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Advisor 1: Prof. Sebastian Stamm
Advisor 2: Nils Camin

Pixel Art in Modern Video Games

How Indie Studios Utilize Contemporary Pixel art

Justin Neumann
student matriculation number: 42522284
kabura.gameart@gmail.com

Abstract

This thesis covers the utilization of pixel art in modern video games. Through examining the evolution of pixel art from its origination to what it has become today, this research will explore what makes this art style still relevant for the modern and ever-advancing game industry, as well as analyzing why especially indie game developers rely on it so extensively. Furthermore, this thesis questions the definition of contemporary pixel art methodologies and studies why and how exactly popular modern indie games make use of them.

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1. Introduction

Over the last decades, the reputation, amount, and quality of video games have drastically increased. At this time, the exponential growth of video games we are witnessing results in uncountable amounts of games for various genres, themes, and art styles. Together with the ever-growing advancement of modern technology, not only our computers and smartphones, but also videogames have evolved to be much more complex, impressive, and realistic than ever before. Especially AAA Studios make use of the steadily increasing capabilities that are provided by the newest high tech hard- and software. While those companies have moved on from the old 8- and 16-bit eras to create photorealistic three-dimensional experiences, many indie developers have been using, or even returning to, the medium of pixel art. Not only has the style of pixel art prevailed, there even seems to be a demand for such games, as many pixel indie games from 2010 and up have become incredibly popular. Games like “Terraria” (2011), “The Binding of Isaac” (2011), “Stardew Valley” (2016), and “Dead Cells” (2018) all have sold millions of copies, proving the success of pixel art games, even in times of technical improvement.

Therefore, the question arises: why do indie studios still make use of pixel art so consistently? Is it because of lower production costs and the general acceleration of the workflow and its subsequent iterations? Do they predicate it on the factor of nostalgia that is always brought up when talking about pixel art? Or is it maybe just an artistic decision, based on aesthetics and abstractions?

Pixel art itself is the predecessor of video game art styles. Born out of necessity, pixel art is simply the result of technical limitations. During the origination of video games, technical capabilities plainly did not allow for any bigger or different resolutions, making it the only medium available for video games during those times. Nowadays, with our greatly improved technologies, there is absolutely no need to depend on pixel art. Even though the medium of pixel art has remained the same since then, with the evolution of our computer systems, many new possibilities for using this medium in diverse and experimental ways have emerged. In particular, the usage of contemporary techniques like shaders, particle systems, and dynamic lighting combined with the style of traditional pixel art can be found in most of the new popular pixel video games.

This Bachelor’s thesis will explore the evolution of pixel art to what it has become today, define what pixel art essentially is, and discuss why it is still so popular for modern indie game developers. Additionally, this thesis will analyze why and how exactly popular indie developers make use of pixel art in their very own video games.

2. What is Pixel Art?

2.1 The history of the pixel

The term “pixel” was popularized in 1965 and, in its essence, is an abbreviation of the words “picture element” (pix-el), meaning that it is the smallest controllable element or fragment in a digital image.[1] Therefore, an image that is displayed on any digital screen consists of thousands, if not even millions, of pixels, which function like tiny building bricks to construct the bigger picture. The very first mention of the term “pixel art”, however, was specified much later by Adele Goldberg and Robert Flegal in a newsletter by ACM in 1982.[2]

The whole concept of pixel art was brought into existence due to the hardware limitations of technology during the time period when video games first originated. Those video game aesthetics were simply defined by the lack of available memory space and computing power, which resulted in the need for extremely simplified graphic elements. Every aspect had to be cut as short as possible in order to make up for the low computing capacity and memory space computers could provide during those times. Games like “Pong” (1972) and “Pac-Man” (1980) are great examples to show how early game developers had to make use of simplified blocks and shapes to create objects and characters. The jump ’n’ run game “Donkey Kong” (1981) by Nintendo is also one of the most remarkable arcade games from that era. Due to the technical restrictions, every single element of this game fits on one simple sprite sheet.

The release of the Nintendo Entertainment System (NES) in 1983 marked the beginning of the 8-bit era. It was restricted to displaying 54 colors total, with a sum of 25 colors being able to be displayed on the screen at the same time. Many popular games, with successors being released on modern consoles up to this day, were first introduced during this 8-bit era. Those games include “Tetris” (1984), “Super Mario Bros.” (1985), and “The Legend of Zelda” (1986). Differently than on the arcade machines before, developers started making use of characters with higher recognition values, adding details and more refined structures to their worlds, as well as implementing cut scenes and other additions. Over the years, technology started to develop further, and together with increasing memory space and computing power, the 16-bit era started in 1987. With increasing capacities, game developers have been able to add even more details and complexity to their works. Games became much more dynamic, and even first attempts in creating three-dimensional spaces were made. Games like: “Street Fighter” (1987), “Sonic the Hedgehog” (1991), and “Super Metroid” (1994) were published during this time period and, together with famous games from the 8-bit era, laid the fundamentals of popular franchises we know until today.

1 Heikkinen, Olli. “Hi-Bit Pixel Graphics – New Era of Pixel Art” Bachelor’s thesis, Tampere University of Applied Sciences, 2021.

