

Using Blender 3D Node-Based Compositor to Replicate Video Home System Visual Analog

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Abstract. Due to its unique analog visual quality and ability to evoke nostalgia, the visual esthetics of the Video Home System (VHS) are once again widely used in various digital works. The aim of this research is to assess how well the Node-Based Compositor in Blender 3D replicates VHS visual features in an integrated compositing approach. This study employs a Practice-Based Research methodology through seven experimental phases that investigate node configurations to produce VHS visual features, which were then verified by thirty participants. According to the study's findings, every respondent (100%) stated that the experimental results accurately depicted VHS-style analog graphics, with 53.3% providing full validation and 46.7% providing conditional validation. These results indicate that the Node-Based Compositor in Blender 3D can be used to replicate analog graphics in a VHS manner while providing more effective and integrated compositing techniques. This study offers a different approach to digital animation creation and advances research on the application of Node-Based Compositor in analog visual reproduction.

Keywords. Node-based compositor, Visual, Analog, Compositing, Blender 3D, VHS

INTRODUCTION

The visual esthetics of the Video Home System (VHS) have experienced renewed popularity in recent years and are increasingly applied across various creative media, including games, films, and animation. This resurgence is driven not only by the retro appeal of analog media but also by its distinctive visual characteristics, which create atmospheric and emotional experiences that differ from those of conventional digital imagery. Features such as noise, scanlines, color bleeding, and signal distortion contribute to a recognizable analog aesthetic that audiences readily associate with VHS, even without direct experience of the original technology. This continuing interest demonstrates that VHS-inspired visuals retain artistic and narrative relevance in contemporary digital content production. Consequently, there is a growing need for techniques that can efficiently reproduce VHS-style visual characteristics while remaining fully integrated into modern digital production workflows, particularly in animation.

Currently, there are two main approaches typically used for VHS-style visual reproduction in 3D animation, either using original analog video recorders or applying visual effects using independent compositing software. Although the use of analog video recorders can produce authentic visual characteristics, it requires longer production times, somewhat expensive equipment, and re-recording of the generated output. On the other hand, using third-party compositing software allows for more exploration but adds to the number of main workflows, which reduces the efficiency of the production process. These limitations indicate that compositing techniques integrated into a single application are

still necessary to replicate VHS images in 3D animation without sacrificing the final analog visual quality.

Various previous studies have explored the visual reproduction of VHS using analog devices and compositing software to produce analog visual characteristics. However, most of these studies have focused more on the quality of the visual output rather than the efficiency of the production workflow. Research specifically evaluating the use of Blender's Node-Based Compositor as a method for integrated VHS visual reproduction within a single workflow is still relatively limited. This condition presents an opportunity for the development of compositing that not only produces analog visual esthetics but also enhances the efficiency of the animation production process.

Based on this gap, this research examines the use of the Node-Based Compositor in Blender 3D as a method to replicate VHS analog visuals in a more efficient and integrated compositing workflow. Through a Practice-Based Research approach, this study evaluates the capability of each compositing stage in replicating the visual characteristics of VHS while also assessing the effectiveness of the resulting workflow. The contribution of this research is not only in the form of a Node-Based Compositor-based VHS visual reproduction method but also offers an alternative compositing workflow that can be efficiently applied in animation production.

METHOD

This study adopts a Practice-Based Research (PBR) approach because it enables new knowledge to be generated through creative practice. In this research, the creative practice consists of a series of node configuration experiments in Blender's Node-Based Compositor to reproduce the visual characteristics of analog VHS. The resulting visual outputs are subsequently analyzed and evaluated as research findings. Accordingly, the creative process functions simultaneously as the research process, producing not only visual artifacts but also systematic knowledge about techniques for reproducing analog visual effects (Lewandowska & Bojnarowicz, 2025). This perspective positions creative practice as the primary source of knowledge generation, a principle that has been emphasized in recent studies on practice-based and arts-based research. For example, Boyd and Barry (2024) argue that direct engagement in creative activities provides a valid means of generating knowledge through practice. Similarly, Westermann (2024) maintains that artistic and design processes generate knowledge through creative action and critical reflection, establishing Practice-Based Research as a rigorous and legitimate research methodology.

