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The Pixel Art as Computer Graphics Artistic Expression in Digital Games

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Abstract: *The limitations of early gaming graphics hardware emerged Pixel Art as a technology necessity. Nowadays, it has undergone a remarkable evolution in contemporary digital graphics and gaming design. The paper explores the innovative ways modern pixel art is utilized to express artistic vision, evoke emotional resonance, and challenge conventional notions of graphical fidelity. Pixel art is a powerful tool for artistic expression, enabling developers to create visually stunning and thematically rich experiences that resonate with players on a profound level. By harnessing the aesthetic charm and its expressive potential, game creators are pushing the boundaries of contemporary computer graphics and redefining digital games' visual language. The key aspect of contemporary pixel art is its fusion of traditional techniques with modern design sensibilities. Artists employ advanced rendering methods, intricate animation techniques, and sophisticated color palettes to imbue pixel art with a level of detail and sophistication previously unseen in the digital medium. This blending of old and new results in visually captivating digital artwork and games that pay homage to the past while embracing the possibilities of the present, thus pushing the boundaries of what is possible in the medium and shaping the future of computer graphics and digital game design.*

Keywords: *pixel art; computer graphics; artistic expression; digital games*

1. INTRODUCTION

Pixel Art is a type of digital art in which representations are created and edited at the level of small digital image elements, commonly known as pixels. It became popular around the 1970s when computers and digital art began to gain wider social relevance. The Pixel Art is defined by its unique visual style, whereas each pixel function is a complete image's founding element. It is stipulated that this type of art is a visual style very similar to mosaic art, beading, cross stitch, and other types of embroidery techniques [1]. The first definition of the term Pixel Art was introduced in 1982 as a reference to an image designed to be reproduced using pixels. Each of the pixels is represented by its own chromatic and lighting values, and they are organized in an orthogonal matrix in the manner of mosaic tiles that generate the gross image through their juxtaposition [2]. Pixel Art is also observed as a representation in which the image, regardless of its form – digital or physical – is generated from an orthogonal matrix analog to low-resolution digital matrices [3]. The term Pixel Art was first published by Adele Goldberg and Robert Flegal of the Xerox Palo Alto Research Center in 1982 [4]. Etymologically, the term originated from the word *pixel* which is unified with the word *art* to give it a certain artistic intention, meaning the creation of an artistic piece using the data from information. Pixel Art owes its origin mainly to digital games. First video games were designed to be played on cathode ray tube (e.g., CRT) screens. It is important to refer since image representation on these monitors was made up of pixels per unit of length and height, i.e., they had resolution. The Pixel Art approach gained strength throughout the years, mainly in video and arcade games. To this day, digital games, programs, software tools, and objects, still use pixel approach in their construction or design. Pixel Art is an epistemology that still lacks knowledge of the full artistic potential that can be generated. As is the case with digital games, which provide us with support when it comes to the variation of elements, shapes, and colors to be able to link them to any field or context related to digital design.

2. THE PIXEL ART AND DIGITAL GAMES

2.1. Art and new technologies

In the world of contemporary communication, digital media became cultural objects developed through technologies that emerged in the digital revolution, computers, and networks. The term "new media art" arose from artists, gallery owners, and critics to refer to works based on digital technology, such as multimedia installations,

interactive virtual reality environments, and online art [5]. The so-called new media art is also called "net art", "digital art" or "interactive art", and resorts to using digital technologies for artistic purposes. In addition to being a means of transmitting information, this art could also be a form of artistic expression such as painting, photography, or video. The conceptual and aesthetic roots of digital art can be found in the Dadaist movement, pop art, conceptual art, and video art, from which it used strategies and modes of expression, experimentation with new techniques, and finally reaching its recognition as an artistic movement in the 1990s [6]. On the other hand, advances in software and hardware in the 1990s made it easier for artists to become comfortable with new digital technologies as means of artistic expression. With the expansion of the Internet, net art was also consolidated as a new form of artistic expression. At the same time, new genres appeared such as software art, game art, and multimedia installations and performances.