2 Elkheshen, Gamal Ahmed. “Pixel Art as a Visual Stimulus in Graphic Arts” Helwan University, Cairo, Egypt, 2021.

The very first 3D game released on consoles, “Virtua Fighter” (1993), used pixel-based UI elements together with the first low-poly 3D models. Even though the entire screen was still pixelated due to its relatively small resolution, the first step towards three-dimensional video games was made. The 16-bit era came to an end in 1993 as computers and consoles advanced more and more. Especially the new generation of consoles like the “PlayStation” (1994) and the “Nintendo 64” (1996) started releasing games with greater resolutions and features. With the new boom of 3D games, pixel art started to decrease in popularity as video games simply did not have the hard restrictions that forced the developers into using it. The times of pixel games were over, as nearly every game company made use of the new technology, which allowed for more and more resolution in an incredibly short amount of time.

Nevertheless, in the last decade, the relatively new genre of “indie games,” meaning games made by small developer teams or even individuals, progressively grew in popularity, and with it, its most frequently used art style: pixel art. Differently than in the times of necessity, the developers now did not need to depend on specific limitations, which resulted in considerably more flexible possibilities when it comes to the usage of the medium of pixel art. Instead of being constrained by technical limitations, game developers now utilize the style of artistic pixelation, incorporating it into larger resolutions, and combining it with vastly more modern techniques that simply did not exist some decades ago. In addition to the usage of traditional pixel art, modern indie games like “The Last Night” (still in development) even break through the limitations pixel art itself entails, in order to fuse it with non-pixel visual effects like light beams, water reflections, and volumetric fog.[3] (See illustration 1).

Because of the potential for experimentation and implementation with various modern techniques, pixel art is able to create unique visuals and experiences. With the increased usage of pixel art in modern indie video games, its story is far from over. Unlike many people might have speculated many years ago, it prevails up to this day.

(Illustration 1: “The Last Night” (still in development), gameplay preview)

3 RocketBrush Studio. “Why Pixel Art Games Have Become Widely Popular“ Article, 2021.

2.2 Defining pixel art

Before discussing and analyzing why and how modern indie developers make use of pixel art in their recent works, we should define what pixel art essentially is. In our current state, the amount of academic resources based on the usage and definition of pixel art is quite limited. Furthermore, the precise definition of pixel art even varies among its practitioners.[4] Nevertheless, certain patterns in the definition finding of pixel art emerge, resulting in a unified base understanding of the term with varying outcomes regarding specified cases that put the boundaries of pixel art to the test.

In its essence, pixel art is a specified art style, defined by its restrictions. With its most outstanding characteristic being apparent on a pixel level, singular pixels have to be visible and distinguishable in order to be labelled as "pixel art".[4] As stated in the pixel art tutorial on the popular online community "pixeljoint.com", another approach to defining pixel art reads: *"Pixel art is set apart from other digital art forms by its focus on control and precision. The artist has to be in control of the image at the level of the single pixel, and every pixel should be purposefully placed. When pixel art is done purposefully, offsetting just a few pixels can have a dramatic effect on the image."* [4] Taking these definitions into account, a digital drawing, which essentially consists of the same square-shaped, pixel-based grid, does not count as pixel art because of the artist's usage of brushes and strokes, instead of being in control of singular, manually placed pixels. This extends to a point where a giant pixel artwork may have a higher resolution than a small digital drawing and still be recognized as such.

However, with the vast experimentation of mixing traditional pixel art with non-pixel art elements, we get to a point where the previously declared definition of pixel art has to be questioned or maybe even re-defined.

Modern influential indie games like "Celeste" (2018), "Hyper Light Drifter" (2016), and "Dead Cells" (2018) all make use of techniques that differ drastically from what pixel art is in its broad definition, and yet they are still determined as being pixel art games. While "Celeste" (2016) mainly bases its art on hand-crafted pixel sprites, many elements are physically simulated and later rendered to imitate the exact art style, making it almost indistinguishably blend with its surroundings. "Dead Cells" (2018) takes this concept even further, using three-dimensional character models, which are cell shaded to mimic the limited color palette and then rendered to a flat pixel grid in order to replicate the appearance of pixel sprites.[5] (See illustration 2).

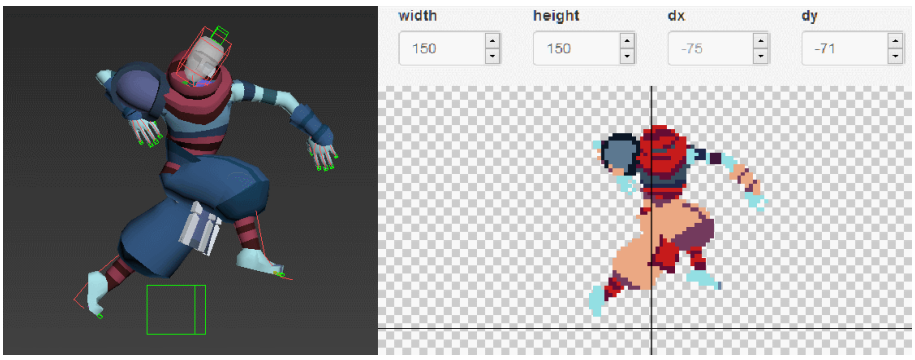
4 Samuelson, Gustav. "Pixel art - The Medium of Limitation: A qualitative study on how experienced artists perceive the relationship between restrictions and creativity" Bachelor's thesis, Umeå University, Faculty of Social Sciences, 2020.

5 Vasseur, Thomas. "Art Design Deep Dive: Using a 3D pipeline for 2D animation in Dead Cells" Article, 2018.

What is needed here is a specific definition of pixel art in various cases. Although the previous definition of pixel art is accurate, the addition of modern experimental possibilities adds another layer of depth that was not considered before. Therefore, the preliminary definition of pixel art as a whole is merely the determination of a section, being “traditional pixel art.” Despite the fact that traditional pixel art is the essential foundation and most common form of pixel art, new sections with the need for more divergent definitions have emerged.

