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The Last Tree of the Forest, the Plastic Bottle, (Before and After) and Helene

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Abstract. *The Last Chair of the Forest and the Plastic Bottle*, created by Edwin Salas Acosta through the McCullough Fellowship and under the mentorship of Dr. Victoria Bradbury, integrates art, technology, and environmental awareness in an immersive virtual reality (VR) experience. Using Unreal Engine 5, it invites participants to reflect on the fragility of Asheville, North Carolina's ecosystems by asking the viewer to virtually sit on the last wooden chair, a poignant symbol of ecological vulnerability. This VR artwork explores the environmental impacts of technological devices and materials, focusing on variables such as the tree, the Oculus headset, disposable plastic bottles, and sustainable design. It aims to connect the production and disposal of consumer products to larger environmental issues such as deforestation and microplastics. Through the concept of the "butterfly effect," this research tracks how everyday consumer behavior contributes to global environmental degradation. This jolt to human consciousness about the impacts of climate change underscores the urgency of addressing the interconnected issues of deforestation, plastic pollution, and artificial intelligence's role in predicting and influencing ecological futures.

Keywords: virtual reality, climate emergency, immersive media, ecology, museums

1 Introduction

The Last Chair of the Forest and the Plastic Bottle was developed in Summer 2024, just months before Hurricane Helene's winds, floods, and landslides devastated Asheville and western North Carolina. The project was launched at The Asheville Art Museum on September 12, 2024, serving as a speculative warning about deforestation and microplastics. However, the subsequent disaster that unfolded exactly two weeks later—which severely damaged parts of the Pisgah Forest and drastically increased the use of plastic bottles due to the loss of potable water to hundreds of thousands of residents of western North Carolina—transformed the work into an immediate commentary on the global climate crisis.

The Last Chair of the Forest and the Plastic Bottle was exhibited from September 2024 through January 2025 as a solo exhibition in The Asheville Art Museum's Digital Lounge. Framed through both a pre- and post-disaster lens, the project challenges viewers to reconsider their relationship with sustainability, technology, and humanity's ability to shape the future. The project is no longer just speculative fiction. After Helene, it serves as a mirror reflecting an environmental emergency unfolding and escalating before our eyes.

Fig. 1. The Last Tree, final Scene

2 Creation Process

The creation process behind *The Last Chair of the Forest and the Plastic Bottle* is an exploration of environmental themes using VR technology resulting in a critical immersive artwork. The project is designed as a 6-minute VR short film to be viewed through the Oculus Quest Headset. The film presents a spherical panoramic vision that allows the viewer to explore the narrative without direct interaction. This approach ensures that users, even those unfamiliar with VR technology, can enjoy an accessible and engaging experience.

The technical goal of this project is to introduce audiences to the possibilities of virtual reality in a way that feels seamless and natural, drawing them into an immersive world of ecological reflection. This proved to be a successful approach in the first exhibition of the project at The Asheville Art Museum. Here, viewers from age 6-80+ were able to experience the piece and engage with the narrative without needing to be adept with the controller.

The narrative of the short film evolved significantly during the creation process. The initial draft of the script was 23 minutes long, but through continuous refinement, the story was condensed to 6-minutes. This reduction was necessary to ensure that the core message of the film—an urgent call for ecological awareness and a reflection on human impact on the environment—was conveyed effectively. This would allow more viewers to move through the experience at the museum without long wait times.

The final script, titled *The Last Chair of the Forest and the Plastic Bottle*, weaves together themes of environmental degradation, deforestation, and plastic pollution. The story follows the speculative journey of the last tree in the Pisgah National Forest in western North Carolina, exploring how human activities such as deforestation and plastic waste harm the natural world. The narrative is divided into 19 distinct scenes, each presenting a different aspect of the tree's journey and the broader ecological context of the forest.

2.1 Menu

The menu leads into an introductory animation that transitions the viewer into the immersive VR film. This ends with the artist’s and Unreal Engine’s logo. Finally, within a chopped tree, the title of the work appears.

The instructions for engaging with the work are displayed outside of VR in the installation space, where users are invited to use only the right controller. By pressing the 'B' button, the menu appears with two options: one to start the experience and the other to exit the menu. The user cannot exit the application. Once the menu is initiated, the trigger is pressed to begin, and after that, there’s no need to use the controls again. The sequence plays and the menu gets deactivated.

2.2 Technical Objectives

The project was created in Unreal Engine for VR. The focus is on creating a spherical experience rather than an interactive one. Since the duration of a museum visit cannot be controlled, the experience has a set maximum length. Visitors can exit early, but the next user must wait until the projection completes before beginning again. This also prevents users from exiting the application when using the MetaQuest.

The experience is seated to prevent balance issues for new VR users.

