

A Study on the Scalability of Design Content Using Pixel Art

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Abstract

The pixel art style evolved from the shortcomings of computer image display technology has gradually transformed from a technical limitation into a widely recognized form of artistic expression since development in the early 20th century. This study analyzes the application and characteristics of the expandability of pixel art style design content in sub industries such as physical goods, environmental design, website design, digital art and illustration in the design field. It aims to explore the visual expression and sustainable development form of pixel art style under the development of new media technology that contradicts traditional technological concepts. The research results show that although the pixel art style generally pursues external visual features such as pixelated visual effects, sawtooth and matrix arrangements, its expansion in the art field shows a unique diversity of visual expressions. It has become an important means to convey nostalgic emotions and cultural values. Through this research, we hope to inspire more academic researchers and technology practitioners to explore the development potential of the pixel art style in emerging fields and promote its innovative application in design practice.

Keywords: *Pixel Art Style, Design Content Scalability, Visual Expression, Sub Style, Pixel Art Creation*

1. Introduction

1.1 Research Background

The emergence and development of pixel art style originated from the shortcomings of image content display in early computer technology using computers as the medium. However, some scholars believe that visual expression forms similar to pixel art styles can be traced back to some long-standing traditional art forms that are combined with handicrafts, such as cross-stitch art and mosaic art.[1] The concept of pixel art has a deep historical origin with other art forms.

Pixel art, which is based on the defects of computer image display technology, has developed from the 20th

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century to the present. With the improvement of scientific and technological ability and the change of artistic aesthetic form, it has gradually developed into a kind of creative art style with nostalgic color.[2] With the development of integrated media, pixel art style has been widely used in various subdivisions of the design industry.

1.2 Research Purpose and Method

By studying the historical origin, development process and application types of pixel art style, this paper subdivides the presentation and application methods of pixel art style in new media visual content into different types. The research focuses on the expanded application from multiple perspectives such as the innovation of artistic design content innovativeness and the retention of traditional artistic image characteristics. It aims to explore in the future integrated visual design expression form and sustainable development methods of pixel art style that is contrary to traditional technical concepts under the development of new media technology.

2. Evolution of Pixel Art

The pixel art style with computer as the medium originated from the computer graphics field in the 1960s. According to the key time nodes of its development, its process can be divided into five stages in Table 1. In the early stages of pixel art's development, technical limitations resulted in artists being able to only use black and white pixels or limited colors to shape image elements. This creative method initially formed the basis of pixel art. With the gradual maturity of technology, although the high-resolution and rich colors of images become possible, pixel art has been inherited and developed because of its unique visual charm and retro feelings. In the 21st century, with the innovation of computer graphics processing technology and digital software, artists can more efficiently create digital art and design thinking. As a result, pixel art has been expanded and is no longer limited to the field of games. So far, pixel art has been transformed from the early technical restrictions into a widely recognized art style form, which has been favored by many artists and the public.

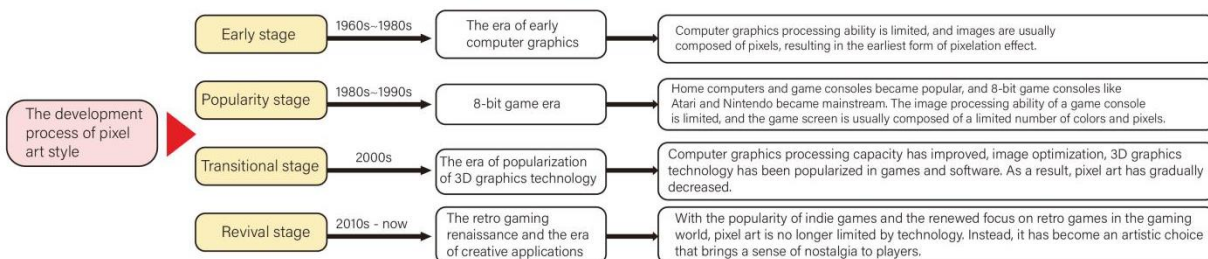


Figure 1. The development process of pixel art style[3]

3. Subdivision and Analysis of Pixel Art

As an important part of digital art, pixel art has evolved a variety of sub-styles with clear style characteristics after years of development and integration. With the continuous expansion of pixel art styles, each sub-style also has a certain status and value in art history.[4] This study provides a detailed feature description of some sub-styles of the pixel art style.

