Автоматизація технологічних і бізнес-процесів Volume 18, Issue 2/2026
ISSN 2312-3125 (print), ISSN 2312-931X (online) http://www.atbp.ontu.edu.ua/
UDC: 004.92:004.94

NON-PHOTOREALISTIC RENDERING OF ANIMATION IN BLENDER. METHODS AND TOOLS FOR ACHIEVING STYLIZATION EFFECTS IN 3D GRAPHICS

[1]Romanenko K.Y., [2]Boltach S.V.

[1,2]Odesa National University of Technology, Odesa, Ukraine
ORCID: [1]https://orcid.org/0009-0005-7535-7981, [2]https://orcid.org/0000-0003-1902-2405
E-mail: [1]smalldragonket@gmail.com, [2]boltach.svetlana@gmail.com

DOI: 10.15673/atbp.v18i2.3491

Abstract. *This work investigates practical approaches to non-photorealistic rendering (NPR) stylization in the Blender environment and their application in the production of stylized 3D animation. NPR methods differ from physically accurate rendering by prioritizing artistic interpretation, simplified lighting representation, and graphic abstraction instead of precise simulation of optical phenomena. The study focuses on tools available in Blender that allow the construction of such stylized visuals, particularly the Shader to RGB node, node-based materials, and compositing techniques. The research examines how shader-based stylization can transform lighting information into discrete color zones using ColorRamp nodes, enabling the creation of flat shading similar to cel or toon animation. In addition to shader methods, the work explores compositing as a separate stage of stylization, where visual effects such as contrast control, outlines, glow, and graphic shadows are created through post-processing using render passes and Cryptomatte masks. To evaluate the practical differences between these approaches, several experimental scenes were produced within a short animation project. Each scene implements a different stylization strategy: shader-oriented NPR materials, compositor-based stylization, and a combined pipeline integrating both techniques. The comparison demonstrates how each method influences the visual structure of the image, the interaction with lighting, and the level of artistic control available during production. The results show that Blender provides a flexible set of tools for NPR workflows and that combining shader stylization with compositing allows the creation of expressive graphic images while preserving the advantages of a three-dimensional animation pipeline.*

Анотація. *У цій роботі досліджуються практичні підходи до нефотореалістичного рендерингу (NPR) у середовищі Blender та їх застосування у виробництві стилізованої 3D-анімації. Методи NPR відрізняються від фізично точного рендерингу тим, що надають пріоритет художній інтерпретації, спрощеному відображенню освітлення та графічній абстракції замість точного відтворення оптичних явищ. Дослідження зосереджено на інструментах Blender, які дозволяють створювати стилізовані візуальні ефекти, зокрема вузлі «Shader to RGB», матеріалах на основі вузлів (node-based materials) та методах композитингу. У роботі розглядається, як стилізація на рівні шейдерів може перетворювати інформацію про освітлення на дискретні колірні зони за допомогою вузлів «ColorRamp», що дозволяє реалізувати плоске (flat) затінення, характерне для cel- або toon-анімації. Окрім шейдерних методів, досліджується композитинг як окремий етап стилізації, де візуальні ефекти, такі як контроль контрасту, контури, світіння та графічні тіні, створюються через пост-обробку за допомогою рендер-пасів та масок Cryptomatte. Для оцінки практичних відмінностей між цими підходами в межах короткого анімаційного проєкту було створено кілька експериментальних сцен. Кожна сцена реалізує окрему стратегію стилізації: NPR-матеріали на основі шейдерів, стилізацію засобами композитора та комбінований пайплайн, що поєднує обидва методи. Порівняння демонструє, як кожен метод впливає на візуальну структуру зображення, взаємодію зі світлом та рівень художнього контролю під час виробництва. Результати показують, що Blender надає гнучкий набір інструментів для NPR-процесів, а поєднання шейдерної стилізації з композитингом дозволяє створювати виразні графічні образи, зберігаючи при цьому переваги тривимірного анімаційного конвеєра.*

Keywords: non-photorealistic rendering, Blender, compositing, stylization, 3D graphics, visualization, 3D animation.
Ключові слова: нефотореалістичний рендеринг, Blender, композитинг, стилізація, 3D-графіка, візуалізація, 3D-анімація.

ISSN 2312-3125 (print), ISSN 2312-931X (online) http://www.atbp.ontu.edu.ua/

I. INTRODUCTION

In modern 3D animation, non-photorealistic rendering (NPR) methods, which imitate traditional drawing, comics, anime, or painted graphics, are gaining increasing popularity. Unlike physically accurate rendering algorithms, NPR approaches focus not on precise light modeling but on stylization and artistic interpretation.