Fig. 2. The Chair

2.3 Narration: Voiceover Script and Project Development Annotations

Voiceover Lines	Project Development
Scene 1: The Last Tree *"In the shadowed depths of the ancient Pisgah Forest, there stands a solitary figure: the last tree, an ancient oak of 574 years. It is a sentinel of silent grandeur, bearing witness to the ebb and flow of human history."*	● Begins with a nighttime scene, symbolizing the twilight of the forest. ● Cinematic camera movement, allowing spherical viewing. ● The camera reaches the tree, a Megascan of an oak tree from the Unreal Marketplace. ● A light moves through the branches, creating a chiaroscuro effect in the style of Caravaggio. ● The tree is absorbed by the Lake of Destiny, symbolizing a time wormhole.
Scene 2: The Chair *"Crafted from the very essence of this venerable oak, there sits a chair – a relic of a bygone era, fashioned with care. Each curve and groove tells a*	● The chair plays a crucial role in the story's science fiction aspect. ● Fully modeled in Blender, based on a real wooden chair, but designed with an oak texture. ● Light animations create a flickering effect, as if from a faulty source.

tale of ages past, a testament to nature's enduring resilience."	
Scene 3: Tracing History *"As one traces their fingers along its weathered surface, the echoes of the ancient forest whisper tales of endurance and wisdom."*	● Transitions to a forest in the past, bathed in light. A violet sky creates an unrealistic, surreal ● atmosphere.
Scene 4: Witness to Human History *"The last tree has borne witness to the rise and fall of empires, from European colonizers to the displacement of the Cherokee, from world wars to climate change."*	● Historical images (sourced from NARA, 2024) are suspended midair, depicting the passage of time.
Scene 5: Silent Menace *"And yet, despite progress and destruction, the last tree remains steadfast, a silent sentinel reminding us of the interconnectedness of all living things."*	● Introduction of the monarch butterfly, ● representing Homero Gómez González. Highlights the impact of deforestation, climate ● change, and monoculture avocado plantations. The butterfly effect is metaphorically connected to global environmental consequences.
Scene 6: The Tree's Decay *"As the last tree stands alone amidst a forever altered landscape, it wonders if its greatness will be remembered, if its sacrifice will be mourned."*	● A sacred water spring, linked to the opening ● scene's time-portal lake. Features randomly moving fish, creating ● a natural and organic ambiance. The butterfly rests on a rock.

Scene 7: Microplastics *"In the Pisgah Forest, a tragedy unfolded. Microplastics, born of human folly, infiltrated the sacred groves, poisoning the essence of life. The tree withered, its leaves turning sickly gray as the toxic tendrils of plastic choked its being."*	● Lighting changes as pollution spreads.
Scene 8: The Tree's Collapse *"The last tree collapsed into the earth, leaving behind a void, a testament to the inexorable march of time and the forces that shape the cosmos."*	● ● The user experiences floating over a desert, then slowly lands. VR-specific adjustments made to prevent motion sickness and vertigo.
Scene 9: The Chair of Contemplation *"In the depths of the ancient forest, a choice was made. A chair was wrought from the ancient oak's wood, a simple seat upon which to contemplate humanity's twilight. It serves as a reminder of mankind's hubris and folly."*	● Inspired by De Chirico and Dalí, blending stark desolation with surrealism.
Scene 10: The Chair's Symbolism *"As the last rays of sunlight filtered through the ancient boughs, the chair stood as a silent sentinel—a testament to the folly of mankind and the resilience of nature. Those who sat upon it found solace in its embrace."*	● The chair serves as a central symbol of loss and resilience.

Scene 11: Floating Bottle *"Then, amidst the silence, a floating bottle caught their eye. It carried a message—a warning from a world on the brink of collapse. The bottles represented a cycle of consumption and destruction, symbols of humanity's disregard for nature."*	● Created in Blender with interior lighting animation. ● Features a particle system to enhance the ● effect. Represents microplastics and environmental contamination.
Scene 12: Reflection on Pollution *"The bottle left in the forest broke down into microparticles, hindering photosynthesis. It was a silent killer, choking the life out of the forest. Yet, amidst the devastation, there were those who clung to hope."*	
Scene 13: Journey of Despair *"As they reflected on the journey from glass bottles to plastic ones, they felt despair. Humanity was growing richer in material wealth but poorer in spirit. They knew the battle was far from over, but as..."*	

Fig. 3. The Bottle

3.1 Artists and the Power of Immersive Media

Artists use multimedia, including VR, to explore environmental themes. Olafur Eliasson's immersive installations, such as *The Weather Project* and *Ice Watch*, address climate change and ecology, using light, water, and large-scale sculptures to engage viewers in contemplating humanity's impact on nature (Eliasson, 2019). Similarly, Thomson & Craighead's *The Last Broadcast* employs multimedia to examine environmental and social issues, using digital experiences to provoke reflection on sustainability (Thomson & Craighead, 2017).

