HABITATION

by

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ABSTRACT

This film and accompanying thesis paper explore the landscapes and ecosystems of the Eastern Shore Barrier Islands of Maryland and Virginia amidst a rocket launch at NASA's Wallops Flight Facility. Through the approach of sensory ethnography and poetic filmmaking, this film delves into the interconnectedness of humans and non-humans through a portrait of the landscape that a rocket launch port occupies. Experimenting with archival audio recordings of the Apollo 11 mission, contact microphone recordings, hydrophone recordings, cyanotype animation, Super 8, and digital media, this project challenges conventional science and natural history filmmaking aesthetics by pushing the boundaries of the form. As the audience is immersed in the landscapes of the film, they linger with machines, snails, seagulls, horseshoe crabs, fish, and wild ponies, offering moments of reflection to draw similarities between the seemingly different objects and organisms. This film connects the content of the film with its form by integrating the extractive processes of cyanotype, analog film, and digital media through the interplay of mediums and what is captured in frame. Organic materials of found salt, seaweed, shells, and sand are exposed in sunlight on cyanotype paper and the individual frames are edited together to create an animation. The ghostly white shapes of the materials dance around the frame in this camera-less technique, evoking an otherworldly swarm of flickering material against an ocean of Prussian blue. The imperfect graininess of the Super 8 footage offers a haptic experience to viewing these organic materials, again enmeshing the materiality of film's fossil fuel origins. In addition to this film, the thesis paper presents a theoretical analysis of the process and aesthetic choices that this film drew inspiration from. It explores the convergence of sensory ethnography and poetic filmmaking to ultimately seek new ways of perceiving how humans and non-humans interact with Earth in the context of the planetary crisis. By juxtaposing asynchronous sound and image, *Habitation* invites reflection on time, extraction, and species to contemplate the value of the life and matter of the planet we inhabit.

CHAPTER ONE

FILMMAKER BACKGROUND

Filmmaker Bio

Karly Noetzel is a Hawai‘i-born documentary filmmaker who creates poetic films that challenge human perceptions of ecology, time, and technology. While pursuing her MFA from Montana State University’s Science and Natural History Filmmaking program, Karly interned for a year at Goddard Space Flight Center, directing and producing broad-audience, science-driven short-form films for the James Webb Space Telescope social media in collaboration with world-renowned scientists and Goddard’s Office of Communications. With a passion for storytelling that delves into ecological crises, indigenous knowledge systems, and history, Karly’s work seeks to explore the diverse and complex relationships between humans and non-humans amidst the planetary crisis. Her film, *Water Bodies*, was an official selection at Maui Film Festival, Hawai‘i International Film Festival, and Big Sky Documentary Film Festival.

Filmmaker Artist Statement

My process of filmmaking is grounded in seeking meaning through sensory experiences. My films engage in a multimedia approach to involve the intrinsic qualities of each medium with the content of the film. Having been raised on the Big Island of Hawai`i within a community that deeply values the interconnectedness of humans and non-humans, my practice of filmmaking is inspired by topics of ecology, cosmology, and indigenous knowledge systems that challenge how we participate in material extraction and consumption on Earth. Approaching each subject with

kindness and openness, I foster an environment of collaboration to unravel multiple layers of narrative. Through a poetic framework, my filmmaking technique reveals a sense of place through a meditation on texture, landscape, and sound. In doing so, I invite audiences towards a more compassionate and curious world.

Film Logline

Micro and macro ecosystems of the Eastern Shore barrier island interact with NASA's rocket launch port.

Film Synopsis

Set along the coast of Virginia's Eastern Shore barrier islands and NASA's Wallops Flight Facility, machines, humans, and non-human organisms interact with each other. In a region where encountering rocket launches and wild ponies is typical for a local resident, *Habitation* provides a meditation on the island chain's terrestrial, aquatic, and aerial ecosystems to explore the interconnectedness of humans and the environment. Ecological crisis, space colonization, geology, and time intersect on micro and macro scales.

Film Crew

Karly Noetzel – Director, Camera Operator, and Editor

Andrew Motte – Camera Operator

Olivia Gorham – Super 8 Camera Operator and Sound Recordist

CHAPTER TWO

ACCESS AND CONNECTION TO MATERIAL

My connection to *Habitation* began during my first experience encountering Wallops Island, Virginia as part of my NASA internship during the summer of 2024. I traveled with my fellow interns to NASA's Wallops Flight Facility, which is the second busiest rocket launch port in the US. I was instantly drawn to the geography and ecosystem of the island. The salty marshes, eroding beach, and prehistoric-looking organisms set against the roaring and modern flight operations of the port, felt paradoxical and fascinating. While the rockets themselves are at the forefront of the space exploration industry, the infrastructure of NASA dates to World War II when the Navy constructed them as a base. What caught my attention most was a story that our tour guide told. In 2014, a rocket was launched from Wallops Island when it exploded about ten seconds after liftoff. We were shown a video of the launch, and a giant fireball consumes the rocket as it plummets back towards Earth. The tour guide described how spectators were screaming and running away as the sonic boom hit their bodies. The explosion destroyed the launch pad, and the story emphasized how expensive it was to rebuild. I decided to ask the question, "How was the ocean impacted?" Debris and rocket fuel contaminated the surrounding waters, as the port is located on a beach. The tour guide discussed how the environmental division at this NASA base is one of the largest and most comprehensive environmental divisions across the agency.

