CM3070 Final Project
Final Report

<The Last Spark>

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Content Page

Introduction (719 words)

Project Concept and Overview

The Last Spark is a short animated film created in Unity using real-time visual effects (VFX). It tells the story of a flame child wandering a desolate snowy landscape, who ultimately sacrifices his last ember to revive a dead tree. Rather than relying on dialogue, the film uses stylized shaders, particle systems, post-processing effects and symbolic visuals to communicate emotion and narrative transformation.

The animation will be developed in Unity's Universal Render Pipeline (URP), using GPU-driven Shader Graphs, particle systems, Visual Effect Graph (VFX Graph) and keyframe animation. All effects will be rendered in real time rather than through static pre-rendered frames, with visual changes closely tied to the emotional arcs of the story.

This project follows template 9.2: Animated Short Film with VFX, with a particular focus on how real-time stylized techniques such as dynamic shader-based glow, evolving particle systems and lighting transitions, can serve as an active visual language for emotional storytelling.

Motivation

Many animated shorts today emphasize technical polish, featuring realistic lighting, smooth rendering pipelines, and physically accurate effects, particularly in real-time productions such as Unity's The Heretic and Enemies (Unity Technologies, 2020, 2022). While these projects are visually impressive, they often lack a strong narrative or emotional depth. Conversely, emotionally resonant films such as The Little Prince (Osborne, 2015) tend to rely on traditional or offline rendering workflows, which limit interactivity and dynamic visual responsiveness.

This project is motivated by the belief that real-time VFX can do more than provide visual spectacle. When carefully integrated with character arcs and visual metaphor, they can act as expressive tools for emotional storytelling. As Thomas and Johnston (Thomas & Johnston, 1995) explain in The Illusion of Life, the heart of animation lies in emotional timing and metaphor. Similarly, Bordwell and Thompson (Bordwell & Thompson, 2010) emphasize how visual symbolism: transformation, contrast, and carefully timed visual cues, can convey meaning without dialogue. Real-time rendering offers advantages in this context, as it allows effects such as flickering flames, particle-based transitions, shader-driven dissolves and dynamic lighting to evolve with the character's emotional state, deepening immersion (Akenine-Möller, Haines, & Hoffman, 2018).

The Last Spark seeks to bridge this gap between technical innovation and emotional depth. Where many real-time projects serve primarily as technical showcases and narrative-driven works often sacrifice interactivity, this project aims to integrate the two. By leveraging Unity's

URP, this film aspires to create a narrative where visual effects function as a language of emotion rather than mere decoration.

Aims and Research Questions

The aim of this project is to explore how stylized real-time VFX can enhance emotional storytelling in short animated films.

My research is guided by the following questions:

- How can real-time VFX be used symbolically to represent emotion and transformation?
- What shader and particle techniques are most effective for conveying internal narrative beats?
- Can stylized visual effects replace or supplement traditional dialogue in building an emotionally resonant narrative arc?

These questions inform both the creative and technical decisions throughout development, from designing visual metaphors to implementing shader-driven emotional cues.

Objectives and Deliverables

To achieve this aim, the project has the following objectives and corresponding deliverables:

Objective	Deliverable
Develop a symbolic narrative using visual metaphor	A storyboard and written treatment of the story arc
Implement stylized real-time VFX	Shader Graph effects for fire, snow, dissolve and tree bloom
Link visuals to emotion through technical methods	Animation, Cinemachine timeline sequences and lighting synced with the character's emotional progression
Evaluate visual clarity and emotional impact	Final rendered demo with reflective evaluation and peer feedback
Reflect and document the process	A written report including design, implementation, and evaluation

Justification of Objectives

These objectives address the core research aim, which is to demonstrate how real-time visual effects can operate as storytelling devices rather than purely aesthetic enhancements. Each deliverable reflects an emotional layer of the film. For instance, the fire flickering to symbolize the child's weakening state, or blossoms blooming to signify renewal at the climax.

Unlike many real-time projects that prioritize spectacle over narrative depth (e.g. The Heretic), The Last Spark deliberately adopts a minimalist, symbolic approach. It uses GPU-driven effects as emotional cues, showing that even non-photorealistic, stylized visuals can carry weight and meaning when integrated thoughtfully.

Ultimately, this project aims not only to test the technical feasibility of such an approach but also to reflect on how effectively emotional storytelling without dialogue can be achieved in a short film using real-time, stylized VFX.

Literature Review (1601 words)

This chapter reviews existing works and research that inform The Last Spark's creative and technical direction. It examines case studies of animated shorts and games that integrate stylized rendering and emotional storytelling, alongside academic discussions on visual metaphors, real-time rendering, and shader-driven narrative techniques. The goal is to identify existing strengths and limitations in the field, while highlighting how The Last Spark builds upon and addresses these gaps through Unity's Universal Render Pipeline (URP) and GPU-driven visual effects and post-processing effects.

Case studies

Love, Death & Robots - The Witness

The Witness, an episode in the Love, Death & Robots anthology, is acclaimed for its hyper-stylized visual design. Director Alberto Mielgo describes the approach as achieved by blending hand-painted environments, exaggerated lighting, and motion to create a surreal urban atmosphere. The style draws from impressionist traditions, leveraging simplified forms and overexposed color palettes to evoke a dreamlike tone. Despite resembling real-time effects, its visuals were offline-rendered, prioritizing artistic control over interactivity (Failes, 2020).

While visually striking, The Witness prioritizes spectacle and tension over emotional resonance. Its narrative centers on pursuit and violence without deep exploration of character

transformation or metaphorical subtext. As a result, the viewer is captivated by its technical craft but left emotionally detached.

The Last Spark draws from The Witness's strength in stylization, but repurpose techniques like dynamic lighting shifts and glow effects to symbolise the fire child's fading life and eventual sacrifice.

The Little Prince

Osborne's The Little Prince (2015) blends two distinct visual styles: stop-motion for the storybook sequences and 3D animation for the framing plot. This dual style approach contrasts the childlike innocence with adult conformity, visually reinforcing thematic depth (Lewis, 2021). The film's visual metaphors like paper planes representing imagination, stars signifying memory, are powerful tools for conveying abstract emotions (Bordwell & Thompson, 2010).

However, the film relies exclusively on offline rendering, lacking technical interactivity or dynamic visual transitions. This limits the responsiveness to emotional or narrative changes. Although metaphorically rich, it cannot dynamically evolve in real time, reducing opportunities for visual interactivity.

The Last Spark adapts the strengths in metaphor and symbolism but reimagines them within a real-time context. Using Unity Shader Graph and VFX Graph, elements like embers dimming and blossoms blooming evolve procedurally, symbolizing sacrifice and renewal in sync with the protagonist's emotional arc in real-time.

The Heretic

The Heretic (Unity Technologies, 2020) is a short film created as a technical showcase for Unity's High Definition Render Pipeline (HDRP), demonstrating cinematic-quality real-time rendering. It features procedural shadows, volumetric fog, and cinematic camera work (Unity Technologies, 2020), which also highlights the potential of real-time engines to achieve near-offline fidelity (Akenine-Möller, Haines, & Hoffman, 2018).

However, the short prioritizes technical demonstration over narrative depth. While the visuals are advanced, it lacks a compelling emotional narrative arc or symbolic storytelling, reducing its role to that of a proof of concept.

The Last Spark builds on The Heretic's techniques, particularly its real-time rendering quality, but channels these tools into emotionally symbolic storytelling. Real-time lighting, shader-based flickers and dissolving, and particle effects are used as narrative devices reflecting the fire-child's emotional journey instead of as technical flourishes.

Ori and the Blind Forest

Ori and the Blind Forest (Moon Studios, 2015) exemplifies emotionally charged visual world-building. Its painterly art style, soft gradients, and ambient particle systems create an ethereal forest suffused with themes of loss and redemption. As Blythe observes, layered GPU effects such as additive blending and post-processing significantly contribute to mood and immersion (Blythe, 2006).

However, Ori's effects are mostly pre-defined, with limited procedural responsiveness to emotional or narrative shifts. While the visuals support atmosphere, they do not dynamically adapt to evolving character states in a real-time context.

The Last Spark addresses this by introducing reactive real-time VFX such as embers fading, snowstorm intensity changes and particles blooming in response to narrative beats, transforming a static atmosphere into an emotional language rendered in real time.

Key concepts and Techniques

Visual Metaphors as Emotional Language

Visual metaphors are central to non-verbal storytelling, allowing abstract emotional states to be externalized through imagery (Bordwell & Thompson, 2010). In animation, metaphors often embody transformation, such as changing colors or growing forms, to represent evolving psychological states (Thomas & Johnston, 1995).

Research also shows that visual metaphors enhance narrative clarity and emotional engagement when tied to character arcs (Fiveable, n.d). However, their effectiveness depends on contextual integration, poorly contextualized symbols risk ambiguity or narrative dissonance.

In The Last Spark, visual metaphors such as flickering embers (life fading), snowstorm intensifying (struggle) and blossoms blooming (renewal) are woven into the story's emotional beats carefully, ensuring they are immediately interpretable and emotionally resonant.

Stylized Real-Time Rendering for Narrative Impact

Stylized rendering departs from photorealism to embrace abstraction and artistic interpretation, enabling more expressive visual storytelling (Unreal Engine, n.d.). As Akenine-Möller et al. (Akenine-Möller, Haines, & Hoffman, 2018) note, real-time pipelines now allow for cinematic-quality stylization while maintaining responsiveness, making them ideal for emotionally adaptive narratives.

Real-time rendering also facilitates iterative emotional refinement, allowing artists to instantly test how lighting, color grading, and effects influence audience perception (Ali, 2023). However,

achieving stylistic consistency without compromising performance remains a technical challenge, particularly in lightweight pipelines like URP.

The Last Spark leverages these strengths by using Unity URP to balance performance and aesthetic flexibility, combining Shader Graph, VFX Graph, and post-processing to heighten emotional tone.

Shader-Driven Storytelling

Shaders allow surfaces and lighting to respond dynamically to parameters like time, movement, or narrative triggers. GPU-driven shaders can animate transformations such as glow, distortion, and color shifts that align with narrative beats (Singh & Kumar, 2025).

In a storytelling context, shaders allow characters and environments to visually respond to emotional states. For instance, glow intensity can mirror hope or vitality, while noise-based flickering may express decay or instability. Despite this potential, shaders in non-interactive films often serve decorative purposes rather than narrative ones.

The Last Spark uses emotionally reactive shaders, including a fire shader that weakens with the fire child's journey, a dissolve shader for the final sacrifice, and a snow shader that records trails using render textures. These demonstrate how VFX can function as narrative symbols rather than decoration.

Real-Time VFX as a Narrative Device

Real-time VFX (e.g. particles, dynamic lighting, volumetric fog) have traditionally been used for spectacle, but they also hold potential for symbolic narrative expression (C&I Studios, 2025). When synchronized with story events, these effects can immerse audiences in character emotions, bridging the gap between visual design and narrative meaning.

However, few creative works fully exploit this capability. Technical demos like The Heretic showcase real-time fidelity without embedding emotional stakes, while narrative-rich works like The Little Prince rely on static, offline pipelines. This leaves a gap in integrating real-time VFX as a symbolic storytelling tool.

The Last Spark addresses this by using reactive particle systems (snowfall, ember trails, blossom bloom), and post-processing transitions (bloom, vignette, exposure shifts) tied to emotional narrative progression, transforming effects from background elements into active narrative participants.

Post-Processing as Mood Design

Post-processing has become an important tool in shaping the emotional tone of digital animation and games. Techniques such as bloom, vignette, exposure adjustments, and color grading are often used to evoke atmosphere and guide audience perception. Research shows that adjustments to hue, saturation, and brightness can significantly shift emotional response: desaturated blues tend to evoke cold, somber moods, while warmer color grading and increased bloom reinforce feelings of warmth or hope (Joosten et al., 2010, Wilms et al. 2017).

In a real-time context, these tools are particularly powerful because they can be adjusted dynamically, allowing mood to evolve alongside narrative progression (Akenine-Möller, Haines, & Hoffman, 2018). When integrated with stylized rendering, post-processing enables more immediate and nuanced control of emotional pacing compared to static pre-rendered workflows.

In The Last Spark, post-processing was deliberately varied across acts: Act 1 used a cold vignette and reduced exposure to emphasize isolation, Act 2 deepened desaturation and added film grain to highlight struggle, and Act 3 shifted towards higher bloom intensity and warm color grading to signify rebirth. These adjustments, while technically subtle, contributed significantly to the symbolic arc of loss and renewal.

Cinemachine and Camera Language in Real-Time Storytelling

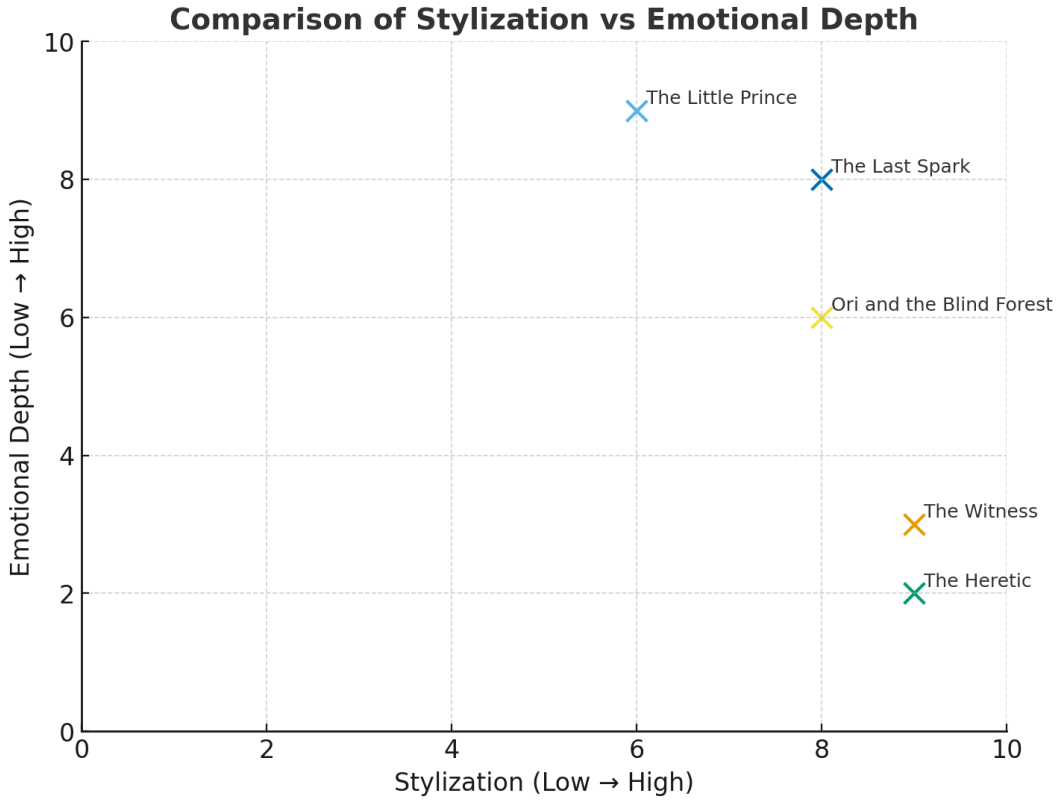
Camera framing and movement are critical to how audiences interpret emotion in film. Bordwell and Thompson (2010) highlight that cinematic perspective, such as low angles, close-ups, or zoom-outs, shapes how viewers perceive vulnerability, scale, or resolution. In Unity, tools like Cinemachine make it possible to automate such camera language while retaining flexibility for iteration.

In The Last Spark, wide establishing shots emphasized the fire child’s loneliness in the snowy landscape in Act 1, low angles in Act 2 amplified the sense of struggle against the storm, and the final zoom-out conveyed both loss and renewal as the tree blossomed. By combining Cinemachine’s dynamic control with real-time VFX, the project reinforced narrative beats not only through effects but also through filmic perspective.

Analysis

Across my research, a few patterns emerge. Works like The Witness and The Heretic excel in technical and stylistic innovation but lack emotional or symbolic depth. Conversely, The Little Prince delivers powerful metaphors yet sacrifices interactivity and procedural responsiveness. Ori demonstrates the potential for an emotional atmosphere but remains largely static. Below is a table summarising how the reviewed works balance stylization, real-time rendering, and emotional storytelling, and a visual map of the projects on two axes: stylization and emotional depth.

Work	Stylization	Real-time rendering	Emotional depth	Narrative metaphors
Love, Death & Robots - The Witness	High	No	Low	Minimal
The Little Prince	Moderate	No	High	Strong
The Heretic	High	Yes	Low	None
Ori and the Blind Forest	High	Limited	Moderate	Moderate



Academic literature underscores the importance of visual metaphors and narrative-driven visual transformations (Thomas & Johnston, 1995; Bordwell & Thompson, 2010), yet few real-time projects integrate these insights meaningfully. The Last Spark aims to bridge these gaps by combining real-time GPU-driven shaders, VFX Graph particle systems, interactive snow trails, and stylized post-processing with metaphorically rich storytelling. This integration transforms VFX from decorative elements into a symbolic language of emotional progression.

Design (1992 words)

Domain and Users

The Last Spark falls within the domain of stylized narrative animation, specifically focusing on non-verbal, metaphor-driven storytelling produced with real-time rendering tools. Its target audience includes viewers who appreciate emotionally resonant visual narratives, such as fans of Ori and the Blind Forest or The Little Prince. These audiences are drawn to symbolism, mood-driven storytelling, and subtle character arcs over dialogue-heavy narratives.

Secondary target audiences include independent animators, students, and researchers exploring Unity's URP and Shader Graph for storytelling. From an academic perspective, the project contributes to the growing discourse on how real-time engines can support cinematic-quality yet emotionally engaging animation, demonstrating Unity's rendering pipeline as a medium for short-form narrative films (Akenine-Möller, Haines, & Hoffman, 2018).