Like these works, *The Last Chair of the Forest and the Plastic Bottle* fits within a tradition of multimedia projects that raise awareness about ecological concerns. By incorporating VR, it offers a unique platform for engaging audiences in critical conversations about the planet's future.

Victoria Bradbury's *Mother Bear Mother Hen* exemplifies the power of VR in environmental storytelling. Using interactive sensory jackets, her work merges virtual experiences with physical sensations, deepening the user's connection to environmental narratives. This approach aligns with *The Last Chair of the Forest and the Plastic Bottle*, which seeks to immerse viewers in ecological themes, fostering both intellectual and emotional engagement (Bradbury, 2024).

By integrating immersive technologies, these projects challenge traditional storytelling, using VR to evoke emotional responses and provide an experiential understanding of environmental issues such as deforestation and plastic pollution. Through this medium, artists create not just narratives, but profound, interactive experiences that inspire reflection and action.

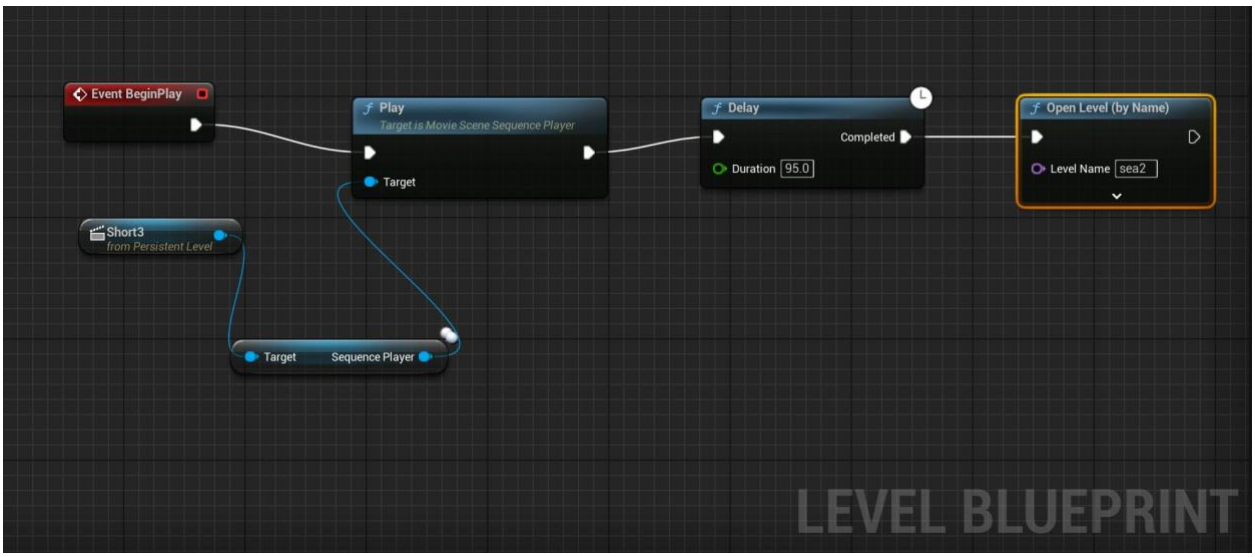

Fig. 4. Blueprint

4.1 Technical Process for Creating an Unreal Executable for VR and Challenges with Oculus Headset Integration in *The Last Chair of the Forest and the Plastic Bottle*

Creating a Virtual Reality (VR) experience using Unreal Engine involves a complex and multifaceted technical process, especially when targeting platforms like the Oculus headset. In my project, *The Last Chair of the Forest and the Plastic Bottle*, this process was crucial as the project merges environmental storytelling with immersive technology. The technical challenges associated with developing this VR experience, including the creation of the Android executable for Oculus, were significant. These hurdles underscored the difficulties faced by independent developers, particularly when working with limited experience and external tools.

Initially, I planned to deploy the project through sideloading directly to the Oculus headset by creating an Android file (.apk) for Oculus via Android Studio. However, due to the file size limitations, performance considerations, and challenges of the integration, I decided to build the project as an executable (.exe) instead. Using Steam, the project was able to connect to the Oculus headset via the PC through a USB cable, allowing users to experience the VR environment while bypassing some of the hardware limitations of the Oculus mobile platform. This solution provided a more stable experience, especially since SteamVR works as a bridge between the PC and the Oculus headset.

Building an executable for the PC via Steam provided several advantages, such as higher graphical fidelity and performance due to the more powerful hardware of the computer. However, this alternative route also required ensuring that the PC met specific minimum hardware specifications. For optimal performance, the PC needed to have a compatible graphics card (NVIDIA GTX 1060 or better), a strong processor (Intel i5 or better), and sufficient RAM (8 GB or more). Additionally, SteamVR required that the Oculus be connected via a USB cable, making the experience tethered rather than fully wireless.

