

Exploring the Cel Shading Style of 2d Character Illustration in Umamusume: Pretty Derby

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ABSTRACT

Umamusume: Pretty Derby is a mobile online game that was launched in 2021 in Japan under Cygames, Inc. for Android, iOS, and PC on DMM Games and Steam later on. This game's concept transforms legendary Japanese racehorses into rivaling girls, which draws inspiration from real stories within their renowned horse racing culture. This game uses 3D models with cel shading style that are consistent with the game's 2D illustration style. What this research aims to examine is the use of cel shading as the primary visual style for character illustrations, specifically in full-body 2D illustrations within *Umamusume: Pretty Derby*. This research uses qualitative methods that consists of observation and re-engineering, that are supported by data from the official game website. This study then reveals an effective illustrative style which has signature stylized outlines, solid visual treatment, striking colors, and simple yet distinctive lighting techniques. When combined, these elements collectively makes for a beautiful, consistent, and instantly recognizable anime-themed visual identity for a game.

Keywords: *Umamusume, anime, cel shading, game, illustration*

INTRODUCTION

Games have always been a part of human nature that is rooted in our instinct to play, and this goes way back to ancient times. They serve as a form of enjoyment, help us unwind, create social bonds, and even let us express ourselves. If we want an example let's take a board game like *mancala* for example. This board game dates back to approximately 3500 BCE and its variation has been known in Indonesia as *congklak*. It is one example of how games can be cultural artifacts that share values across different societies across the world. This urge for structured play with objectives has been known to push our technological progress forward. We went from ancient gaming pieces made from stone to the first digital game in 1952, when A.S. Douglas programmed tic-tac-toe on Cambridge University's EDSAC computer. These steps leads to evolution, from room-sized machine to today's portable device.

Modern games we have now has always been deeply intertwined with culture, they have been known to incorporate narratives and mythology from diverse traditions. For example *God of War* draws from Greek mythology, while Bandai Namco's *God Eater* names its creatures after deities—such as *Vajra*, a tiger-like monster that controls electricity that references the Hindu god *Indra's* thunderbolt. This is an

example of anthropomorphism, the attribution of various human characteristics to non-human entities. They manifests in metaphorical, analogical, symbolic, and literal forms. This research focuses on literal anthropomorphism as exemplified in *Umamusume: Pretty Derby*, which transforms legendary Japanese racehorses into anime-style teenage girls while incorporating each horse's real-life story.

Since its 2024 anniversary, *Umamusume* has generated over \$2 billion in revenue, becoming Cygames' primary income source. This game has introduced many players to horse racing culture following its global release in June 2025. In Indonesia itself, the viewership for the IHR Indonesia Derby 2025 tripled. The players frequently commented on the emotionally resonant characterizations as the main appeal of *Umamusume*, supported by harmony between storytelling, gameplay, and visuals. Under the supervision of art director for *Umamusume*, Takumu, they coordinated 2D and 3D teams which worked deliberately to achieve the game's distinctive look: cel shading. This style serves as the primary visual language for both character art and overall presentation.

This research investigates how cel shading functions within their art style by exploring the reconstruction of the illustration style. Because the Indonesian game industry's growth following international recognition of works like *A Space for The Unbound*, it becomes increasingly relevant to develop an eye catching art direction as a game's main style. Through observation and reconstruction, the goal is to seek to understand the principles behind *Umamusume*'s cel-shaded visual. Now. We are addressing the question this research will try to explore: How can one engineer an illustration to achieve the cel-shaded quality seen in *Umamusume: Pretty Derby*?

LITERATURE REVIEW

Cel shading, or *toon shading* is a 3D technique in computer graphics designed to make 3D models appear flat by utilizing fewer colors to recreate the look of 2D animation. Primary goal of cel shading is to replicate the style of comics, cartoons, and mainly traditional 2D animation. This term originates from "cel," which is short for celluloid, they are transparent sheets used in traditional animation, where characters were painted to create movement over static backgrounds. In short, cel shading tries to digitally mimic the distinctive look of those hand-painted art, giving the 3D object a two-dimensional appearance as close as possible to look a certain way.