Table 1. Main Parameters

Sub style	Characteristic	Representative works
8-bit pixel style	<ol style="list-style-type: none"> Limited colors: usually 256 colors or less Simplify shapes: Shapes and designs are usually more abstract and graphical. Sharp edges. 	Super Mario Bros
Isometric pixel art style	<ol style="list-style-type: none"> Angle: The oblique angle of 45 degrees makes the front, back, left and right sides visible, but the top and bottom are not obvious. Equal proportion: All three visible faces are presented at the same angle and length on the graph, with symmetry. Depth and Dimension: 2D planar drawing, presenting a 3D visual spatial effect. Pixel integrity 	SimCity 2000
Voxel Style	<ol style="list-style-type: none"> Composition of 3D pixel blocks. Objects and scenes have structural depth. Clear boundaries Modular structure: composed of independent voxel blocks, allowing artists to easily add, remove or modify individual blocks.[5] 	Minecraft
HD Pixel Art	<ol style="list-style-type: none"> High resolution: Unlike traditional pixel art, it is typically created on a larger canvas. Clear pixels: Each pixel is be still clearly defined and displayed, preserving the core aesthetics of pixel art. Richer details: Utilize the advantages of high resolution to include more details and textures. Complex palette: Use more colors to create richer and more detailed effects. 	Owlboy

Pixel art style is not limited to Table 1. With the innovation of technology, there are also 16-bit Style, 32-bit Style, Block Art Style, and Pixel Puzzle Style and other pixel art subdivision styles. These sub-styles not only reflect the integration of technology and art, but also reflect the reinterpretation and innovation of traditional art forms by artists in the digital era. With a new aesthetic perspective, the public can have a deeper understanding and appreciation of the charm and value of pixel art.

4. 4. Research on the Expandability of Pixel Art

The pixel art style developed from the basic characteristics of pixel graphics, under the background of modern technology, it has the coexisting style characteristics of traditional and digital art such as reproduction, order, purity, interactivity, popularity and interest.[6] The pixel art style is based on the traditional square pixel shape, and in the continuous fission, it is often used by artists and designers for modern fusion art creation through their creative techniques. This article analyzes the application characteristics, application expansion methods and cases of four types of pixel art styles of design subdivision industries.

4.1 Physical Goods

In the design of contemporary physical goods, the application of pixel art style has been widely extended to many fields such as clothing, accessories, home accessories, and toys. For example, the pixel art series jewelry launched by APM Monaco brand in October 2018 and February 2019 clearly showed the

characteristics of this style. The designer used simple geometric shapes, combined with sharp and single color contrast, to combine retro and modern fashion elements, thereby giving the jewelry excellent recognition and retro aesthetic emotions. In addition, in some clothing designs, classic pixelated game characters or patterns like Super Mario or Space Invaders are often introduced. These designs not only evoke the golden age of video games, but also harmonize with modern aesthetics to provide consumers with a unique and in-depth visual experience.[7]



Figure 2. APM Monaco brand pixelated series of works

4.2 Environment Design

Pixel art style has also been creatively introduced into environmental design. In interior design, this style is widely used in walls, floors and roofs, while in exterior design, it extends to the appearances, landscape and public art creations. The characteristics of pixel art style in the process of environmental design mainly focus on geometry, modular design, layering and interactivity. For example, the exterior of the pixelated dome restaurant building in Oman is characterized by four pixel volumes. Its dome and interior design adopt the pixel art style, echoing the concave convex shape of the outside, and with the assistance of reflective glass, forming a dynamic space environment inside and outside. In an apartment building in Nanterre, France, the distinctive pixel block color contrast is adopted in the building facade, which not only weakens the sense of oppression of the building facade, but also makes the building displayed in the form of pixel sculpture, make it aesthetically pleasing and have a sense of design.[8]