This study employed an exploratory approach using Blender 3D's Node-Based Compositor to reproduce VHS-style analog visual characteristics through a series of compositing experiments. The creative exploration process served not only as a means of producing visual outputs but also as a method for generating knowledge through the interaction of artistic practice and digital technology. Purba et al. (2025) argue that digital compositing techniques can support both visual analysis and the creation of specific visual aesthetics. Similarly, Li (2024) emphasizes that digital technologies facilitate systematic media experimentation and the evaluation of aesthetic outcomes within qualitative research. Consistent with this perspective, the present study adopts an exploratory qualitative approach to investigate the workflow, potential, and effectiveness of Blender 3D's Node-Based Compositor in reproducing VHS-style analog visuals.

The focus of this study is the node configurations and compositing techniques in Blender 3D that can reproduce VHS-style analog visual characteristics. The experimental configurations were selected using purposive sampling based on predetermined criteria relevant to the research objectives. Purposive sampling refers to the deliberate selection of research elements according to criteria established by the researcher to address the research questions effectively (Lenaini, 2021). Blender 3D served as the primary

experimental platform for exploring VHS-style analog visual reproduction through the Node-Based Compositor. Throughout the experimental process, technical observations, node configurations, visual parameters, production time, and creative considerations were systematically documented in a research journal for subsequent analysis.

Participatory observation was used to collect data for this research. The Node-Based Compositor in Blender 3D is continuously explored, and every node change, visual result, and technical decision is methodically documented through experimental notes. According to (Purba et al., 2025), step-by-step technical recording, creative documentation, and visual experimentation are essential components of practice-based research as they allow for direct examination of the relationship between the creative process and the visual outcomes achieved. One important instrument in art-based research to understand the impact of technical choices on the final product is the documentation of the creative process, including reflective notes and visual artifacts (Spencer, 2025). In-depth analysis of the relationship between node configuration, the resulting VHS esthetics, and the efficiency of the compositing workflow is documented in the form of Node Compositor screenshots, render outputs, screen recordings, project file archives (.blend), literature studies, and visual references.

The data analysis technique in this research uses an exploratory qualitative approach, in line with practice-based research that emphasizes the creative process and esthetic explanation. Several stages in the data analysis technique. The analysis consisted of four stages:

1. Visual analysis stage, which involves observing the rendering results and node configuration to describe the impact of configuration changes on the visual quality of the resulting VHS.
2. Technical analysis stage, by comparing compositing and rendering times to assess the effectiveness of using a node-based compositor in speeding up the workflow.
3. The esthetic analysis stage, where the researcher reflects on the experimental results based on process journal notes to assess the alignment between the film's visual effects and narrative.
4. Comparative and synthesis stage, comparing the visual results produced from the experiment with VHS visual references to draw conclusions and knowledge about the node-based compositor as a creative and practical way in creating VHS-style analog visuals in 3D animation.

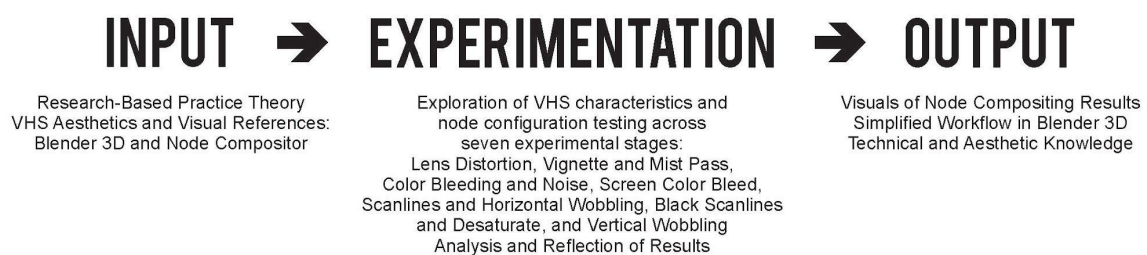


Figure 1 Flowchart of research on node-based compositor exploration

The Practice-Based Research (PBR) process employed in this study to investigate the use of Blender 3D's Node-Based Compositor for producing VHS-style visuals is illustrated in Figure 1. The research process begins with the collection of theoretical references, visual references, and technical resources that serve as the foundation for the experiment. The next stage involves a series of compositing experiments aimed at reproducing VHS visual characteristics, including noise, scanlines, color distortion,

and lens distortion. The resulting visual outputs and workflow effectiveness are subsequently evaluated before being integrated into the compositing workflow applied to the animated film project *"Christmas Night."* The final outcomes of this process include the developed VHS-style node configurations and documented knowledge regarding effective node-based compositing strategies for reproducing analog visual aesthetics.