After this experience at Wallops Island, I wanted to know more about how NASA responds to and prevents rocket disasters, as SpaceX's actions in recent years have severely

impacted local communities and ecosystems near their port in Boca Chica, Texas.[1] As private space companies compete to launch the most advanced rockets, I wanted to know how and if they are being held accountable for the disasters, noise, and pollution that the launches create. Most recently, a SpaceX rocket exploded in the sky, shuttling debris into the ocean and nearby islands.[2] We must question what the cost is of rocket launches on Earth as private companies race to leave our planet. Just as Rebecca Solnit describes the 19th century trains and the railroad system as an annihilation of space and time, past and present space travel does the same. Searching for habitable worlds to support human life, increasing national security and military might, and harvesting natural resources that have been depleted on Earth are some motivations for expanding space exploration today.[3] While these reasons for space exploration may be motivated by governments to improve life on Earth for their country's economy, safety, and access to natural resources, these motivations are not sustainable long-term solutions.[4] Research professor at George Washington University, Linda Billings, describes that "all life on Earth evolved to live in Earth conditions…If humans can't figure out how to adapt to, or arrest, changing conditions on Earth- then I can't see how humans could figure out how to adapt to a totally alien environment."[5] If colonizing another planet or moon were even possible, humans would be miserable due to a slew of illnesses that could immediately kill them due to the differences in climate on another planet or moon.[6] Additionally, given humanity's "abysmal past

[1] Sharon Wilcox, "The Terrible Irony of Destroying Earth in Search of Plan(et) B: SpaceX's Impacts to Boca Chica, Texas," *Defenders of Wildlife* (blog), 2024.
[2] Issam Ahmed, "US Grounds SpaceX's Starship after Fiery Mid-Air Explosion," *Phys.Org* (blog), 2025, https://phys.org/news/2025-01-grounds-spacex-starship-fiery-mid.html.
[3] The Editors of ProCon, "Space Colonization," 2025.
[4] Ibid.
[5] Ibid.
[6] Ibid.

performance in caring for Earth's ecosystems…we care not capable of enacting a successful colonization of another planet."[7]

These questions of technological progress and how humans treat Earth are close to my values as a person, which is why I decided to create this film. The access that I have through NASA enabled me to tell this story. I established trust with my subjects by getting to know them outside of this film's setting, and the subjects were open and willing to talk about their experiences in their professions. Through this relationship, I learned that they are from this region and so are previous generations of their family. I was fascinated by this aspect of their story, as rocket launches and wild ponies were a prominent part of their childhood memories. I collaborated with my subjects by approaching them with respect, curiosity, and kindness. They were made aware that my intentions for this film were to share my interpretation of this ecosystem, their work at NASA, and their experiences growing up on the island from a place of curiosity and respect. I achieved consent by establishing that the subjects can say no to any requests or questions I have for them. To address safety concerns associated with filming a rocket launch, my crew and I completed training required to go onto the island and we communicated daily with security regarding where we would be filming and what we would be doing.

[7] Ibid.

CHAPTER THREE

RESEARCH TOPIC AND ARTISTIC APPROACH

Research Topic

Ecological crisis, space colonization, geology, and time are topics that *Habitation* converses with. Inviting reflection on how human and non-human organisms inhabit vulnerable spaces on macro and micro scales is the driving question of my film. What is the value of human and non-human life on Earth versus the value of exploiting Earth's resources to colonize outer space? Habitation explores this question through the materiality of cinema, the landscape, and the diverse human and nonhuman habitats near the Wallops Island rocket port. Consumption of natural resources is a driving factor of space exploration. This includes harvesting minerals, finding a habitable world for humans, and colonizing Earth's orbit with surveillance technology, telecommunications services, and military operations. These motivations have created an increase in demand for rockets, spacecraft, satellites, and natural resources.[8]

Rocket launch activities receive significantly less attention than other human activities that threaten global biodiversity. During rocket launches, large plumes of combustion, the roaring noise of the engines, and debris fallout occur, all of which negatively impact local ecosystems.[9] At NASA's coastal Wallops Flight Facility, the environmental division monitors nesting endangered species, water contamination, and acoustic levels produced by rocket launches.[10] While studying these factors are important to inform NASA's response to the impact

[8] The Editors of ProCon, "Space Colonization."
[9] Ibid.
[10] "Wallops Environmental Natural Resources," NASA, April 14, 2025.

of launches on endangered species, waterways, and humans, I argue that these practices can be pushed farther to evaluate the impacts on non-endangered species.

My film will challenge how we categorize certain organisms over others as being deemed deserving of protection. The discussion of how humans place value on certain organisms over others, namely those sharing senses and anatomy most like our human experience, is present in *Habitation* through exploring the "umwelt" of creatures that are traditionally deemed as insignificant, such as aquatic plant material, microorganisms, snails, crabs, and seagulls. Umwelt is the "sensory bubble," or an organism's perceived experience of the world.[11] The way an organism senses light, color, pain, heat, taste, smell, and electrical fields are examples of umwelt. For instance, the way a human perceives sound and smell is different than how a dog perceives these experiences. Understanding and accounting for how other organisms encounter the world is vital for creating a more eco-centric society.[12] Human umwelt limits our ability to understand nonhuman umwelt, as our way of knowing is constrained to how our senses evolved.

For example, the sonic and vibrational experience of a rocket launch to a human's anatomy differs from the sonic and vibrational experience to an aquatic organism's anatomy. To inform the exploration of umwelt, understanding the properties of underwater sound is a crucial part to my research. Science writer, Amorina Kingdom, describes that sound underwater is a means of survival for aquatic organisms. Aquatic organisms use sound to detect the location of food and safety. While scientists initially studied larger mammals that have anatomy like ours, Kingdon describes how smaller, less-obvious sound-producing creatures such as crabs, corals,

[11] Ed Yong, *An Immense World: How Animal Senses Reveal the Hidden Realms around Us* (New York: Random House, 2023).
[12] Ibid.

and fish rely on sound for survival as well.[13] Where there is present human-created noise, organisms flee ecosystems to seek survival resources elsewhere. The physics of underwater sound is significant to this issue of human-created noise in bodies of water too. Sound travels four and a half times faster in water than in air, and it can travel across seas in the right conditions. Additionally, sound can also be perceived as 60 decibels louder underwater than the same sound produced in air.[14] In relation to rocket launches, the rocket port of Wallops Flight Facility is located directly next to the ocean. A study was conducted at Wallops Flight Facility to track the noise produced by rocket launches.[15] This assessment was conducted to test the amount of dBA produced by four types of launch vehicles that are used at Wallops Flight Facility. The purpose of this study was to assess the potential damage to human hearing and infrastructure within five miles of the launch pad. While this study is useful for protecting human hearing and infrastructure, I believe that the study could be expanded to discuss the implications of non-human animal health. This report states that sonic booms are produced by the four launch vehicles, and that the booms intercept with the ocean 30 miles offshore. As Kingdon describes the importance of an aquatic organism's ability to perceive sound, sonic booms intercepting the ocean can damage their fragile anatomical structure and thus decrease biodiversity as organisms evade the ecosystem or die.[16] I challenge a new way of perception by exploring the sonic experience of non-human organisms such as the crabs, fish, mussels, and corals that Kingdon describes as being excluded from the dialogue of how sound affects their ability to survive.[17] By