Design Justification

The design decisions in The Last Spark are guided by the project's aim: to explore how real-time stylized VFX can enhance emotional storytelling.

URP vs HDRP

URP was chosen over HDRP because it offers a balance between performance and visual fidelity. While HDRP provides higher-end cinematic effects, it is resource-intensive and less flexible for iterative development. URP supports lightweight stylized rendering, ensuring smoother performance and stable frame rates during real-time playback. This is crucial for screenings and peer testing, increasing the feasibility on mid-range hardware for a short film targeting accessibility for student production (Unity Technologies, n.d.).

Feature	URP (chosen)	HDRP
Performance	Lightweight, optimized	Heavy, hardware-intensive
Stylization flexibility	High	Moderate
Iteration speed	Fast	Slower (complex pipeline)
Target Audience	Mid-range PCs	High-end workstations

Summary of Comparison of URP and HDRP

Non-verbal storytelling

Non-verbal storytelling removes linguistic barriers, making the film emotionally universal (Thomas & Johnston, 1995). Symbolic imagery like flickering fire to represent life, intensifying snow to signify struggle, and blooming blossoms to symbolise renewal, was prioritized over dialogue to deepen viewer immersion. This aligns with Bordwell and Thompson's (Bordwell & Thompson, 2010) assertion that visual motifs can communicate narrative arcs as effectively as dialogue when tied to pacing and structure. Unity's Timeline tracks (animation, activation, visual effect, audio) and Cinemachine framing were also integrated as cinematic tools to reinforce emotion without spoken words. Hence, allowing audiences to read emotion without words.

Shader Graph for Visual Metaphors

Unity's Shader Graph allowed rapid prototyping of custom stylized shaders without coding, supporting creative iteration (Ali, 2023). Procedural shaders enable dynamic emotional metaphors, for example, firelight dimming over time to reflect the flame child's fading strength. These shaders will integrate with Unity's particle systems to produce reactive, layered visuals that evolve with narrative beats. Key shaders include:

- Fire shader: emissive HDR output built from gradient noise, UV distortion, Voronoi breakup and power lerp blends to create an organic, irregular flicker that reads as weakening energy over time, symbolizing the fire child's fluctuating vitality.
- Interactive snow shader: render-texture displacement driven by footsteps, leaving trails that act as both physical interaction and metaphor of fragile presence.
- Dissolve shader: used in Act 3 to visually communicate the fire child's final sacrifice.

This helps viewers map visuals to emotion as it evolves with the narrative.

Minimalistic Aesthetic

A minimal snowy environment without complex background detail was chosen to direct focus toward the emotional arc of the fire child and reduce cognitive load. Post-processing (bloom, vignette, color grading) reinforced this aesthetic, creating distinct emotional tones across acts so viewers don't struggle to parse story state changes. This reduces visual noise and emphasizes symbolic VFX, aligning with The Little Prince's thematic simplicity (Lewis, 2021).

Overall Structure

The film follows a three-act structure, where emotional transformation is expressed through evolving shaders, particles, post-processing and camera framing.

Act 1: Hopeful search

A fire child walks through a snowy wasteland. Warm emissive shaders contrast against cold grading. Ember particles orbit the character, symbolizing its vitality and providing a visual contrast between the warmth and lifelessness. Wide cinemachine shots emphasize isolation.

Act 2: Struggle and loss
The fire child's fire weakens as he journeys forward. Snowstorm activation track intensifies snowfall while the fire shader emission gradually dims and ember particles rate falls. The camera framing becomes tighter with low shots to emphasize struggle. Post-processing shifts to desaturation, deeper vignette, and film grain.

Act 3: Sacrifice and Rebirth
The fire child reaches a lone frozen tree and sacrifices his ember to revive it. A dissolve shader removes his form as embers extinguish. The tree bloom effect emerges via particles baked from the whole tree SDF, accompanied by warm post-processing. A final zoom-out camera conveys resolution and rebirth.

This storyboard ensures emotional beats are synchronized with visual transitions, creating a cohesive emotional journey without dialogue (See Appendix A, Figure 2.1).

Technologies and Methodologies

URP

I will be using Unity's URP as it provides optimised, real-time rendering with support for stylized shader development, making it ideal for rapid iteration. For my project where dynamic lighting and shader responsiveness are important, URP proves to be a suitable choice.

Shader Graph

Shader Graph was central to the project, enabling the design of emotionally reactive materials without writing shader code manually. Three key shaders were developed:

- Fire Shader (Flame Child): Combined gradient noise, UV distortion, and Voronoi breakup, blended with power and lerp masks, to drive emissive HDR output. Fade parameters created a non-repetitive flicker tied to the child's weakening vitality.
- Interactive Snow Shader: Sampled a RenderTexture to displace and tint the snow surface, leaving real-time trails that functioned both as footprints and as a metaphor for the child's fragile presence (See Appendix A, Figure 2.2).
- Dissolve Shader: Used animated noise masks and emission falloff to gradually erase the fire child in Act 3, dramatizing the moment of sacrifice (See Appendix A, Figure 2.3).

Visual Effect Graph (VFX Graph)

I used Unity's VFX Graph to handle more complex and large-scale effects that went beyond the Particle System's flexibility. Two major systems were created:

- Tree Bloom Effect: The dry tree mesh was baked into a Signed Distance Field (SDF) to spawn blossom particles across its volume during Act 3 (See Appendix A, Figure 2.4).
- Snow Trails Painter: Generated particle data that was written to the RenderTexture, enabling the Shader Graph to display displaced snow trails as the child walked.

Particle Systems

Another technology I used is Unity's particle system to simulate the environmental elements. The particle systems were developed to complement these shaders and reinforce the emotional tone of each act. A box-shaped particle emitter with collisions simulated the falling snow. Lifetime controls ensured flakes "melted" on contact with the ground. For the fire child, I anchored a donut shaped particle emitter to its body, producing small, upward-drifting embers that suggest both life force and fragility. In Act 2, I also intensified snow and turbulence using an activation track in Timeline, increasing particle noise and density emission rate to represent heightened struggle. These systems were integrated carefully with shaders to ensure that VFX reinforced symbolic meaning rather than acting as background decoration.

Lighting and Post-Processing

I used Global Volume as mood shaping tools across the three acts. Each act employed distinct lighting and post-processing effects where the dynamic lighting changes mirror the character's emotional arc, moving from cold blue hues to warm gold. Higher bloom in Act 1 enhanced the fire child's glow, film grain in Act 2 to emphasize struggle, and white balance adjustments shifted the overall scene temperature to support the cold-to-warm narrative arc.

Keyframe Animation and Timeline

The fire child's movement was animated using a combination of Mixamo clips for tripping, get-up, collapse (Mixamo, n.d.) and package-provided idle and walk animations. This choice prioritized narrative clarity while saving time for shader and VFX experimentation. To sequence the narrative elements over time, I used Timeline:

- Animation tracks handled character movement and cameras, as well as the fire child state.
- Activation track controlled snowstorm active state.
- Visual Effect track triggered the tree bloom particles.
- Audio tracks synchronized footsteps, wind, and collapse sounds.

Cinemachine Camera

Cinemachine was used for camera direction and angles. Camera choices were made deliberately per act to showcase the different arcs:

- Act 1: Wider shots to emphasize isolation and vulnerability.
- Act 2: Over shoulder and low-angle shots to convey pressure and disorientation under the storm.
- Act 3: A final zoom-out camera to symbolize resolution and the return of balance as the tree bloomed.

Audio Integration

Audio was integrated through Timeline tracks to strengthen immersion. Sounds of wind, footsteps, and the snowstorm grounded the visuals, while the child's collapse was marked by a subtle audio cue, reinforcing the dramatic climax. Audio assets were sourced from Pixabay, ensuring open licensing (Pixabay, n.d.).

Development Workflow

The project is divided into five main phases: Project Initiation and Planning, Prototype Development, Full Project Assembly, Testing and Refinement, and Finalisation. Each phase is broken down into subtasks, ensuring continuous progress towards the final deliverables (the short film and the final report) while allowing flexibility for iteration and peer feedback. All these are planned to align the submission deadlines (Refer to Gantt Chart in Appendix B).

Phase 1: Project Initiation and Planning (April 17 - May 5)

- Finalise project concept and objectives
- Storyboarding and overall design
- Identify target audience
- Background research and case studies
- Supervisor feedback and revisions
- Milestone: Submit video project proposal and slides (May 5)

Phase 2: Prototype Development (May 6 - June 17)

- Develop fire shader prototype (shader graph)
- Develop snow particle system
- Technical tests for shader responsiveness
- Milestone: Submit preliminary project report and feature prototype (June 17)

Phase 3: Project Assembly (June 18 - August 14)

- Implement full fire child shader and ember particles
- Snowy environment set up (terrain, snow particles)
- Implement blooming tree effect

- Lighting and post-processing adjustments
- Camera animations and cinematic framing
- Keyframe animations for character movement
- Emotional beats synchronization (VFX timed to narrative)
- Milestone: Submit draft report (August 4)

Phase 4: Testing and Refinement (August 11 - August 30)
- Conduct peer testing and collect feedback
- Performance testing on different hardware
- Visual quality and consistency check
- Final polishing of VFX, lighting and post processing
- Revise animation timing and effects based on feedback

Phase 5: Finalisation (August 30 - September 22)
- Write and Finalise the final report
    - Introduction
    - Literature review
    - Design
    - Implementation
    - Evaluation
    - Conclusion
- Render and export final short film
- Milestone: Submit final report and short film (September 22)

Testing and Evaluation

To ensure that The Last Spark meets both its technical and artistic goals, I will assess both the technical performance and the emotional effectiveness of the project, aligning directly with the project's aims and research questions.

The project will be evaluated against the following aims:
- Emotional resonance: measure how effectively the film conveys its intended emotions of loss, sacrifice, and rebirth without the use of dialogue.
- Visual effectiveness: assess whether the stylized real-time VFX enhances the storytelling and is clear, coherent and aesthetically consistent.
- Technical performance: ensure that real-time rendering maintains visual fidelity while achieving smooth performance (a minimum target of 60FPS)

1. Peer feedback and user surveys
    a. A group of viewers will watch the short film and complete a Likert scale based survey evaluating:
        i. Emotional impact (e.g "I felt the character's journey was emotionally moving")

        ii. Visual clarity and coherence (e.g “The visual effects supported the story’s emotional arc effectively”)
2. Observation and reaction logs
    a. Informal observations during peer testing will record viewer’s immediate reactions, such as moments of engagement or confusion, to gauge emotional response without relying solely on self-report data.
3. Technical performance testing
    a. Unity profiler will be used to monitor frame rates, draw calls, and GPU performance during runtime.
    b. Tests will be conducted across at least two hardware configurations (e.g personal computer, laptop) to ensure consistent performance.
4. Visual quality checks:
    a. The final renders will be reviewed for artifacts, shader errors, or inconsistencies, ensuring that lighting, shading and particle effects perform as intended.

I chose these evaluation strategies because there is established research on animation and visual storytelling. As Thomas and Johnston (1995) emphasize, emotional resonance in animation is achieved through carefully timed visual transformation. Meanwhile, real-time rendering performance benchmarks recommend maintaining at least 30FPS for smooth playback in cinematic experiences. (Akenine-Möller, Haines, & Hoffman, 2018).

Furthermore, peer feedback provides insight into emotional effectiveness, ensuring that the film resonates with audiences beyond the technical aspects. Technical performance testing ensures that the real-time VFX techniques employed do not sacrifice stability or polish, fulfilling the project’s goal of merging visual beauty with responsive design.

By combining subjective (audience) and objective (technical) evaluation methods, this plan ensures a comprehensive assessment of both the artistic and technical success of The Last Spark.

Implementation (2205 words)

Environment Setup

The environment for The Last Spark was designed to be minimalistic but functionally robust, serving as both a visual stage and an interactive canvas for particle and shader effects. The goal was to create a cold, barren snowy landscape that contrasts with the warmth of the fire child, while keeping the scene modular and lightweight for smooth real-time playback in Unity.

Ground plane and colliders

The base of the environment was constructed using a scaled plane (100x100 units), which acted as the ground surface throughout all three acts. A Box Collider was attached to the plane to prevent animation clipping and to provide a surface for particle collision detection. This allowed snowflakes to disappear on ground impact and ensured that the fire child's animations stayed grounded. By relying on a simple collider rather than a detailed mesh, the environment balanced physical interaction with computational efficiency.

Tree Focal Point

A dry tree model imported from the Unity Asset Store (Unity Asset Store, n.d.) was positioned as the narrative focal point for Act 3. This tree remains visually lifeless throughout Acts 1 and 2, symbolizing absence and desolation. In Act 3, it becomes the site of transformation through a VFX Graph bloom effect triggered by the fire child's sacrifice. The choice to use a static asset rather than a procedurally generated tree simplified implementation while allowing greater focus on particle-driven symbolism. The tree thus served both as a spatial anchor for the camera and as a visual metaphor for renewal.

Character Implementation

The Fire Child character began as a prefab from Unity Asset Store package. Direct editing of this prefab would affect the entire package, so I created a Prefab Variant named firechild.prefab. This allowed independent customization of its materials and child components while preserving the original asset as a reference.

The character's movements were driven by a combination of imported and pre-existing animations. Idle and walk cycles came from the original package, while actions such as tripping, standing up, and dying were sourced from Mixamo's animation library (Mixamo, n.d.). This enabled the fire child character to express both ordinary motion and narrative turning points.

To ensure synchronization with the film's emotional beats, these animations were sequenced in Unity's Timeline. Timeline provided frame-accurate blending and ordering, which allowed smooth transitions between states (e.g., walk > trip > collapse) while staying in sync with Cinemachine camera framing. This approach avoided manual animator transitions and gave more precise control over timing in relation to the narrative structure (See Appendix C, Figure 4.1). Other elements tied to the character, such as the ember particle system and fire shader fading, are discussed in subsequent sections.

Shader Graphs

Fire Shader

The flame child's material is a Shader Graph inspired by a procedural flame approach demonstrated by Daniel Stringer but adapted to my project (Daniel Stringer, 2022). The Shader Graph builds HDR emission from a distorted flame mask, then attenuates it with a procedural fade. UVs are first warped by a Gradient Noise field (driven by a distortionamt parameter) using a Lerp between the original UV and the noise, this breaks repetition and gives the flame a living wobble. The warped UVs sample a grayscale flame shape texture (Unity Asset Store, n.d.), which is tinted by an exposed flamecolor and routed to both Base Color and Emission outputs (See Appendix C, Figure 4.21 and 4.22).

Two exposed floats, fade scale and fade power, were keyframed in Timeline to control the shader dynamically. By gradually increasing these values across Acts 2 and 3, the fire child's glow became progressively weaker until it disappeared completely during the final sacrifice. This parameter animation linked the shader's visual intensity to the character's emotional decline, making the fading of the fire both a technical and symbolic effect. (See Appendix C, Figure 4.23)

Interactive Snow Trail Shader

The snow surface uses a Shader Graph that samples a Render Texture (RT) written by a secondary "particles-only" camera. As the VFX Graph spawns step and brush particles, that camera renders them into the RT. In the shader, the RT is inverted and added to a low-frequency noise field, then remapped to produce a height mask. That mask offsets the mesh in the vertex stage (small negative displacement) to create shallow depressions and also modulates albedo or roughness so the pressed snow looks slightly darker. Exposed properties like the SnowScale, VertexOffset, SnowBrightness, allows me to tune print size and depth per scene. (See Appendix C, Figure 4.31 and 4.32) This implementation was adapted from a tutorial demonstrated by Gabriel Aguiar Prod (Gabriel Aguiar Prod, 2021) with my own tweaks to integrate more closely with my project's goals.

Dissolve Shader

For the disappearance in Act 3, a noise-driven dissolve shader was implemented, informed by techniques outlined in Gabriel Aguiar Prod. (2023), but customized for this narrative context. A tiled Simple Noise fed an Alpha Clip Threshold that swept from 0 to 1, while the same noise (adjusted through power) reduced Emission so edges glowed briefly before vanishing. The shader was animated in Timeline in two steps: first, the material was switched from the Tempoflame fire shader to the dissolve shader at the collapse moment. Then, the exposed DissolveAmount property was keyframed from 0 to 1, producing a complete fade-out that aligned with the narrative beat of sacrifice. This ensured that the technical dissolve matched the emotional pacing of the scene. (See Appendix C, Figure 4.41, 4.42 and 4.43)

Particle Systems

Snow Particle Systems

To create the snowfall, I implemented two separate particle systems: one for the lighter ambient snow seen in Acts 1 and 3, and another for the intense snowstorm introduced in Act 2. This separation gave me more control during sequencing, since I could simply activate or deactivate the storm system using a Timeline Activation Track rather than modifying parameters on a single system.

Act 1 and Act 3 snowfall

The base snowfall effect used Unity's Particle System configured with looping emission. The emitter was shaped as a large Box Volume (300x300x50 units) to ensure coverage across the playable space and camera angles. Flakes' lifetime was random between two constants so they could fall naturally across the scene, and their size was set within a small random range (0.8 to 1.5) to keep flakes subtle but still able to be seen. Additional modules shaped the motion (See Appendix C, Figure 4.5):

- Velocity over Lifetime applied a steady downward pull with a slight sideways drift.
- Noise introduced subtle turbulence, giving the snow a more natural, floating quality.
- Size over Lifetime was set to start flakes slightly larger, shrink them mid-fall, and fade them before they hit the ground.

These combined settings made the snow appear gentle, soft, and consistent with the quiet tone of the opening and closing acts.