RESULTS AND DISCUSSION

1. Analysis

In this study, seven experiments were conducted using Blender 3D's Node-Based Compositor. The experiments involved selecting and configuring specific nodes based on their ability to generate VHS-style analog visual characteristics. The purpose of these experiments was to digitally reproduce analog visual aesthetics by simulating key VHS features within a compositing environment. The resulting visual outputs were applied to the visual effects composition of the film *"Christmas Night"* to create a nostalgic atmosphere and a visual appearance resembling footage recorded on VHS.

This research investigates the capability of Blender 3D's Node-Based Compositor to reproduce analog visual characteristics in a digital compositing environment. In previous creative productions, such as the film *"Backrooms Movie – Surveillance"* by Andy R Animation, VHS-style effects were achieved through the use of external recording equipment to obtain an analog appearance. This approach demonstrates the authenticity of analog reproduction but also highlights the need for a more integrated digital workflow capable of simulating VHS aesthetics without relying on additional hardware.

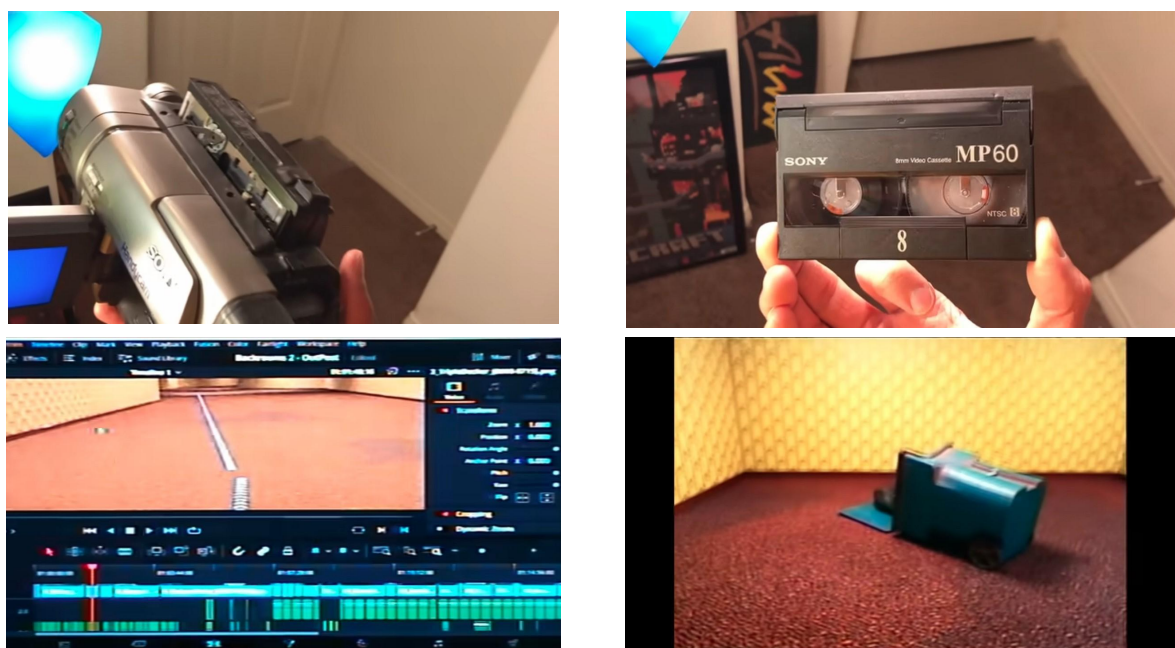


Figure 2 Screenshot of an analog camera, 8-millimeter cassette screen, recording process, and final result

Source: Andy R Animations (2023)

The world-building and animation processes were carried out using the Blender 3D application. For the compositing and visual effects stages of the film, the creator, Andy R Animation, employed an analog recording system to produce VHS-style visual characteristics. The rendered animation output from Blender 3D was displayed and subsequently recorded using analog video equipment with 8mm-format recording media to achieve an authentic analog appearance. This production approach demonstrates a

hardware-based method for generating VHS aesthetics, which can serve as a reference point for evaluating the effectiveness of digital compositing techniques using Blender's Node-Based Compositor.

The experimental setup involved connecting the camera's RCA output to an HDMI converter, allowing the device to be recognized by the computer as a webcam input. As illustrated in Figure 4, the rendered animation output displayed on the computer screen was subsequently recorded using the analog camera system. This process was conducted to introduce visual characteristics associated with analog recording, such as signal degradation, image distortion, and the appearance of VHS-style footage.