[13] Amorina Kingdon, *Sing Like Fish: How Sound Rules Life under Water* (New York: Crown, 2024).
[14] Ibid.
[15] Michael James, Alexandria Salton, and Micah Downing, rep., *Launch Noise Study for the Wallops Flight Facility Programmatic Environmental Impact Statement* (Asheville, North Carolina: Blue Ridge Research and Consulting, 2015).
[16] Kingdon, *Sing Like Fish*.
[17] Ibid.

inviting the sensory experience of life as an organism living near a rocket port, I encourage a "reorientation of vision" from anthropocentric to eco-centric materiality.[18]

In addition to my incorporation of exploring the umwelt of creatures living near the NASA launch port in the context of sound and heat emissions, the technological invention of rockets is significant to understanding how human perception of space and time has changed through technological inventions from the industrial revolution. As described by Rebecca Solnit, the invention of photography and the railroad annihilated society's perception of space and time. This is due to photography's ability to freeze a moment in time and for the railroad's ability to carry human great distances in fractions of time that it would take to travel by animal or on foot.[19] The invention of the camera enabled humans to stop time, as the photograph preserved a moment in the past. With the invention of the railroad, physical distance was no longer an obstacle for transporting humans, goods and services. The speed limit of nature vanished, and this redefined what reality looked like as humans' sense of physical space immediately shrunk.[20] Solnit argues that prior to these inventions, time flowed like a river which human beings floated in.[21] Humans never bobbed faster or slower than the power of currents, wind, and muscles. Trains freed humans from these natural constraints and launched them out of the flow of the river. Photography froze the ever-passing waters of time.[22] Just as the invention of the railroad altered society's perception of space and time, I argue that the invention of the rocket contributes to our shifting perception of space and time as well. As humans were previously constrained to

[18] Siobhan Angus, *Camera Geologica: An Elemental History of Photography* (Durham: Duke University Press, 2024), 44.
[19] Rebecca Solnit and Eadweard Muybridge, *River of Shadows: Eadweard Muybridge and the Technological Wild West* (New York: Penguin Books, 2004), 13.
[20] Ibid.
[21] Ibid, 18.
[22] Ibid.

the forces of gravity and the need for oxygen from Earth's atmosphere, space crafts provided a life-sustaining capsule for humans and technology to leap beyond Earth's atmosphere and orbit.[23] Fossil fuels and processes of extraction enabled this invention. Materials that are radiation resistant and can withstand speeds exceeding 17,000 mph while enduring extreme temperatures are necessary.[24] Upon reentry to Earth, the exterior of a spacecraft reaches 5,000 degrees Fahrenheit, and the heat shield is a mere one to five inches thick.[25] The tiles that make up the heat shield are made of pure silica, which is then refined into sand.[26] Other extracted materials to construct the body of rockets include aluminum, steel, carbon composite, and titanium.[27] The propellants, which are the combustion products used to create thrust for launch, are quickly burned off as the rocket ascends. Concoctions of liquid hydrogen, alcohol, kerosene, aluminum powder, nitrogen, and oxygen are used as fuels.[28]

All these extracted Earth materials come from systems of labor and capitalism. Capitalism "shrinks space and speeds up time," which increases profits, as extracted and refined materials provide greater efficiency to catapult humans and technology across the cosmos.[29] In the case of the rocket filmed in *Habitation*, this mission was contracted by the United States Department of Defense.[30] The mission was to test a payload with hypersonic technology. This

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[23] Edward Price, "Rocket," *Britannica*, 2025, https://www.britannica.com/science/space-exploration/United-States.
[24] Ronny Baccus and Gary Jordan, "5000ºF," audio blog, *NASA* (blog), October 12, 2018, https://www.nasa.gov/podcasts/houston-we-have-a-podcast/5000f/#:~:text=That's%20your%20primary%20barrier%20that,of%20about%205000%20degrees%20Fahrenheit.
[25] Ibid.
[26] "Entry Systems," web log, *NASA* (blog), 2025, https://www.nasa.gov/ames/core-area-of-expertise-entry-systems/.
[27] Edward Price, "Rocket."
[28] Ibid.
[29] Solnit, *River of Shadows*, 18.
[30] Mike Wall, "Rocket Lab's Secretive Launch Last Month Was a Hypersonic Test for the US Military (Photos)," Space.com, December 10, 2024, https://www.space.com/space-exploration/launches-spacecraft/rocket-labs-secretive-launch-last-month-was-a-hypersonic-test-for-the-us-military-photos.

technology is commonly used for deploying missiles at high speeds.[31] The use of rockets for warfare adds further meaning to rocketry's ability to annihilate, as this transforms how society views violence on a temporal and spatial scale. Today, war is hypersonic and can be engaged in from afar. A hypersonic missile can travel at a speed of Mach 5, and it is highly maneuverable, which creates greater target accuracy. The Pentagon's 2025 budget requests $6.9 billion in funding for hypersonic research.[32]

In conclusion, *Habitation* was made in response to the increasing development of rocket weaponization and space colonization. By connecting the aesthetic properties of cinema with the material qualities of geology, we can begin to reclaim our understanding of today's ecological crisis. As the U.S. government invests billions of dollars into hypersonic weapons research, I urge reflection on the slow geological process it took Earth to create those materials that have become industrialized to colonize or destroy, which perhaps can offer alternative outcomes for the future of Earth and its inhabitants.