The demand for stylized graphics is only growing today. Following the release of the film "Spider-Man: Into the Spider-Verse" (2018) by Sony, audiences saw that animation could function like a comic – with a distinct style, textures, imperfections, and artistic conventions [1]. This trend was later reinforced by "Arcane" (2021) [2], "The Bad Guys" (2022), "Puss in Boots: The Last Wish" (2022) [1], "The Wild Robot" (2024), and other projects that consciously rejected photorealism in favor of style.

The aim of this work is to investigate and systematize practical methods that allow achieving NPR effects in Blender, as well as to form an approach to creating short stylized animation, where the visual style is key.

II. LITERATURE ANALYSIS

2.1. What is NPR?

Non-Photorealistic Rendering (NPR) is a branch of computer graphics focused on creating images and animations with a distinctive artistic style. NPR draws inspiration from traditional artistic practices – drawing, painting, graphics, animation – and aims for a stylized representation of the world [3].

Unlike physically accurate rendering, where the main goal is realistic reproduction of lighting, materials, and optics, NPR departs from precise modeling of physics and works with generalization, stylization, and artistic convention. Realistic engines typically use ray tracing [4] and complex material models to achieve the most natural result – in contrast, NPR may employ simplified color planes, contour lines, hand-drawn textures, and so on.

A characteristic feature of such methods is that they simultaneously combine technical means of 3D environments with artificial artistic constraints: flattened shadows, minimal texture detail, outlines, and reduced realism of lighting.

2.2. NPR Techniques

There is no single strict classification of styles in NPR; however, there is a set of commonly used techniques that shape the distinctive artistic perception of a scene. Among the most common:

1. cel shading;
2. toon shading;
3. hatching;
4. outline;
5. watercolor / ink wash.

Cel shading – is a technique where surfaces are rendered using a minimal number of shadow zones and flat color planes. This creates a "painted" graphic effect similar to classic animation.

Toon shading is often used as a synonym for cel shading, but sometimes a distinction is made: toon shading includes additional stylization effects such as outlines, color posterization, and specific lighting transitions [5].

Hatching imitates a manual technique – cross-hatching, quick linear strokes, or textured fills. This brings the image closer to graphic techniques used in comics, illustrations, or engravings.

Outline – the addition of contour lines along the silhouettes and inner edges of objects. Such outlines help simplify shapes, making the scene "readable" and stylized.

Watercolor and other techniques that imitate watercolor or ink washes use unstable color spots, uneven fills, and paper texture for a soft, less controlled appearance [6].

Through these techniques, or their combinations, creators can achieve very different styles – from comic graphics to book illustrations or paintings [7].

2.3. Tools for creating stylized graphics in Blender

Blender currently lacks a large set of purely NPR tools, but there are several key systems that allow for the creation of stylized renders.

Shader to RGB. A special node in Blender (for example, in version 4.4) for the EEVEE engine that converts shader output into color. This allows for the implementation of cel shading, toon shading, posterization, or conveying the influence of lighting in the form of flat color zones [8].

Grease Pencil is a system that allows combining 2D and 3D. It is convenient for outlines, animation, comic effects, hand shading, lettering, and more. For stylized graphics, it is a very powerful tool [9]. However, for effective use of Grease Pencil, it is advisable to have a graphics tablet.

Compositor. Post-processing is also part of the NPR pipeline. Through the compositor, you can add grain, blur, textures, color posterization, filters, outlines, and other effects that "break" photorealism and bring the image closer to an artistic environment [10].

Goo Engine is a version of Blender by DillonGoo Studios, which focuses on stylized anime graphics. Goo Engine provides more toon settings, better outlines, alternative shaders, and a distinct approach to lighting [11].

In general, there are not many specialized tools for NPR in Blender, but they are quite sufficient for a wide range of creative tasks. In this work, not all mentioned capabilities will be applied, but those relevant to the chosen stylization will be used.

III. OBJECT, SUBJECT, AND METHODS OF RESEARCH

Object: non-photorealistic rendering.

ISSN 2312-3125 (print), ISSN 2312-931X (online) http://www.atbp.ontu.edu.ua/

Subject: technical methods of NPR stylization in the Blender environment.

Research methods:

analysis of existing NPR techniques in Blender;

1. experimental work with shaders and compositor;
2. comparison of render results of different approaches.