This technique of cel shading 3D object emerged from major media nations like Japan, the United States, and South Korea, with Japanese anime being the main catalyst for its popularity. This style, known as "manga films," eventually made its way into the video game industry and changed how games were designed. *Jet Set Radio* by Sega for the Dreamcast is often credited as the first game to really master cel shading, bringing those cool Japanese 2D vibes into gaming. This launched a trend in the early 2000s, leading to its use in many popular titles like *The Legend of Zelda: The Wind Waker* and *Tales of Symphonia*. It proved that a unique visual style, which didn't just aim for realism, could actually enhance a game's appeal. This opened the door for more creative artistic choices in gaming.

When we discuss cel shading in 2D illustration, we refer to a technique that produces images with sharp contrasts between light and shadow. This gives them a poster-like appearance often found in anime. Unlike realistic rendering, which seeks smooth transitions, cel shading uses clear bands or blocks of color. The idea is simple: less is more. You usually work with base colors, shadow tones, and highlights to indicate shape and dimension. This deliberate flattening of depth results in a style that emphasizes silhouette, movement, and expression. Cel shading emphasizes visual clarity and style instead of sticking to realism. *Umamusume: Pretty Derby* exemplifies the application of this technique. Takumu, the art director, leads the team to achieve a distinctive illustration style that bridges 2D character art and 3D in-game models. Its in-game illustrations maintain characteristic sharp shadow divisions while

incorporating subtle textural details such as clear shadow boundaries combined with their subtle texturing. These prevent the aesthetic from appearing overly simplistic, while still looking clean and beautiful.

Previous Research

Several academic studies have examined cel shading from various perspectives. Decaudin (1996) was one of the pioneers who laid the technical foundation for cartoon-style rendering of 3D scenes. Lake et al. (2000) subsequently developed scalable stylized rendering techniques for real-time 3D animation. Gooch et al. (1998) influenced the development of cel shading through their non-photorealistic lighting model for technical illustrations. Further research by Todo (2013) focused on discovering more artist-friendly 3D cel shading techniques to achieve hand-drawn 2D visuals. Kähäri (2022) investigated techniques for making real-time 3D game characters resemble comic and cartoon-inspired 2D art with cel shading aesthetics, meanwhile Sugianti (2023) explores cel shading usage of 3D object to make aesthetically 2D short movie.

Research Gap

This study fills a gap in the discussion of cel shading—specifically in 2D illustration, particularly with anime style. While previous research has discussed cel shading techniques in the context of 3D application, this study aims to examine cel shading specifically as a style in 2D illustration, within the scope of illustrations for anime-themed games.

METHODOLOGY

Research Approach

This study employs a qualitative approach with descriptive-analytical methods. The qualitative approach was selected because this research aims to understand visual phenomena, specifically regarding the application of cel shading techniques in *Umamusume: Pretty Derby* illustrations. As Creswell (adapted from Creswell, 2007) states, qualitative research is an approach for exploring and understanding the meaning individuals or groups assign to social or human problems. Descriptive style is used in this research, as we will describe some specific visual elements of cel shading being used in the visual style of the subject. Analytical means examining the relationships between these elements, and how they construct the desired distinctive visual style.

Research Methods

The two methods used are visual observation and re-engineering. Visual observation involves examining the four main aspects of cel shading: outlines (line thickness, consistency, color treatment), flat colors (palette selection, saturation, brightness), shading and highlights (light and shadow placement, shape, transition levels), and details/texture (stylized details without compromising the overall aesthetics). This observation particularly targets a specific subject, which is the 2D illustrations of *Umamusume*'s first main character, Special Week.

The re-engineering used adapts reverse engineering principles from design and technology, which allows practical understanding of how a visual style is achieved. This method follows Frayling's (1993) concept of research *through* art and design. This will approximately involves four stages: deconstructive analysis (breaking down reference illustrations into basic components), principle identification (formulating general rules governing component usage), practical reconstruction (creating new illustration with identified principles), and the evaluation.