Act 2 snowstorm

For the storm sequence, I created a separate particle system with higher emission rates, and more variation in downward velocity (random values for velocity over lifetime X and Y). The noise strength was also increased, simulating a blizzard with the turbulence. This produced a denser, more aggressive blizzard effect that visually reinforced the fire child's struggle during this act. Because the storm was handled with its own system, I could easily toggle it on and off in the Timeline using an Activation Track, allowing smooth transitions without interfering with the base snowfall.

Ember Particles

To represent the Fire Child's vitality, a donut shaped particle emitter was attached to the character. This produced glowing embers that drifted upward with slight randomness. Color over lifetime transitioned from bright orange to transparent, giving the appearance of fading sparks. The emission rate was reduced progressively in Act 2 to symbolize the child's weakening state. By Act 3, the embers fully ceased, visually linking particle intensity to the character's emotional arc (See Appendix C, Figure 4.6).

Visual Effect (VFX) Graphs

Tree Bloom Effect

The bloom sequence at the climax was implemented using a Signed Distance Field (SDF) baked from the entire dry tree mesh. evaluation: This choice simplified the process compared to building a custom leaf mesh in Blender but a limitation was that fine control of individual leaves was lost. Future iterations could improve realism by baking only leaf meshes. Instead of generating geometry for each leaf, particles were spawned across the SDF volume to simulate blossoms emerging directly from the tree's structure. When triggered by a Visual Effect Track in Timeline, a burst of particles was initialized with randomized lifetime and turbulence to create a natural spread. The particles were rendered as quads with an orange-yellow gradient texture, oriented toward the camera plane. This design simplified implementation while still creating a strong symbolic transition from lifelessness to renewal (See Appendix C, Figure 4.71, 4.72 and 4.73). The method drew inspiration from demonstrations of stylized particle foliage (Zii, 2021), which I adapted to suit the project's symbolic aesthetic.

Interactive Snow Trails

The snow trail system was created by integrating VFX Graph with the custom interactive snow shader. A secondary camera rendered footsteps into a Render Texture, which was then sampled by the snow shader to displace surface geometry. The VFX Graph acted as a "painter," projecting particle masks into this texture whenever the fire child's collider intersected the snow surface. This enabled footprints and trails to persist dynamically as the character moved. Exposed properties such as particle lifetime and size were tuned for performance, ensuring trails felt responsive while maintaining efficiency (See Appendix C, Figure 4.81 and 4.82). The design was informed by prior tutorials on interactive snow displacement (Gabriel Aguiar Prod., 2021), but extended here with additional shader integration to better fit the narrative and technical goals of The Last Spark.

Timeline and Cinemachine Sequencing

The sequencing of all narrative and visual elements in The Last Spark was controlled through Unity's Timeline system, which acted as the central orchestration layer for the film. By layering multiple track types, I was able to synchronize animations, visual effects, audio, and camera changes with frame-level precision. This ensured that each act transitioned smoothly and that emotional beats aligned consistently across different components.

Animation Tracks

Beyond driving the Fire Child's movements (idle, walk, trip, get-up, collapse, see Character Implementation), animation tracks were also used to animate scene properties that contributed to narrative clarity. The emission intensity of the fire shader was keyframed to dim across Act 2

and 3, reflecting the character's vitality fading (See Appendix C, Figure 4.92). Similarly, the ember particle system's emission rate was gradually reduced until it ceased completely by Act 3. Animation tracks also handled parameters for the dissolve shader during Act 3, producing a gradual vanishing effect tied to the final sacrifice (See Appendix C, Figure 4.91).

Activation Tracks

Activation tracks were used to enable or disable secondary systems on cue. I utilized it for the Act 2 snowstorm by toggling its active state rather than adjusting parameters of the base snowfall. This ensured clean transitions into and out of the storm without risking inconsistencies in particle behaviour (See Appendix C, Figure 4.92).

Visual Effect Track

Unity's Visual Effect track was employed to trigger the tree bloom in Act 3, initiated through a VFX Graph event called by Timeline, causing blossoms to emerge immediately after the Fire Child's sacrifice (See Appendix C, Figure 4.93).

Audio Tracks

Ambient wind played softly in Act 1 to establish the cold atmosphere. In Act 2, a separate storm track with higher intensity was layered in, activated alongside the snowstorm particle system to reinforce the blizzard visually and sonically. Footstep sounds were aligned with the Fire Child's walk cycle, timed against the animation frames for consistency. Finally, a short collapse sound was introduced in Act 3 to mark the child's sacrifice, placed at the same moment as the dying animation. This tight coupling of audio to visual events helped avoid desynchronization that might break immersion (See Appendix C, Figure 4.94). All audio assets were sourced from Pixabay (Pixabay, n.d.), ensuring royalty-free use.

Cinemachine Integration

Cinemachine cameras provided flexible framing that was blended and animated through Timeline control. In Act 1, wide angles were mostly used to emphasize the child's isolation. Act 2 shifted toward tighter, low-angle shots to convey instability and struggle in the snowstorm. Finally, Act 3 concluded with a zoom-out, framing both the Fire Child's sacrifice and the revived tree as a single frame. Timeline allowed these transitions to be choreographed without destructive edits, enabling iterative refinement until the intended emotional arc was achieved.

Lighting and Post-Processing

Lighting and post-processing were used as emotional cues across all three acts. Common effects such as vignette, bloom, and white balance adjustments were applied throughout, but their intensity was adapted to mirror the fire child's state. Act 1 emphasized contrast, with cool tones and moderate bloom to highlight the child's warmth against the snow. Act 2 deepened vignette, reduced exposure, and introduced film grain, visually reinforcing struggle and disorientation in the storm. Act 3 shifted towards warmth, raising bloom intensity and easing vignette to frame the rebirth at the tree.

The closing shot used its own post-processing layer to emphasise closure and the sense of renewal. A bright bloom pass combined with warmer white balance created a radiant tone around the tree, while vignette was reduced to almost nothing, expanding the visible frame. This allowed the environment to open outward, visually symbolising renewal spreading beyond the immediate space of the story. Subtle tint adjustments (orange and gold hues) reinforced the transition from struggle to hope, giving the film an emotionally resonant final note.

Evaluation (1496 words)

Peer Feedback and User Survey

A survey (See Appendix D) was conducted with seven participants representing the intended audience of stylized narrative animation. The respondents ranged from peers with moderate familiarity with stylized animation (scores 2 to 4 on a 5-point scale) to one highly familiar participant (score 5). This diversity of experience provided a balanced range of perspectives on both accessibility and clarity.

Emotional Resonance

One of the key aims was to convey themes of loss, struggle, and sacrifice without spoken dialogue. The final user survey suggests this was largely successful: 100% of participants rated the film as emotionally engaging (scores 4 to 5), with written responses highlighting Act 2's snowstorm and Act 3's sacrifice as the most powerful moments. Viewers frequently mentioned "struggle," "sacrifice," and "bloom," aligning with the intended emotional arc. This marks a clear improvement from the earlier prototype survey (See Appendix E), where participants noted that the scene felt static and requested greater camera movement and narrative variation. These critiques directly informed the addition of Cinemachine camera tracks, shader fading animations, and audio cues, which collectively enhanced emotional pacing in the final cut.

However, feedback also identified areas of improvement. Some viewers felt the final dissolve was "too quick" or suggested that the Fire Child could have made a final gesture, such as reaching toward the tree, to heighten emotional closure. Others noted that the snow trail could

have been refined into more detailed footprints. These comments suggest that while the core emotions were communicated effectively, additional animation polish and symbolic gestures could make the storytelling more nuanced in future iterations.

Visual Effectiveness

The visual clarity and symbolic use of VFX were consistently rated high. In the prototype stage previously, user survey confirmed that the Fire Child stood out clearly against the snow and that the environment successfully conveyed bleakness. In the final evaluation, these strengths remained: 100% of respondents agreed the Fire Child was visually clear, 86% rated the cold atmosphere as strongly communicated, and most described the bloom effect as visually impactful. Participants also cited the final zoom-out as a favorite moment, confirming that camera framing and VFX integration worked together to produce closure.

The Fire Child's design was also validated, with 100% of participants rating his glow and embers as effective in communicating vitality. Nevertheless, feedback suggested that more refinement in background detail and trail rendering could enhance visual polish. Some respondents also recommended minor additions such as sound cues for the bloom, which shows how visual and audio layers are intertwined in audience perception. These critiques highlight that the stylized aesthetic was effective in broad strokes, but smaller details could be refined to increase immersion. This confirmed that non-verbal visual concept, rather than dialogue, successfully conveyed the intended narrative arc, aligning with my project's central research question.

Observation and Reaction Logs

In addition to survey responses, I also conducted a live viewing. However, due to scheduling conflicts and limited availability of peers, most participants completed the survey asynchronously rather than attending the live viewing session. This restricted opportunities to gather in-person observational data. Nevertheless, for the two individuals who did watch the film alongside me, I noted their immediate reactions at key narrative beats (See Appendix F for detailed observation notes). These logs provided qualitative insights into moments of heightened engagement or confusion, complementing the survey results. These logs show that engagement was strongest during Act 2's struggle and Act 3's sacrifice, echoing the survey results. While these observations are not statistically representative, the comments about the dissolve being abrupt reinforce survey feedback about pacing, while the positive reactions to the bloom and zoom-out confirm the visual effectiveness of the climax.

Technical Performance

Performance testing was carried out using Unity's Profiler on a laptop with integrated graphics (See Appendix G). The target was to maintain smooth real-time playback at or above 60 FPS across all acts.

In Act 1 (frames 0-869), the profiler recorded CPU frame times averaging around 16 ms (about 60 FPS) and GPU times around 4-5 ms. This indicates stable performance with sufficient headroom for continuous snowfall effects, successfully meeting the project's FPS target during the opening sequence.

In Act 2 (frames 869–1894), where the snowstorm particle system and turbulence effects were introduced, CPU frame times spiked up to 36-44 ms (approximately 20-25 FPS). These spikes show that particle-heavy sequences placed noticeable strain on the CPU, causing performance to dip below the 60 FPS goal. Despite this, playback remained largely coherent, with stuttering present but not disruptive to the viewing experience. The GPU remained consistent at about 5 ms, suggesting that the bottleneck in this act was CPU-bound particle simulation rather than graphical rendering.

In Act 3 (frames 1894-3818), during the bloom effect and final dissolve, CPU times varied between 15 ms and 24 ms (approximately 40-60 FPS), with occasional peaks above 30 ms. While this meant the sequence hovered between meeting and falling short of the target, the overall playback quality remained visually consistent. GPU times again stayed below 5 ms, suggesting that draw call batching and shader optimizations were effective in managing complexity.

These profiler readings align with user survey responses: 71% of viewers reported the film played "very smoothly," with only a small portion noting minor stutters in the storm sequence. No major technical failures (e.g., freezing or crashes) occurred. The main limitation is that profiling was only conducted on a single laptop. Broader benchmarking across multiple devices, including higher-spec desktops and lower-spec systems, would ensure stronger validation of performance stability. Nevertheless, the results demonstrate that the film achieved its minimum requirement of 30 FPS at all times and often approached or reached the target of 60 FPS in less demanding sequences. The performance dips in Act 2 highlight the cost of particle-heavy effects, but they did not compromise narrative clarity, showing that real-time Shader Graph and VFX Graph techniques were computationally sustainable within the project scope.

In the future, optimization could focus on reducing the number of storm particles, lowering turbulence strength, or introducing level-of-detail adjustments. These refinements would help stabilise CPU load and make it easier to maintain 60 FPS consistently across all acts. Beyond meeting the current project's goals, they also point to how the film could scale if it were developed further. For instance, a 4K render or a longer runtime would quickly magnify the CPU strain seen in Act 2, and a VR version would demand even tighter frame-time budgets to remain

comfortable for viewers. Identifying the CPU as the main bottleneck in particle-heavy sequences shows both what worked in this build and where future growth should focus on.

Visual Quality Checks

The final renders were also reviewed for shader inconsistencies, and overall coherence of lighting, shading, and particle effects. Overall, the stylized visual style was successful in achieving clarity and mood. The Fire Child's glow and ember particles communicated vitality effectively, and the bloom of the tree in Act 3 was consistently highlighted by user feedback as a visually striking moment. Snow particles, lighting, and vignette layering also combined well to establish the cold, bleak tone intended for Acts 1 and 2.

However, several limitations were identified during testing. The ember particle system, which used a torus-shaped emitter, appeared to orbit the character rather than emerge directly from its body. While functional as a metaphor for vitality, this limited realism. A mesh-based emitter using the Fire Child's geometry would allow particles to spawn more naturally from the surface, improving coherence with the idea of a living flame.

The snow particle system also showed visual and technical trade-offs. Increasing emission rates did achieve a denser blizzard effect, but at the cost of noticeable frame time spikes and slower load times. This confirmed earlier suspicions that particle-heavy emitters could become performance bottlenecks. While acceptable within this project's scope, future refinements could involve level-of-detail particle culling, GPU-driven snow systems, or blending Unity's built-in snow particles with VFX Graph optimizations to reduce CPU strain.

The interactive snow trails provided a basic way to tie environment and character together, but the depressions lacked the fine detail of footprints. This reduced realism and at times made the trails appear more like smudges than steps. With more development time, this could be refined by sculpting higher-resolution displacement maps or incorporating normal map blending to simulate compacted snow.

Finally, the dissolve shader and the Fire Child's base character mesh were effective but remain areas for improvement. The dissolve effect communicated sacrifice clearly, but several viewers noted it ended too quickly. A slower progression with additional polish, such as ember flickers or fragmenting textures, would create greater emotional weight. Similarly, while the prefab character mesh was serviceable for testing shaders and animations, it lacked the silhouette of a flame. A custom mesh or Blender-sculpted design could better align the character's physical form with the symbolic concept of a fading ember.

Overall, these checks highlight that while the visual quality achieved the project's core aims of visual clarity and emotional resonance, further refinements in particle realism, shader polish, and asset design could elevate the film's stylization toward a more immersive, professional finish.

Conclusion (443 words)

In conclusion, The Last Spark set out to explore how stylized real-time visual effects could serve as a visual language for non-verbal storytelling. By leveraging Unity's URP, Shader Graph, VFX Graph, and particle systems, the project aimed to communicate themes of loss, struggle, sacrifice, and renewal without relying on dialogue. Instead, it used evolving shaders, camera work, and symbolic environmental effects to create an emotional arc that audiences could understand visually.

The completed short film demonstrates that these aims were largely achieved. The Fire Child's emissive shader and ember particles successfully communicated vitality and its decline, while the snow environment provided a stark contrast that amplified the sense of fragility. The Act 2 snowstorm and Act 3 bloom sequence were consistently highlighted by viewers as the most powerful moments, confirming that the layering of shaders, particles, and Cinemachine-driven cinematography could produce a cohesive emotional journey. Technical evaluation also showed that the film maintained stable real-time playback, with only minor performance dips during particle-heavy sequences, validating that procedural VFX can be computationally sustainable even on modest hardware.

At the same time, the project revealed clear areas for improvement. Audience feedback suggested that the final dissolve sequence could have lingered longer to provide greater emotional closure, and that environmental details such as snow trails and background polish could enhance immersion. From a technical perspective, the reliance on a prefab character mesh limited the metaphorical strength of the Fire Child's design, and the ember particle system would benefit from a surface-based emitter to increase realism. These limitations do not diminish the success of the project but instead highlight directions for refinement in future iterations.

In the future, several extensions could broaden the scope and impact of the film. Optimizing particle systems with GPU-based solutions or level-of-detail culling could make the experience more scalable, especially if rendered in higher resolutions or adapted for VR, where performance budgets are stricter. The Fire Child could also be re-imagined with a custom mesh or Blender-sculpted design to align its physical form more closely with the metaphor of a living flame. Finally, more nuanced animation cues, such as subtle gestures or additional symbolic effects could deepen the storytelling without undermining the non-verbal approach.

More broadly, The Last Spark contributes to ongoing discussions about the role of real-time engines in cinematic storytelling. It demonstrates that real-time procedural effects can act as more than aesthetic embellishments: they can be integral to narrative expression, communicating emotion and metaphor in ways that transcend language. In this sense, the project not only met its original aims but also points toward the growing potential of real-time animation as a medium for emotionally resonant, visually symbolic short films.