Following the development process of previously mentioned pixel art games with non-pixel art elements being transformed to precisely match the pixel graphic aesthetics, we are far off the definition of traditional pixel art. We end up with a new technique of creating pixel art visuals, being “imitative and generative pixel art”. Imitative as well as generative pixel art, similarly to traditional pixel art, can still be defined by its visual outcome, identifiable as rasterized graphics, apparent on a pixel level. The crucial difference however, lies in the process of creating these graphics. Contrastingly from traditional pixel art, where the artist relies on pixel perfect precision for their artwork during the entire process, imitative pixel art only becomes such after being processed into a pixel grid. Therefore the specific element does not count as pixel art until the pixelation process has concluded. Taking “Dead Cells” (2018) as an example, the character’s 3D model was first animated, then pixelated and edited, and lastly, the finished animation frames were exported as pngs.[6] This procedure is what marks it as imitative pixel art. Pixel art visuals are created, imitating the appearance of traditional pixel art while being created with entirely different methods. Another subcategory that unfolds with the definition of imitative pixel art is the technique of generative pixel art. Generative pixel art is the approach of creating imitative pixel art with the extension of being, as the name reveals, generated uniquely. Accordingly, while pre-rendered and exported sprites of imitative pixel artworks will always stay as they are, a real-time pixel-rendered particle system that generates unique and individual pixel graphics can be defined as producing generative pixel art.

Concluding the new definition of pixel art subcategories, any form of pixel art can be determined as such if its central elements, no matter if before or after post processing, are purposefully visualizing pixel rasterized graphics, just like traditional pixel art does.



(Illustration 2: “Dead Cells” (2018), development process)

6 Vasseur, Thomas. “Art Design Deep Dive: Using a 3D pipeline for 2D animation in Dead Cells” Article, 2018.

3. What Makes Pixel Art Unique?

3.1 Limitations induce creativity

Unlike other art styles, pixel art is defined by the set of restrictions it comes with. Modern pixel artists specifically choose to limit themselves for various reasons; one of them might be simple aesthetic reasons, a challenge to practice minimalism, or to achieve the effect of nostalgia through the imitation of past constraints.

The restriction of canvas size and color palette plays an important factor when it comes to important design decisions. Setting a small canvas size can result in a need for artistic creativity, as a pixel will never be able to change its independent size. Compared to a drawing, where the brush size is easily adjustable in order to fit smaller details, a character on a tiny pixel grid needs to be incredibly simplified, as the small number of pixels cannot simply individually differ in size.

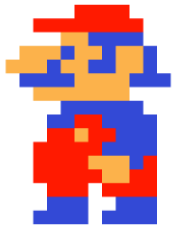
A great example is provided by one of the most iconic video game characters of all time: Mario. Many of his remarkable features, like his prominent mustache and the red hat, are purely the consequence of the harsh canvas limitations in the time of his origination. In his very first appearance, in "Donkey Kong" (1981), Mario has a default height of 16 pixels. (See illustration 3). In an interview with CNN in 2007, Shigeru Miyamoto, the creator of Mario, explained: *"We had to draw Mario as a small character and at the same time, we had to make him look human. To do that, we needed to draw a distinctive feature for him, such as giving him a big nose. We gave him a mustache so that we didn't need to draw a mouth. It is difficult to show facial expressions with small characters."* [7] In another interview with USA Today in 2010, Miyamoto elaborated on this topic even further, saying: *"The technology of the time really dictated how we did character design. If I gave Mario a lot of hair you have to animate it or it doesn't look right. By giving him a hat we didn't have to worry about that. We also didn't have to draw his eyebrows, his forehead or any of these other things. It was just a really useful tool to help us emphasize what we were trying to do on this small screen."* [7]

Nonetheless, not only can the canvas size create a challenge for certain designs, but also a limited color palette often demands creative problem solving. When a pixel artist chooses a set color palette for their work, the amount of colors available mostly does not suffice to give every object its very own tone. In that case, normally different colored objects might get colorized the same way, just to have the additional colors available to be utilized for shading.

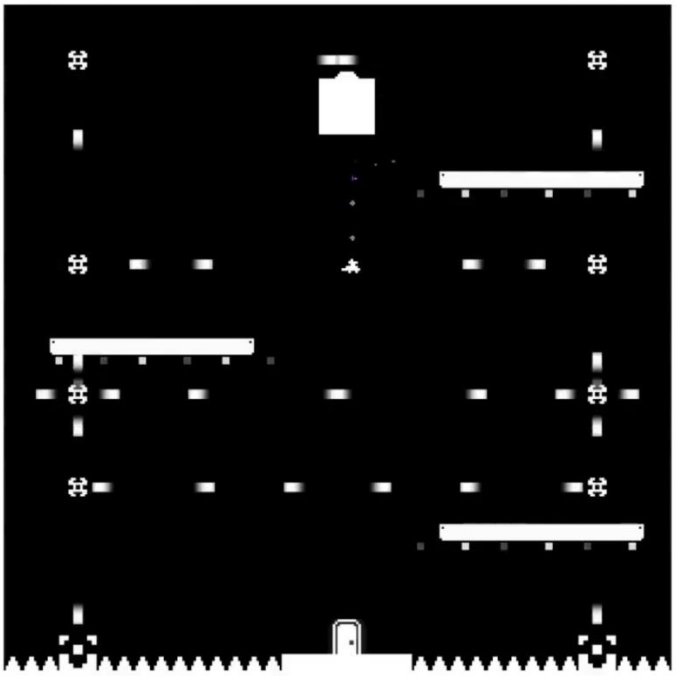
7 Lewis, Dan. "Why Mario Has a Mustache" Article, 2020.