IV. RESULTS

During the research, a short animation with test scenes was created, and several NPR-stylization methods were tested, differing in their image formation principles. In Scene C, the stylization is based on stylized shaders. Scene B is stylized exclusively using the Compositor. In contrast, Scene A combines both of these approaches. We will examine each one separately.

4.1 Shader-oriented stylization, Scene C

The first approach was based on the use of the Shader to RGB node, which allows converting shader data about lighting into a flat RGB signal.

To demonstrate the principle of constructing a basic NPR shader, an example material for slippers is used, as shown in Fig. 1.

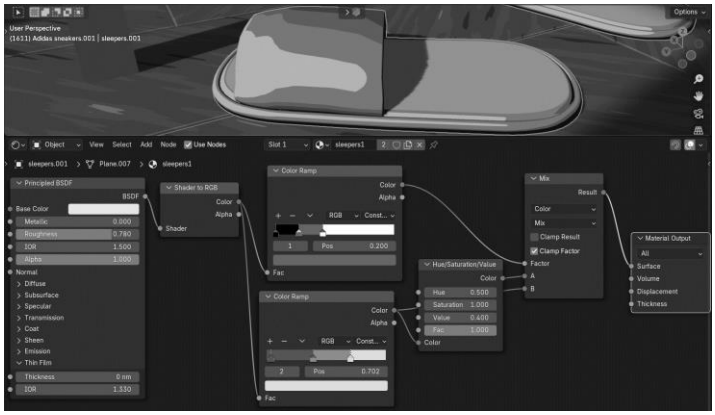

Fig. 1. Settings for the stylized shader of slippers

The key element of this shader is the Shader to RGB node, which converts lighting information into color, which can then be used for stylization (for example, to separate light and shadow areas). This allows for the abandonment of physically accurate material reproduction and transitions to a conditionally graphic representation.

To achieve flat color fill, the ColorRamp node is used in Constant mode. This way, the shades of lighting are divided into clearly defined zones without smooth transitions. Another ColorRamp is responsible for the object's color palette.

The obtained values are combined using the Mix node. A darkened variant of the color (through the Hue/Saturation/Value node, where brightness is reduced) is fed into Color A, the main color into Color B, and a black-and-white signal from the first ColorRamp into Fac. This ensures a correct distribution between the base and shadow colors on the object.

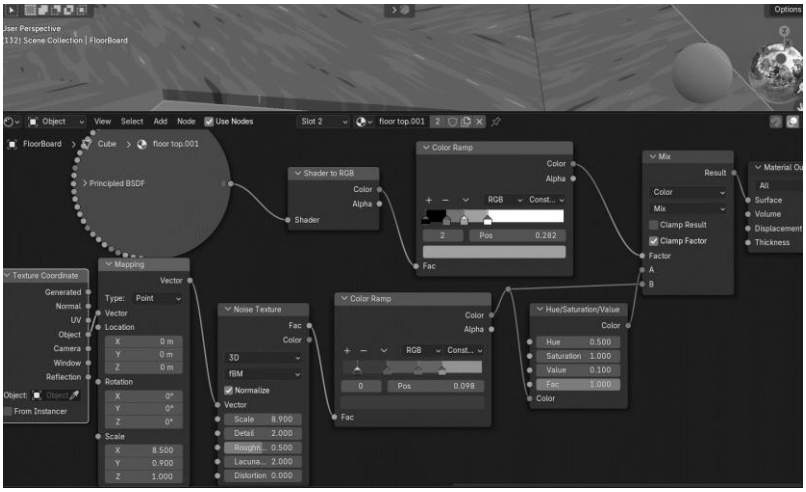

Fig. 2. Floor Shader

A shader for the floor is constructed using a similar logic (Fig. 2).

Shader to RGB is also applied here to respond to lighting; however, the colors are defined using a Noise texture, which is passed through a ColorRamp to create decorative visual variability.

ISSN 2312-3125 (print), ISSN 2312-931X (online) http://www.atbp.ontu.edu.ua/

The post-processing of scene C in the Blender compositor focused on creating the impression of nighttime or early morning (Fig. 3). The main goal was to establish the appropriate mood through color correction, lighting, and shadows.