Appendices

Appendix A

Figure 2.1 Storyboard of The Last Spark

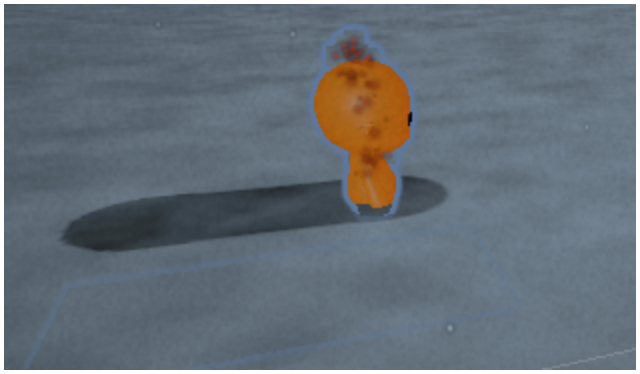


Figure 2.2

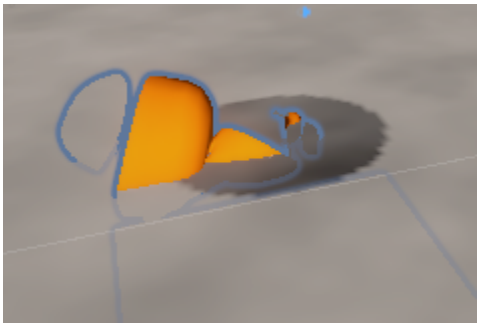


Figure 2.3

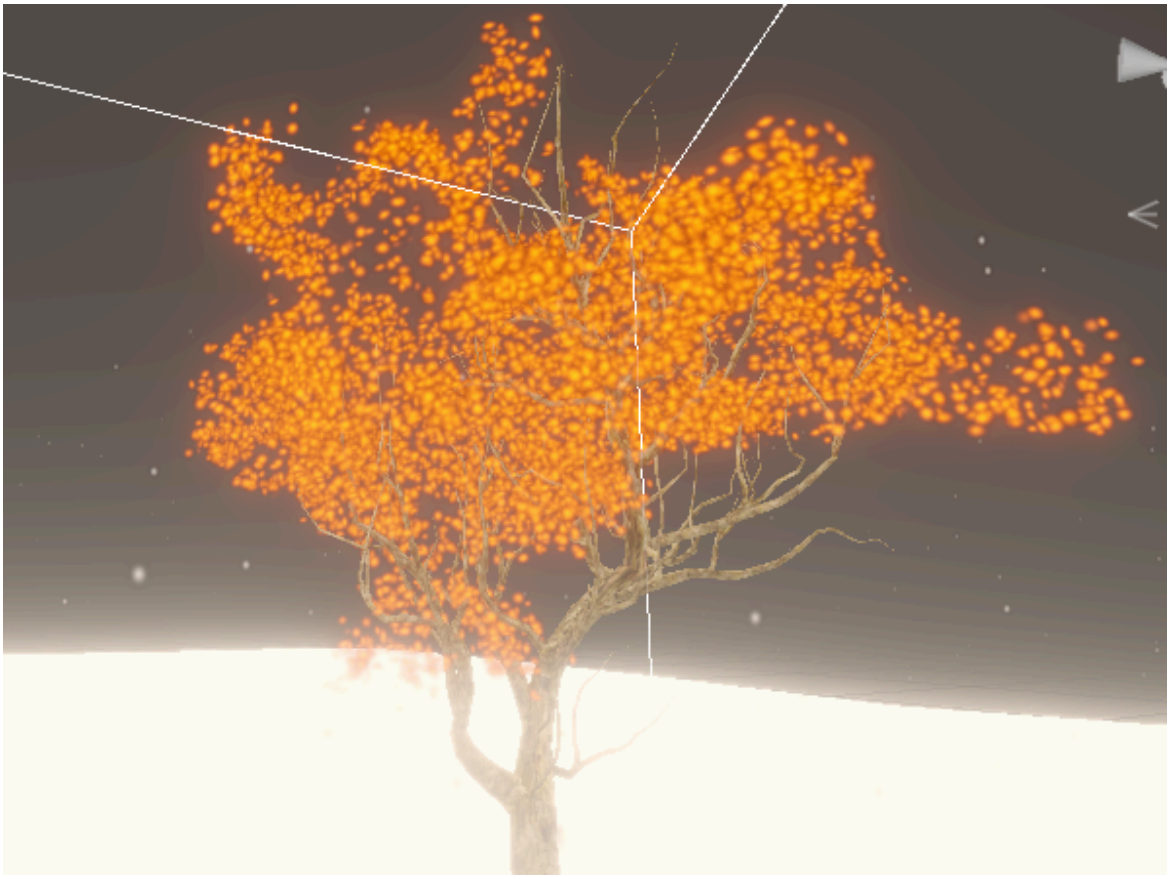
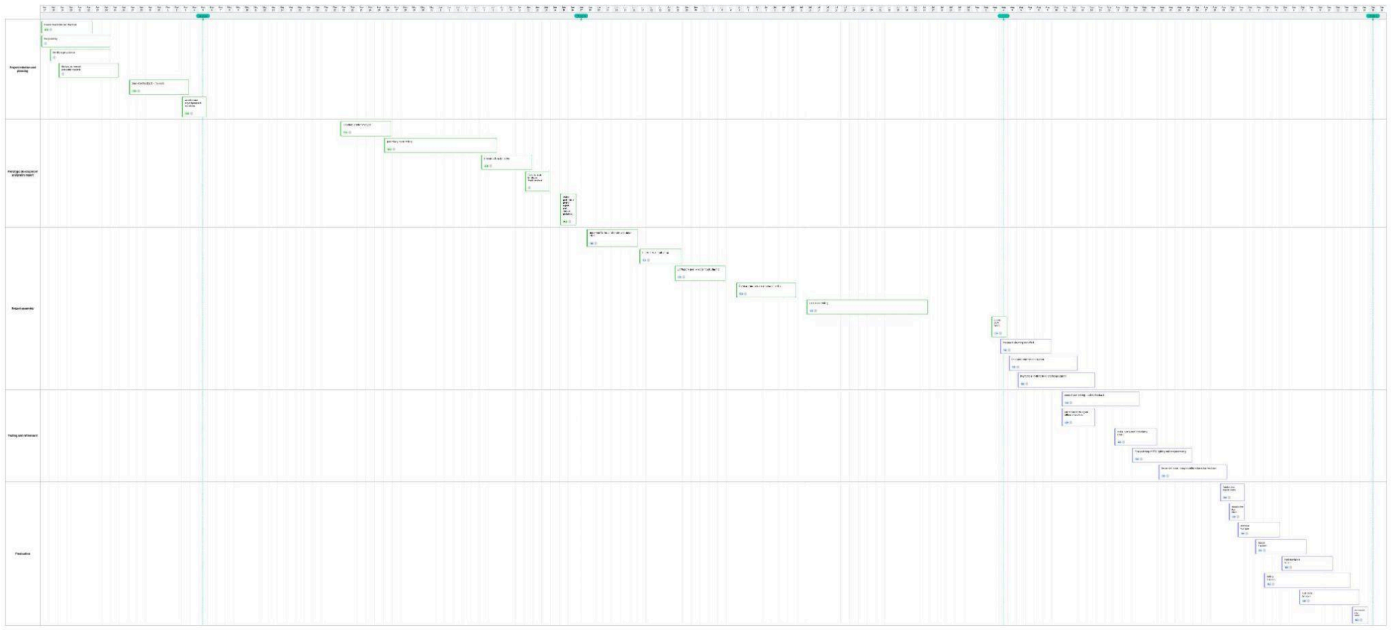


Figure 2.4

Appendix B



[Gantt Chart link]

Appendix C

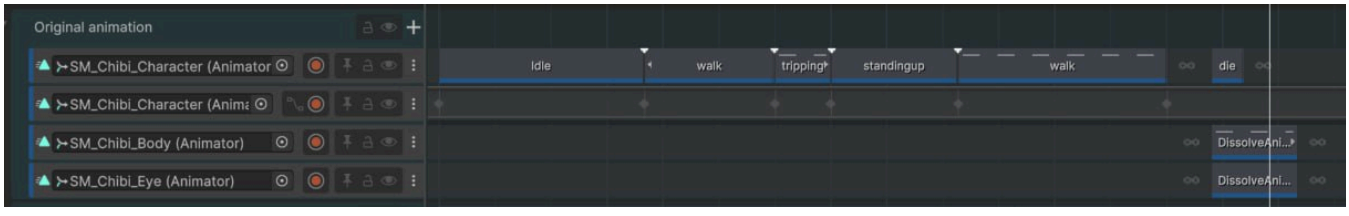


Figure 4.1

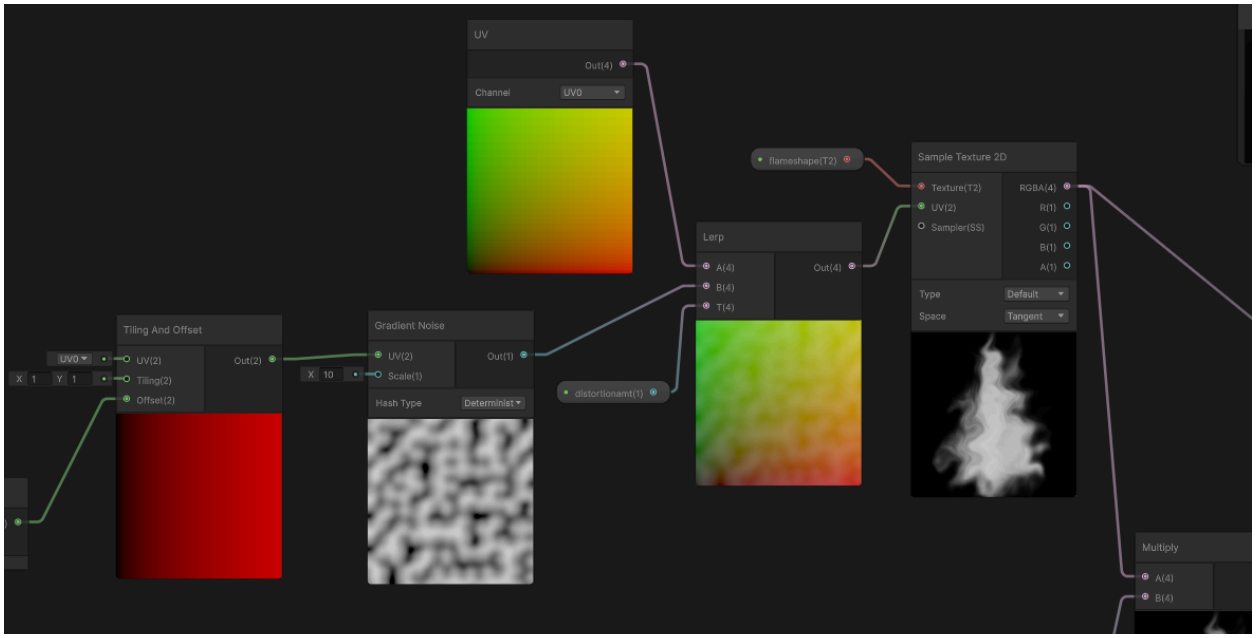
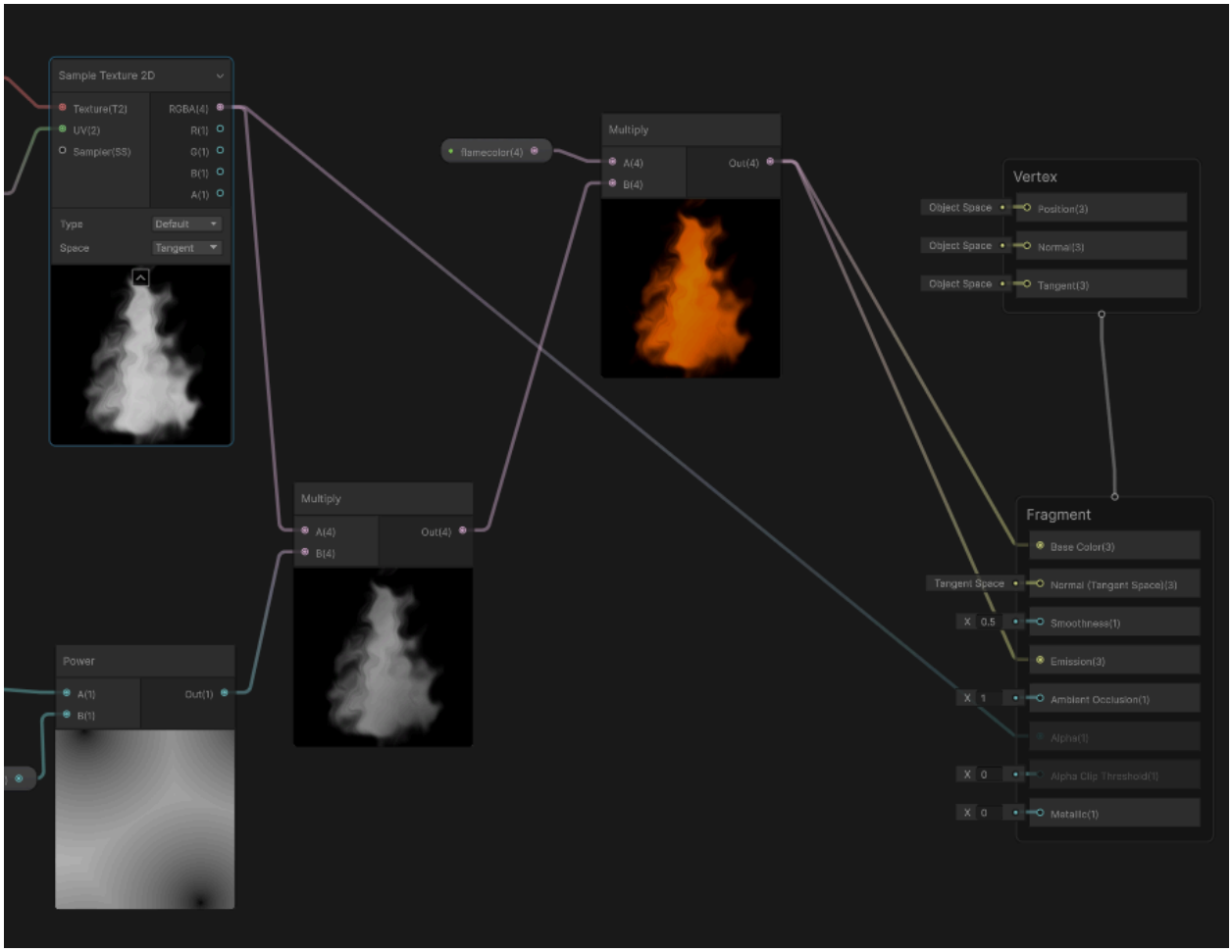


Figure 4.21



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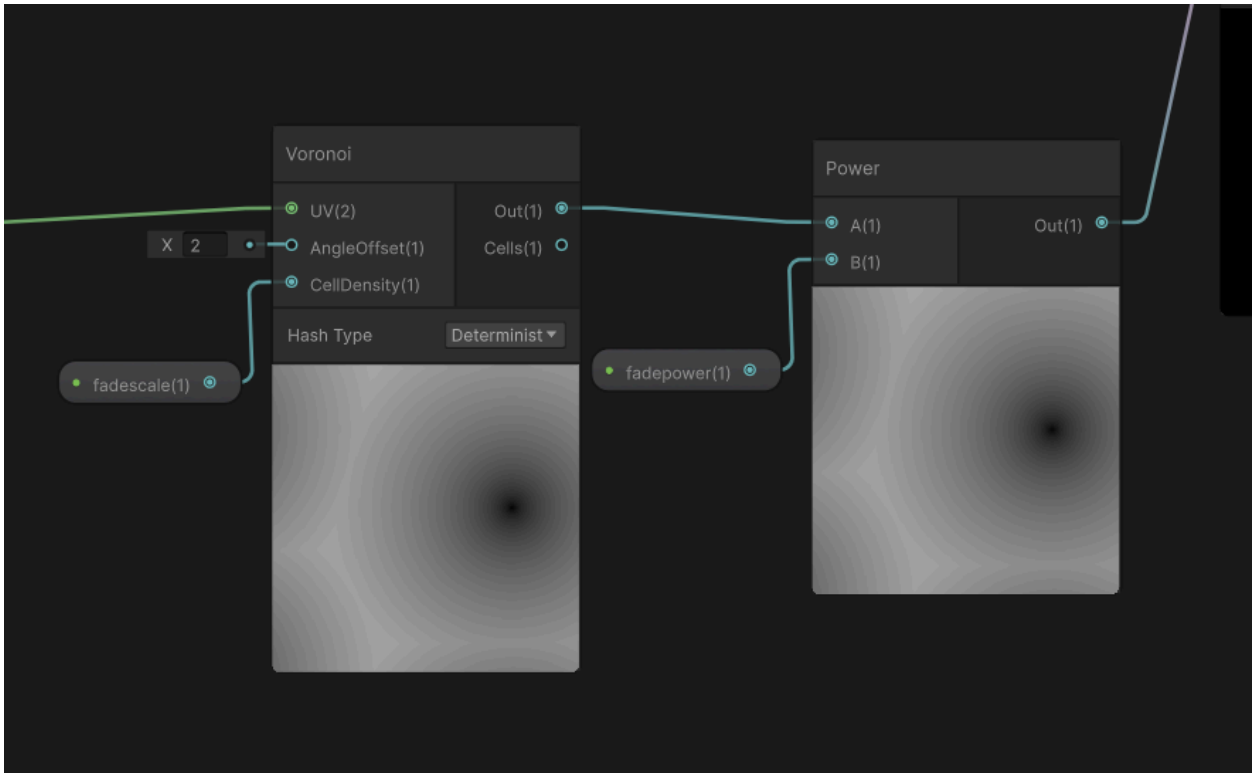