Data Sources

Primary data consists of character illustrations from the official *Umamusume: Pretty Derby* website for the selected character that is *Special Week*, which represents the standard visual style as the game's first main character. Secondary data includes illustrations of other characters from *Umamusume* in general, published interviews with art director Takumu in *Cygames Magazine* (May 16, 2025), articles from

industry sources such as Famitsu, articles from open forum and sites which had relevancy by the 2015 time frame, academic literatures on cel shading and character designs, and historical studies of cel shading development in games and animation. The research scope is focused specifically on cel shading techniques applied to in-game characters, excluding other irrelevant visual elements such as typography and menu design, unless directly relevant.

DISCUSSION

Short History of Its Significance

To see how important it is to keep the visual style the same in Umamusume: Pretty Derby, you should watch the first development footage that Cygames released in 2017. The screencap in Figure 1 is from Cygames' YouTube channel and shows the game in its early stages of development.



Figure 1. Umamusume Project First Shown Development Stage (1st Trailer Movie.) Source: Cygames Youtube Channel (2017)

Their early models looked quite good for their time. Cygames had previously developed successful Android titles like *The Idolmaster Cinderella Girls: Starlight Stage* (2015), and Umamusume seems to be following the visual style and unspoken rules of this particular type of mobile games from that time. Figure 2 below shows an early development visual that looks like the formula, which is artist illustration with a 3D model in a different style.



Figure 2. Early Development Shows a Clear Difference Between the 2D and 3D Models. It shows that it needs the 2D illustration to be good on its own by showing different art styles. Source: Cygames YouTube Channel (2017)

It was common to use illustrations as a mobile game's selling point, as shown by the success of Fate/Grand Order at the time. But, there was no *specific* method that worked best in the industry. Cygames had their success with *Princess Connect* and *Idolm@ster* which are unique in their own way. It was *that* crucial to be unique. The first Umamusume teaser made it look like they were trying to appeal to multiple audiences instead of paving their own way.



Figure 3. Fate/Grand Order Gameplay and Graphics, Source: Josh Torres on RPG Site, 2015

Fate/Grand Order had this of doing things: famous artists contributed 2D artwork while in-game battle sprites maintains a specific style, and this can be seen in Figure 3. This contrast between the visuals really increased its appeal. It captured the whole 'collectible art' vibe seen in many mobile games. When Umamusume was first shown, it hinted at a similar concept with its collectible 2D illustrations. However, that created a challenge. They needed the 3D models to fit well with the 2D art

By 2018, Umamusume found a good balance. The 2D and 3D looked polished, cleaner, and more cohesive. This really set the tone leading up to the game's launch in 2021. This kind of consistency not only made the visual and gameplay smoother, but also gave the game its own unique charm, a new level of polish, and character. Meanwhile, their previous 2D illustrations from various artists became sort of an 'official design illustration' that are displayed on their official umamusume site on their character page, but are nowhere to be seen on the main game itself. The final game focused more on using its 3D models throughout the game, while the 2D illustrations are only used for "Support Cards" (a core game mechanic), and event illustrations that complements narrative storytelling. Figure 4 shows the final 2D illustration cel shading style inside the mobile game Umamusume: Pretty Derby.



Figure 4. Final 2D Artwork in Special Week's R Rarity Support Card and In-game Event Cut Scene of Special Week and Her Friend, Silence Suzuka. Source: Umamusume: Pretty Derby (2021)

Since it is a regularly updated game, Umamusume required an efficient production process that will allow it to keep operating for a prolonged period under strict deadlines. The developers also emphasized the characters should also exhibit unique features, specifically the characteristic of "cool and cute" design (Cygames Tech Conference, 2021). This further adds to the importance of creating 2D illustrations that blend seamlessly with 3D character models. More importantly, the 2D illustration is considered as the "design anchor," since the 3D models are expected to mimic the look of the 2D illustrations. Takumu (2021) explains:

3D excels at depicting diverse, dramatic scenes with a sense of realism through nuanced facial expressions, dynamic motion variations, and context-responsive camera work. 2D illustrations can encapsulate entire scenes within a single frame. This allows us to leave room for users' imagination, enabling us to show character relationships or express comical exchanges. Furthermore, by incorporating stylized characters throughout as a third expressive method, we can add more comical and vivid color to the game world.