The recorded footage was subsequently processed using DaVinci Resolve to assemble the final video composition. The resulting film demonstrates recognizable analog visual characteristics, including the appearance associated with VHS-style recording. However, this hardware-based approach has limited accessibility due to the requirement for specialized analog recording equipment. Although the use of analog cameras provides distinctive visual qualities, as shown in Figure 2, the overall production process requires additional stages, longer processing time, and multiple software and hardware components. These requirements reduce workflow efficiency and highlight the need for a more integrated digital compositing approach for reproducing VHS-style analog visuals.

The production approach described by Andy R Animation shows that the analog esthetic in digital media is the result of the accumulation of several forms of visual distortion consciously arranged (Andy R Animations, 2023). This indicates that the VHS effect is not singular, but rather an artifact system constructed through several visual parameters working simultaneously. In this study, the concept is implemented through a node-based compositor that allows each form of distortion to be modeled as a separate processing unit, thereby providing flexibility in reconstructing the analog visual character with greater precision (Andy R Animations, 2023)

2. Experiment

During the exploration of node-based visual effects using Blender's Node-Based Compositor, each parameter modification produced a different visual state that could be documented and reproduced through specific node configurations. This approach enabled an iterative and flexible exploration process, allowing multiple experimental variations to be compared and evaluated. This characteristic corresponds with the concept of exploratory branching described in Spellburst, where variations are represented as nodes within a graph structure to facilitate the analysis of changes across different stages and conceptual relationships (Angert et al., 2023).

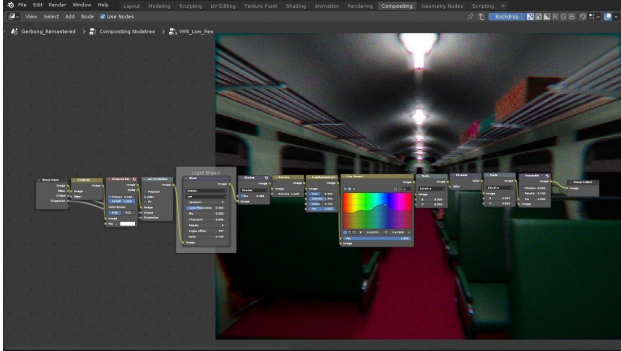
This node-based exploration method serves as an iterative mechanism in influencing parameter settings while also providing a visual framework. Each node in the Blender compositor implementation reflects a combination of specific parameter values that produce numerous visual variants, allowing for methodical experimentation and documentation in the form of visual branches.

A. Experiment I

The first experiment focuses on creating the basic visual characteristics of analog media. Posterize, Distance Key, Lens Distortion, Glare, Shadow, Gamma, Hue/Saturation/Value, Hue Correct, Scale, Pixelate, and Despeckle nodes were used in the process. The most significant nodes are Glare (Low Streaks) for light dispersion, Lens Distortion (Distort = 0.020; Dispersion = 0.050) for optical distortion and color aberration, as well as Posterize (Step = 800) and pixelate to reduce the quality of color gradients and image details. The experimental results (Table 1) show that the combination of these nodes produces low-fidelity images with optical distortion, reduced detail, and color degradation that characterize the visual style of analog media. This stage serves as the foundation before the addition of

specific VHS artifacts, such as color bleeding, scanlines, and tracking distortion, in the subsequent experiments.

Table 1 Screenshot of Node and Render Results of Experiment I

Figures	Notes
	The process of Experiment I with the compositor node consists of the node panel: (1) Posterize; (2)Distance key; (3)Lens distortion; (4) Glare; (5) Shadow; (6) Gamma; (7) Hue/saturation/value; (8) Hue correct; (9)Scale; (10)Pixelate; (11) Despeckle
	Results of First Experiment

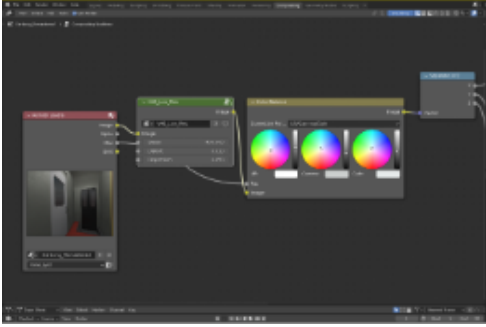
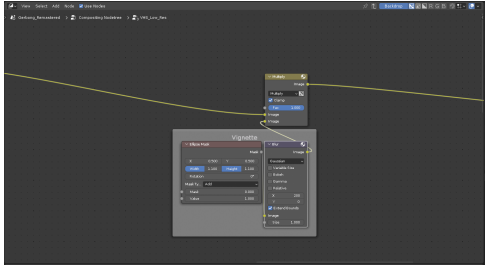
Before introducing more specific VHS effects, the initial experiment established a visual foundation by reproducing the degraded characteristics commonly associated with analog media. The results indicate that VHS aesthetic reproduction begins with the construction of low-fidelity visual characteristics as a basis for subsequent compositing stages rather than relying on a single visual effect. Therefore, each compositing stage serves a complementary function in gradually developing the visual appearance associated with VHS-style analog footage.