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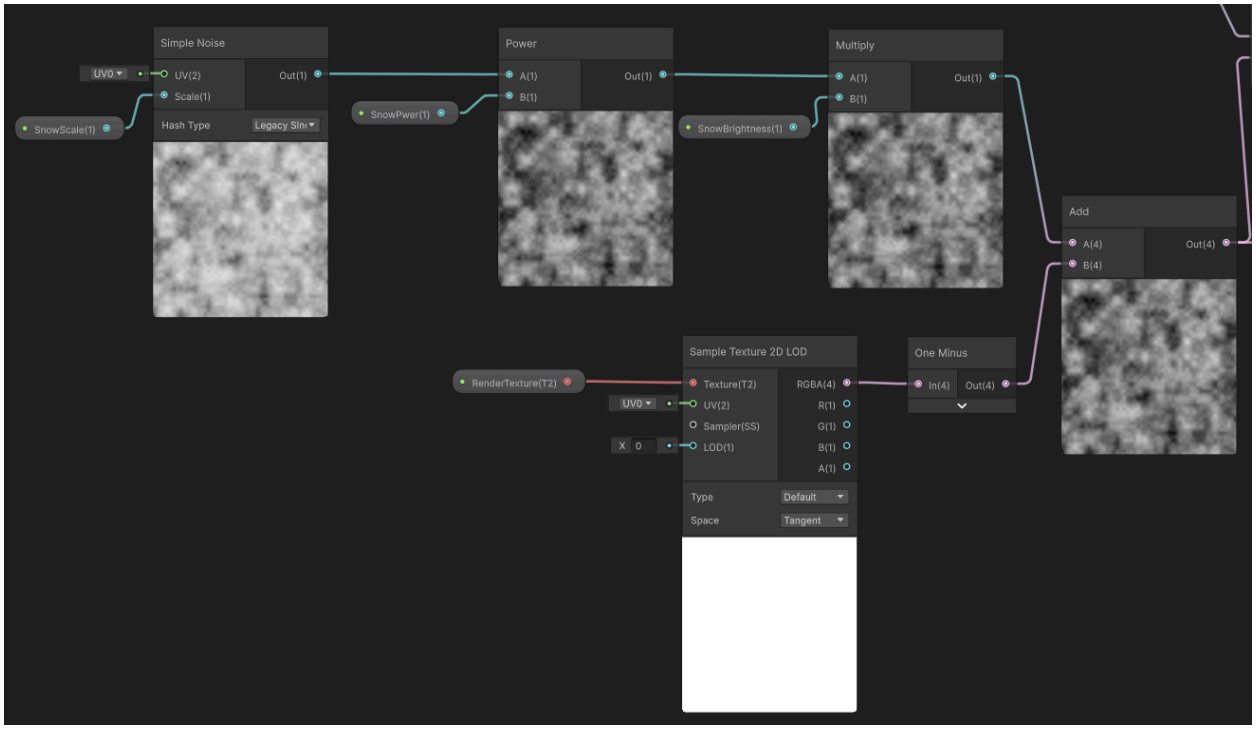
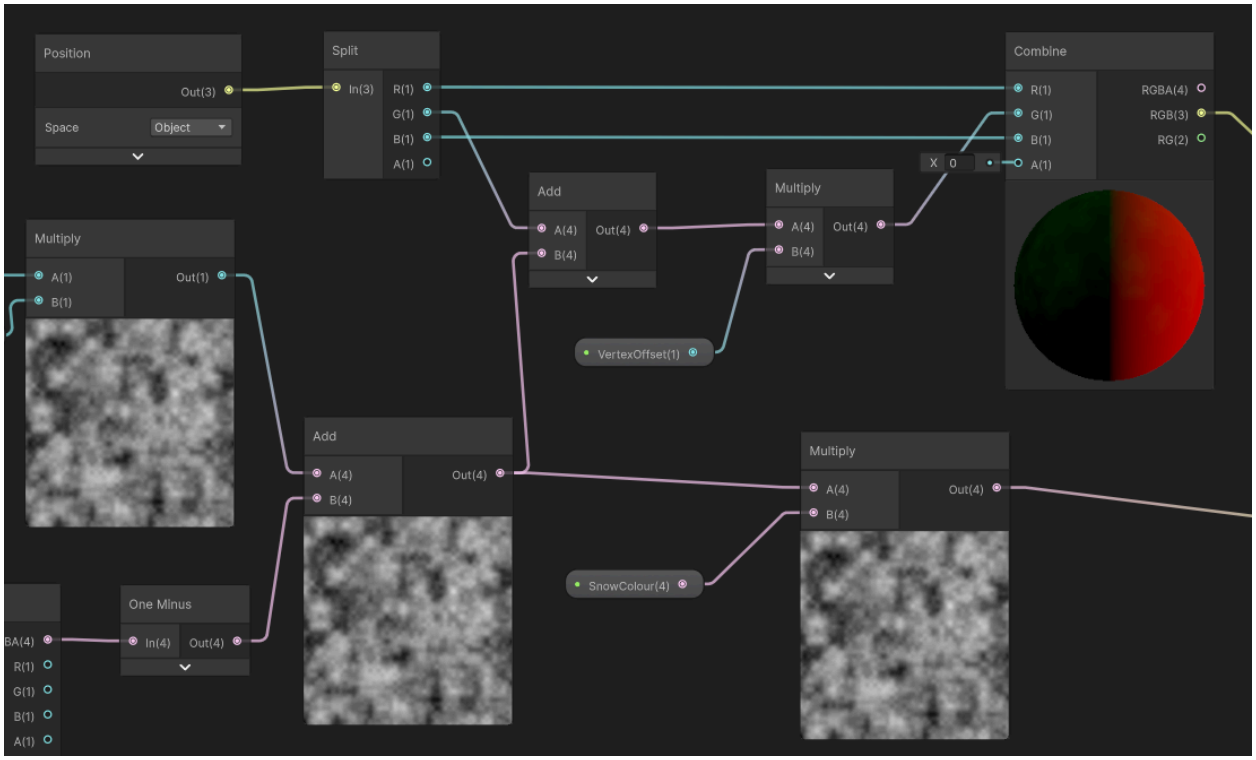


Figure 4.31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VertexOffset(1)
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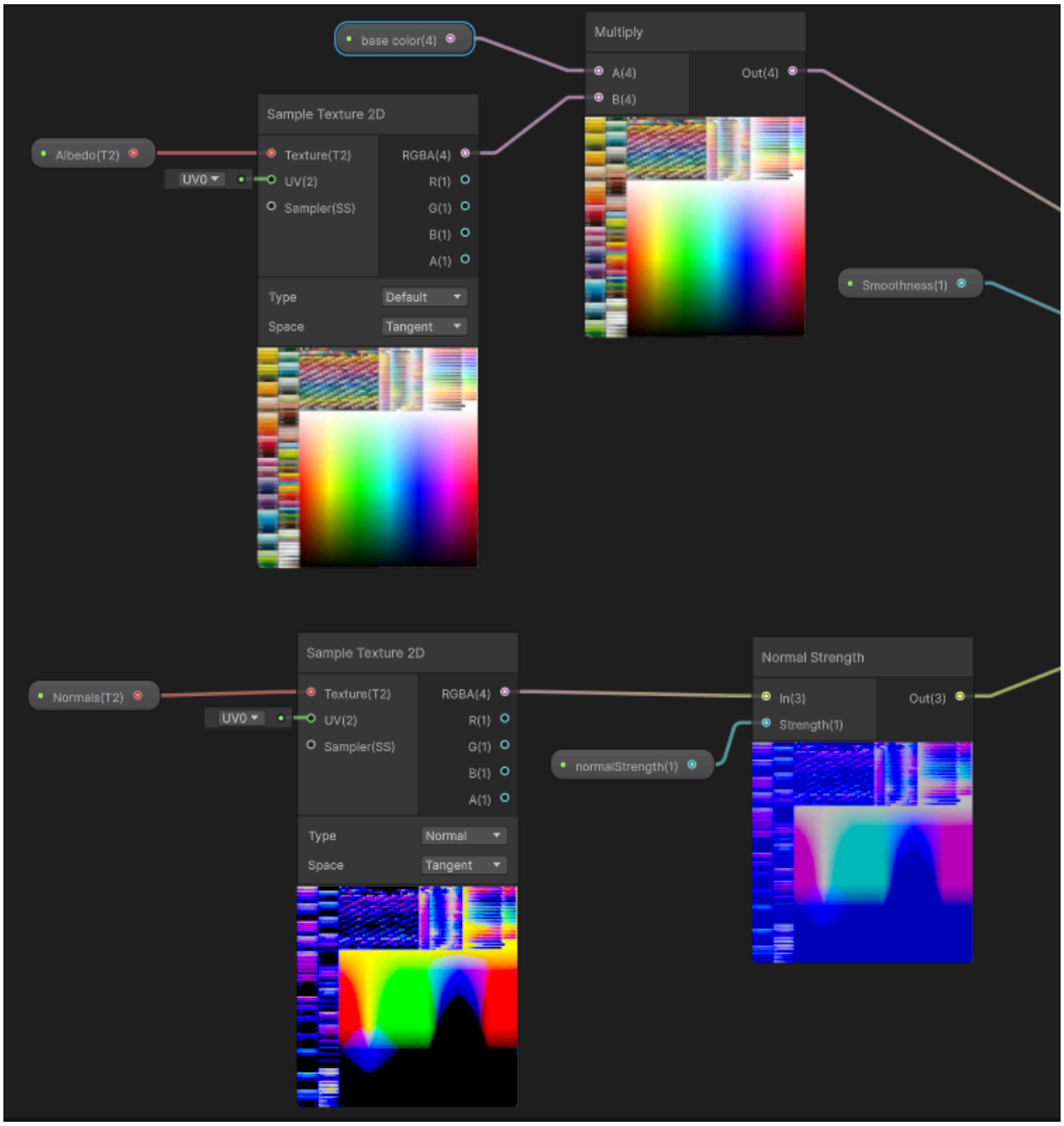
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G(1)
B(1)
A(1)
Type
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Space
Tangent
Smoothness(1)
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UV0
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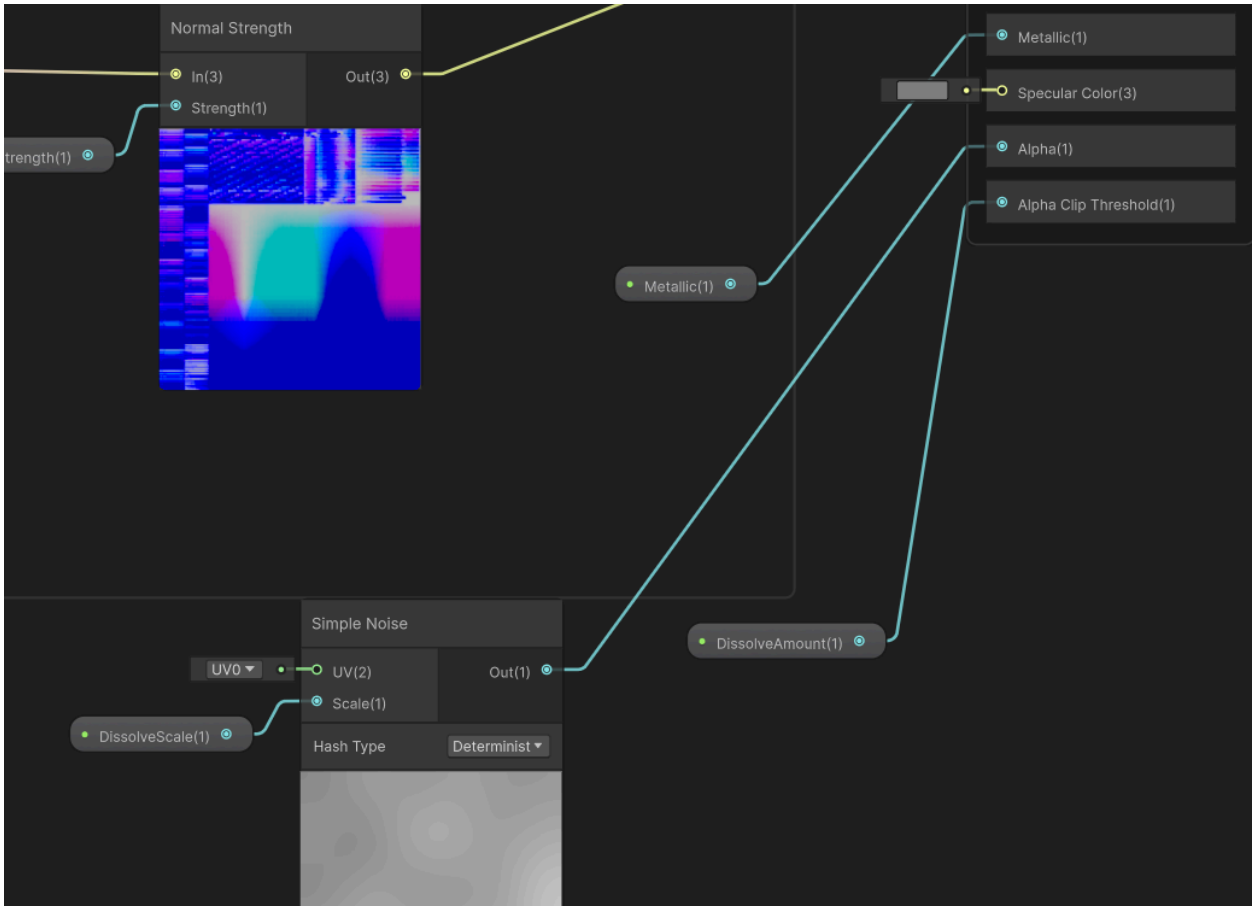

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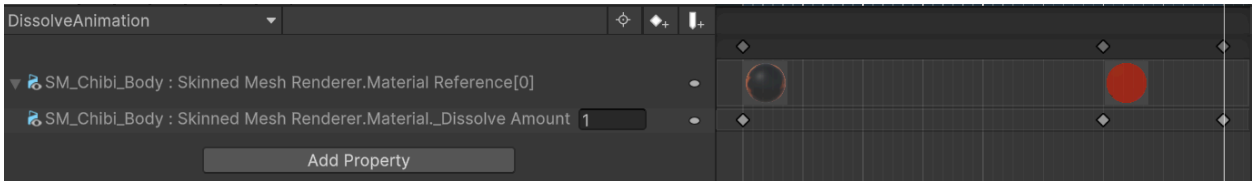


Figure 4.43

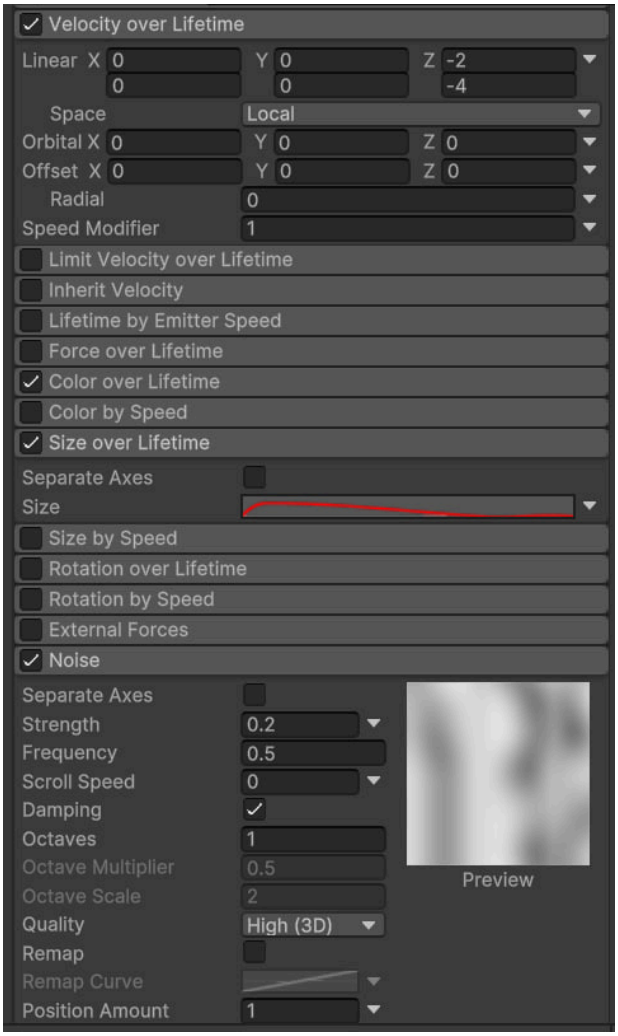


Figure 4.5

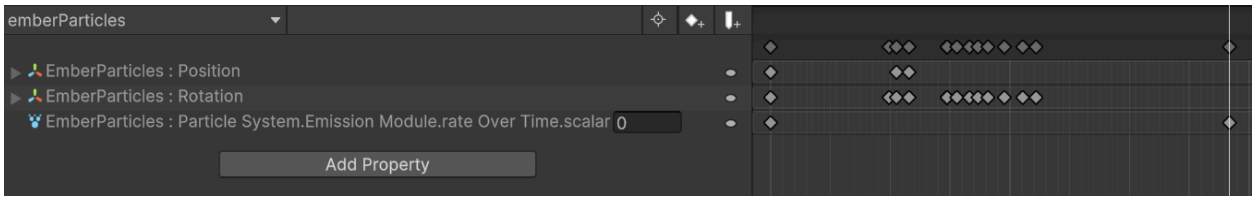
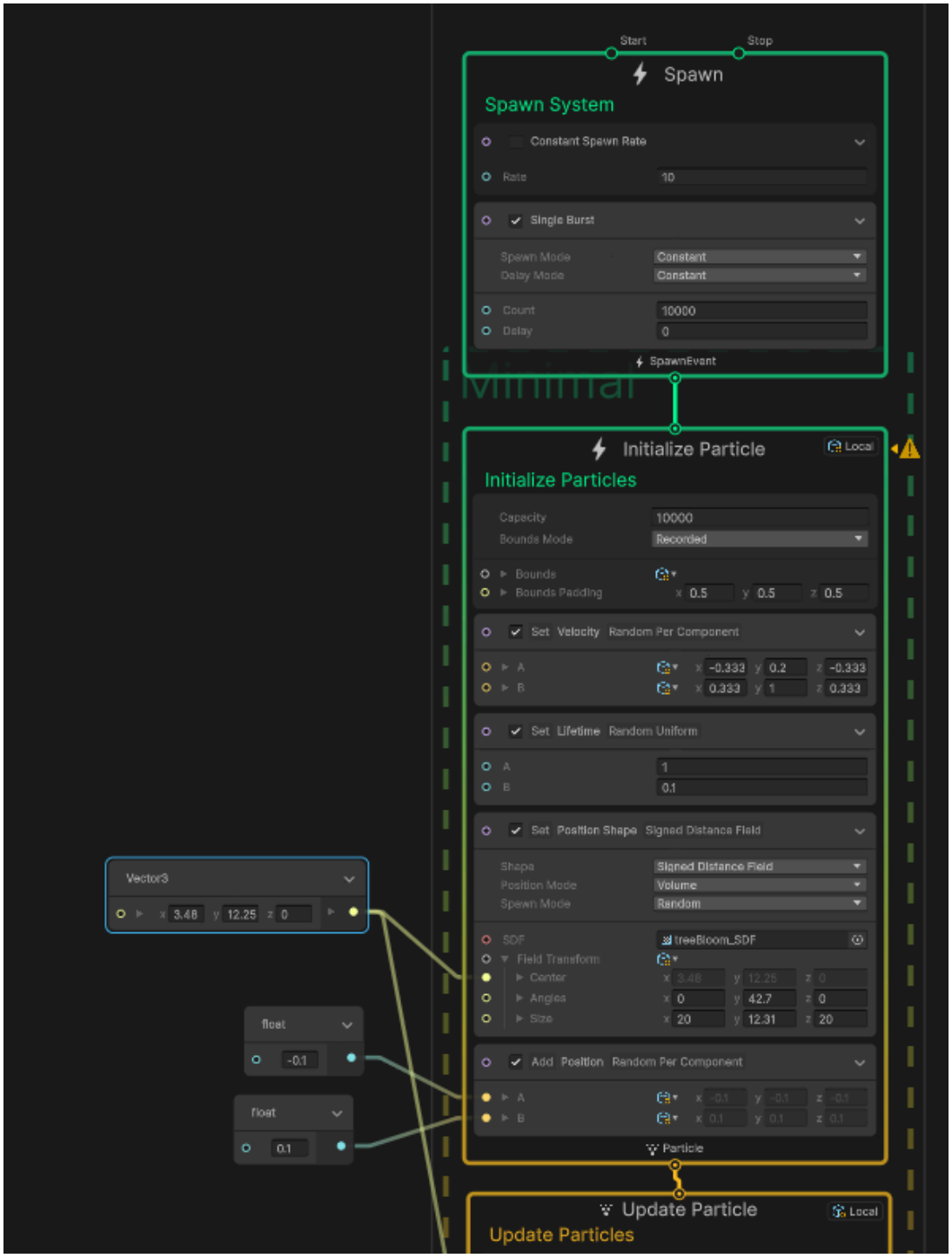