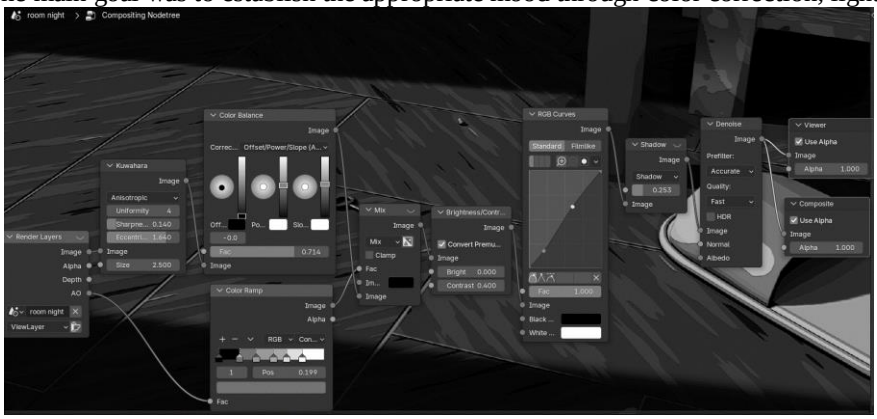

Fig. 3. Demonstration of the compositor for scene C

The figure shows the node structure of the compositor used for this scene. On the left is the standard input layer Render Layers, followed by the Kuwahara node. It adds a soft stylized blur that simplifies details and gives the scene a more artistic appearance. Next, the Color Balance is applied, allowing adjustments to the color balance in the shadows, midtones, and highlights. With its help, the shadows were darkened, and the light areas were brightened. Additionally, to enhance contrast, Brightness/Contrast nodes were used. The RGB Curves node allowed for color adjustments to blue-purple tones to create a cold nighttime atmosphere.

A Mix node was also applied along with a mask from Color Ramp for local darkening. This added depth to the scene and made the lighting more expressive. In the final stage, the result went through Denoise, after which it was output to Composite and Viewer for saving and viewing the final image (Fig.4).

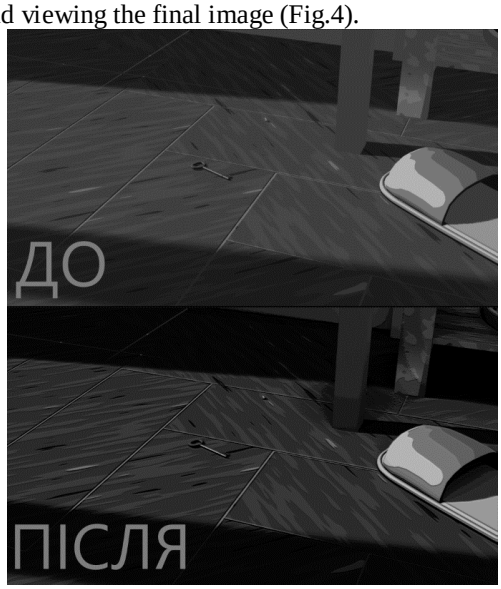

Fig.4. Visual result of compositing scene C

This compositor scheme was not aimed at creating a stylized or NPR effect. The main task was to make the scene more atmospheric through color and light-shadow correction.

4.2 Compositing as a Tool for Stylization

The second approach involved stylization at the post-processing stage: using RGB curves, Glare, Threshold, Kuwahara filter, and Cryptomatte masks to highlight individual elements.

A shader was created for scene B that simulates the glow of mushrooms (Fig.5).