Artistic Approach

The artistic approach of *Habitation* uses sensorial aesthetics to weave ecology, rocketry, and atmospheric science with the mixed mediums of cyanotype, Super 8, and digital video. *Habitation* is experimental in form to invite the viewer to gather meaning through their senses. Providing multiple layers of narrative offers an open dialogue where the viewer uses their embodied experience to craft meaning. Regarding the topics of ecology and planetary crisis, this

[31] Congressional Research Service and Kelley Sayler, R45811 (2025).
[32] Ibid.

approach provides limitless interpretations where the viewer is invited to form their own conclusions rather than feeling confined to one narrative.

My editing involves cutting between each medium to shift between multiple ways of perceiving the world. This encourages the viewer to experience each landscape and object differently and understand multiple ways of perceiving the world. Shifting away from an anthropocentric framework is essential to better understand our planetary crisis. A question that drives my process is, what new information do we gain by reading an object or landscape through different mediums? I explore this question by incorporating diverse forms of media and editing them together, drawing connections between celluloid media, digital media, and camera-less media.

Through these mediums, I engage with scale and manipulate time through editing and the concept of transvaluation. This manipulation lends to one of the meanings of my film, which is that the industrialized materials we consume today come from a slow geological process spanning millions of years. By juxtaposing modern machinery, plastic, and aluminum with fossil-like organisms, I draw connection to the origin of these industrialized materials. Additionally, I involve the concept of transvaluation. This concept means that the camera apparatus possesses a unique ability to reveal information to the viewer that the human eye alone cannot perceive. This is due to the camera's technological capabilities such as the manipulation of temporality and scale. For example, by inserting a macro lens into the hollowed-out exoskeleton of a crab, I play with scale by juxtaposing an aircraft with the crab's gigantic-appearing anatomy. By shrinking the viewer down to a size where they can experience the

cavernous interior of a crab, I offer a new experience of perceiving our place in the environment. This conversation is important for reevaluating how we interact with our habitat of Earth.

My involvement with scale and time offers both melodic and abrupt shifts in tone throughout the film. At times we gently transition between mediums, landscapes, and objects through sonic and visual matches whereas at other moments we are launched into a foreign environment with a hard visual and sonic cut. In doing so, I provide a visceral experience transitioning through each space. These transitions incite comparison and connection between objects and landscapes that I want the audience to see in the same space. Industrialization exists in the same space as what is considered wild or natural. Industry cannot be separated from the environment because it comes from that exact process of geology that produced those materials over the course of millions of years. While society invents boundaries and borders where civilization ends and nature begins, these divisions are not how non-human organisms and processes of Earth exist. Regarding content, by juxtaposing plastic wrappers, sand, shells, Coca-Cola cans, and feathers, I stitch these materials together to confront this fabricated separation of humans from the natural world.

In addition to my editing techniques, my sound design speaks to scale and perspective to invite a sensory experience. The first sound heard in *Habitation* is a recording of the Apollo 11 moon landing as the astronauts descend upon its surface. This archival audio is woven throughout my sound design to reinforce the interconnectedness of the machinery of the lunar lander with the process of extraction. I engage with scale as these audio recordings are edited with a wide shot of the moon. The audience hears close-up audio from inside the spacecraft even though the imagery of the moon is taken from hundreds of thousands of miles away. This

juxtaposition connects the metallic origins of the lunar lander's technology to the geological origins of those materials.

Apart from my use of archival audio, my recording process involves hydrophone and contact microphone recordings to compose a textural soundscape that differs from what our human anatomy perceives. For example, through a hydrophone, I recorded the sounds of melting lake ice and sand churning in the ocean, which are not perceptible to human ears in the ways a hydrophone can detect these sounds. With the contact microphone, I recorded the clicking sounds of tidepool organisms, the roar of a jet engine through the tarmac, the swaying of tree branches, and the tumbling of pebbles in a brook. These ideas for recordings were inspired by Jacquelyn Mills's *Geographies of Solitude*, as she explores experiencing a physical space in more-than-human ways through the means of camera and sound technology. This concept decenters the human experience of inhabiting Earth to offer an eco-centric approach. During the launch of the rocket, the sensory experience was embodied as I could feel the physical vibrations while the rocket soared into the sky. I weave the content of the rocket launch with form as my sound design emulates this experience through layers of low frequencies and the thundering recording of the rocket to create a visceral experience.

These techniques of recording and editing invite multiple layers of narrative where the viewer uses their physical experience to craft meaning. Through experimental form, I approach these topics of ecology with open dialogue where meaning is found through the senses to offer viewers an embodied and personal way of perceiving the planetary crisis.

CHAPTER FOUR

THEORIZING YOUR FILM

Habitation speaks to film and photographic history and theory through my research of animal photogénie, geological filmmaking, sensory ethnography, and haptic visuality. Jean Painlevé's *Sea Urchins* (1958) and *Pigeons in the Square* (1982), Percy Smith's *Secrets of Nature* (1931) series, Jacquelyn Mills' *Geographies of Solitude* (2022), Joshua Bonetta and J.P. Sniadecki's *El Mar La Mar* (2017), Gabriella Osio Vanden and Jack Weisman's *Nuisance Bear* (2021), and Maxim Arbugaev and Evgenia Arbugaeva's *Haulout* (2022) are films that *Habitation* is informed by through content and form. In this essay I will describe how each of these elements of film theory motivated my process of creating *Habitation* and how I gleaned inspiration from these films.

Beginning with my discussion of animal photogénie, film scholar James Leo Cahill describes photogénie as "the capacity of people, places, beings, and things to be translated by photography in a captivating manner".[33] According to early 19th-century film theorist, Jean Epstein, photogénie sparks a critically re-evaluative vision of the world. Epstein argues that there is a "perpetual becoming" of the identity of the filmed subject and that the subject's identity is not fixed. *Habitation* engages with Epstein's concept of transvaluation, as my choice to explore the umwelt of non-human organisms invites re-evaluation of how we place value on humans versus non-humans. While filming, scientists told me that most organisms are "unaffected" by rocket launches and that only endangered species are "worth" relocating, however, I challenge

[33] James Leo Cahill, *Zoological Surrealism: The Nonhuman Cinema of Jean Painlevé* (Minneapolis: University of Minnesota Press, 2019), 26.