Figure 4.6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Spawn Mode
Constant
Delay Mode
Constant
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Delay
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Initialize Particle
Local
Initialize Particles
Capacity
10000
Bounds Mode
Recorded
Bounds
Bounds Padding
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B
x 0.333 y 1 z 0.333
Set Lifetime Random Uniform
A
1
B
0.1
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Shape
Signed Distance Field
Position Mode
Volume
Spawn Mode
Random
SDF
treeBloom_SDF
Field Transform
Center
Angles
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Size
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Add Position Random Per Component
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Figure 4.71

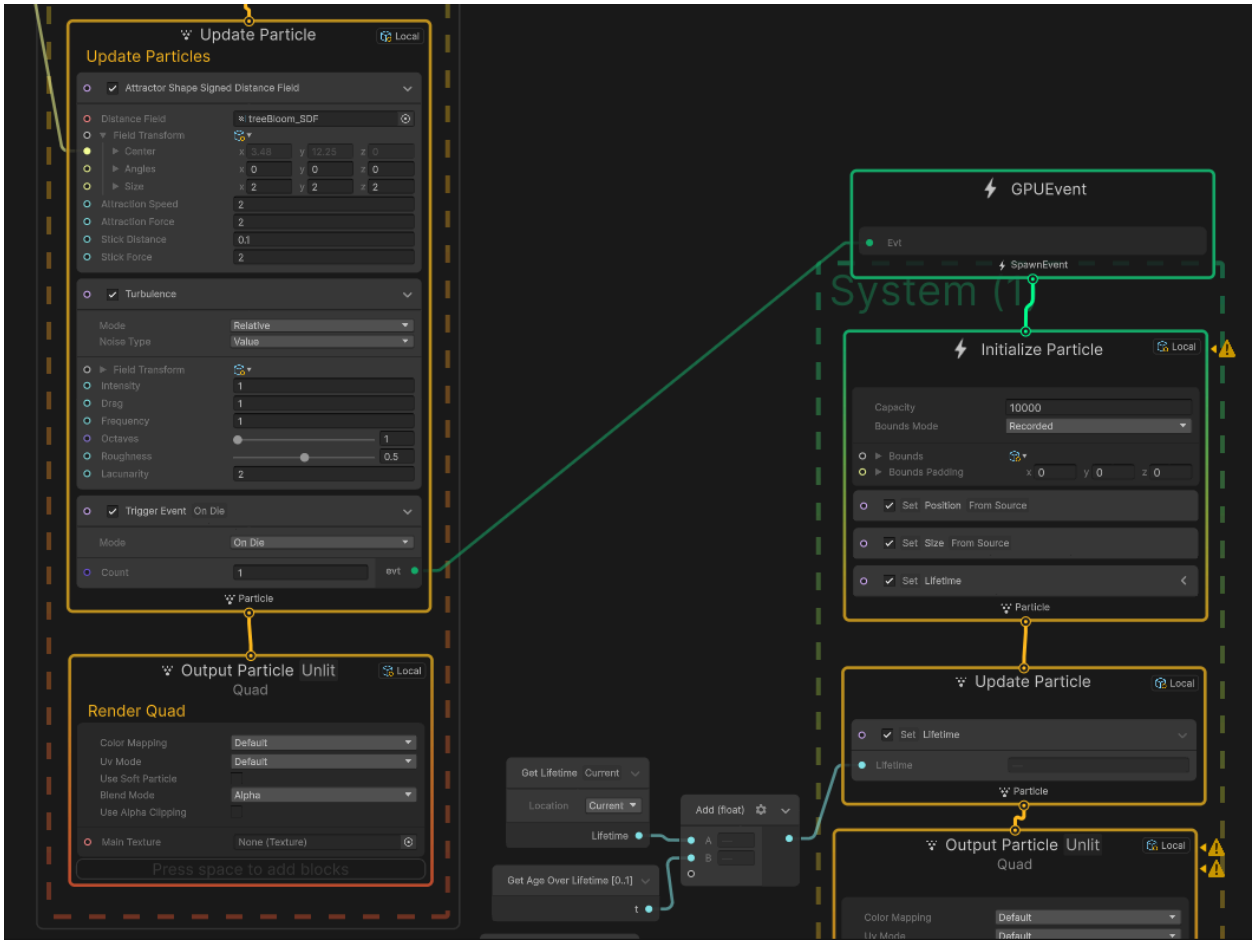
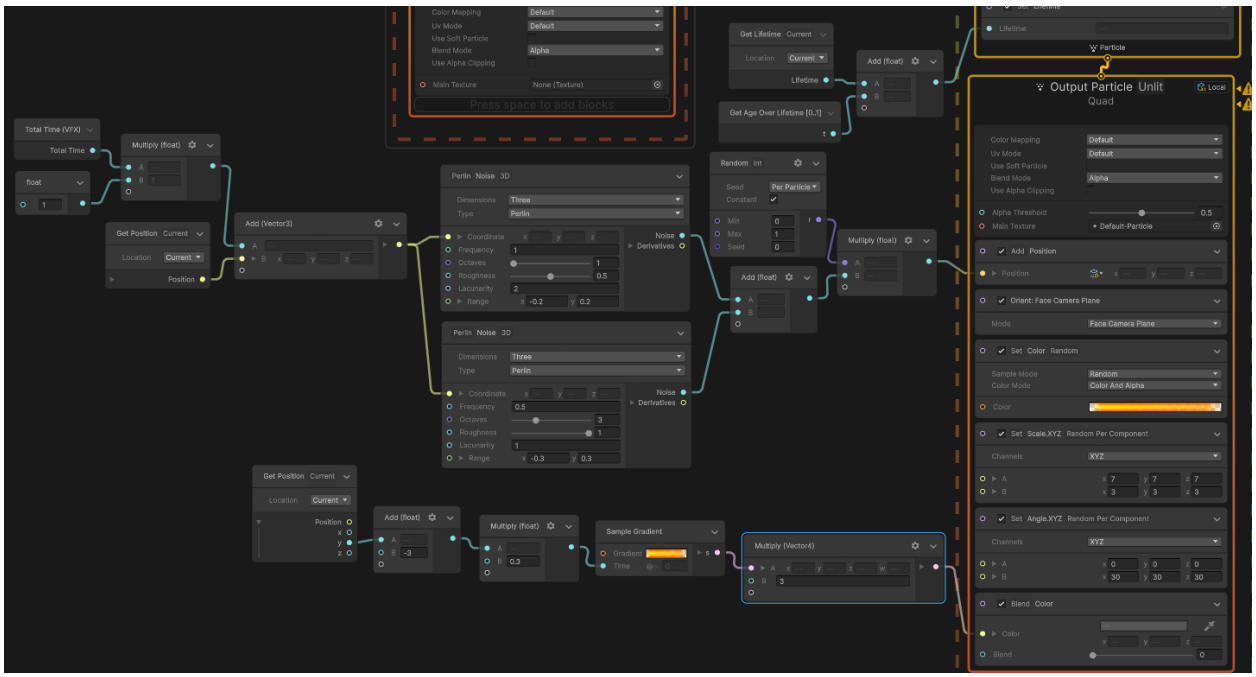


Figure 4.72



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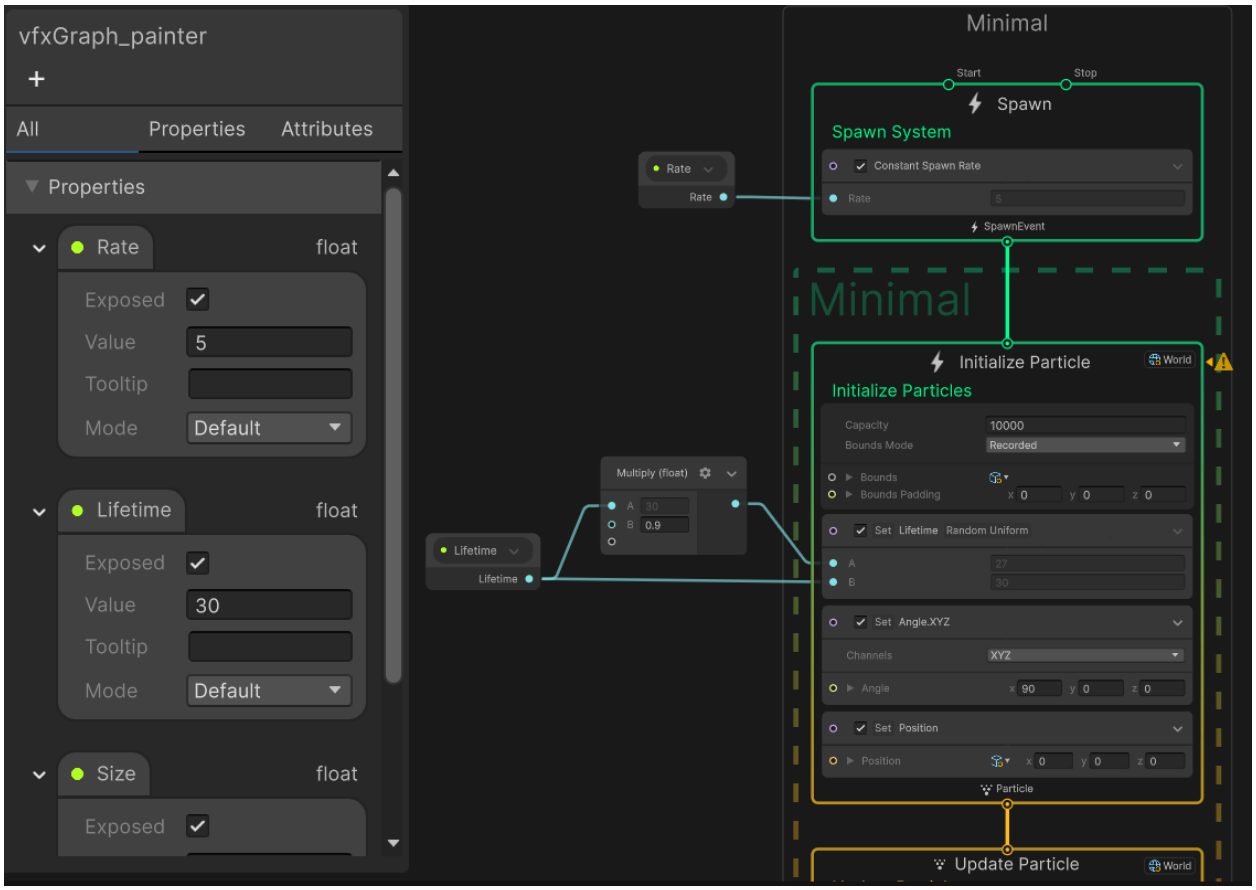
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Tooltip
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Tooltip
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Size
float
Exposed
Minimal
Start
Stop
Spawn
Spawn System
Constant Spawn Rate
Rate
SpawnEvent
Minimal
Initialize Particle
World
Initialize Particles
Capacity
10000
Bounds Mode
Recorded
Bounds
Bounds Padding
Set Lifetime Random Uniform
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XYZ
Angle
Set Position
Position
Particle
Update Particle
World
Multiply (float)
Lifetime