ISSN 2312-3125 (print), ISSN 2312-931X (online) http://www.atbp.ontu.edu.ua/

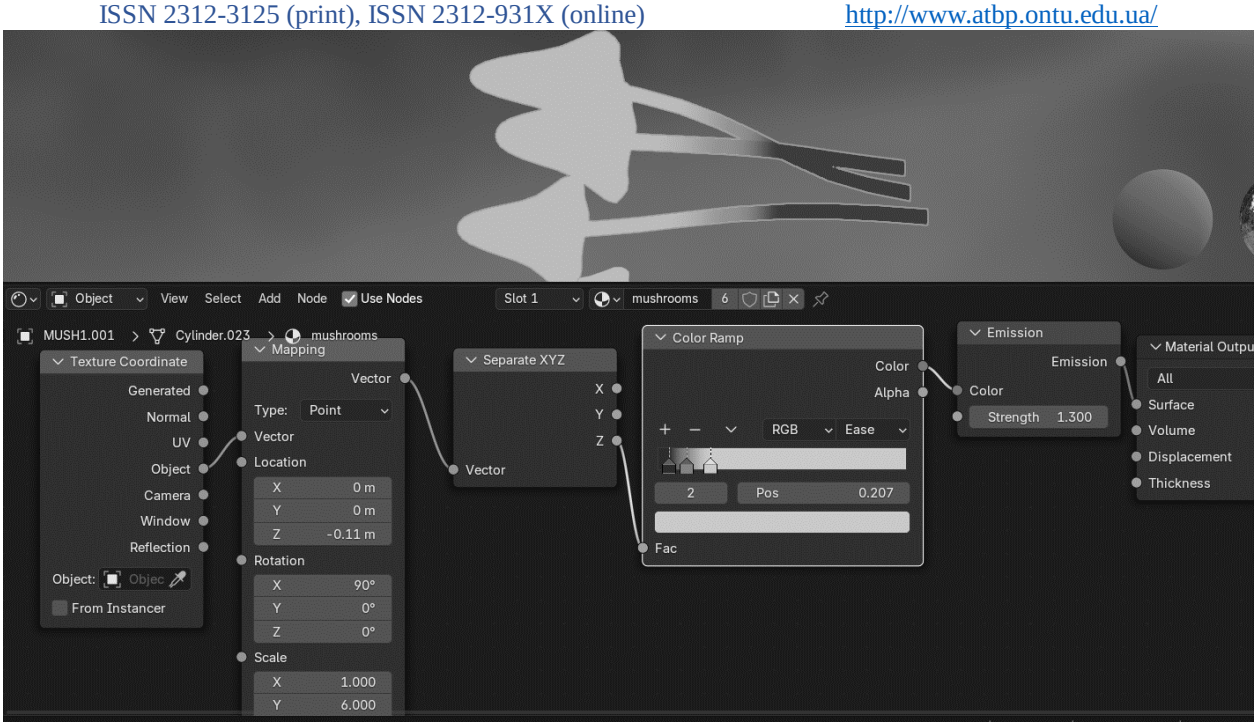

Fig. 5. Mushroom Shader

The basis consists of the Emission node, which allows the material to glow. The color is controlled through ColorRamp, while additional nodes are responsible for the spatial arrangement of colors and the formation of gradients.

Fig. 6. Compositing scene B with division into effect branches

For environmental elements, particularly caves and rocks, simplified gray materials based on Principled BSDF were used, without additional stylization. In this scene, they do not require expressive visual design.

ISSN 2312-3125 (print), ISSN 2312-931X (online) http://www.atbp.ontu.edu.ua/

To create a stylized NPR look in scene B, the compositor played a key role, as the shaders used do not provide sufficient artistic expressiveness on their own. Fig.6 presents the overall scheme of the compositor divided into separate branches of effects. Each of them is responsible for a specific visual aspect of the final image. Fig.7 demonstrates the change in rendering under the influence of individual effect branches.

The main branch – BlackWhite. This part of the compositor forms a stylized black-and-white look of the base image. The image from Render Layers is first converted to grayscale using the RGB to BW node. Then, a Color Ramp with Constant interpolation type is applied, allowing smooth gradations to be transformed into sharp contrasting boundaries between light and shadow. The intensity of the effect can be adjusted using Multiply, that is, setting the level of contrast.

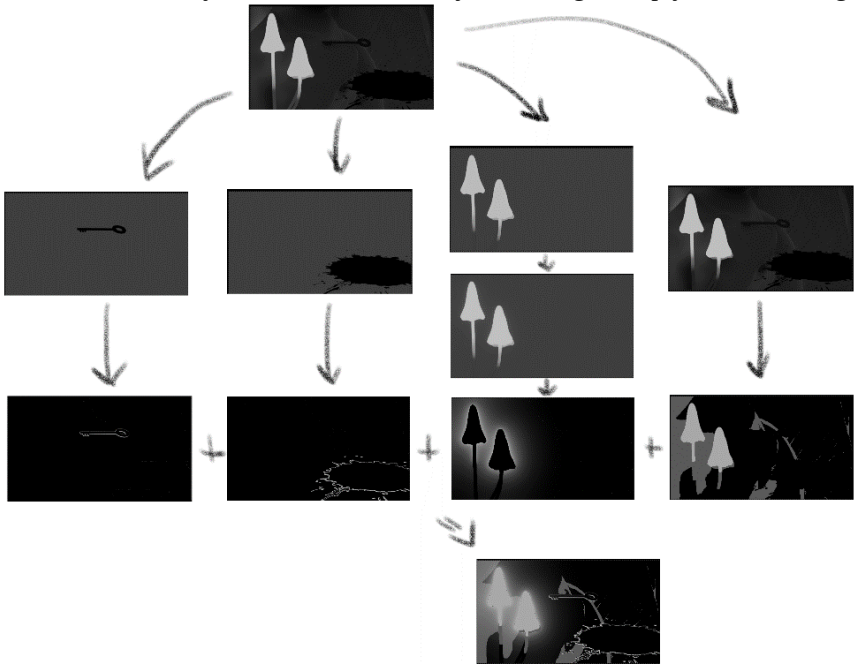

Fig. 7. Visual demonstration of effects

The glare branches – Mushrooms glare and Eyes glare. These branches add a glow effect to individual objects – specifically, the eyes of creatures and mushrooms. Using Cryptomatte, the corresponding masks are extracted, after which Glare with Bloom type is applied. In the case of mushrooms, to avoid glowing the entire surface, the mask is additionally edited – part of the image is subtracted to ensure that only the halo around the mushrooms glows (Fig. 8).