this perception through my exploration of various species inhabiting these spaces. In Painlevé's *Sea Urchins*, the filmmaker utilizes extreme close-ups of the anatomy and behavior of sea urchins.[34] The microscopic photography is significant for the engagement of scales.[35] The tiny claws and pincers that human eyes could not detect are made gigantic on the screen through the microscope. This play with scale confronts our perception of these creatures and sparks a re-evaluative gaze of the world.[36] This film informed my approach to capturing the shells of horseshoe crabs. I incorporate scale by inserting a probe lens into the hollowed-out shell. The scale of the shell is massive, and it appears cavernous and cave-like, which contrasts with how our human eyes would perceive the shells. In an economic context, horseshoe crabs are harvested for their blood by biotech companies and have become commodified. By framing them as gigantic, I invite transvaluation of our perception of these creatures. In addition to horseshoe crabs, I frame barnacles, shells, and seaweed in this form as well. Viewing these organisms at this scale is made possible through the camera and probe lens, which, as Cahill writes, is a "mode of vision and way of seeing that is valuable precisely for its difference *from* rather than replication *of* human perception."[37] My human eyes cannot perceive the intricate details of the organisms at a scale that fills my vision the way a camera and probe lens can. Another example where scale transforms the perception of organisms is in Percy Smith's *Magic Myxies*.[38] This film displays the growth of slime mold, which would not be possible with human eyes at this

[34] *Sea Urchins*, directed by Jean Painlevé, 1929.
[35] Ibid, 22.
[36] Ibid, 26.
[37] Ibid, 20.
[38] *Magic Myxies*, directed by Percy Smith, 1931.

speed and scale. This perception of time and scale is made possible through the camera apparatus and editing.

Why were early filmmakers such as Painlevé and Smith interested in capturing life through a lens different from our own eyes, though, and why focus on non-human subjects that are traditionally regarded as pest-like? The historical context of interwar and post-WWII life in society is significant to the rise of animal photogénie films.[39] For example, there was "enthusiasm for inhuman modes of perception…and their articulation with the anti- or critical humanist lines of thought" was prominent after "the development of planet destroying atomic weaponry."[40] After the world went through the horrors of genocide and war, alternative modes of thinking about how humans interact with each other was necessary for survival as society tries to grapple with what it just went through. Society questioned how and why humans decided to treat each other and the planet with mass violence and destruction. The trauma, loss, and pain that people went through incited a need for a new way of perceiving the world, as the dismantling of societal values of life were thrown away through mass causalities and genocide. This desire for a new way of perceiving the world is connected to rise of new arts and sciences of the time such as comparative anatomy, zoology, and surrealism.[41] In response to this allure for a different way of experiencing life, Painlevé developed a method of looking at and filming organisms to bring attention to how humans perceive ourselves. By drawing our attention to non-human worlds, humans can "critically alter conceptions of human life."[42] This is relevant to *Habitation* because I want to invite reflection on how looking at the ways diverse organisms inhabit spaces can

[39] Cahill, *Zoological Surrealism*, 3.
[40] Ibid.
[41] Ibid, 311.
[42] Ibid, 3.

provide introspection on how humans inhabit Earth, space, and the universe in relation to the technological context of today's surge of space missions. According to Cahill, looking at concerns and approaches to science in the past is relevant to present day attitudes to "imagine other arrangements and ways of being."[43] *Habitation* incites questions about how we can learn from other organisms on macro and micro scales to better inhabit our ecosystem of Earth.

In addition to *Sea Urchins* and *Magic Myxies*, Painlevé's *Pigeons in the Park* draws on transvaluation. His choice to film pigeons as a subject lends to the theory of animal photogenié, as Painlevé finds beauty in animals regarded as pest-like or mundane. By pointing his camera at pigeons, he invites the viewer to draw connections between us and the subject. Painlevé describes how slow-motion video allows the viewer to perceive the full movements of pigeons flapping their wings.[44] He narrates that pigeons cannot walk backwards, but with editing technology, he can play their forward walking in reverse, which we would never see in real life. This ties into the essentiality of the camera apparatus providing transformed ways of seeing. Furthermore, he juxtaposes pigeons flocking towards bird food with the sounds of a soccer match as players steal the ball from each other. This is relevant to my film, as I chose to film seagulls in a parking lot as they feed on bread. There were a hundred of them, and the crew recorded the stereo sound of their wings fluttering all around us. I filmed in 120 fps as they hovered just above our heads, and the viewer can see them making eye contact with the camera. The gulls appear angelic and larger than life as their wings flutter in slow-motion above the camera. While seagulls are typically regarded as a nuisance or pest-like, I want to bring attention to how they interact with each other, humans, and the camera in that moment, which may reveal

[43] Ibid, 313.
[44] *Pigeons in the Park*, directed by Jean Painlevé, 1929.

a shifted opinion about them. By aiming my camera at the gulls and juxtaposing them in the context of rocket launches and space travel, I invite transvaluation for how society perceives the value of life on Earth and today's ambition to leave our planet to colonize elsewhere. The seemingly ordinary gull is transformed through the camera apparatus and invites the viewer to critique our conceptions of human life.[45]

In addition to shifting opinions about how non-human organisms are perceived, *Habitation* also works to shift perspectives on how time, geology, and Earth's natural resources are viewed. Filmmaker and scholar Sasha Litvintseva proposes the concept of geological filmmaking as a practice of connecting the aesthetic properties of cinema in conversation with the material properties of geology to tackle our experience of today's ecological crisis.[46] According to Litvintseva, a reclamation of the imperceptible and material crises is possible through cinema. To do so, Litvintseva argues that the medium of film must recognize the terrain from which it emerges, which is Earth.[47] Film can be read through the lens of geology, where form, materiality, and temporality coincide, and vice versa, where geology can be perceived through these same aspects of film.[48] Scholar Siobhan Angus' writing speaks to this theory where Earth itself is a medium of recording time, as materials transform through heat and pressure.[49] The process of fossilization also functions this way, and it is comparable to photography, as both require light from the sun, which Angus links to deep space and time.[50] The sunlight used to fossilize organic matter, which transforms into oil through time, is the same

[45] Cahill, *Zoological Surrealism*, 3.
[46] Sasha Litvintseva, *Geological Filmmaking* (London: Open Humanities Press, 2022).
[47] Litvintseva, *Geological Filmmaking*, 109.
[48] Ibid.
[49] Angus, *Camera Geologica*, 47.
[50] Ibid, 49.

source of light that preserves a moment in time through photography. Photographs therefore are a form of a fossil- a preservation of something *being* in the there/then.[51]

In relation to Litvintseva and Angus' discussion of the materiality of film and photography, *Habitation* involves the materiality of cinema through the form of Super 8 film stock and cyanotypes. Film stock comes from oil, which is a natural resource extracted from Earth. The consumption of fossil fuels needs a reorientation of vision, and by engaging with the form of the extracted resource of oil through film stock, I knit the content of *Habitation* with the medium. By encapsulating botanical matter, salt and shells, and manmade debris on celluloid, *Habitation* invites transvaluation of time and geology.