Deconstructive Analysis

First let's see the basics of Umamusume styled cel shading. The components are:

- 1) Flat Color
- 2) Shading and Highlight (Core Shadow, Highlight, Rim Light, and Reflected Light)
- 3) Outline
- 4) Texture (details and texture)

These are simplified and stylized basics rooted in art practice. While the graphic is stylized, it is necessary for it to *make sense*. See Figure 5 for the visualization of Umamusume styled cel shading.

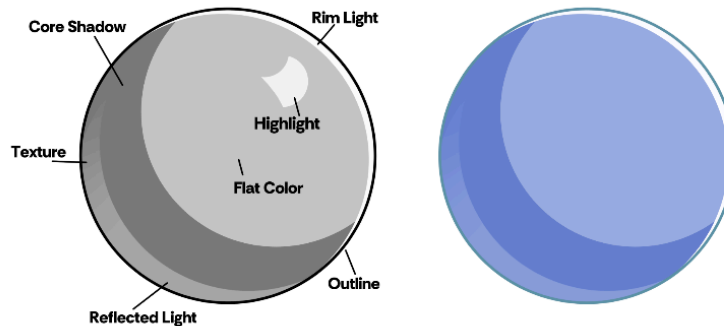


Figure 5. The Basics of Umamusume Cel Shading. Left is shiny surface, right is rough surface. Source: author's work.

These are simplified and stylized basics rooted in art practice. While the graphic is stylized, it is necessary for it to *make sense*. See Figure 5 for the visualization of Umamusume styled cel shading. Now we will break down each of its components in the usage of character art in Umamusume:



Figure 6. Self Breakdown of Special Week's Close Up Shot. Source: Umamusume Pretty Derby (2021)

See Figure 6 on the placements of the various components. Each component is there for a reason. Flat colors establish clean, graphic foundations reminiscent of traditional anime/manga illustration, providing base layers upon which all other elements are applied. The shading system employs few selective elements—core shadows as distinct hard-edged shapes defining form; highlight are used to convey a shiny surface; rim lights creating separation, depth, and visual pop; and subtle reflected light preventing shadows from appearing flat—all rendered with overall sharp style to preserve the cel-shaded quality. Clean outlines define silhouettes and details while reinforcing the anime-inspired graphic identity; details like eye texturing are made so the character pops visually and to show each character's personality; and only subtle texturing are used—like the feathering out in reflected lighting is an example on how it should not break the cel shading style.

Even though these features may be simplified and stylized, they are constructed based on artistic principles which make sure that their appearance *makes sense* visually. Each shadow placements,

highlights, and lines should not *only* look good, but also has their meaning to be there. Which means that stylization should not come at the cost of understandability. This grounded approach to stylized rendering makes it possible for Umamusume characters to look in such a way that they can achieve the intended clarity while making for their own unique stylization. For this purpose, it is a beautiful and clean design to implement.

Principle Identification

The next thing is the development of rules that will govern the use of each aspect:

Flat Color

Umamusume's color scheme really stands out with its bright and warm tones. Because these tones stay vivid, the game's mood always feels open, friendly, and never distant. Even when some specific characters need cooler shades, like blues or purples, they add warmth back in or balance it out so it doesn't come off as dull. The colors are intentionally bright, not washed out, and they keep everything lively. Plus, the brightness is also considered with their visibility as a fundamental concern. Each shade works to keep energy present, even in quieter moments. This is to ensure that each character's design reads clearly and their intended personality shine through, without overwhelming details that might muddy their characterization.

Shading and Highlight

Core Shadow

The 2D illustrations in Umamusume have a strong contrast between light and dark because of how light hits the edges. Instead of blending softly, shades sit boldly in place because of cel shading techniques. One clear direction feeds all lighting decisions with mostly no scattered sources. Shadows stretch across surfaces like broad strokes on canvas. Their shape are sharp, never fuzzy or unclear. They're visibly dark yet warm, ensuring the whole picture feels more vibrant rather than flat and lifeless.