Popular ranges for color palettes include sets of 64, 32, 16, 8, or even just 4 colors. A generally favored color range is the 4-color palette, which was used for the Nintendo Gameboy back in 1989. Many artists try to reconstruct their works in order to imagine what they would have looked like on this classic console. Obviously, the limitations here have strong boundaries to the aspects of nostalgia, but severe restrictions can also be chosen out of pure artistic decisions. As a reference, the game “Zero Zero Zero Zero” (2019) makes use of the so-called “1-bit” art style, which essentially only uses 2 different colors as a whole. (See illustration 4).

The limitations pixel artists face today are more or less similar to the restrictions that earlier game developers were forced into, with the distinction that modern artists have the freedom of choice. They may choose a specific canvas size or color range, but as a crucial difference, they do not have to limit themselves involuntarily.



(Illustration 3: “Donkey Kong” (1981), first appearance of Mario)



(Illustration 4: “Zero Zero Zero Zero” (2019), gameplay preview)

3.2 Aesthetics and nostalgia

Pixel art connects with its audience in different ways. One of the most obvious features is the remarkable factor of nostalgia, due to its prominent history and recognition value. Players who grew up in times where common video games depended on the medium of pixel art often feel a strong bond towards pixelated games, as they convey a similar atmosphere to the retro-arcade games from their memories.[8]

But despite the relationship to nostalgia, pixel art does not purely rely on it in order to be celebrated. In particular, younger generations, growing up without the necessity for pixel art, still enjoy pixel art for what it essentially is: an art style. In an interview with Jake Rocheleau, the experienced pixel artist Jason Perry states: *"Most pixel art games nowadays are trying to emulate certain retro styles, like Shovel Knight replicating the NES. But it's possible to make some really great stuff for a more modern visual style that still uses pixels."* [9]

With all the experimental and flexible usages of pixel art in modern games, the blocky aesthetics might evoke a feeling of nostalgia for some people, but as it is not always intended to do so, the factor of nostalgia in pixel games is often in the eye of the beholder.

3.3 Artistic abstraction

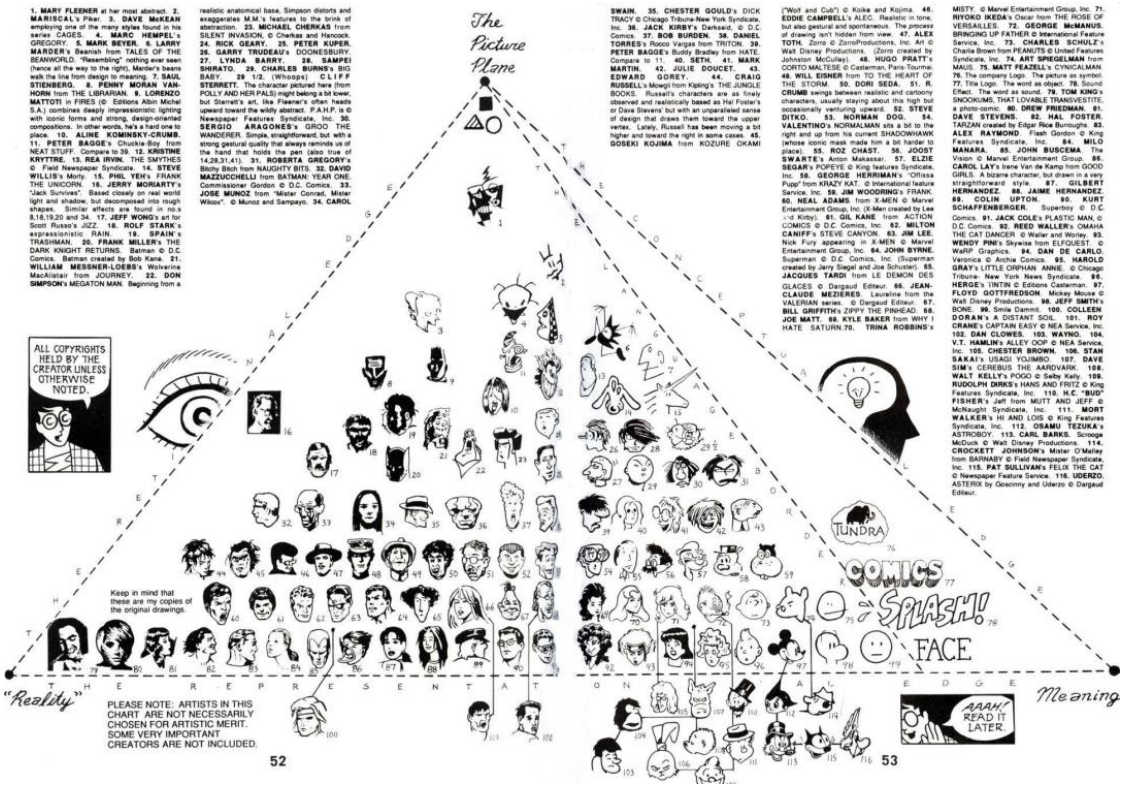
Differently from more realistic approaches, pixel art will never be able to exactly replicate the object it tries to resemble. This distance from realism marks pixel art as a form of abstraction. While interacting, the player subconsciously interprets and converts the image into its real-life resemblance. Pixel artist Pedro Medeiros, also the visual artist behind the popular indie game "Celeste" (2018), says: *"Pixel art has a lot of parallels with Impressionism."* As its abstract depictions make the viewer decipher each image individually in order to "fill in the blanks".[10]