2.2. Art and digital games

Digital game art, like other modalities of new media art, used digital technology for artistic purposes and appeared with the popularization of personal computers during the 1980s and 1990s. Even though video games had previously emerged without clear artistic intention (e.g., Pong, Tetris, etc.), the 1993 video game Doom created by Id Software can be considered a pioneer of game pixel art [7]. The studio launched a reduced and free version of the game online that revolutionized the game monetization model. As a result, millions of copies of software were distributed that allowed players to create new content, thus creating large player communities. This form of in-game creation possibility also attracted the attention of the artistic community which was given the tools to appropriate and modify elements of the audiovisual apparatus of the video game to use them in their artistic discourse [8]. A characteristic of new media art (and game art in particular) inherited from the 20th-century avant-garde ensured that the public became active participants, although in most cases it did not affect the final result. The players appreciated game art in different ways depending on their decisions, since the interactive game inevitably required their participation. The essential part of digital game identity is how it looks on screen and how the combination of its mechanics, visuals, and sound creates the game's aesthetic [9]. This combination evokes an emotional response in the player and defines the mood of the game. Mood is as important a part of design as any other element, just as important as gameplay or story. In recent years, digital games have gone from being just another example of new technologies to becoming key elements in digital media. Digital games now represent one of the essential vital art forms suited to the digital era we live in. They facilitate access to new aesthetic experiences and convert the computer screen into a widely accessible realm of experimentation and innovation. Computer games are interactive medium that imply the active participation of the viewer, converted into a user, who establishes a dialogic relationship with the machine. This interaction is not produced only on a theoretical or mental level, but also takes place on a physical plane, generating visible changes in the composition of the artwork.

2.3. Gaming aesthetics

The experiences and transformations that have taken place in the field of digital game art involve radical changes in the processes of creation, perception, and aesthetics. Interactive art is the starting point for the approach of a new aesthetic discourse that represents a reaction against the theory centered on the art object, a broad interconnection between disciplines, and a redefinition of the roles of the author and the observer [10]. Most researchers observe that game aesthetics is an ambiguous term. However, we can define game aesthetics as a sensory phenomenon that a player encounters when playing the game – we talk of a visual, auditory, and tactile experience. In this way, many game designers have sought inspiration from art books, giving rise to aesthetics influenced by expressionism and romanticism. Some authors define game aesthetics as an "experience" based on the pleasure or emotion that the player feels, explicitly excluding the audiovisual section. Anyway, technological improvements should not be confused with aesthetic advances. Some researchers even argue that digital games suffer a kind of envy of cinema tending towards clumsy realism with 3D graphics and that they should find their form of expression, capitalizing on unique properties such as dynamic systems and participatory player enrollment [11]. Finally, it seems that the consensus between various definitions may be the clue. Game aesthetics should not be referred to solely as the graphics and sound of the game, but as the empirical result that the player experienced by interacting with the design, that is, the player experience [12].

A classification of game aesthetics can be proposed:

- Sensory aesthetics – brings pleasure or sensation to the senses via audiovisual resources and other interfaces;
- Empirical or experiential aesthetics – refers to the emotional experience within the game and can be evoked by emotional factors such as drama or love, or physical factors such as fatigue, discomfort, or pain;
- Exploration aesthetics – discoveries that are made within the game are related to the

curiosity and pleasure of progressing and completing tasks;
- Immersive aesthetics – provides pleasure when entering the context that poses the game. As with works of fiction, the player has to give up a part of his beliefs to fully immerse in the narrative;
- Competitive aesthetics – refers to the challenge of overcoming obstacles, either intellectual or psychomotoric. It is related to power and success.

2.4. The Pixel Art

A digital image is an image designed to be reproduced using pixels or image elements and/or objects, each of which is represented by a chromatic value and organized in a matrix. This digital representation system was born from the need to adapt an image to the technological limitations of the first computers with very low image resolution. Specifically, the first application of pixel art was the design of icons for the visual interfaces of Xerox and Apple operating systems. Nowadays, once these technical limitations have been overcome, pixel art is the way of representing an image on any type of digital media, establishing a creative self-limitation that serves to relate the artistic discourse with the digital environment, its visual language and its forms of specific communication. On the other hand, the appearance of mobile devices brought digital games to an even broader audience, which is often satisfied with simpler graphic images typical of pixel art aesthetics. This approach allowed the possibility of competing small independent teams of programmers and artists, as opposed to traditionally large companies that dominated the digital gaming industry [13]. Therefore, we can affirm that in contrast to digital games with astonishing and realistic graphics many gaming studios nowadays also compete with pixel art as an alternative and artistic decision in the development of a creative project, especially as it can also be monetized in the form of non-fungible tokens (NFTs). Some game creators are adamant about not leaving pixel art aside, a clear example is Minecraft. This famous game still survives with this format, and in fact, there is a game mode that is precisely called pixel art.

There are two main Pixel Art styles:

A. Isometric – consists of creating angles in each pixel with the purpose of making a 3D projection within a 2D plane. It is one of the most used types, especially because it is not necessary to resize the objects or calculate their perspective distortion. To compose this type of pixel art, the artist must focus on the use of colors, since they give the perspective to the drawing. For example, the brightness of colors is used to represent the distance of objects. The further away it is, the less bright the object is. This technique was used in old-school video games such as Final Fantasy (Fig. 1), Metal Slug, Tarzan, etc.