Figure 7. How they use shadow to create layers and depth on Special Week's legs. Source: Umamusume Pretty Derby (2021)

Shadows do more than just show where the light is. It outlines shape, yet it reveals how far things sit from each other - like showing one leg ahead of another, which grounds the drawing in something real, even if drawn simply, much like in Figure 7. In some Umamusume-style art, artists stack color over main shadows through blend modes for a particular look. Additional shading appears when detail calls for it, whether matching current dark zones or shaping soft tones with brush-like control, depending on what mood feels right at that moment, for example to make the tone warmer. This creates finer depth distinctions without breaking the overall stylization.

Highlight

One of the most common uses of highlight is the hair rendering for characters. Hair highlights consistently use the same geometry in terms of positioning in relation to the entire hair mass, which is along the same ring or curve, along with some stylized subtle texturing to indicate how light falls on hair strands. These highlights are visible but would not be overpowering, since their function is more related to shape and form than to color.



Figure 8. Highlights in Umamusume Style. Special Week and Vodka. Source: Umamusume Pretty Derby (2021)

Beyond the usage on hair, highlight techniques extend to other elements as it is also employed to give materials a definition. The character's tail may get some highlighting to create the illusion of fur or hair, while some objects with shiny surfaces, such as golden ornaments or leather, will receive highlights that give material hints to viewers. See Figure 8 for example on usage of main highlight on hair (top image), subtle highlights on leather material (middle image), and highlight on gold material (bottom image).

Rim Light

Rim lighting is another type of direct lighting that actually comes from photography. It is where light highlights the edges of a subject to create a glowing “halo” effect. In Umamusume, it’s used specifically for a stylistic purpose. The glowing edges aren’t intended to make the illustration look realistic, but instead to enhance the overall impact of the illustration. This helps tie together all the elements in the illustration, making them feel like they belong together. You can find rim lighting across the game's 2D art being applied to various character features, from hair to clothing, and the example can be seen on Figure 8. The colors of these rim lighting in Umamusume illustration style can vary for dramatic effect they want to achieve. Most often, it appears as white or a bright color that matches the edges, but colored and even highly saturated rim lighting can also be used to create a specific visual impact.

Reflected Light



Figure 9. Subtle Reflected Light on Special Week's Hair. Source: Umamusume Pretty Derby (2021)

Reflected light or also known as indirect lighting occurs when light bounces off one surface and illuminates another. Picture how soft glows shape the look in Umamusume's 2D art. Light lifts shadows just enough so they stay too heavy. Warmth slips in gently, holding the mood without shifting it. It serves a few key roles: it brightens up the shadow to prevent them from getting excessively dark, it adds that warmth to maintain the overall tone, and introduces color pops that keep things visually engaging. Moreover, reflected light helps to differentiate overlapping elements or set a character apart from their background, making the illustration clearer and adding depth. It's rendered subtly using gradient edges that gradually fades or with airbrush techniques that softly introduces light or color cues into the object. You can see this use of subtle reflected light in Figure 9.

Outline

The outlines in Umamusume illustrations are drawn thin, at about hairline thickness. This gives a nice subtle separation that's reminiscent of an anime style. These lines serve multiple functions: they help to differentiate character parts, shape definitions, and even add details like clothing folds or accessories. Instead of using pure black, the outline colors usually feature darker shades that match the overall tone of the art. Harmony stays intact because the borders follow the scene's mood instead of standing out. When the outlines meet rim lighting, the line color is often a step brighter to make them look more balanced. You'll also see some extra stylization where the outermost outlines receive slightly thicker rendering to highlight the character's form against a background.

Texture



Figure 10. Dirt Detailing on Character: Mr. C.B.'s Support Card. Source: Umamusume Pretty Derby (2021)

Every now and then, texture shows up in Umamusume that are done thoughtfully and carefully. It never overshadows the clear visual base and don't take away from its overall structure. Usually, you'll see textures added in specific ways like adding blush to a character's face, patterns on kimonos, stripes on uniforms, or sometimes grit sticks to shoes or clothes, like in Figure 10. Given the style's heavy reliance on distinct color blocks, these textural details function primarily as embellishment, beautifying the

already simple illustration, or introduce a focal point to attract the player to. In the end, it contributes to the overall polished aesthetic while maintaining the readability which is important to the game's visual identity. Or, sometimes texturings are done to reach the developer's artistic vision on specific cases.