In his book "Understanding Comics: The Invisible Art", released in 1993, the author Scott McCloud explores this concept of visual abstraction even more, as he analyzes the method and philosophy of simplification. With his examination of what he calls "amplification through simplification," McCloud demonstrates how, through the elimination of dispensable details, the focus on more crucial elements is intensified. Following this example, the artist is more in control of what they actually want to convey, as they can amplify the meaning of their work in a way that realistic art cannot.[11]

8 Silber, Daniel. "Pixel Art for Game Developers" Book, 2016.
9 Rocheleau, Jake. "Pixel Artist Jason Perry Shares His Experience In The World Of Modern Pixel Art" Interview, 2016.
10 Moher Aidan. "The Pixel Art Revolution Will Be Televised: How retro blocks overtook 3D gaming to win the hearts of modern players." Article, wired, 2022.
11 McCloud, Scott. "Understanding Comics: The Invisible Art" Book, 1993.

Based on this conclusion, McCloud even classifies and sorts many well-known cartoon and comic characters, showing the progression of abstraction in the realm of the entire pictorial vocabulary of visual art.[12] (See illustration 5).

This concept, therefore, can also be applied to pixel art as well. As an artistic medium, pixel art is a method of minimalism. Similarly to art forms like Impressionism, pixel art stands out due to its very unique way of depicting its abstract creation.



(Illustration 5: "Understanding Comics: The Invisible Art" (1993), pictorial vocabulary of visual arts)

3.4 Pixel art is timeless

Lastly, pixel art as a medium is timeless. But what does that mean exactly?

When we take a look at old 3D games, we often notice how the visual depiction of the three-dimensional world and its characters feels a lot less convincing. The vast evolution of technology that allows for a more realistic representation of three-dimensional worlds today makes previous attempts to imitate these worlds look considerably worse. Pixel art, however, does not imitate reality. With its form of abstraction, the only factor of visual quality depends on the competence and proficiency of the artist. As the style of pixel art does not improve due to technical advancement, a pixel sprite will look just as good in a decade as it does today.[13]

12 McCloud, Scott. "Understanding Comics: The Invisible Art" Book, 1993.

13 Byford, Sam. "Pixel art games aren't retro, they're the future: It's still hip to be square in video games" Article, The Verge, 2014.

4. Pixel Art in Modern Video Games

4.1 Why indie games consistently use pixel art – and why AAA games do not

As a general comparison, the main difference between AAA and indie studios lies in the amount of budget available and the number of developers working on the game. While AAA studios, consisting of massive companies with enormous budgets, have many teams of developers working on their projects, indie studios consist of independent developers, in small groups or even as individuals. With a budget and team size, considerably lower than the ones of AAA companies, indie developers generally resort to divergent methods of creating a game.

AAA studios commonly aim to create photorealistic three-dimensional experiences, based on brand new technology to achieve commercial mass appeal.[14] A character in modern AAA games can consist of 50,000 to 100,000 polygons to accomplish a photorealistic appearance, which results in the need for extremely precise animations to not break the players' immersion.[15] In comparison to that, a pixel art character, consisting of merely 100 to 500 pixels total, does not only come with a considerably smaller workload, it also takes much less effort to create an animation that feels satisfying.[15] Pixel artist Jason Perry, in his interview with Jake Rocheleau, specifies: *"Low resolution naturally hides a lot of errors. But when you move into higher resolutions or have really complex animations, your shortcomings will be noticeable."* [16]

When dealing with hyper-realistic games, a framerate of at least 24 frames per second is necessary for it to look passable for what it tries to convey. Pixel art games, however, can have object animations with just 2 frames total for it to look vivid. This difference between realism and simplified abstractions is just another example of why smaller indie studios tend to make use of the medium of pixel art. Despite the differences in creating and animating video game graphics, many other aspects with differing workflows and iteration processes stand out.

When it comes to world building and level design, photorealistic AAA titles include exceptionally detailed areas, making the surroundings appear as life-like as possible. Looking into the development process of many pixel games however, a popular approach in designing levels embraces the usage of sprite sheets and tile maps. (See illustration 6). Tiles, often only needing versions with variations to not look too repetitive, align and merge seamlessly on the grid due to the sharp and blocky nature of their sprites.

