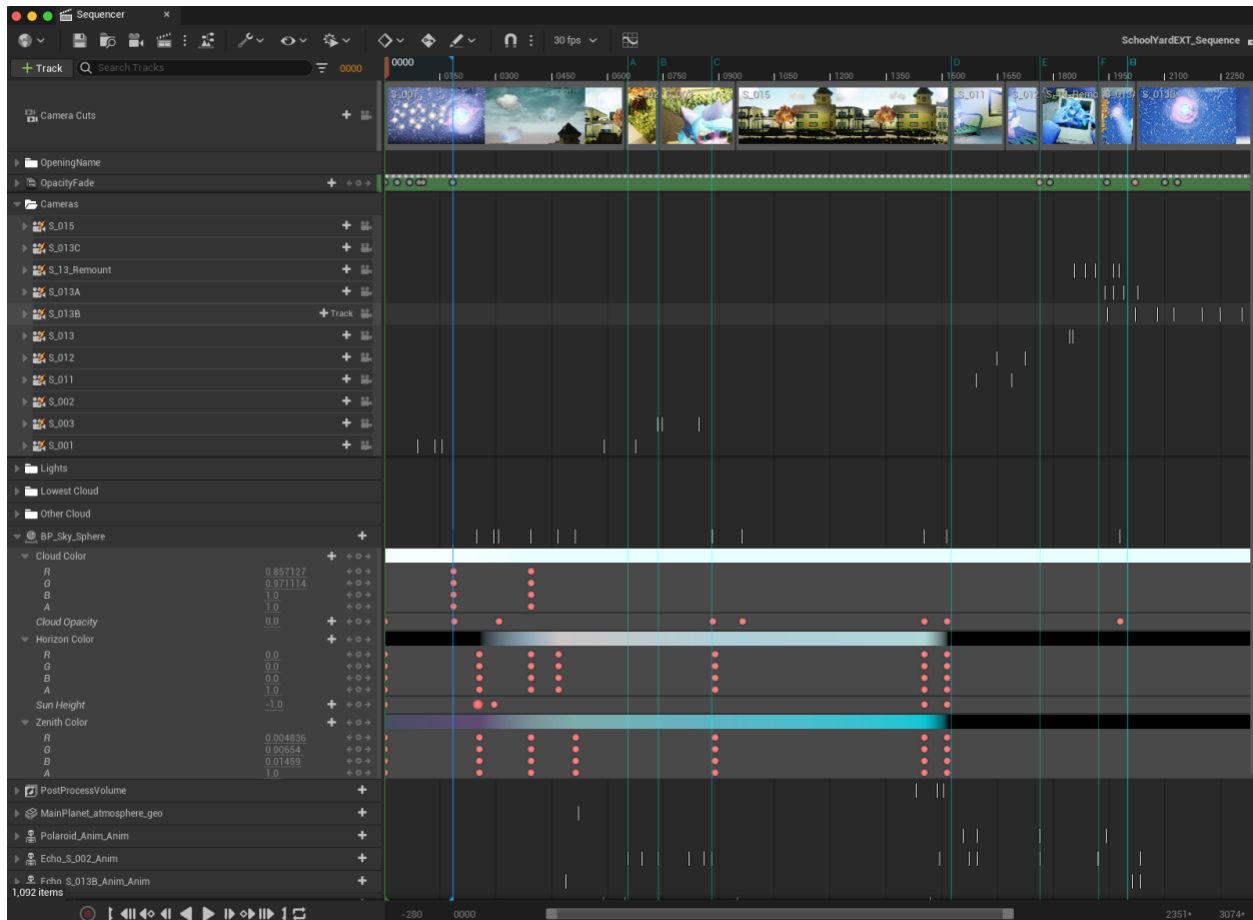hours or production time.

Using Sequencer

Figure 6: Sequencer for the Schoolyard Exterior Sequence

The entire film is broken into two main environments: the classroom's interior and the schoolyard's exterior. Because these two environments are wildly different, they were created in two separate levels and treated independently of one another. Each level has a corresponding master level sequence where all the camera shots are stored in order. The production process from that point was a matter of transferring the camera data from Maya into Unreal. Individual shots were then placed in timeline order with gaps in between for necessary editing that allows for the entire film to also be preliminarily cut and edited in Unreal.