Figure 4.81

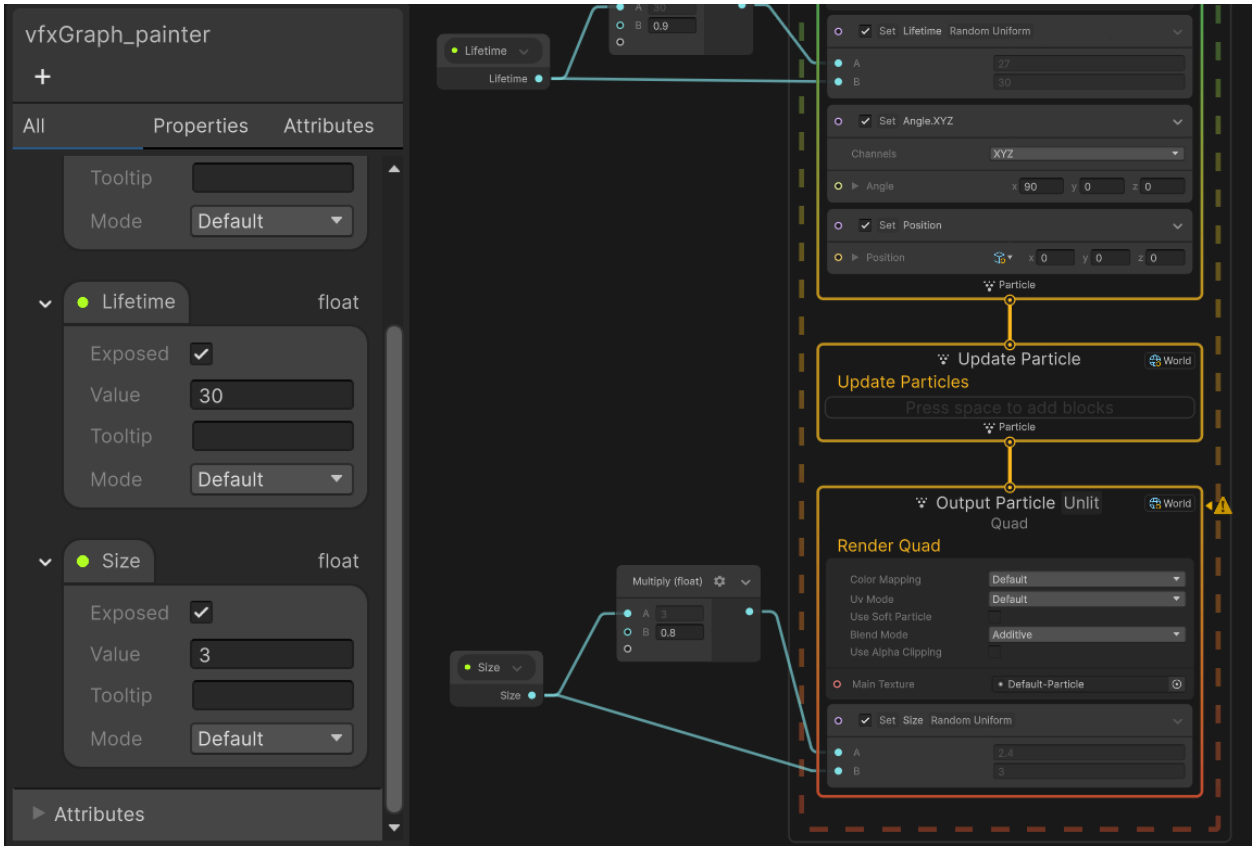


Figure 4.82

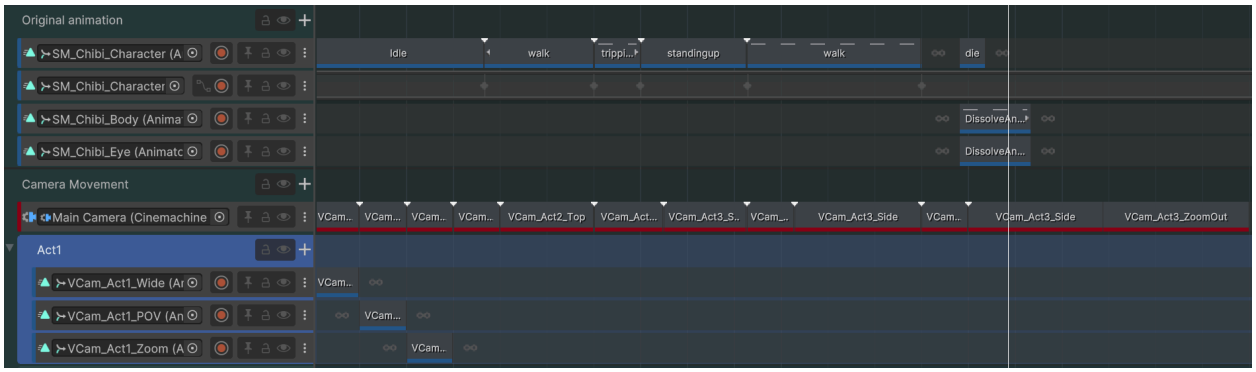


Figure 4.91

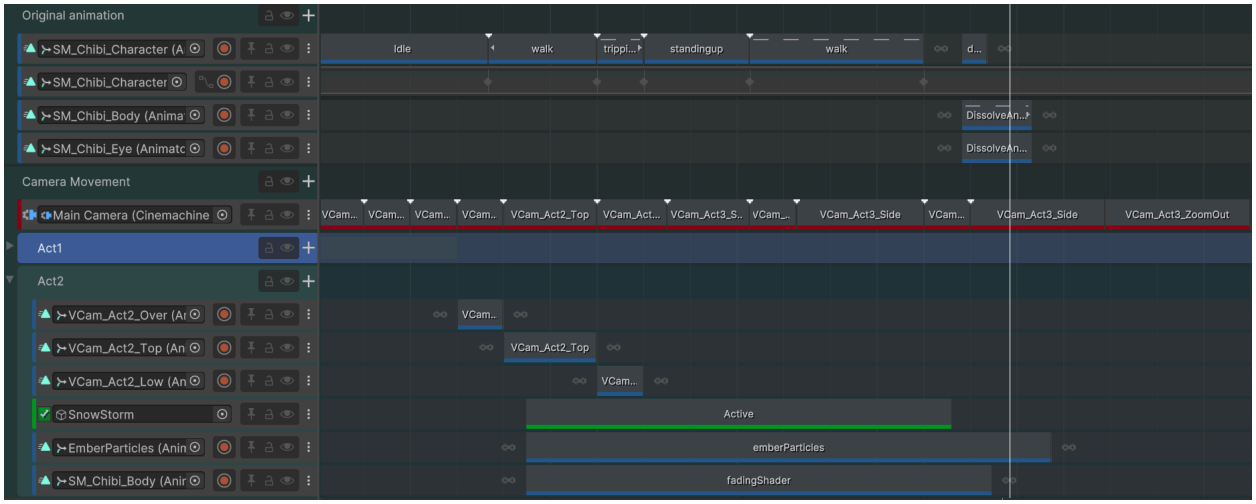


Figure 4.92

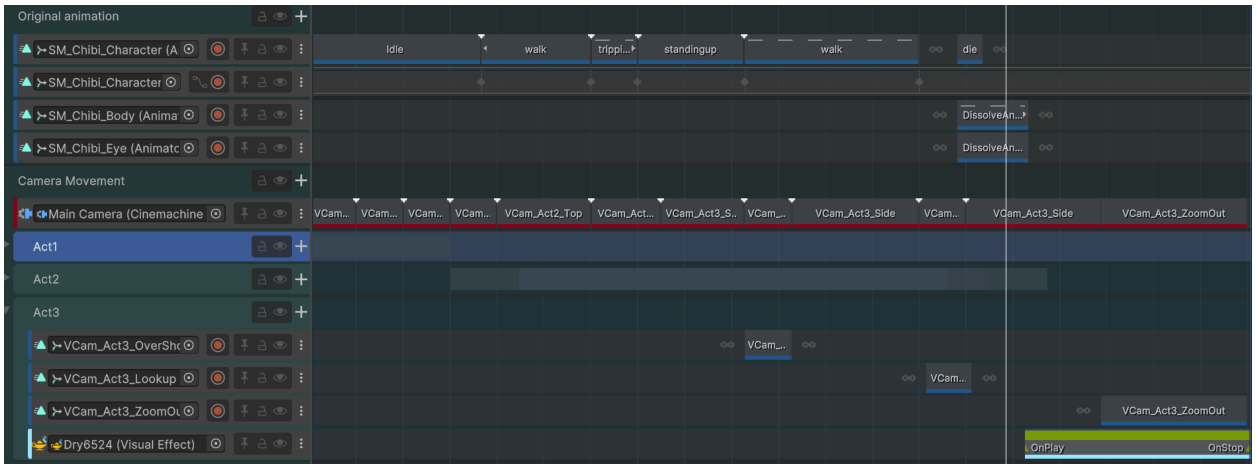


Figure 4.93

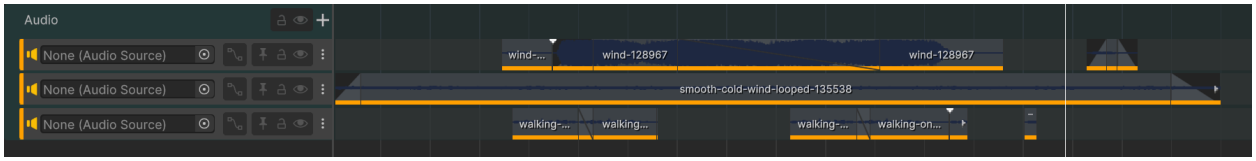
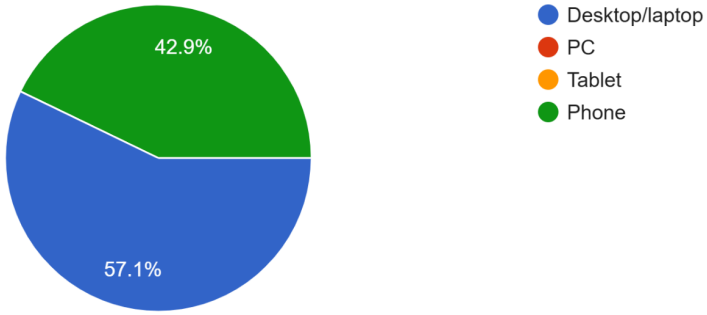


Figure 4.94

Appendix D

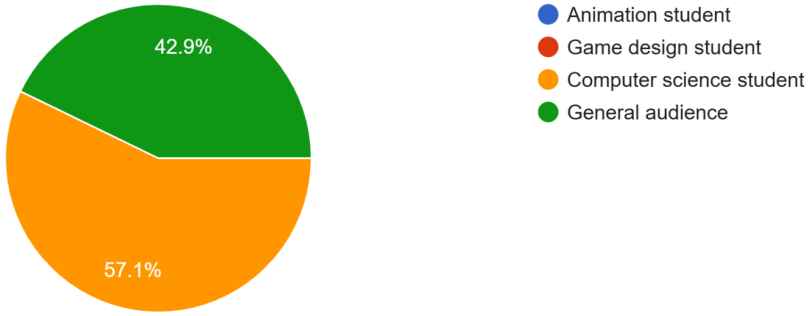
What is the device you are using to watch this?

7 responses



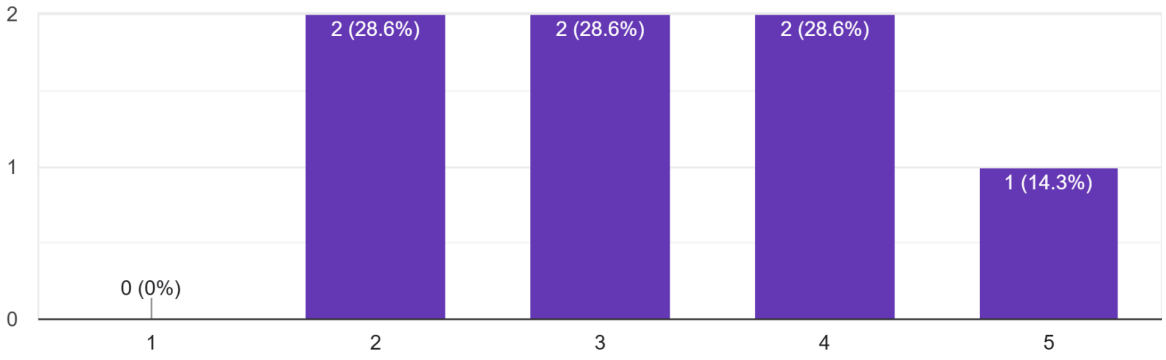
What is your background?

7 responses



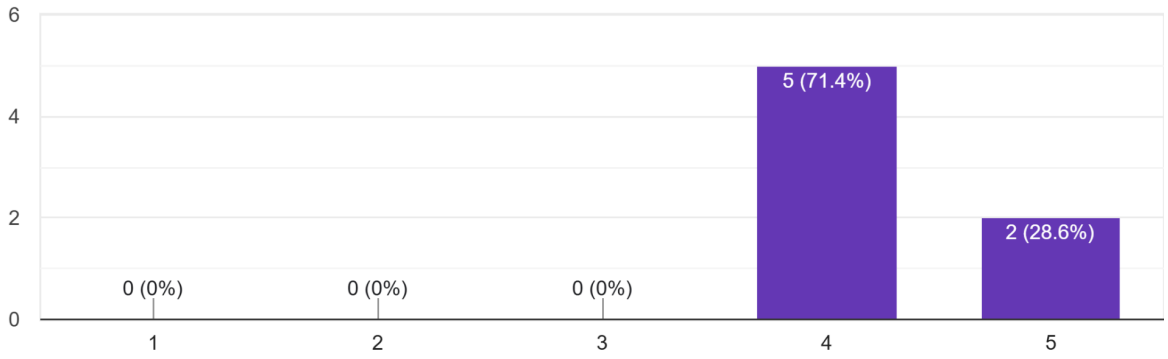
Are you familiar with stylized animation?

7 responses



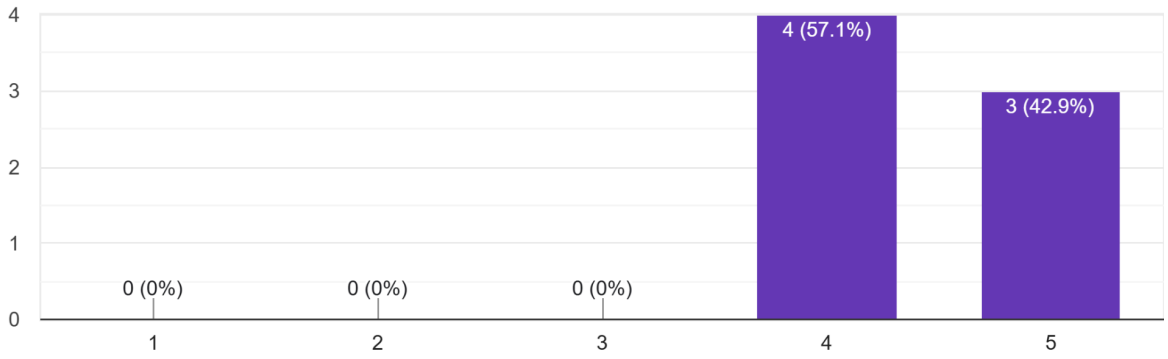
On a scale of 1–5, how emotionally engaging did you find the film?

7 responses



Did you feel the Fire Child's journey conveyed themes of loss, struggle, and sacrifice effectively?

7 responses



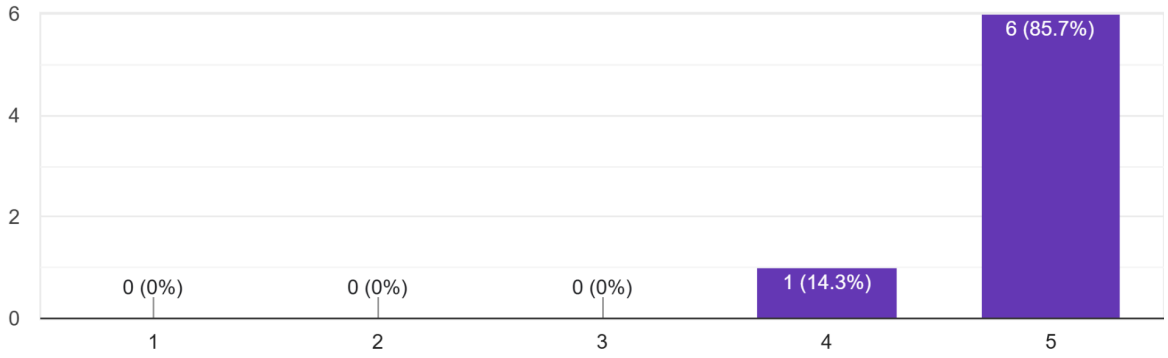
Describe a moment in the film that made you feel most emotionally connected.

7 responses

- The snowstorm in Act 2, when he was struggling to keep walking
- the struggle and then not giving up
- the fire child's struggle
- When the child collapsed in front of the tree the glow fading out made me feel the sense of final sacrifice.
- the fire child dying and giving life to the tree
- Seeing the blossoms bloom after he died
- I love it when the character fell and got up and in the end made the tree bloom

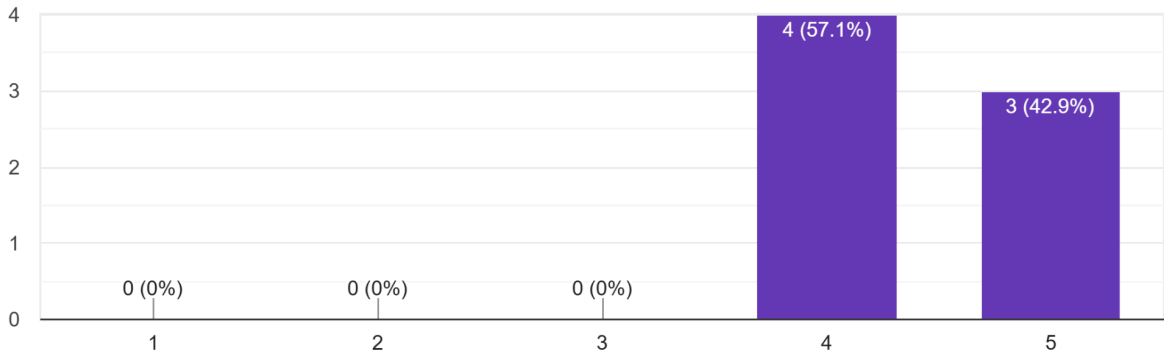
How clearly does the environment (snow particles, lighting) communicate a cold, bleak mood?

7 responses



How effectively does the Fire Child's visual design (glow, embers) communicate vitality or "life"?

7 responses



Were there any moments where the visuals were confusing or distracting?

3 responses

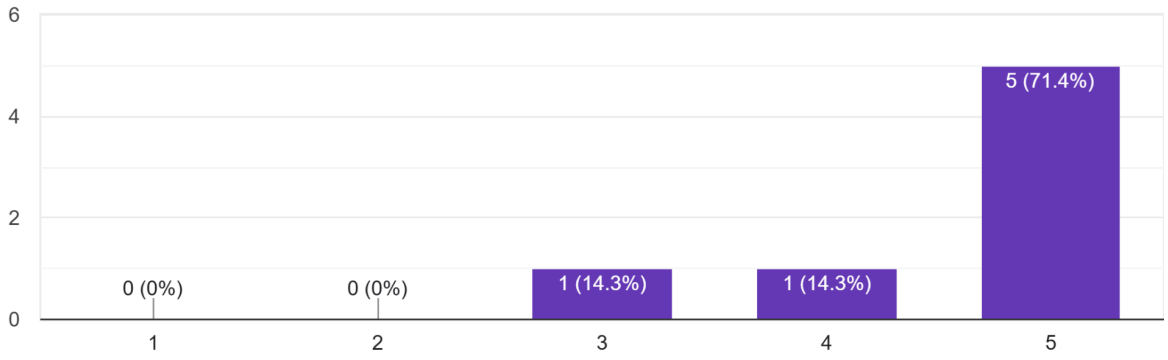
nil

At first the trail in the snow looked a bit weird, but afterwards its ok

no

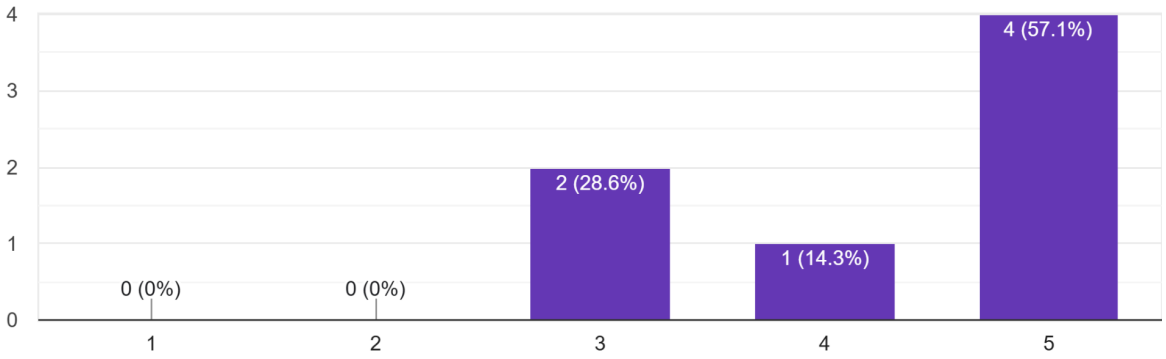
The film played smoothly without noticeable stuttering or lag.

7 responses



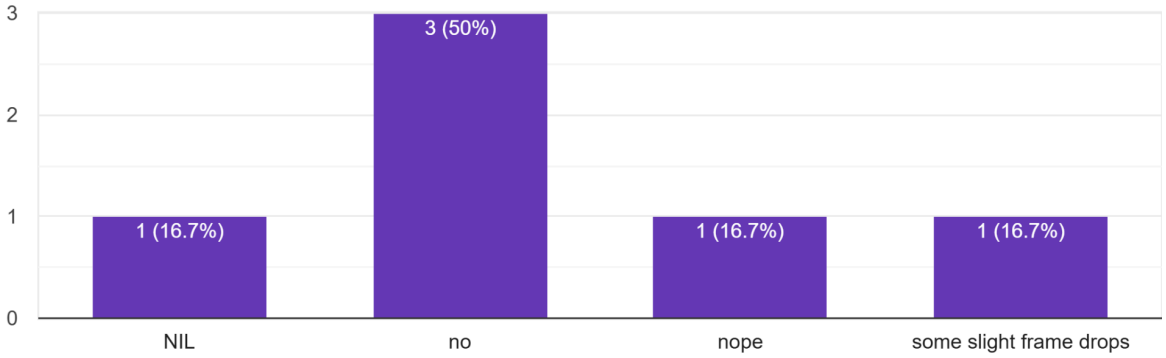
On your device, the visual quality (lighting, particles, shaders) was consistent and polished.