Figure 1. *Final Fantasy game Pixel Art*

B. Non-isometric – type of pixel art only projects a flat image within a space, that is, instead of 3D drawings, with non-isometric pixel art only the dimensions of height and width matter. It can be observed as a style that allows the creation of pixel art in a simpler way, although its uses are more limited. The first installment of Mario Bros is a clear example of what non-isometric pixel art looks like.

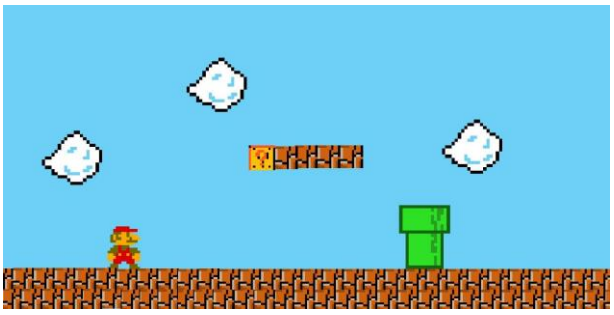

Figure 2. *Mario Bros game Pixel Art*

The creation of pixel art is usually started based on the object morphological analysis, extraction of its form, and the conceptual approach. Through a process of abstraction and subtraction of forms, a variety of 2D patterns are created where breaking patterns and constant patterns are identified. This is how the formal decomposition of the pixel art object is achieved without losing its appearance. Once the idea process is conceived, the selection of proposals is analyzed in terms of the expressive and representative quality of the designed objects in addition to their formal and technological conditions. These are the mechanisms used for the selection and formal concretion. The functional match is determined based on the morphological, typological, and chromatic qualities and particularities of each element of the object. This is how the process appropriates ergonomic and anthropometric spectrums, so that, in turn, the proposed object line respects and executes the maximum requirements in terms of adaptability and adequacy to the original morphology.

2.5. Indie Developers

Opposite to the large video game companies, there are independent or indie video game studios, which still hold only a small part of the gaming industry's economics. Indie video games are developed by small groups or small companies that do not have adequate financial support and are focused more on creative than economic objectives. Their great advantage is that they have no creative limitations and do not require the approval of layers of managers as the large company does. On the other hand, individual participation in a small group encourages innovation, creativity, and artistic experimentation in development and user experience design [14]. The growing interest in indie video game production correlated with the popularization of the Internet and the possibility that games could be distributed online via commercial platforms such as Xbox or Steam, which allowed developers access to the global market. However, most indie digital games are not well-known due to the highly saturated market, especially in mobile games. The reason for publishing this type of product usually lies in the motivation to make teams known in the wider community or simply in individual programmers' passion. In general, it can be stated that indie video games are distinguished by their innovation in design and narrative, the result of creative freedom.

3. CONCLUSION

Pixel Art has carved a unique niche in the landscape of computer graphics and digital games, showcasing a blend of technical constraints and artistic expression that transcends its ostensibly simplistic form. This paper explored the intricate ways pixel art has been employed as a medium for artistic expression within digital games, highlighting its historical significance, aesthetic qualities, and evolving role in contemporary game design. The analysis indicates that pixel art's charm lies in its ability to evoke nostalgia while simultaneously offering a canvas for modern creativity. Despite the advancements in graphical fidelity and realism, the deliberate choice of pixel art by developers underscores a preference for stylistic distinctiveness and emotional resonance. The minimalist approach inherent in pixel art demands a high level of creativity and precision, pushing artists to innovate within a restricted pixel grid and limited color palette. Furthermore, pixel art fosters a unique connection between the gamers and the game world. The abstraction inherent in pixelated graphics allows for a more personalized and imaginative engagement, where players fill in the gaps with their interpretations and memories. This phenomenon contributes to a deeper, more intimate interaction with the game, enhancing the overall experience. The resurgence of pixel art in indie game development reflects a broader cultural and economic shift within the gaming industry. Indie developers, unbound by the commercial pressures that dictate hyper-realistic graphics, often embrace pixel art to convey originality and artistic integrity. This resurgence is not merely a nostalgic revival but a testament to pixel art's enduring relevance and adaptability in expressing complex narratives and emotions.

In conclusion, pixel art stands as a testament to the enduring power of artistic expression in digital games. Its unique blend of simplicity and sophistication continues to captivate audiences and inspire game developers. As the gaming industry evolves, pixel art remains a vital and dynamic form of digital artistic expression, proving that creativity thrives within constraints, and sometimes, less truly is more.

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