Jacquelyn Mills' G*eographies of Solitude* informed my choice to explore the materiality of cinema through utilizing Super 8 and cyanotypes. Mills engages the geography and ecology of Sable Island through 16mm film, the application of natural and manmade materials directly onto the film strip, and film processing through seaweed. After Mills' subject, Zoe Lucas, sorts and documents washed up balloon debris from all over the world, Mills directly applies the strings and plastic rings of the balloons onto a film strip and splices them. Colorful and unidentifiable objects dance across the frame, which offers the viewer a haptic experience, as the viewer gains information from the frame a whole rather than by optical identification. By physically enmeshing the content of plastic with the form of a celluloid medium, Mills speaks to the materiality of cinema and offers a critical lens to the extraction and consumption of fossil fuels. This sequence speaks to the mass discard of plastics, which Lucas thoroughly documents as gyres deposit debris from around the world onto the shores of Sable Island. *Habitation* involves

[51] Ibid, 48.

the materiality of cinema through the cyanotype, which is a solution of extracted iron salts. By engaging with this medium, the materiality of the cyanotype is woven with the complex chains of extraction, production, refining, and labor.[52] Each of these links in the chain of consumption interlock with "often life-extinguishing social relations of production and social reproduction across geographies.[53] The cyanotype can point to new conceptions of living and insists we take seriously the profound entanglement between the human, botanical, geological, and industrial dimensions of our existence.[54] The materials applied to the cyanotype in *Habitation* include manmade debris, lichen, seaweed, sand, shells, and salt, which speak to the knitting of the human, industrial, and natural world that Angus discusses through the materiality of the medium. This cyanotype sequence offers a haptic experience as *Geographies of Solitude* does, as the materials flickering across the frame are not easily identifiable through optical information, which I will discuss furthermore below.

Film scholar, Laura Marks, describes haptic visuality as "a sharpness that provokes the sense of touch" and "privileges the material presence of the image".[55] Haptic visuality is the tactile quality of vision, as if our eyes could touch. There is a bodily relationship between viewer and image. Viewers subconsciously use their body memory and imagination to "feel" with their eyes. Marks describes that humans know how certain movements or objects feel because we have experienced them ourselves. Additionally, there is a divergence of haptic quality between analog and digital film. Marks describes that analog film, and particularly Super 8, has obvious

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[52] Ibid, 147.
[53] Ibid.
[54] Ibid, 163.
[55] Laura U. Marks, *The Skin of the Film: Intercultural Cinema, Embodiment, and the Senses* (Durham, N.C: Duke University Press, 2006), 162-163.

graininess that can evoke a sense of touch.[56] Marks argues that haptic images can lend the impression of seeing for the first time. As the eye grazes across the image, the viewer gradually discovers what the image is of "rather than coming to the image already knowing what it is".[57] The viewer cannot clearly identify the contents applied to the cyanotype, and the viewer must gradually form their perception of the image as it unfolds. In regard to my use of Super 8, many of the images gradually come into focus, or stay out of focus, as the camera moves, which speaks to Marks' discussion of haptic images "discouraging the viewer from distinguishing objects and encouraging a relationship to the screen as a whole".[58] I focused on capturing textures of seafoam, shells, sand, plants, water, rocks, metal, and light in both digital and Super 8. Each of these elements speak to my previous discussion of the materiality of cinema through engaging with organic materials, extracted material, cyanotype, and celluloid.

Another significant element of inspiration for Habitation is from Mills's sound recording techniques used in *Geographies of Solitude.* Contact microphone recordings are laced throughout my sound design and the technology translates sound through the physical touch of an object. This further speaks to the physicality and materiality that I aim to create in my film through the tactile application of materials onto the medium. Trickling water, tumbling pebbles, wind blowing through the branches of trees, roaring jet engines, and crawling bugs create soundscapes that feel foreign to how human ears perceive these materials using a contact mic. The contact microphone invites an alternative way of experiencing these subjects, which I argue transvaluates the meaning of these materials. While a crawling bug may seem silent due to the

[56] Ibid, 175.
[57] Ibid, 178.
[58] Ibid, 172.

limitations of human anatomy, the sensitive technology of the contact microphone offers a new way of hearing and perceiving creatures that our human senses overlook. Another example is feeling the vibration of a jet engine through the Earth. By challenging how our senses perceive organisms and manmade materials, we can challenge how we perceive our human impact in these landscapes.