B. Experiment II

The second experiment aimed to enhance the atmospheric characteristics of the VHS-style visual output by introducing vignette and environmental effects. The Ellipse Mask and Blur (Flat) nodes were used to create a vignette effect by generating a smooth dark gradient along the image edges. Meanwhile, the Mist Pass node was applied to produce a fog-like atmospheric effect, which was further adjusted using Hue Balance. The Mix (Add) node with a value of 0.050 was then used to combine the vignette layer with the main image composition, ensuring consistent integration of the effect within the overall visual output.

The experimental findings (Table 2) indicate that the combination of atmospheric and vignette effects enhanced visual depth and directed attention toward the center of the image, resulting in optical characteristics that more closely resembled analog camera footage. These results suggest that the vignette effect functions not only as an aesthetic component but also as a refinement stage that strengthens the basic visual characteristics established in the first experiment. Therefore, this stage contributed to reinforcing the perception of VHS-style analog aesthetics within the digital compositing workflow.

Table 2 Experiment II process node mist pass, node vignette, and experiment II render results

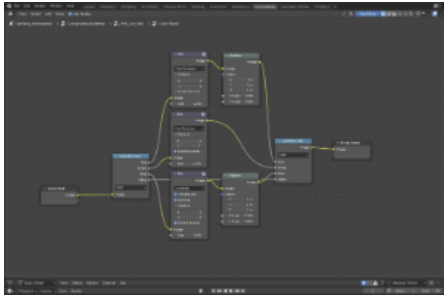
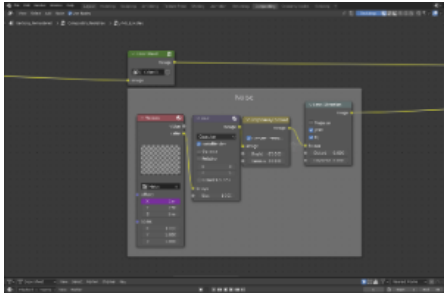
Figures	Notes
	The process of modifying Mist Pass by combining Hue Balance in color processing.
	The process of creating the vignette effect is done using an Ellipse Mask and Blur (Flat).
	The render results of experiment II show a deeper and more realistic visual character compared to experiment I.

C. Experiment III

The third experiment focused on generating noise and color bleeding effects, which represent important characteristics of VHS visual degradation. To produce color bleeding, the RGB color channels were separated using the Separate Color node. Each channel was then modified through a combination of Blur and Displace nodes to create color shifts that simulate signal instability and channel misalignment commonly found in analog video systems. Subsequently, the Noise Texture node was combined with Blur and Brightness/Contrast adjustments to generate analog-style noise. To ensure that the noise pattern changed dynamically across frames rather than appearing as a fixed digital texture, the Offset parameter was animated based on the frame number.

The experimental findings (Table 3) indicate that the combination of color bleeding and noise effects enhanced the VHS visual characteristics by introducing dynamic degradation textures and chromatic distortion. This stage introduced additional visual artifacts that contributed to the distinctive appearance of VHS-style footage, extending the basic analog visual foundation developed in the previous experiments. These findings suggest that color channel manipulation and temporal variation in noise patterns play an important role in strengthening the perception of analog aesthetics within the digital visual simulation.

Table 3 Experiment III process node color bleed, node noise, and render results

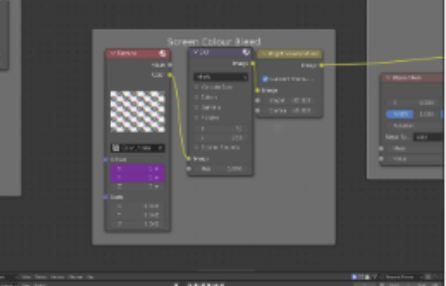
Figures	Notes
	The experimental process of creating Color Bleed using the Separate Color node.
	The noise effect is produced using Blur (Fast Gaussian) and brightness/contrast to adjust the size and intensity of the noise.
	The results of experiment III render produced stable, rhythmic, and controlled VHS visual and esthetic disturbances.