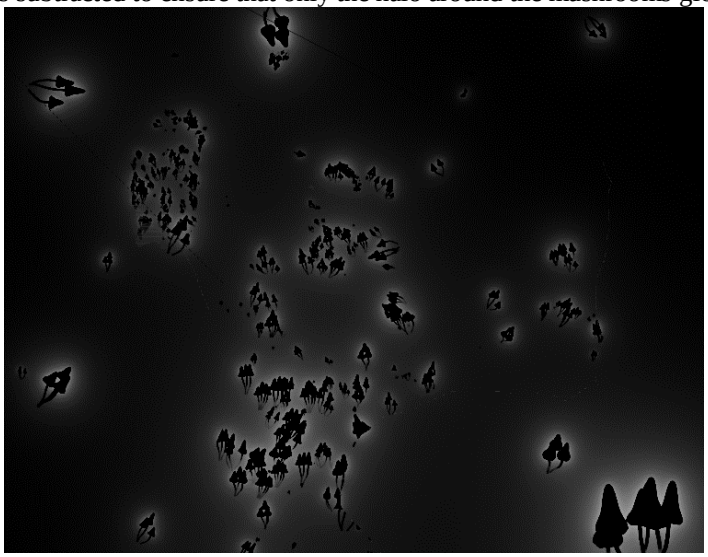

Fig.8. Glow effect of the halo around mushrooms

The contour branches – Portal shadow and Key shadow. These elements are fake shadows that visually separate the key and portal objects from the background, creating light contours around them (Fig. 9).

Masks are also created using Cryptomatte, after which they are offset in space using Translate. Then one mask is subtracted from another, forming an outline, the brightness of which is adjusted using Multiply. This way, outlines are visible around the key and portal, helping the viewer better perceive the composition of the scene.

ISSN 2312-3125 (print), ISSN 2312-931X (online) http://www.atbp.ontu.edu.ua/

Fig. 9. Demonstration of the key and portal outline

All the aforementioned branches are combined with each other using Mix nodes in Add mode, allowing for the careful layering of individual effects. After merging, the final image is sent to Composite and Viewer.

4.3 Combined Approach, Scene A

The third approach combines the advantages of the first two. The shaders in Scene A are the same as those in Scene C. Two Sun-type light sources with different colors – orange and red – were set up for lighting. This approach allowed for a smooth transition between illuminated and shadowed areas, visually hinting at the evening time of day.

In the process of creating NPR stylization for Scene A, the Shader to RGB node was actively used, which is the basis for building many stylized shaders. However, its peculiarity is that after converting the shader to RGB format, the image loses its connection with the lighting in the scene – that is, the color of the light sources no longer affects the appearance of the objects (Fig. 10).

Fig. 10. Render of Scene A without processing in the compositor

Fig. 11. Scene A1 with materials that react to light

In the figure, it is clearly visible that the vast majority of objects in Scene A do not show any reaction to the warm lighting, even though there are two Sun-type light sources in the scene that create characteristic evening shadows. As a result, the scene looks too flat and lacks depth. To fix this, a copy of Scene A was created (hereafter referred to as Scene A1) with the same objects, but without NPR materials. Instead, simple basic shaders were applied to them, which better convey the influence of lighting (Fig. 11).

In Scene A1, expressive color transitions between illuminated areas and shadows are well visible, which better conveys the mood of the evening. However, the goal was to preserve the NPR stylization while combining it with a more "alive" reaction to light. For this, the Blender compositor was used (Fig. 12).