The first step in creating the .exe file was to optimize the Unreal Engine project for PC VR. Unreal Engine's robust VR capabilities needed to be fine-tuned to ensure it ran smoothly with SteamVR, which works by streaming the PC's resources to the headset. This process included optimizing assets, reducing the graphical

load where necessary, and ensuring that the frame rates were stable to prevent VR motion sickness. This was especially important because VR applications are more demanding on hardware resources than traditional applications, requiring higher frame rates (90 FPS or more) to ensure the experience is immersive and comfortable.

One of the major obstacles was the coordination between different development tools. To successfully compile and deploy the project, I needed to work with a range of software: Unreal Engine for the VR environment, SteamVR for managing the VR headset connection, and multiple programming languages, including Python and Java for certain functionalities. This integration presented a steep learning curve, especially since I had to manage external dependencies and ensure that all tools worked seamlessly together.

The integration of Python, Java, and SteamVR with Unreal Engine also raised challenges when compiling the .exe file. These different environments needed to be synchronized, but the constant need to ensure compatibility between them led to frequent troubleshooting and debugging. Even with the appropriate configurations, issues often arise related to SteamVR's compatibility with specific Oculus hardware versions, requiring detailed troubleshooting and often needing to adjust the SteamVR settings.

Despite these challenges, the process allowed me to gain invaluable experience in working with immersive technologies. The lack of a single unified plugin solution meant that I had to develop a deep understanding of each piece of the technology stack, from Unreal Engine to SteamVR. I also had to navigate the difficulties of ensuring that all software versions were stable and compatible, learning through trial and error. This process underscored how VR development, while highly rewarding, is fraught with technical obstacles that can hinder progress.

Moreover, the lack of a unified solution for creating VR applications for Oculus makes it more difficult for independent developers to streamline the process. As noted by experts, even with the right versions of Unreal Engine, SteamVR, and Oculus SDK, the process is still prone to unexpected errors, requiring constant testing and tweaking of configurations (Gersick 1991; Eliasson 2019). The coordination between different software tools and the constant version control required is a critical challenge for many independent developers, as it increases the risk of failure during the deployment phase (Thorne 2014).

In conclusion, creating *The Last Chair of the Forest and the Plastic Bottle* for the Oculus headset using an .exe file through Steam required overcoming several technical challenges, particularly when it came to managing the integration of Unreal Engine with SteamVR, Android Studio, and other external tools. The complexity of developing VR experiences for platforms like the Oculus was compounded by the lack of a unified plugin and the need to coordinate various programming environments. Despite these difficulties, the project ultimately succeeded in creating a compelling and immersive VR experience, underscoring the potential of immersive media to convey urgent environmental messages. The experience not only taught me valuable technical skills but also deepened my understanding of how complex VR development can be, especially when working with large-scale, resource-intensive projects.

Fig. 5. Vr Installation

5.1 VR in Asheville Art Museum and the McCullough Fellowship

The Asheville Art Museum (AAM) presented *The Last Chair of the Forest and the Plastic Bottle* as their first ever virtual reality artwork on display. Created by Edwin Salas Acosta through the McCullough Fellowship under the mentorship of Dr. Victoria Bradbury, this project immerses viewers in an ecological reflection, aligning with the museum's exploration of technology's impact on the environment. Using Unreal Engine 5, the work presents Asheville's fragile ecosystems through an interactive experience. Sitting on the "last wooden chair of the forest," visitors confront the consequences of overexploitation and pollution. The project highlights three key elements: the Oculus headset, plastic consumption, and sustainable design. Through the "butterfly effect" metaphor, it illustrates how everyday consumer behavior contributes to global environmental degradation (Fleming, 2021).

In Fall 2024, the Asheville Art Museum was presenting several concurrent artworks that integrate technology, and environmental awareness by Ginny Ruffner and Bill Viola. Ruffner's *Reforestation of the Imagination* envisions an apocalyptic world in which withered plants revive through augmented reality, offering a hopeful perspective on technology's role in environmental restoration. In contrast, *The Last Chair of the Forest and the Plastic Bottle* serves as a warning about the destructive consequences of technological choices and resource waste.Bill Viola's *Moving Stillness: Mount Rainier, 1979* explores nature's beauty and violence, depicting Mount Rainier's image dissolving and reforming as water shifts state, symbolizing cycles of death and renewal. While Viola highlights nature's resilience, *The Last Chair of the Forest* critiques humanity's role

in disrupting that balance, suggesting that regeneration depends on changing our relationship with technology and consumption.

Both Ruffner and Viola use immersive media to deepen our understanding of nature, transformation, and mortality. While their works emphasize adaptation and renewal, *The Last Chair of the Forest* questions whether we are making the right choices to prevent an irreversible future. Being exhibited alongside these artists validates the relevance of this project and underscores VR's power as a medium for social and environmental reflection.