D. Experiment IV

To simulate the light reflections often seen in VHS recordings, the fourth experiment focuses on creating a light leak effect. Magic Texture is used to create this effect, which is animated using the Offset parameter with the value `#frame`. Blur (Mitchell) is then used to create a soft light spread. To prevent the light reflections from appearing too sharp or digital, the color intensity is then modified using Brightness/Contrast.

Experimental findings (Table 4) show that, unlike static noise patterns, the combination of Magic Texture, Blur, and Offset animation produces dynamic light reflections that more closely resemble the optical response of an analog camera. The light leak effect enhances previous research by adding a layer of optical deterioration that reinforces the analog visual impression. As a result, the VHS simulation displays more realistic and engaging lighting characteristics in addition to color distortion and noise.

Table 4 Experiment process IV node color bleed, node noise, and render results

Figures	Notes
	Experiment on processing node screen color bleed.
	The results of experiment IV render, where analog light reflection and color distortion interact to produce an analog esthetic.

E. Experiment V

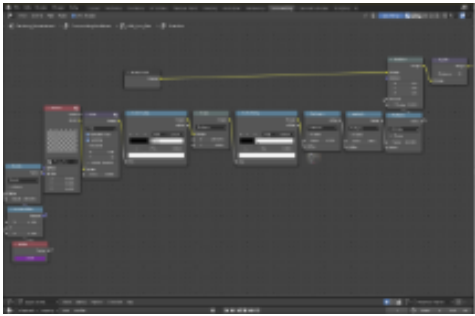
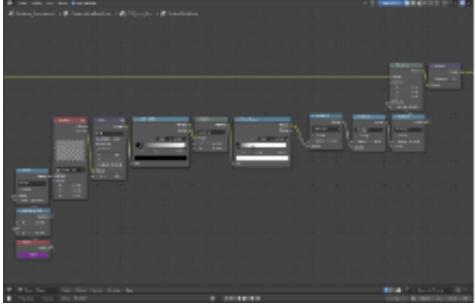
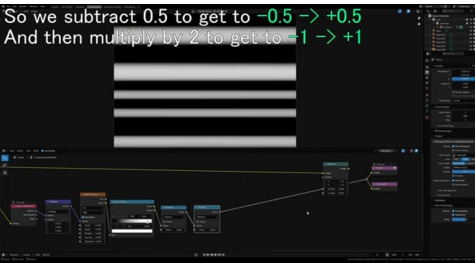
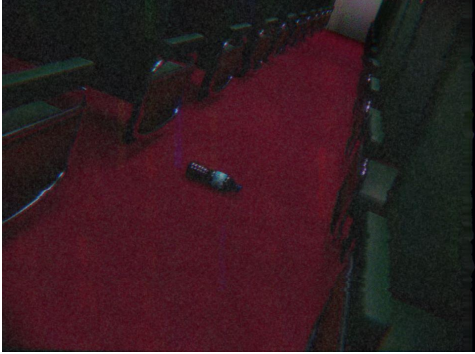
In the fifth experiment, mechanical disturbances in the VHS recording are represented by scanline effects and vertical jitter. Combine XYZ with the #frame value on the Y-axis to animate the scanline effect, which is built using a modified Noise Texture and mathematical operations (Subtract and Multiply) to create horizontal lines. Dynamic vertical shifts in each frame are created by combining Noise Texture, Scale, Color Ramp, and mathematical procedures to produce vertical oscillations (Polygons, 2025).

Experimental findings (Table 5) indicate that the combination of mathematical operations and texture manipulation can produce scan lines and vertical jitters that mimic signal instability and scanning issues in VHS media. This stage includes temporal distortion, which provides a more vibrant and realistic visual simulation compared to previous tests that focused on color and lighting degradation. These results indicate that the use of mathematical nodes combined with frame-based animation is crucial for mimicking the characteristic motion of analog media, which enhances the overall VHS visual experience.

F. Experiment VI

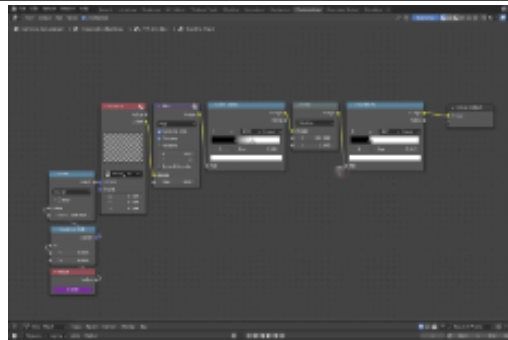
To enhance the appearance of deteriorating VHS material, the sixth experiment focuses on generating black lines and desaturation effects. The modified Noise texture through Scale is used to create the black line effect, which is then animated with Combine XYZ using the #frame value to create dynamically moving horizontal black lines. Meanwhile, the desaturation effect is achieved by using Separate Color to separate the HSV components, RGB Curves to change the saturation values, and Combine Color to merge them back together.