7 responses



Did you notice any technical issues (e.g., frame drops, glitches)?

6 responses



What was your favorite part of the film (visual or narrative)?

7 responses

when he was struggling to keep walking it made me really sympathize with the character

narrative wise i think it made the point

the camera movement

The final shot where the camera zooms out and shows the tree glowing

the emotions

I liked the flowers blooming on the tree looks pretty

When the child fell but still didnt give up

What would you suggest to improve the film's visuals or storytelling in future iterations?

7 responses

The dissolve was too quick at the end and perhaps can add an action like reaching out a hand to the tree

visually can have more improvements/refinements like the smaller details

improve on the background

Maybe can make the snow trail better maybe footprints next time

nil

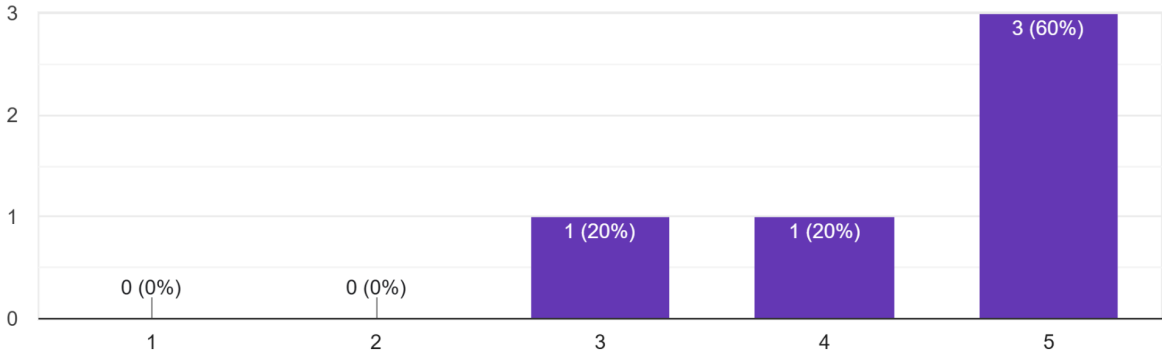
Perhaps include a short sound cue when the blossoms appear

Probably some refinements to the coordinates of the character, looks like he is floating at some point

Appendix E

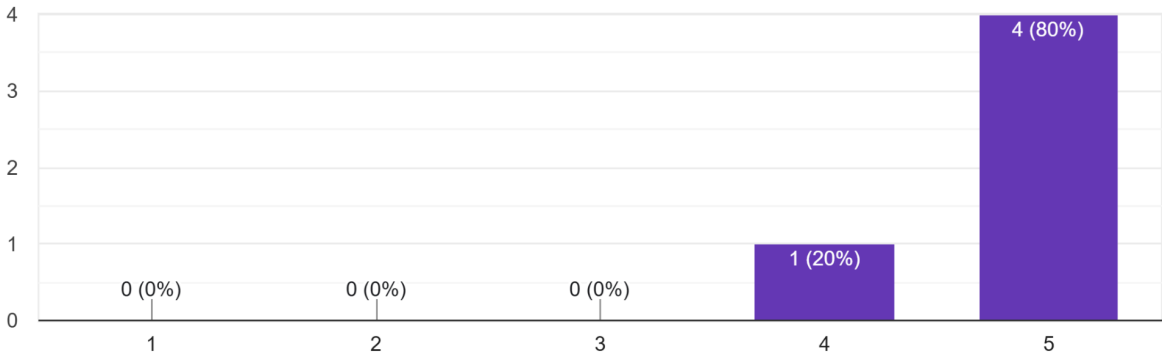
1. How effectively does the Fire Child's visual design (glow, embers) communicate vitality or "life"?

5 responses



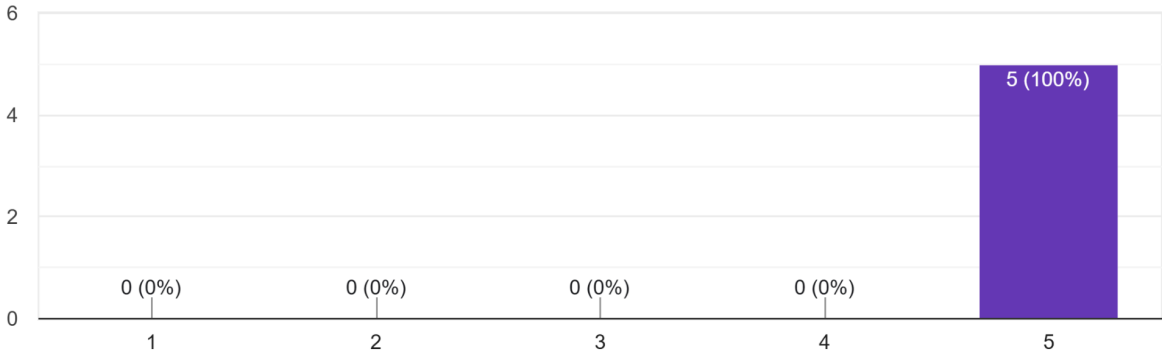
2. How clearly does the environment (snow particles, lighting) communicate a cold, bleak mood?

5 responses



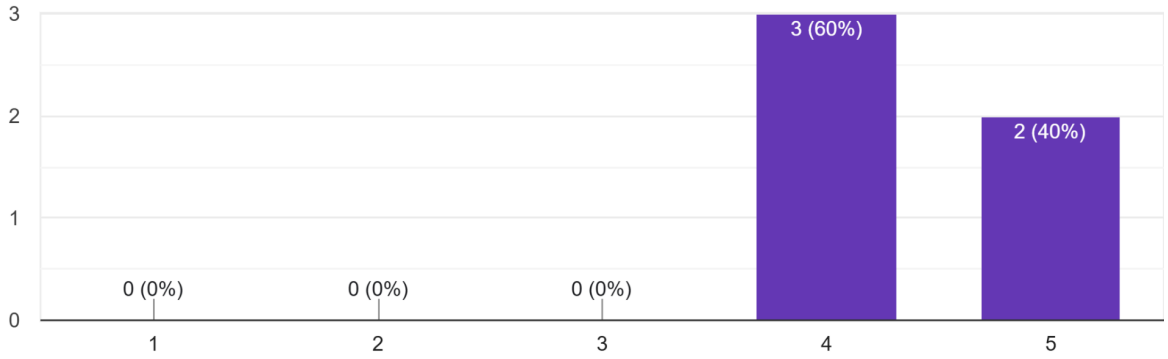
3. How visually clear is the Fire Child when placed in the snowy environment?

5 responses



4. How emotionally engaging did you find the prototype scene?

5 responses



What changes or additions would make the prototype scene more visually or emotionally impactful?

5 responses

Maybe can show some emotion on the face of the fire child?
can add some camera movement or zooming in to create more emotional focus on the fire child
need more camera shots
increase snow density
-

Appendix F

<u>Observation Log: Participant 1 (General Audience)</u>

Act 1 (Opening Walk): Participant remained quiet, posture relaxed, occasionally glancing between the Fire Child and the snow environment. No visible confusion, suggesting clarity of scene composition.

Act 2 (Snowstorm Struggle): Participant leaned forward, eyes fixed on the Fire Child character. Verbally remarked, “he looks like he’s struggling,” indicating empathy and emotional engagement. Body language suggested tension, with arms crossed more tightly.

Act 3 (Collapse and Dissolve): Participant nodded slowly during the collapse animation. When the character faded, she whispered, “oh nice” indicating surprise and recognition of the sacrifice.

Final Bloom and Zoom-Out: Participant smiled briefly when blossoms appeared, then leaned back, looking satisfied. After the film ended, they commented that the ending “felt a bit sudden but powerful.”

Observation Log: Participant 2 (Computer Science student)
Act 1 (Opening Walk): Participant remained silent with no confusion, looking like he is interested in how the video will turn out.

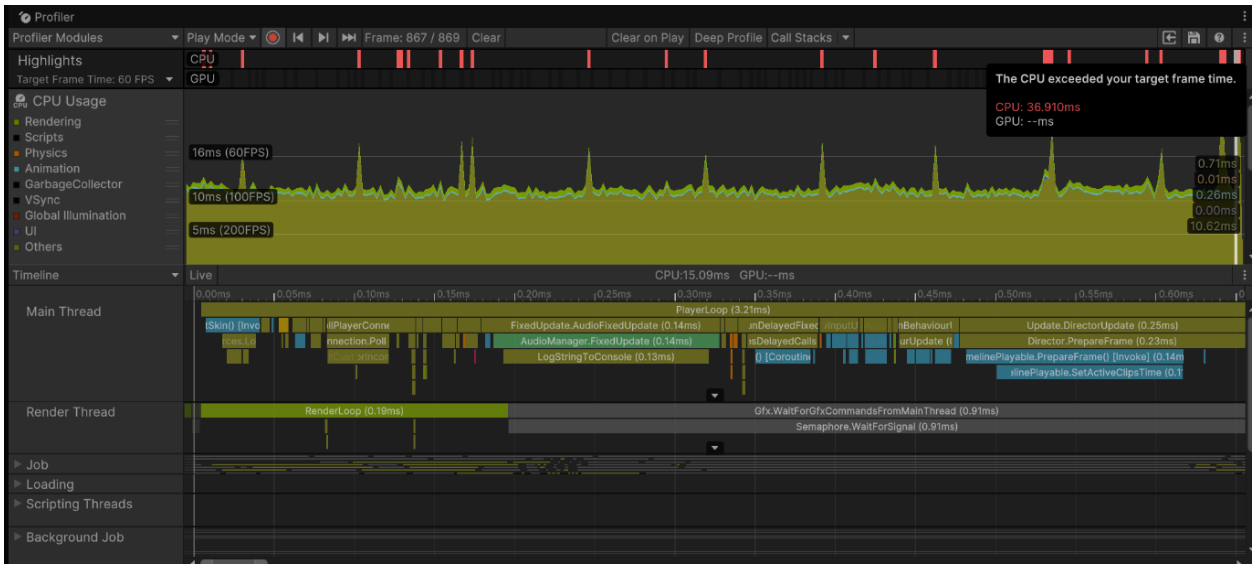
Act 2 (Snowstorm Struggle): Participant gave a small laugh during the tripping animation, commenting “that was unexpected,”. Participant frowned slightly and tilted his head, following the Fire Child’s slowed movement closely. His focus remained on the character’s flickering glow, suggesting attention to the weakening vitality.

Act 3 (Collapse and Dissolve): Participant exhaled when the Fire Child collapsed, and his shoulders relaxed as the glow dimmed. He later remarked that the fade-out “happened quickly” but agreed it communicated finality.

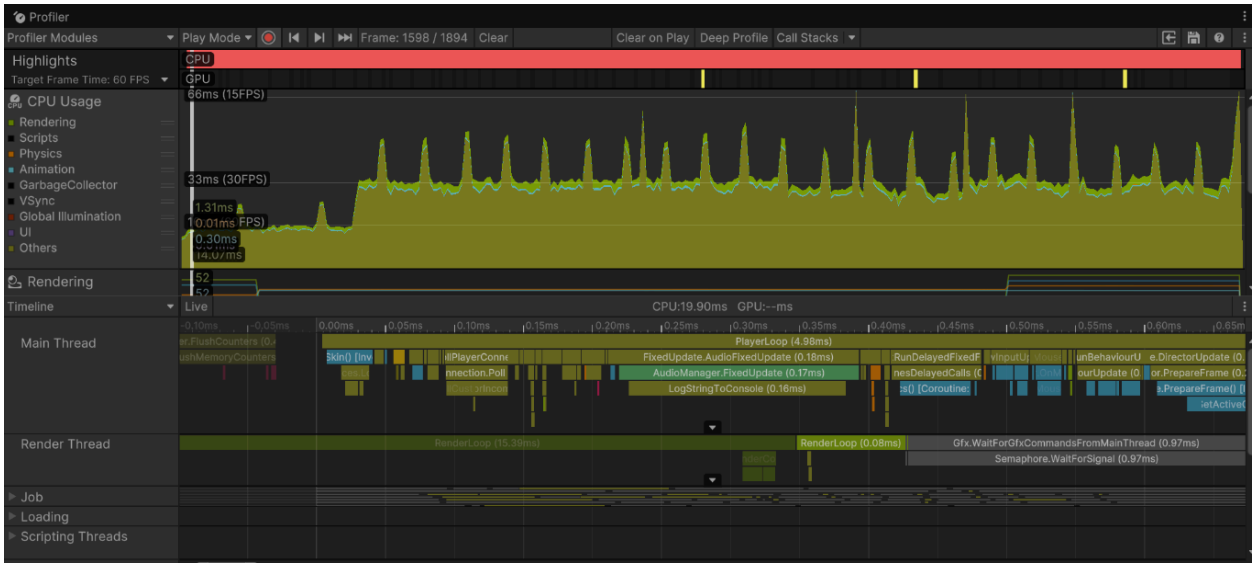
Final Bloom and Zoom-Out: Participant sat upright, nodding slightly as the blossoms spread. His only comment after the viewing was “the flowers looked really pretty, it worked.”

Appendix G

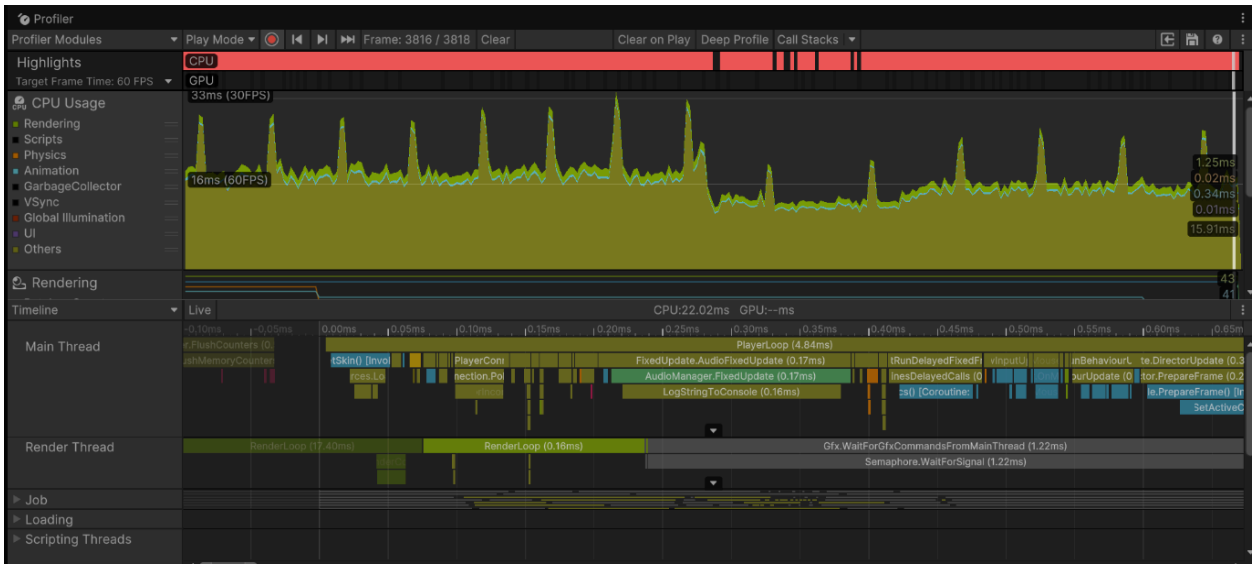
Act 1



Act 2


Profiler
Profiler Modules
Play Mode
Frame: 1598 / 1894
Clear
Clear on Play
Deep Profile
Call Stacks
Highlights
Target Frame Time: 60 FPS
CPU
GPU
CPU Usage
Rendering
Scripts
Physics
Animation
GarbageCollector
VSync
Global Illumination
UI
Others
66ms (15FPS)
33ms (30FPS)
1.31ms
0.30ms
Rendering
Timeline
Live
CPU:19.90ms GPU:--ms
Main Thread
PlayerLoop (4.98ms)
FixedUpdate.AudioFixedUpdate (0.18ms)
AudioManager.FixedUpdate (0.17ms)
LogStringToConsole (0.16ms)
Render Thread
RenderLoop (0.08ms)
Gfx.WaitForGfxCommandsFromMainThread (0.97ms)
Semaphore.WaitForSignal (0.97ms)
Job
Loading
Scripting Threads

Act 3


Profiler
Profiler Modules
Play Mode
Frame: 3816 / 3818
Clear
Clear on Play
Deep Profile
Call Stacks
Highlights
Target Frame Time: 60 FPS
CPU
GPU
CPU Usage
Rendering
Scripts
Physics
Animation
GarbageCollector
VSync
Global Illumination
UI
Others
33ms (30FPS)
16ms (60FPS)
1.25ms
0.02ms
0.34ms
0.01ms
15.91ms
Rendering
Timeline
Live
CPU:22.02ms GPU:--ms
Main Thread
PlayerLoop (4.84ms)
FixedUpdate.AudioFixedUpdate (0.17ms)
AudioManager.FixedUpdate (0.17ms)
LogStringToConsole (0.16ms)
Render Thread
RenderLoop (0.16ms)
Gfx.WaitForGfxCommandsFromMainThread (1.22ms)
Semaphore.WaitForSignal (1.22ms)
Job
Loading
Scripting Threads

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