The McCullough Fellowship, a sustainability-focused grant supporting ecologically driven projects at UNC Asheville, further strengthened the exhibition's sustainability themes. The inclusion of *The Last Chair of the Forest* in this context highlights the urgency of addressing the environmental crisis through a dialogue that merges art, technology, and social awareness.

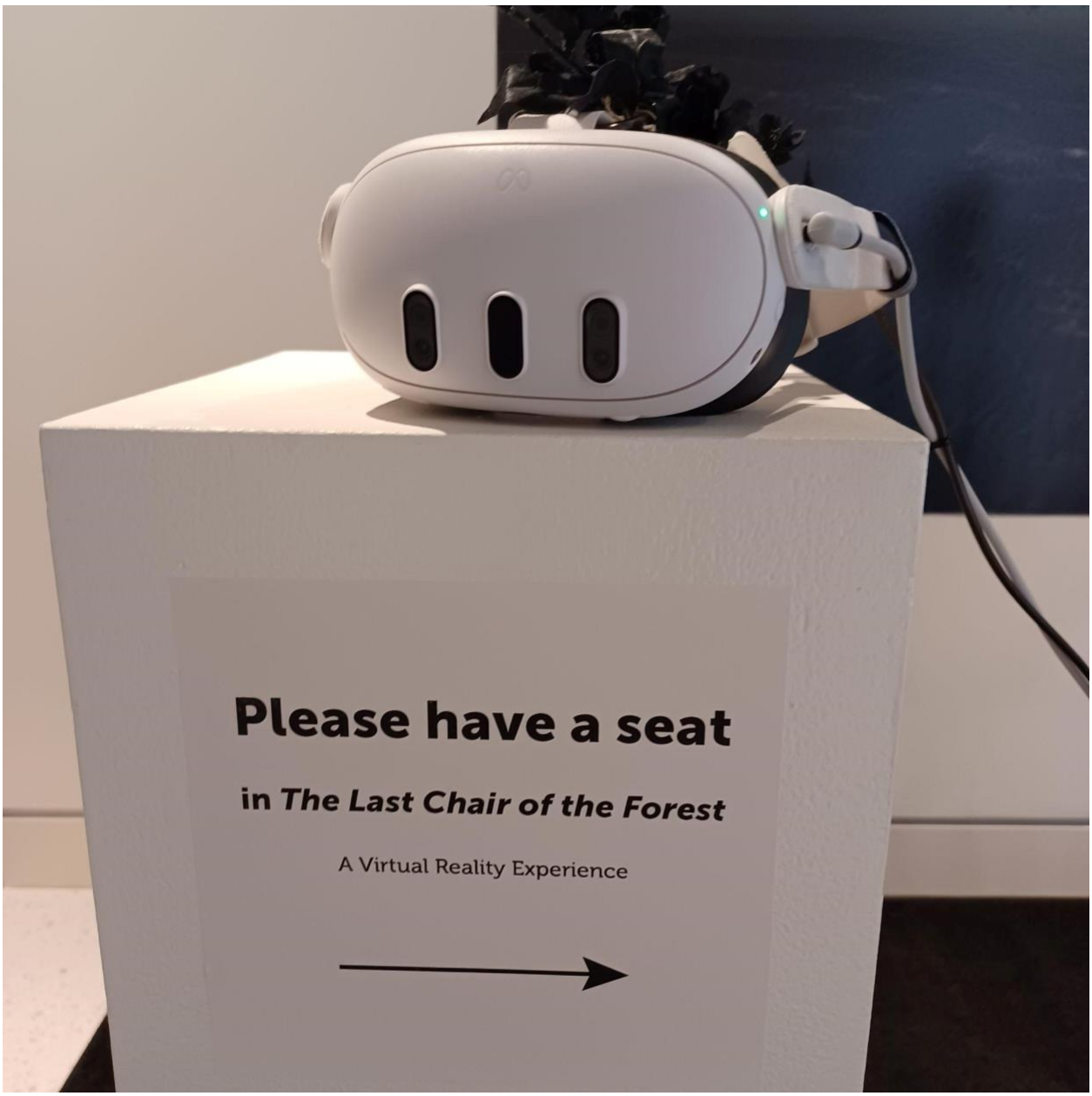

Fig. 6. The Oculus Headset

6.1 Environmental Impacts of Technology:

6.2 Oculus Headset:

The environmental footprint of the Oculus headset, like other electronics, involves a range of significant impacts that demand further exploration. From production through distribution, fossil fuel use to obsolescence, the impact of the headset must be examined. According to studies by the European Environment Agency (EEA), the extraction of metals, including rare earths like neodymium for magnets in electronics, leads to severe environmental degradation, deforestation, and water pollution (European Environment Agency, 2020). The United Nations Environment Programme (UNEP) also highlights that e-waste,

including devices like VR headsets, is a growing global issue, with millions of tons ending up in landfills each year, releasing toxic materials into the environment (United Nations Environment Programme, n.d.).