Practical Reconstruction

The only thing left to do is to reconstruct an imitation of Umamusume character art. First we need to imagine or take a horse as an example before moving to create the character art. For this purpose, author decided to go with Meikei Yell from Nagoya Horse Racing Corporation and try to emulate her into Umamusume design as a reconstruction study.



Figure 11. Meikei Yell at Chukyo racecourse. Source: Nadaraikon (2022)

Meikei Yell (as seen in Figure 11), was a Japanese racehorse that was foaled February 23, 2018. She is nicknamed the "Selfish Princess" for her strong-willed personality, which made her a fan favorite. She is a horse from Nagoya Horse Racing Corporation. She achieved significant success in sprint and mile races, winning multiple graded stakes including the 2020 Fantasy Stakes (setting a 2-year-old record), 2021 Tulip Sho, and in 2022 capturing the Silkroad Stakes, Keio Hai Spring Cup, and Centaur Stakes.

Despite her talent and popularity, a G1 victory proved elusive in her 26-start career. She finished her racing career in March 2024 with a final ninth-place run in the Takamatsunomiya Kinen. Though she retired without a top-level title, she was honored as the top vote-getter in the 2022 "Idol Horse" fan poll. She now resides at Northern Farm in Hokkaido to begin her career as a broodmare.

The decision is because of the nickname "Selfish Princess" could be interesting in concept, and because she had rivalry with the pure white *Cinderella Horse* Sodashi which was a G1 horse when she raced. Meikei Yell's story is an interesting story of a racing horse. Particularly on "rivalry", a theming that's often used in *Umamusume: Pretty Derby*.

Reconstruction

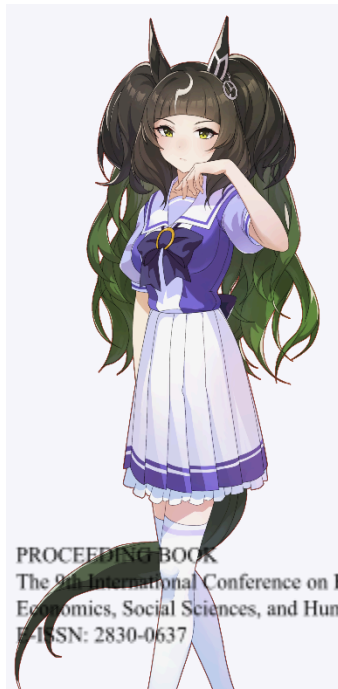


Figure 13. The Face Part, Where Most of the Components are Shown. Princess-vibe concept.



Evaluation

See Figure 12-16 for the complete reconstruction attempt on Umamusume styled cel shading rendering. The author worked on a visual reconstruction using Clip Studio Paint. The main goal is trying to mimic Umamusume's style as closely as possible. This illustration pushed the author's technical skills and letting the author dive more into a personal creative interest. The final illustration is about as close as the author can get given on their current skill level. This personal project was originally started as just playing around with character design, before it turned into a deeper exploration of rendering techniques. The author has found that streamlined cel shading process in particular is a great choice to get a clean, professional appearance without taking up too much time in production.

CONCLUSION AND RECOMMENDATION

This paper explored cel shading as an efficient rendering technique, focusing on the key guidelines for its stylization that should be set *before* starting production. Which in this case includes: flat colors, shading and highlights, outlines, and texturing. By firstly observing and documenting the visual principles behind Umamusume's artwork, the author created an amateur character design and a rendering project that maintained a reasonable production time, showing how these insights can be practically applied in some case.

In today's visual culture, hand-drawn art still holds a lot of value; it can really become the heart and soul of a creative brand. Umamusume itself emerged from its team's passion and dedication, and it successfully captures audiences through thoughtfully crafted stories and supported by its visuals. In an era where image generation increasingly replaces manual creation, interest in hand-drawn art that are documented through experiment, study, and research will carry a particular value. This paper offers that engagement: examining successful franchises to extract principles that may inspire personal artistic development or inspire variations within anime-influenced cel-shaded artwork.

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