Once shots were tweaked and adjusted, both master level sequences were transferred to

Premiere to combine the two-level sequences together into what would become the final cut of

the film. Additionally, by using the Unreal Cinematic Cameras, further ability to tweak depth of

field, light bloom, and animation allowed for the entire edit to be rendered in what is referred

to as "in camera," which means that no outside compositing work had to be done once the

shots were rendered out of Unreal.

Lumen

In conducting research and development with Lumen for version 5.02 of the engine, it

was discovered that when working with interior scenes, it was more economical from a render

standpoint to use primitives with a high emissive map applied to them as indirect lighting

elements compared to filling the room with actual movable lights. The overall picture also

improves as the engine is calculating light bounces natively compared to through a light

blueprint. Later updates to the UE5 Engine improved this idea in their base lights instead of

primitives, but for this version of the engine this was the most efficient approach.

For exterior shots, using the BP_Sky_Sphere that is native to the UE5 engine content

became integral for creating accurate clouds and light shadows casting from the sky onto the

objects in the environment. By adding the BP_Sky_Sphere to the Sequencer and exposing all

the attributes to Cinematics, the author had full control over making a scene go from nighttime

to daytime instantly, as happens in the very first shot of the film. Additionally, clouds could be

added or removed in camera as opposed to layering them in a compositing program outside of

Unreal. By approaching the entire film this way on the front end, the entire post-production

phase of the project was reduced to nonexistent. This also allowed for more time to iterate

upon ideas, improving textures and lighting, and overall enhancing the final composition of the

film.

Rendering

The render times out of Unreal have been astounding, with the entire film's 2 sequences

at thirty fps full production lighting quality taking just under two hours to render at 4K(four

thousand pixels) resolution. By comparison, one test shot done near the start of production

took over twelve minutes to render per frame using Maya and the Arnold render engine. If that

were to be extrapolated to the full film, the hypothetical render time for the entire film using

traditional render practices would have taken 5.3 weeks to fully render. Furthermore, in the

entire time the film would have taken to render once out of Maya, the entire film could have

been rendered 468 times out of UE5. By using this pipeline, what otherwise would have only

been 5.3 weeks of waiting for the film to render could not be repurposed time to rededicate

back to story development and environment design, making this pipeline revolutionary for

narrative driven projects.

CHAPTER 5: CONCLUSION

The goals in developing *Echo* are to inform the viewer and present the journey of an immigrant through a non-racial lens to broaden the minds of the audience. With the use of a real-time renderer in UE5, the production cycle changed drastically and allowed for more development in story and asset creation without risking final quality. This technology will only continue to improve in the coming years, giving the author great confidence in this pipeline being adopted by major studios and companies to produce their own real time animated shorts and experiences soon. Over the course of production, there has been tremendous progress in technology as well as societal understandings of the impact immigration has on children and young adults, and there is an increasing amount of interest in the pursuit of telling marginalized stories with advanced technology growing with each passing day. As an artist, these findings foster an immense sense of pride to see this pipeline starting to be adopted by major studios knowing that the author is also having a hand at contributing to that development. Using the UE5 pipeline reinvigorates the ability to be organically creative within the parameters of what could often be strict timetables while never compromising on final quality. The author is confident that this pipeline and project will serve as a historical technological point in the world of animation as one of the first projects to adopt this mentality while also highlighting the benefits of using this approach.

Newer updated versions of UE5 promise the ability to generate native control rigs within the engine as opposed to relying on rigging and animating solely within a DCC like Maya. Additionally, the Lumen and Nanite engines continue to improve upon the fidelity of final

renders rivals those of even feature films. Within the next 5 years, the author submits that there

will be a winning film in a large awards show using this real time engine rendering pipeline and

that the animation industry is sitting on the precipice of technological change once again.

Moving forward, the author intends to improve this pipeline and continue to iterate on

future projects both personally and professionally. While Echo's story may have been told,

there are many others that are yet to be discovered.

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