From a scientific standpoint, life cycle assessments (LCAs) show that manufacturing virtual reality devices has a significant carbon footprint due to energy-intensive production processes, including the fabrication of the plastic and metal components. The growing demand for lithium batteries, essential for devices like the Meta Quest VR headset, highlights the environmental challenges tied to lithium extraction. Chile, as part of the
Lithium Triangle, plays a critical role in supplying this resource, with operations centered around the Salar de Atacama. This region, while rich in lithium, faces significant environmental pressures due to the extensive water usage required for extraction in one of the driest areas on Earth. As the global shift towards electrification accelerates, sustainable practices in lithium mining will be essential to mitigate ecological and social impacts (Deutsche Welle 2024).

While artists like Olafur Eliasson, Laurie Anderson, and Trevor Paglen use their work to critique environmental and technological issues, it raises an important question: is the art world itself exempt from these critiques? These artists highlight the ecological costs of human activity and the impact of technology, but the creation and exhibition of their works—through the use of materials, energy consumption, and global travel—could contribute to the very issues they aim to address. This paradox invites us to reflect on whether art can truly separate itself from the environmental and ethical concerns it critiques (Olafur, 2024).

Furthermore, in the context of technological artworks, the devices used—such as VR headsets—also play a significant role. Early devices like the Oculus Rift had limited reusability, contributing to electronic waste and environmental harm. In contrast, newer technologies could prioritize eco-friendliness, using materials that are easier to recycle and systems that encourage reusability. Artists and creators could adopt more sustainable practices by choosing devices that are modular, like laptops with easily replaceable parts, or using energy-efficient technologies that reduce their carbon footprint.

One notable example of this is the Framework Laptop, a device designed by Nate Mitchell, one of the co-founders of Oculus. After his work on the Oculus Rift, Mitchell sought to address the growing problem of e-waste by creating a laptop that is fully modular and repairable. The Framework Laptop allows users to easily replace components such as memory, storage, and even the screen, thereby reducing the need for complete device replacements and contributing to a more sustainable tech ecosystem. This approach not only benefits the environment but also empowers users to extend the lifespan of their devices (Mitchell, 2024).

By making these considerations, the art world could better align its creative expressions with the sustainability it advocates, ensuring that the tools and methods it employs to critique environmental issues do not inadvertently contribute to them (Olafur, 2024; Anderson, 2024; Paglen, 2024).

In conclusion, while the Oculus and similar devices hold immense potential for advancing human interaction with digital spaces, their environmental toll highlights the need for a sustainable approach to their design and manufacturing. Incorporating circular economy practices, such as reusing materials and improving energy efficiency, is essential to mitigating these impacts, as pointed out by researchers in both technological and ecological fields.

6.3 Plastic Bottles, Art, and Environmental Reflection

Plastic bottle production significantly impacts the environment by depleting natural resources, generating pollution, and releasing harmful carbon emissions. The manufacturing process requires the extraction and processing of fossil fuels, emitting substantial greenhouse gases that exacerbate climate change (University of Colorado Boulder 2023). Additionally, plastic waste accumulation in oceans and landfills leads to the formation of microplastics, which threaten marine biodiversity and disrupt ecosystems (LaVie Bio 2023). With decomposition taking up to 1,000 years, plastic bottles present a major waste management challenge (Healthy Human 2023).

While plastic bottles contribute to environmental degradation, they also play a crucial role in emergency situations. During the 2024 Hurricane Helene, which caused a severe water crisis in Asheville, bottled water became a vital resource for affected residents. The disaster underscored the dual nature of plastic bottles: indispensable in crises but unsustainable for regular consumption (Geyer, Jambeck, & Law 2017). I personally experienced this contradiction when, after receiving a 24-pack of bottled water at a relief site, I stood in my backyard contemplating the fallen trees from the Blue Ridge Parkway. The irony of my VR project, *The Last Chair of the Forest and the Plastic Bottle*, was reflected in that moment—technology, like plastic, is both a problem and a necessity.

Artists have long used plastic waste to critique unsustainable practices. HA Schult, for instance, transforms garbage into sculptures that expose environmental excess (Causeartist 2023). Chris Jordan's large-scale photographic compositions highlight the staggering scale of consumer waste (Jordan 2008), while Tara Donovan repurposes plastic into intricate sculptures that challenge perceptions of disposable materials (Donovan 2013). These works bridge the gap between scientific concerns and emotional engagement, making the consequences of plastic pollution more tangible (School of Visual Arts 2023).

This interplay between critique and medium is central to *The Last Chair of the Forest and the Plastic Bottle*. The VR project employs Oculus MetaQuest headsets to immerse viewers in an ecological narrative, exposing the paradox that the very technology enabling this reflection is part of the environmental issue. The production and disposal of VR equipment contribute to e-waste and resource depletion, mirroring the concerns depicted in the work. This self-referential approach invites audiences to engage with the complexity of ecological crises, questioning the sustainability of technological innovation and its role in environmental advocacy.