Table 5 Screenshots of node v.wobbling, node scanlines, math method, and experimental render result

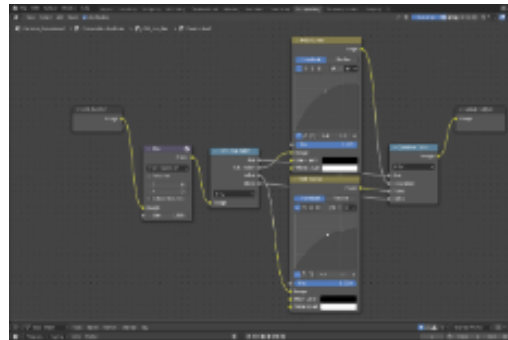
Figures	Notes
	Visual pattern experiments can be combined to create scanline and vertical wobbling effects.
	Process of scanline effects.
	The math method experiment in mathematical manipulation allows visual patterns to change in response to frame movement, making both effects successful.
	The render results of experiment V effectively mimic the mechanical disturbances and signal instability commonly found in VHS devices.

The experimental findings (Table 6) indicate that the combination of desaturation and black line artifacts produced a more textured and muted visual appearance, resembling the degradation characteristics commonly associated with aged VHS footage. These findings are consistent with Al-Jubouri (2023), who concluded that chromatic reduction contributes to the perception of aesthetic qualities and supports the development of low-fidelity visual characteristics. Therefore, this experiment strengthened the impression of aging and degradation associated with analog video media while introducing additional visual artifacts to the VHS simulation.

Table 6 Experiment process of node b. Scanlines, desaturated node, and render results of experiment VI



Node b experimental process. Scanlines, to create lines of visual texture layers that mimic mechanical disturbances on a VHS tape scanner.



The desaturated panel node pattern indicates that a reduction in color saturation can be achieved using separate color (HSV).



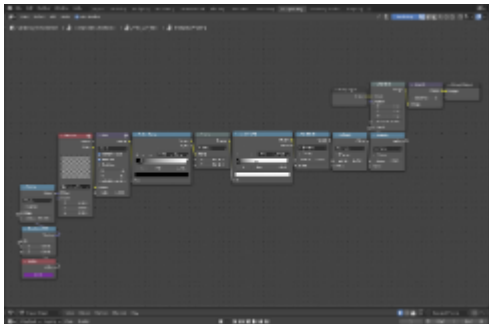
The render results of Experiment VI demonstrate a degraded visual appearance and VHS-style atmosphere. The combination of black line artifacts and desaturation effects produced a visual output that corresponds with the characteristics of analog video degradation, particularly the loss of color intensity and the appearance of damaged recording signals.

G. Experiment VII

To mimic the horizontal instability often observed in VHS recordings, the seventh experiment focuses on producing a horizontal shake effect. By moving the motion control from the Y-axis to the X-axis, this effect is produced from a vertical shake structure. Each frame has a dynamic horizontal shift when the #frame value is used to combine the Noise Texture, Blur, and Offset settings.

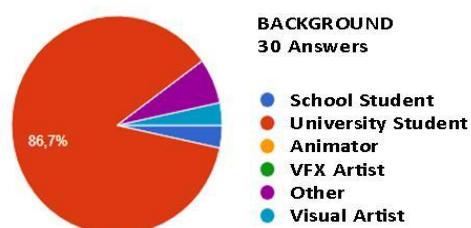
The experimental results (Table 7) show that horizontal wobbling can more convincingly represent signal fluctuations due to the movement of the magnetic tape. As a final stage, this effect complements the artifacts built in previous experiments, resulting in a more complete VHS visual simulation, both in terms of color degradation, lighting, texture, and motion instability. These findings indicate that the esthetic reproduction of VHS is achieved through a gradual combination of various visual artifacts, rather than a single effect.

Table 7 Process of experiment node h. Wobbling and results of experiment VII render

Figures	Note
	The horizontal wobbling experiment process produces more accurate horizontal distortions.
	The results of the VII experiment render show signal fluctuations that appear natural.