The next element of film theory that informs *Habitation* is sensory ethnography. Sensory ethnography filmmaking is a practice of filmmaking that challenges classic observational documentaries by decentering the presence of humans, voiceover, or interviews, and draws attention to non-human subjects. Sensory ethnography films focus on sensorial experiences, which allows the audience to engage their senses in an "immersive, embodied way".[59] This approach to filmmaking rejects "any one universalizing message" and allows for multiple meanings to unfold.[60] Through emphasis on the senses (i.e., sound, smell, touch, and taste) viewers are invited to de-center Western tradition by drawing meaning through visceral experience rather than exclusively through sight.[61]

El Mar La Mar is a sensory ethnography film that inspired my editing choices in *Habitation. El Mar La Mar* traverses the Sonoran Desert and explores the mythical and chilling stories of people crossing the desert to reach the U.S. border.[62] Off-camera, people inhabiting or traveling through the desert describe their experiences while the filmmakers juxtapose their dialogue with imagery of organisms and the landscape. This film is driven by associative editing,

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[59] Elena H. Guzman and Emily Hong, "Feminist Sensory Ethnography," *Visual Anthropology Review* 38, no. 2 (September 2022): 184–210, https://doi.org/10.1111/var.12273, 190.
[60] Ibid, 189.
[61] Ibid, 188.
[62] *El Mar La Mar*, directed by Joshua Bonnetta and J.P. Sniadecki, 2017.

and this technique offers breathing room for viewers to form their own opinions through juxtaposition of sound and image. For example, one sequence begins with a close-up shot of a human hand holding an ignited lighter. The next cut is an extreme wide shot of a raging wildfire at night. The sound design utilizes a hard cut to launch the viewer into a new space while drawing on meaning from the previous cut of the human hand holding a flame. The flames roar until the next cut of a freight train rumbling by is made. Swarms of insects flit past the camera in the following shot, and the filmmakers bridge these distinct images through textural sound such as the crackling of fire, the humming of insects, the rhythmic clanking of machinery, and the fluttering of insect wings. The filmmakers also play with scale and perspective by juxtaposing an extreme wide-shot of a person walking across a landscape with up close sound recordings of their footsteps. In *Habitation*, I juxtapose recordings from the Apollo 11 moon landing with imagery of the moon. The 4.5-billion-year-old celestial body juxtaposed with recordings of humans landing on its face from nearly 60 years ago invites a discussion of time and technology. By crafting an experience that contains multiple layers of meaning, the filmmakers encourage the viewer to gather meaning through the weaving of an embodied, sensorial experience of juxtaposition. Humans, the environment, and animals intersect through nuanced layers of connotation. This contrasts with traditional Western ocular approaches, which can explicitly corral the viewer into perceiving one message rather than a multitude of possibilities.[63] Regarding topics of science and natural history, this approach presents a sensory-driven method to communicate issues of ecological crisis.

[63] Guzman and Hong, *Feminist Sensory Ethnography*, 2022.

In addition to *El Mar La Mar, Nuisance Bear*, directed by Gabriela Osio Vanden and Jack Weisman, and *Haulout,* directed by Maxim Arbugaev and Evgenia Arbugaeva, inspired my portrayal of human and non-human interactions through a sensory ethnography framework. *Nuisance Bear* follows the story of polar bears migrating through Canadian towns due to habitat loss and how they have become disruptive and dangerous for humans.[64] This film is observational and leans into creating visual and sonic associations that allow the viewer to form their own opinion rather than being driven by narration. For example, the filmmakers juxtapose imagery of a polar bear migrating through town with imagery of a waste transfer station, polar bear management vehicles, helicopters, trains, and traffic. This juxtaposition offers critique of the perception that the polar bears are problematic and need to be contained rather than the lack of accountability for consumption, disposal of waste, and infrastructure development that has barricaded the polar bears from trekking on their generational path of migration. The form of this film inspired how I documented the people and wildlife of Wallops Island and Chincoteague Island, and it informs my edit. For example, on the beach of Assateague Island, I juxtapose human-made debris and fencing with imagery of the wild horses eating and navigating their natural environment. I then bring in audio recordings of helicopters, traffic, and planes played over imagery of the horses, as this region was industrially developed for militaristic use of the Navy during WWII. The horses were brought to this region by colonizers in the 1600s, and I invite a discussion of what the land, ocean, and animals have witnessed across time by entangling human industry with the environment.[65]

[64] Nuisance Bear, directed by Gabriella Osio Vanden and Jack Weisman, 2021.
[65] Claudia Padilla, Maryland Department of Natural Resources, accessed April 14, 2025.

In addition to the edit of *Nuisance Bear* inspiring *Habitation*, *Haulout* informed my approach to capturing human and non-human relationships. *Haulout* follows the story of a naturalist that surveys the walrus beaching that occurs in Siberia.[66] Thousands upon thousands of walrus beach themselves at once when there is no sea ice for them to inhabit. The naturalist dwells in a tiny shack, which the walrus eventually encroaches upon to the point where they come through the windows and doors. This film utilizes minimal dialog and, like *Nuisance Bear*, invites the audience to draw conclusions from the senses.

In conclusion, the works of Jean Painlevé, Percy Smith, Jacquelyn Mills, Joshua Bonetta and J.P. Sniadecki, Gabriella Osio Vanden and Jack Weisman, and Maxim Arbugaev and Evgenia Arbugaeva informed my choices of weaving content and form together to depict this story of micro and macro ecosystems of the Eastern Shore barrier islands amidst rocket launches. My research of animal photogénie, geological filmmaking, sensory ethnography, and haptic visuality speak to the history, studies, and practices of documentary filmmaking that cultivated the process and creation of *Habitation*. Inspired by Litvintseva and Angus, as they describe that approaching topics of climate crisis through a geological and material lens can provide new ways of perceiving time, *Habitation* offers an experimental conversation surrounding topics of space colonization, ecological crisis, and geology.[67] By looking at concerns and approaches to science in the past, as early filmmakers were interested in, imagining alternative ways of being through the sensory experience of non-human species can invite questions about how we can learn from other organisms to better inform our approach to the ecological crisis today.[68]

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[66] *Haulout*, directed by Maxim Arbugaev and Evgenia Arbugaeva, 2022.
[67] Litvintseva, *Geological Filmmaking*, 109.
[68] Cahill, *Zoological Surrealism*, 313.

CHAPTER FIVE

DISSEMINATION

Financial Information

Table 1. Production budget describing costs of various camera, sound, and lighting equipment.