Furthermore, the integration of art with environmental science fosters deeper reflection on consumer habits and their long-term impact. Artists not only raise awareness but also inspire action, urging society to move beyond reliance on disposable plastics toward sustainable alternatives. By transforming discarded materials into powerful artistic statements, they emphasize both the urgency of the environmental crisis and the potential for creative solutions. *The Last Chair of the Forest and the Plastic Bottle* aligns with this artistic tradition, using immersive technology to challenge viewers to reconsider their relationship with consumption, waste, and sustainability.

Ultimately, while plastic bottles may be necessary in emergencies, their routine use must be reevaluated. The intersection of art, technology, and environmental awareness provides a compelling platform to address these pressing issues, encouraging communities to adopt more responsible practices for the preservation of our planet.

Fig. 7. The User

7.1 The Last Chair of the Forest – Symbolic Design

The "Last Chair of the Forest" is a powerful symbol of sustainable design, created from a second-hand chair sourced from Habitat for Humanity (which flooded during Helene), a non-profit that promotes sustainable living through the reuse of materials. The chair, though not directly crafted from the last tree in the forest, serves as a poignant representation of repurposing and ecological awareness.

Incorporating extensions with skull motifs, the chair symbolizes the past, present, and future. The central skull, inscribed with Morte (Death) in Italian, reflects the environmental toll humanity faces from its ongoing

destructive practices. This artwork serves not only as a critique of wastefulness but also as a reminder of the interconnectedness of time, life, and environmental consequences. It challenges viewers to reflect on the broader narrative of ecological destruction, urging both personal responsibility and collective action for the preservation of nature.

The choice of materials, in this case, a reused chair, aligns with principles of sustainability, reducing waste, and promoting circularity. This approach mirrors artistic practices that challenge traditional notions of value and materialism while integrating environmental consciousness into creative expression. As with many artists who use discarded objects in their work (Marcel Duchamp, Robert Rauchenberg, Louise Bourgeois, and others.), the act of repurposing becomes a metaphor for transformation and rebirth while also reflecting the history of the used object into the museum space.

By using a repurposed object in the chair's construction, *The Last Chair of the Forest and the Plastic Bottle Hacks* audiences to reconsider their relationship with the world around them. In this context, the skulls—often associated with mortality—take on a dual meaning: a reflection on the finite nature of life and a call to action for ecological preservation.

Fig. 8. The Bottle

8.1 Plastic Bottles, Environmental Crisis, and Artistic Reflection

Plastic bottle production significantly contributes to environmental harm by depleting natural resources, generating pollution, and releasing harmful carbon emissions. The manufacturing process involves the extraction and processing of fossil fuels, which emit substantial greenhouse gases, exacerbating climate change (University of Colorado Boulder 2023). Additionally, fossil fuel extraction for plastic production can lead to environmental degradation, including deforestation, which negatively impacts ecosystems and biodiversity (FoodPrint 2023). Once produced, plastic bottles are often discarded improperly, accumulating in oceans and landfills, where they break down into microplastics that disrupt food chains and biodiversity (LaVie Bio 2023).

Plastic bottles decompose very slowly, taking up to 1,000 years to break down, exacerbating global waste management challenges (Healthy Human 2023). This issue extends beyond science, inviting artistic reflection on human consumption. Artists have long repurposed waste materials, including plastic bottles, to critique unsustainable practices and highlight environmental consequences. HA Schult, for example, transforms garbage into sculptures that expose ecological concerns (Causeartist 2023), while Chris Jordan captures the overwhelming scale of waste in his photographic work (Jordan 2008). Such artistic interpretations bridge scientific reality with emotional engagement, prompting deeper reflection on ecological degradation (School of Visual Arts 2023).

However, plastic bottles also play a crucial role during crises. The 2024 Hurricane Helene caused a severe water crisis in Asheville, leaving bottled water as the primary hydration source for many residents. When local water systems were compromised, plastic bottles became essential for drinking and hygiene. This event underscores a paradox: while plastic bottles are environmentally harmful, they can be lifesaving in emergencies. I experienced this firsthand, standing in my backyard with a 24-pack of bottled water from a relief site, gazing at the fallen trees from the Blue Ridge Parkway—the stark irony of my VR project mirrored in reality.

The increase in plastic bottle use during crises is understandable, but their continued reliance for everyday consumption remains unsustainable. The widespread use of disposable plastics is a global issue, demanding alternatives (United Nations Environment Programme 2018). Artists such as Tara Donovan, who turns plastic into intricate sculptures (Donovan 2013), emphasize this concern, using art to transform waste into powerful messages.