3. Validation

To evaluate the extent to which the node-based compositor experiment reproduced the visual characteristics of analog VHS, an aesthetic validation was conducted through a questionnaire involving 30 respondents. The respondents consisted of members of the target audience, visual practitioners, and students to obtain perspectives from both general viewers and individuals with relevant creative backgrounds.

**Figure 3** Correspondent background diagram

The instrument uses a five-point Likert scale with assessment indicators including VHS visual similarity, grain, horizontal wobbling, scanlines, and color bleed. Based on Figure 3, most respondents rated the experimental results as having well-represented VHS visuals, although some noted that the grain was still too fine, the wobbling effect was not strong enough, the color saturation was still high, and the scanlines and color bleed were not yet dominant enough. These findings indicate that the effects produced have approached the visual character of VHS but still require refinement in several parameters. These results align with (Jandrić et al., 2024), which states that user perception is one of the important indicators in assessing the success of esthetic representation in post-digital practices.

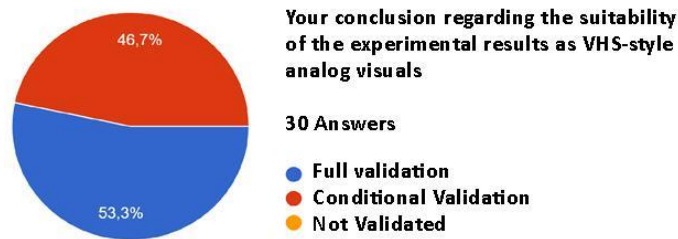


Figure 4 Pie chart of the feasibility of the VHS analog visual experiment

According to 30 respondents in Figure 5, the Node-Based Compositor in Blender 3D is considered suitable for producing visual effects in the Video Home System (VHS) style. The results were rated as "Adequate" by 76.7% of respondents, "Very Suitable" by 16.7%, and "Average" by only 6.7%. The fact that no respondents chose the "Inadequate" or "Very Inadequate" categories indicates that the experimental pipeline is capable of reliably mimicking the properties of analog signals. As a result, the user validation results support the evidence that the Node-Based Compositor is efficient and effective enough to present VHS images that are considered authentic by most observers.



Figure 5 Pie chart of the feasibility of using a node-based compositor

According to Figure 6, most respondents consider the visual results of the experiment to resemble Video Home System (VHS) recordings. 66.7% of respondents chose "Accurate," 20% chose "Very Accurate," and 13.3% chose "Average." No respondents chose "Inaccurate." These results indicate that visual analog replication with a node-based compositor can produce directly recognizable analog features such as color bleeding, grain, optical distortion, and signal anomalies commonly found in VHS recordings. The high level of perceptual agreement among respondents suggests that the 3D node-based blender technique is technically solid and successful in creating a visual experience that respondents perceive as a genuine analog recording. These findings support the ability of the node-based compositor, created reliably, to produce VHS aesthetics and its suitability as a convincing visual representation.

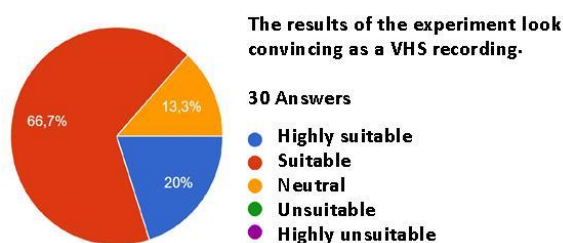


Figure 6 Pie chart of visual experiment confidence as a VHS recording

CONCLUSIONS

Through a series of experiments mapping the configuration of each node to the formation of color bleeding, grain, scanlines, and lens distortion characteristic of analog media, this research demonstrates that the use of a node-based compositor in Blender 3D can consistently and purposefully

replicate the visual esthetics of the analog Video Home System (VHS). Because the entire process is conducted within a single software environment without the need to re-record physical media, the practice-based research method used produces a clear working model of how specific node configurations can create authentic low-fidelity visual characteristics while also providing a more efficient production workflow. Validation results show that 86.7% of respondents rated the visual output as "Suitable" to "Very Suitable" as a VHS recording, supporting the feasibility of this experiment. Experimental results indicate that the visual degradation produced is organic, with an esthetic consistency close to the VHS reference. This research demonstrates that 'visual flaws' can be an esthetic value that can be methodologically constructed and produces a pipeline prototype that can be used as a reference for generating analog visuals for animation and other digital works. The development of techniques to replicate the visuals of old media in contemporary digital production is influenced by these findings, which also pave the way for further research on enhancing color characteristics, noise, and jitter to more closely resemble the behavior of analog signals.

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