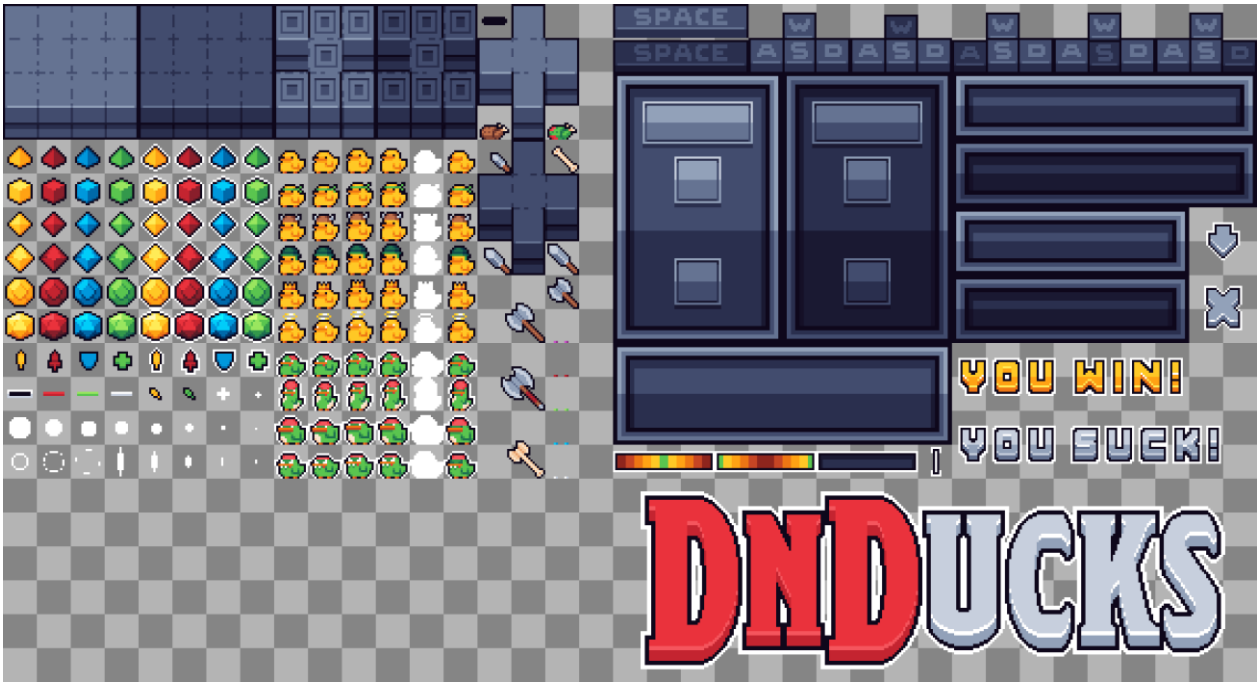
14 Alvarez, Gonzalo. "Pencils, Paints or Pixels? How Aesthetic Choices of Indie Games Affect Interactive Experience" Lamar University, 2016.

15 Out of Sight. "Why is every indie game made with Pixel Art?" 2019.

16 Rocheleau, Jake. "Pixel Artist Jason Perry Shares His Experience In The World Of Modern Pixel Art" Interview, 2016.

In addition, creating pixel art graphics is much more accessible than high-resolution 3D animations, as most programs needed are not only less expensive and complex, but also demand way less computing capacity. The same principle does not only apply to creating, but also playing said video games. Therefore, a two-dimensional indie game based on pixel graphics will most likely never exceed the file size of a brand new AAA title, making it accessible for players without a high-end gaming computer.

Differently from AAA studios, which aim for extremely realistic and extraordinary graphics and experiences, indie developers do not have the need to make use of the most advanced technology available. This divergence in gameplay focus, budget, and artistic decisions impacts the preferred methods used when creating video games. As both types of game developers have distinctive goals and separate expectations of what their game should convey, AAA games tend to go into the hyper-realistic art direction for the sake of utilizing the most advanced technology available, while indie games often tend to stay in the direction of more simplistic styles.



(Illustration 6: “DnDucks” (2022), Sprite sheet for tile mapping)

4.2 Analysis of various traditional and unconventional pixel art techniques used in popular modern indie games

4.2.1 Celeste

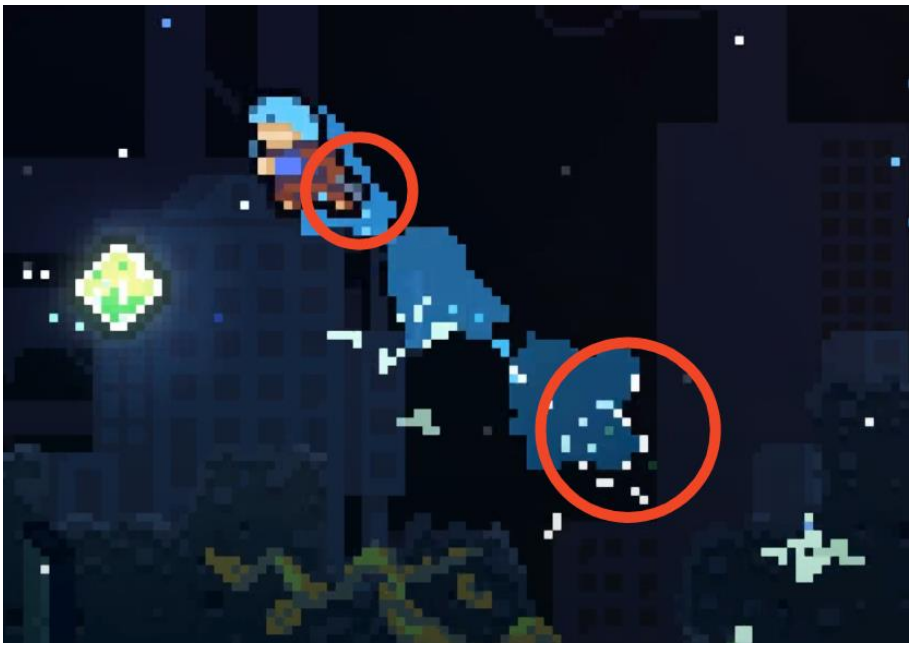
The iconic indie jump 'n' run game "Celeste" (2018) is well known for its immersive gameplay, pleasing soundtrack, and, most importantly here, its fluent and vivid pixel art animations.