This interplay between critique and medium is at the heart of *The Last Chair of the Forest and the Plastic Bottle*. The project embodies a "critical hyper metaphor," where the artwork's medium participates in the critique itself. Using Oculus MetaQuest headsets to immerse viewers in environmental narratives highlights a paradox: the very technology used to critique ecological harm contributes to e-waste and resource depletion. This self-referential dynamic challenges viewers to engage with ecological crises, where solutions often intersect with the systems they critique. By embracing this tension, the project invites audiences to reflect on the sustainability of technological innovation and its role in addressing environmental challenges.

9.1 Case Studies and Global Examples.

In the Pisgah National Forest, the proposed expansion of logging, which could quadruple in some areas, threatens critical carbon sinks, including old-growth forests that store vast amounts of carbon. These forests play a crucial role in mitigating climate change, and their loss could release significant amounts of stored

carbon, worsening the climate crisis. Such plans reflect broader environmental policies, such as those enacted during the Trump administration, which prioritized development over conservation.

During the first Trump administration, key environmental protections were weakened, including lifting the Roadless Rule in the Tongass National Forest, a vital carbon sink. This decision allowed logging in ancient forests, raising similar concerns about its negative impact on climate change. Other regulatory rollbacks, such as easing EPA emission standards, further amplified the environmental risks associated with such actions (U.S. Environmental Protection Agency, 2020; Environmental Defense Fund, 2020).

With Trump's re-election, there are concerns that these rollback policies could be reinstated or even expanded, potentially leading to further damage to protected ecosystems. This includes the weakening of environmental regulations that help prevent deforestation and protect carbon-storing forests. Additionally, a return to policies that favor resource extraction over environmental conservation could accelerate climate change by reducing the capacity of critical carbon sinks to function effectively (Environmental Protection Network, 2020; The New York Times, 2020). President Trump already signed an executive action on his first day in office during his second term to remove the US from the Paris Climate Agreement, which may have a ripple effect around the world.

Hurricane Helene, which struck Western North Carolina in late September 2024, added to the region's environmental struggles. The storm caused "moderate to catastrophic" damage to over 187,000 acres of national forest land, roughly 20% of the total forest area. The U.S. Forest Service estimated that damages totaled around $44 million in lost vegetation and land destruction. Conservation groups now urge the Forest Service to adjust its management plan for the Pisgah and Nantahala National Forests to account for the increasing frequency of natural disturbances, like those caused by Helene.

The storm's aftermath has highlighted the need for increased protections for these vital ecosystems. The loss of 117,000 acres of vegetation and the subsequent threat to wildlife habitats are significant concerns. These damages also elevate the risk of invasive species survival, further degrading the forests' ecological balance. This catastrophic impact, combined with the ongoing threat posed by potential policy rollbacks, illustrates the pressing need for stronger conservation efforts to protect these carbon-storing forests (Asheville Times, 2024).

10.1 Conclusion and Future Directions

The Last Chair of the Forest and the Plastic Bottle highlights the urgency of environmental action through a fusion of art, technology, and ecological awareness. By presenting a speculative yet tangible narrative of deforestation, microplastics, and human consumption, the project serves as both a warning and a call to action. The devastation caused by Hurricane Helene in western North Carolina reinforced the project's relevance, transforming its speculative themes into a direct commentary on real-world environmental crises.

This research opens new avenues for artistic exploration. One possibility is integrating predictive analytics powered by AI to model the ecological impact of consumer behaviors and technological developments. Collaborating with specialists in environmental science, data analytics, and AI could extend the project's scope beyond artistic expression into actionable environmental policy recommendations. This interdisciplinary approach would enhance its scientific credibility and provide practical insights for addressing ecological challenges.

Another direction involves incorporating real-time environmental data through forest sensors. By utilizing sensor technology, the VR experience could dynamically reflect ecological conditions such as deforestation rates, air quality, or microplastic contamination. This interactive layer would deepen users' engagement with environmental data, reinforcing the urgency of sustainability efforts. Collaborations with environmental monitoring organizations could further position VR as a tool for visualizing and interpreting ecological data in innovative ways.

VR also holds significant potential for scientific research. Immersive environments could simulate complex ecological scenarios or provide virtual training for researchers working in remote or fragile ecosystems. Bridging the gap between data and visualization, VR can contribute to interdisciplinary approaches in environmental preservation.

Future iterations of the project could include interactive elements allowing users to make decisions and witness their ecological consequences in real time. While this would enhance engagement and illustrate the butterfly effect in environmental systems, it might limit accessibility for broader audiences due to the need for advanced interaction skills. Expanding the project through digital platforms could help reach a global audience and foster wider participation in these critical conversations.

Additionally, the project raises broader questions about art's role in ecological awareness. By merging storytelling with pressing environmental themes, it demonstrates how immersive media can inspire action. Future research could examine the long-term impact of such artistic interventions on public behavior and policy making. Through these avenues, *The Last Chair of the Forest and the Plastic Bottle* seeks not only to reflect on humanity's role in ecological degradation but also to empower individuals and communities to envision and contribute to a more sustainable future.

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