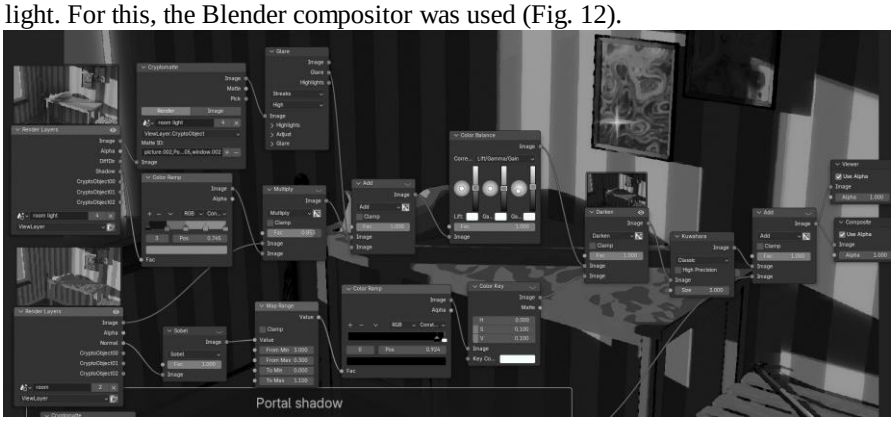

Fig. 12. View of the Compositor for Scene A

The Compositor combines data from two separate Blender scenes. From scene A1, where simple shaders are used, several render layers are extracted: one for creating a mask of illuminated objects (to which the Glare effect is applied, adding sun flares), and another for conveying shadows, which are then combined with NPR stylization.

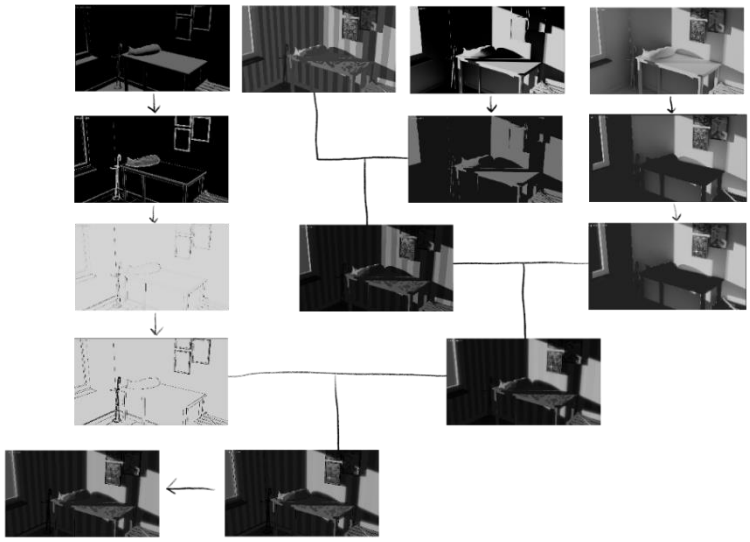

Fig. 13. Demonstration of the change in the appearance of scene A

Scene A contains an already stylized image with NPR materials. It is combined with the previous layers through Mix, Add, and Darken nodes to integrate lighting effects into the stylized render. Additionally, an outline of the scene objects based on normals is added to enhance the graphic effect. Thus, by combining information from two scenes, it was possible to create an NPR image with expressive evening lighting. Fig. 13 shows the change in the appearance of the scene under the influence of each individual effect and the interaction of the effects with each other.

In conclusion, different approaches to NPR stylization were used for the three animation scenes. In scene C, shaders played the main role, defining the style through materials. For scene B, the key tool was the Compositor, which achieved the stylization. Meanwhile, for scene A, a combined approach was applied: shader stylization was combined with compositing for precise adjustment of lighting and shadows.

V. CONCLUSIONS

This work explored several methods of NPR stylization in Blender. It was shown that achieving a stylized NPR effect is possible through:

1) the use of Shader to RGB and ColorRamp to control the light-shadow structure;
2) the application of compositing for outlines, glow, and graphic shadows;
3) the combination of NPR materials with physically accurate lighting through two renders.

It was experimentally established that none of the methods is universal; however, their combination provides a more artistically expressive result. The obtained results can be integrated into production pipelines for animation, illustration, and game content.

Список використаних джерел

1. The revolutionary animation style of Spider-Man: Into the Spider-Verse // Latino Review Media: вебсайт. 2023. URL: https://lrmonline.com/news/the-revolutionary-animation-style-of-spider-man-into-the-spider-verse/ (дата звернення: 26.01.2026).
2. Netflix's Arcane changed the animation industry forever // Screen Rant: вебсайт. 2025. URL:

https://screenrant.com/arcane-netflix-new-standard-animated-shows/ (дата звернення: 26.01.2026).
3. Non-photorealistic rendering // Wikipedia: вебсайт. 2025. URL: https://en.wikipedia.org/w/index.php?title=Non-photorealistic_rendering&oldid=1320522396 (дата звернення: 26.01.2026).
4. Ray tracing (graphics) // Wikipedia: вебсайт. 2025. URL: https://en.wikipedia.org/w/index.php?title=Ray_tracing_(graphics)&oldid=1332158126 (дата звернення: 26.01.2026).
5. Basic toon shader in Blender // Yarsa Labs DevBlog: вебсайт. 2022. URL: https://blog.yarsalabs.com/basic-toon-shader-in-blender/ (дата звернення: 27.01.2026).
6. Delicious latte & cookies recreated in 3D with a watercolor style // 80 Level: вебсайт. 2025. URL: https://80.lv/articles/delicious-latte-cookies-recreated-in-3d-with-a-watercolor-style (дата звернення: 27.01.2026).
7. What is non-photorealistic rendering? Discover artistic 3D // NBY IT Solutions: вебсайт. URL: https://nbyit.com/what-is-non-photorealistic-rendering/ (дата звернення: 27.01.2026).
8. Shader to RGB // Blender Manual: вебсайт. URL: https://docs.blender.org/manual/en/4.2/render/shader_nodes/converter/shader_to_rgb.html (дата звернення: 31.01.2026).
9. Blender 5.0: Grease Pencil // Blender Developer Documentation: вебсайт. 2025. URL: https://developer.blender.org/docs/release_notes/5.0/grease_pencil/ (дата звернення: 31.01.2026).
10. NPR outline composition feedback // Blender Artists: вебсайт. URL: https://blenderartists.org/t/npr-outline-composition-feedback/1612076 (дата звернення: 31.01.2026).
11. Dillongoostudios. Goo Engine: репозиторій програмного забезпечення // GitHub: вебсайт. URL: https://github.com/dillongoostudios/goo-engine (дата звернення: 31.01.2026).

References

[1] “The revolutionary animation style of Spider-Man: Into the Spider-Verse,” Latino Review Media, 2023. [Online]. Available: https://lrmonline.com/news/the-revolutionary-animation-style-of-spider-man-into-the-spider-verse/. Accessed: Jan. 26, 2026.
[2] “Netflix's Arcane changed the animation industry forever,” Screen Rant, 2025. [Online]. Available: https://screenrant.com/arcane-netflix-new-standard-animated-shows/. Accessed: Jan. 26, 2026.
[3] “Non-photorealistic rendering,” Wikipedia. [Online]. Available: https://en.wikipedia.org/w/index.php?title=Non-photorealistic_rendering&oldid=1320522396. Accessed: Jan. 26, 2026.
[4] “Ray tracing (graphics),” Wikipedia. [Online]. Available: https://en.wikipedia.org/w/index.php?title=Ray_tracing_(graphics)&oldid=1332158126. Accessed: Jan. 26, 2026.
[5] “Basic toon shader in Blender,” Yarsa Labs DevBlog, 2022. [Online]. Available: https://blog.yarsalabs.com/basic-toon-shader-in-blender/. Accessed: Jan. 27, 2026.
[6] “Delicious latte & cookies recreated in 3D with a watercolor style,” 80 Level, 2025. [Online]. Available: https://80.lv/articles/delicious-latte-cookies-recreated-in-3d-with-a-watercolor-style. Accessed: Jan. 27, 2026.
[7] “What is non-photorealistic rendering? Discover artistic 3D,” NBY IT Solutions. [Online]. Available: https://nbyit.com/what-is-non-photorealistic-rendering/. Accessed: Jan. 27, 2026.
[8] “Shader to RGB,” Blender Manual. [Online]. Available: https://docs.blender.org/manual/en/4.2/render/shader_nodes/converter/shader_to_rgb.html. Accessed: Jan. 31, 2026.
[9] “Blender 5.0: Grease Pencil,” Blender Developer Documentation, 2025. [Online]. Available: https://developer.blender.org/docs/release_notes/5.0/grease_pencil/. Accessed: Jan. 31, 2026.
[10] “NPR outline composition feedback,” Blender Artists. [Online]. Available: https://blenderartists.org/t/npr-outline-composition-feedback/1612076. Accessed: Jan. 31, 2026.
[11] Dillongoostudios, “Goo Engine,” GitHub repository. [Online]. Available: https://github.com/dillongoostudios/goo-engine. Accessed: Jan. 31, 2026.

Отримана в редакції 14.04.2026. Прийнята до друку 23.04.2026. Розміщено в інтернеті 31 травня 2026.
Received 14 April 2026. Approved 23 April 2026. Available in Internet 31 May 2026