Celeste makes use of many traditional pixel art techniques, like typical sprite sheet animations and 8x8 pixel tile maps for the general level design. However, not every pixel art technique used in Celeste has its origin in the traditional sense. Particle systems play a big role in the creation of generative pixel art, which is used to make the surrounding world feel significantly more natural. A canvas renderer is used to render the entire artwork onto a pixel-perfect grid, making every intended element appear pixelated. This technique does not only result in polished and satisfying aesthetics, where every pixel graphic flawlessly aligns, but it also allows many different non-pixel art elements to appear as such. (See illustration 7).

Together with the usage of a pixel perfect canvas renderer, particle systems spawn randomly generated graphics of dust clouds while running and jumping, falling snow is produced in the background and foreground, as well as visualizations of wind to showcase the direction it is coming from. Similarly, when using the dash mechanic, little particles are spawned, moving and fading on the pixel rasterized grid. Apart from these particle systems, some elements are physically simulated to generate fluent and unique animations. Wires, cables, and flags in the background sway slowly and naturally, caused by the wind, as well as the protagonist's hair, which is physically simulated and only later, during post processing, rasterized and edited to appear as generative pixel art.

Nonetheless, despite the whole pixel rasterization method, not every element in Celeste is rendered to pixel graphics. The developers distinctively decided on non-pixel art visuals when it comes to the level selection and UI in the game. The title screen and level selection feature low-poly 3D models and high-resolution digital art, as well as the gameplay UI and dialogue fields. In this particular case, the developers of Celeste particularly decided on having high-resolution character portraits for the dialogues, as they are able to convey the characters' complex emotions in a more detailed and realistic manner.[17]

17 FullIndie. "Pedro Medeiros de Almeida – The Art of Celeste" 2019.

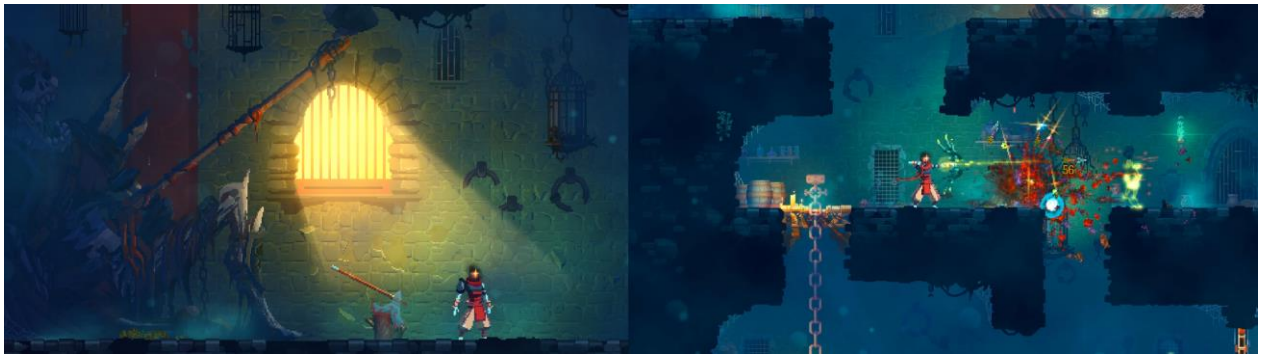


(Illustration 7: “Celeste” (2018), gameplay screenshot)

4.2.2 Dead Cells

“Dead Cells” (2018) takes the concept of rendering graphics into a pixel grid even further, as many of the characters are rasterized and rendered 3D models. In an article on the popular developer website Gamasutra.com, Thomas Vasseur, co-developer and artist of the indie game Dead Cells, shares insights of his unique production workflow. With the 3D tools “3DS Max” and “Filmbox”, he modeled and animated the three-dimensional characters which, later on, were rendered into small, cell-shaded, and non-aliased pixel graphics with the help of a homemade program developed for this specific task.[18]

In addition to the unique character animations, Dead Cells also makes use of many particle systems for various visual effects, as well as glowing materials and dynamic lighting that simulates shadows, adjusting to their individual surrounding light sources. (See illustration 8).



(Illustration 8: “Dead Cells” (2018), gameplay screenshots)

18 Vasseur, Thomas. “Art Design Deep Dive: Using a 3D pipeline for 2D animation in Dead Cells” Article, 2018.

4.2.3 Fez

“Fez” (2012), developed by the indie studio Polytron Corporation, fuses its pixelated art style with the addition of three-dimensional space. Differently from “Dead Cells” (2018), where 3D objects are rendered and exported to flat png’s to fit into the two-dimensional world, Fez embraces the usage of three-dimensional space for a unique player experience. Even though objects appear to be made with traditional pixel art at first, Fez uses the square graphics to its advantage, in order to render the cubic models to appear like a pixel image on a flat surface.[19] (See illustration 9).

The blocky 3D models, also known as voxels, pair up with an orthographical camera view, to imitate the aesthetics of pixel art graphics. As the lead programmer implemented various render methods and culling algorithms for the unique appearance of the three-dimensional objects in Fez, Renaud Bédard, co-developer of Fez, refers to the unique objects as “trixels”.[20] Utilizing the full potential of this experimental three-dimensional pixel art technique, during the game, the player is able to rotate the world in order to discover new paths and hidden passages.