HABITATION BUDGET	Quantity	Unit	x	Rate	Total
PRODUCER/DIRECTOR					
Producer/Director - Karly Noetzel	28	weeks	1	In Kind	$ -
SUB-TOTAL					**$ -**
INTERVIEWEES					
Interviewees	2	weeks	1	In Kind	$ -
SUB-TOTAL					**$ -**
SOUND CREW					
Sound Recordist - Olivia Gorham	10	days	1	In Kind	$ -
SUB-TOTAL					**$ -**
EDITING CREW					
Editor - Karly Noetzel	15	weeks	1	In Kind	$ -
SUB-TOTAL					**$ -**
EQUIPMENT					
Camera Equipment					
Sony FX3 CAM A	14	days	1	In Kind	$ -
Sony A1 CAM B	10	days	1	In Kind	$ -
Canon Super 8	10	days	1	In Kind	$ -
Sony 35mm GM 1.4	14	days	1	In Kind	$ -
Sony FE 100-400 f/4-5.6 GM OSS	14	days	1	14.00	$ 196.00
Sony Teleconverter	14	days	1	61.00	$ 61.00
ND Filters	14	days	1	18.00	$ 18.00
Polarizer Filter	1	unit	1	90.00	$ 90.00
Batteries, expedibles	1	unit	1	80.00	$ 80.00
Tripod	10	days	2	In Kind	$ -
EasyRig	14	days	1	In Kind	$ -
Sound Equipment					
Mix Pre 3	14	days	1	In Kind	$ -
Tentacle Sync Generator	1	unit	1	In Kind	$ -
Tentacle Sync Kit	10	days	1	In Kind	$ -
Contact Microphone	1	unit	1	100.00	$ 100.00
Sound Kit	14	days	1	In Kind	$ -
Hydrophone	14	days	1	In Kind	$ -
Stereo Microphone	10	days	1	In Kind	$ -
Lighting Equipment					
iKan LED Kit	14	days	1	In Kind	$ -
SUB-TOTAL					**$ 545.00**
FILM & TAPE STOCK					
Shooting Stock					

Table 2. Continued production budget describing the expenses of film materials, post-production, transportation, insurance, and distribution.

HABITATION BUDGET	Quantity	Unit	x	Rate	Total
Super 8 Film Stock	5	rolls	1	$ 40.00	$ 200.00
Super 8 Film Stock Development	5	rolls	1	$ 225.00	$ 225.00
Media Cards	14	days	1	$ 2.80	$ 39.20
SUB-TOTAL					**$ 464.20**
POST PROD.					
On Line					
Color Correct	1	allow	1	$ 650.00	$ 650.00
SOUND					
Sound Mix	1	allow	1	$ 200.00	$ 200.00
Surround Sound Mix	1	allow	1	$ 200.00	$ 200.00
SUB-TOTAL					**$ 1,050.00**
ARCHIVE					
Public Archive Material	1	allow	1	$ -	$ -
SUB-TOTAL					**$ -**
TRANSPORT					
Flights to and from Norfolk	3	flights	1	In Kind	$ -
Rental Cars	1	allow	0	$ 500.00	$ 500.00
SUB-TOTAL					**$ 500.00**
HOTEL & LIVING					
Crew Hotel in Norfolk	1	nights	2	In Kind	$ -
Crew Airbnb	9	nights	1	$ 1,300.00	$ 1,300.00
Food and Water for Crew	1	unit	1	$ 500.00	$ 500.00
SUB-TOTAL					**$ 1,800.00**
INSURANCE/FINANCE					
Production Insurance by MSU	1	allow	0	$ -	$ -
Camera Insurance	1	allow	1	$ 25.00	$ 25.00
SUB-TOTAL					**$ 25.00**
Distribution					
Film Festival Travel Costs	3	allow	1	$ 500.00	$ 1,500.00
Marketing	1	allow	1	$ 100.00	$ 100.00
SUB-TOTAL					**$ 1,600.00**
TOTAL					**$ 5,984.20**

Distribution

I plan to distribute *Habitation* initially through a 2026 festival run. I would like my film to premiere in North America at Big Sky Documentary Film Festival because of the emphasis on experimental documentary that I experienced while attending the festival in 2025. I value the opportunities provided by the festival to meet other filmmakers and attend workshops. I found great inspiration through films that I watched this past year, and I want to immerse myself in this environment again for the learning opportunities. As a "reach" festival, I will submit to Sundance Film Festival. I will also submit to Chicago Underground, True/False, Ann Arbor Film Festival, Slamdance Film Festival, Camden International Film Festival, Antimatter Media Art, and Chicago International Film Festival. I compiled this list by researching where documentaries that are comparable to mine in experimental form were accepted. I have a few "reach" festivals on this list. For the European leg of my festival circuit, I would like to apply to Alchemy Arts, Oberhausen, CPH DOX, L'alternativa, and IDFA. I will be creating a spreadsheet to track my submissions, acceptances, and premieres.

I also plan to potentially host a screening of this film for the subjects and community of NASA Wallops Flight Facility, as their participation was essential for the creation of this story. This screening would be held at a small theater room that is on site at Wallops. A few people that I work with in the Office of Communications as part of my internship were greatly helpful at connecting me with the subjects and granting me access to the locations I filmed, so I would like to provide a screening for them as well. This screening would likely take place in Greenbelt, Maryland at Goddard Flight Facility, which is where I interned this summer. My mentors and peers have been interested in the progress of my film, and I think they would love to see it.

While I was interning this summer, a grad student from another film program screened her thesis film at Goddard, and her topic also incorporated NASA. She screened her film in a theater on site and held a Q&A afterwards. This is a screening event that I would like to engage in, as it would provide a professional setting for me to showcase my film to the employees of Goddard, my peers, and my mentors.

For long term distribution, I was offered the opportunity to potentially house my film on NASA+, however, this is not in alignment with my goals, as the producers want a say in my edit, and so my film will likely be made available through my website after my festival run. I also would like the opportunity to showcase my film through Virginia or Maryland PBS, as I feel the audience would be drawn to a local story about the barrier island ecosystems. In addition to possibly collaborating with these PBS stations, I would like to connect with the local Chincoteague Island Theater. Chincoteague Island Arts Organization is a non-profit that aims to offer diverse films to the community and visitors of Chincoteague. As the subjects of *Habitation* are from Chincoteague and most of our filming took place there, I feel it would be exciting to share this story with the community, as I would value connecting with community members. Within the Bozeman community, I was offered to submit my film for consideration to a Tinworks Art screening this fall, which I would love to participate in to connect with local artists and the community.

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