(Illustration 9: “Fez” (2012), gameplay screenshot)

19 Kylmäaho, Noora. “Pixel Graphics in Indie Games“ Bachelor’s thesis, Tampere University of Applied Sciences, 2021.

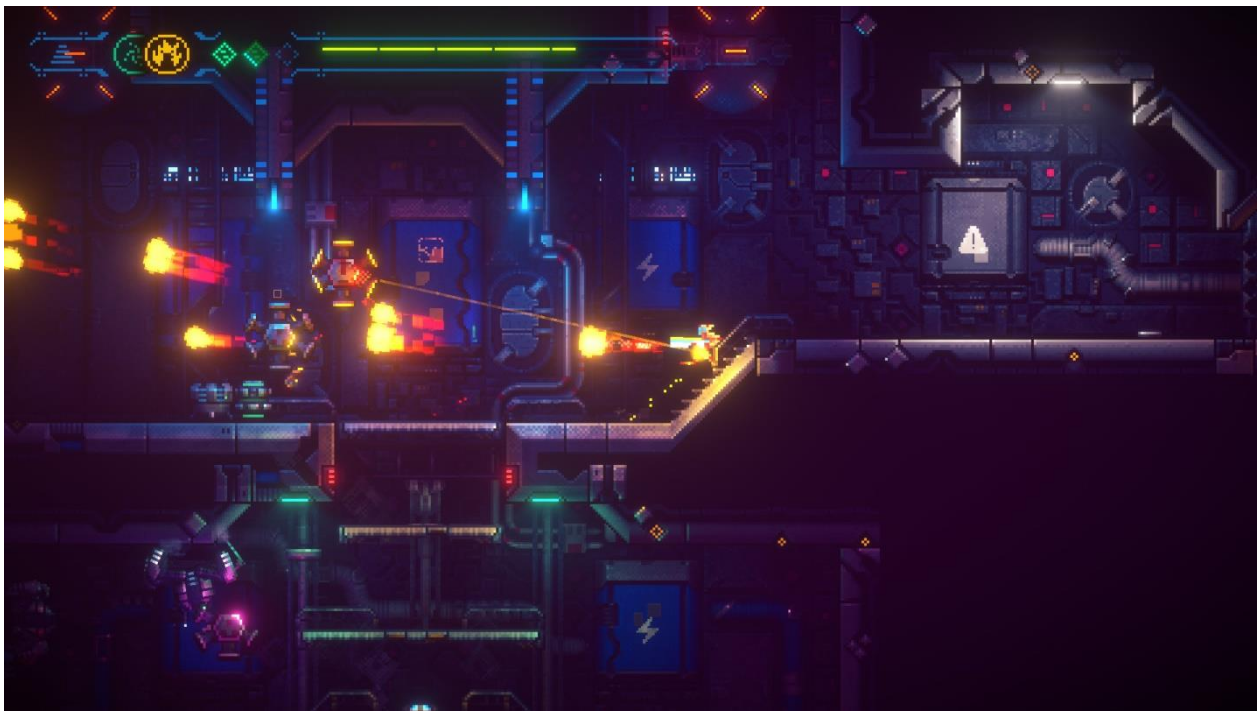
20 Bédard, Renaud. “Behind Fez: Trixels (and why we don’t just say voxels)” 2007.

4.2.4 Megasphere

The action platformer “Megasphere” (2015) by AKGames lays its main visual focus on dynamic lighting. In contrast to early video games, where lighting was either simply drawn onto the sprites or had to be imitated by semi-transparent layers, simulating more realistic and dynamic lighting is now a fairly common method.

Megasphere does not only make use of various lighting techniques, it also includes the addition of normal mapping. A normal map is used to simulate depth and texture on a flat surface. This additional layered texture makes three-dimensional objects, as well as two-dimensional sprites, appear to have more depth and detail, which is often used for additional texturing and more dynamic lighting.[21] As used for Megasphere’s distinctive visual style, due to the many reflections and light sources, the surfaces, essentially only being 2D sprites, appear to be metallic and three-dimensional. (See illustration 10).

With the help of normal mapping, distinctive areas have simulated three-dimensional shapes, making the light reflect accordingly, thus resulting in the optical illusion of imitated depth.



(Illustration 10: “Megasphere” (2015), gameplay screenshot)

21 Heikkinen, Olli. “Hi-Bit Pixel Graphics – New Era of Pixel Art” Bachelor’s thesis, Tampere University of Applied Sciences, 2021.

5. Conclusion

Since the origination of pixel art in early video games, this style of artistic abstraction has evolved from a simple necessity to a medium of choice for various artists all around the globe. Over the past decades, pixel art has not only shifted into an art style that many indie game developers rely on, but with the exponential advancement of technology and game making techniques, many new possibilities for implementing and merging this medium with experimental and contemporary methods have emerged.

As an iconic art style, various generations of players enjoy pixel art for multiple reasons. These pixel graphics do not only rely on the factor of nostalgia, they also shine with a unique form of stylization and high recognition value. Therefore, as a popular medium for modern indie games, pixel art is here to stay. Despite the demand for pixel art games in times of technical advancement, indie developers choose this style for numerous reasons. With great accessibility for developers and consumers, lower production costs, the factor of nostalgia, as well as aesthetic uniqueness, pixel art has many game makers and players choosing this style based on various preferences.

As the appreciation for pixel art prevails, with the help of contemporary techniques, game developers keep pushing the boundaries and possibilities for the utilization of pixel art further and further. And it does not end here. Even if it is hard to tell what will come next for the future of pixel art, it is clear that it will still remain a prominent part of the modern game industry.

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8. List of Illustrations