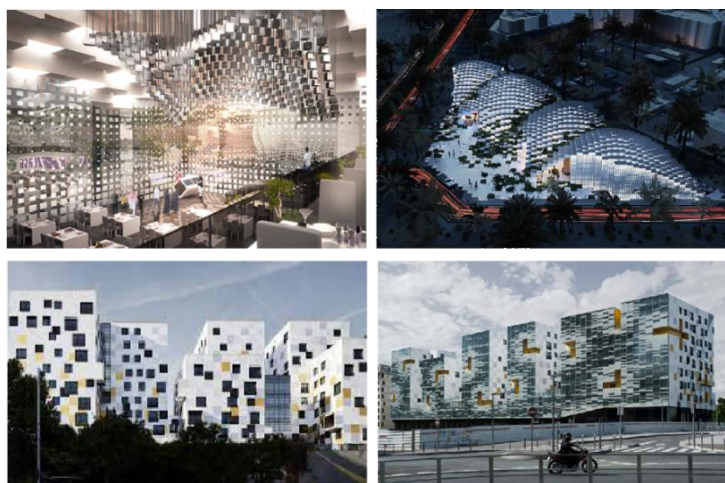


Figure 3. Pixelated dome restaurant in Oman and apartment building in Nanterre, France

4.3 Website Design

The characteristics of pixel art style in website design are more represented by its unique graphical interface, bright colors, dynamic effects, retro fonts and interactive elements. In website design, these features are often applied to the background, icons, buttons and other interface elements.[9] As an online free pixel art production tool, Piske adds some pixelated dynamic effects to its website homepage design, which fully reflecting this style of pixel art. Habitica, a habit tracking and task manager that combines task management with role-playing games. Throughout its website design, all elements from characters, pets to rewards are perfectly integrated into the pixel art style. It provides users with a unique online experience.

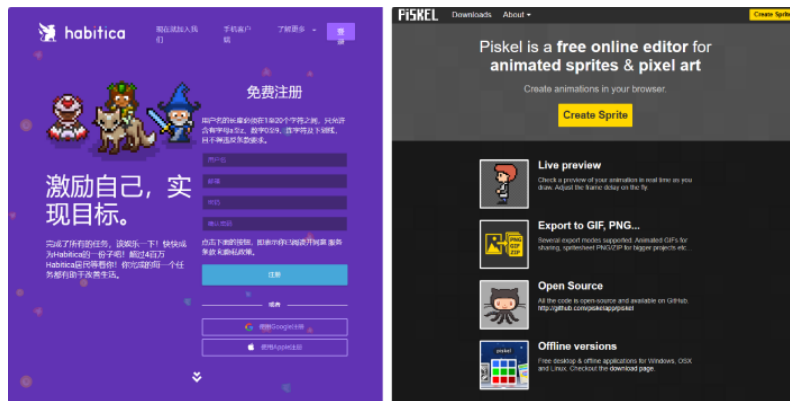


Figure 4. Habitica website and Piske website

4.4 Digital Art and Illustration

In the field of modern digital art and illustration, pixel art style has become a noticeable art form. In the creation process of digital art and illustration, it covers pixel details, geometric forms, distinctive color blocks, image simplification and an obvious nostalgic feature. This special style not only makes images have unique aesthetic value, but also provides artists with a unique way to tell stories.[10] Among them, Octavi Navarro is an outstanding representative in this field. As a renowned pixel artist, Octavi Navarro's works show how to capture delicate pixel details in a simplified medium. Although he uses the pixel style full of nostalgia, his works are very rich and complex in emotional expression and story plot. This also shows that even within the simple framework of pixel art, artists can create works of considerable depth and multi-dimensionality that challenge traditional artistic boundaries.



Figure 5. Illustrations by Octavi Navarro

5. Conclusion

This study provides an in-depth analysis of the application of pixel art style in different fields, and focuses on exploring its unique visual expression in the art world. The study found that although pixel art styles generally pursue external visual features such as pixelated visual effects, jagged edges, and matrix arrangement, its expansion in the art field shows unique visual expression diversity. From the perspective of practical application, pixel art style has gone beyond the scope of pure art, providing designers with a distinctive visual language. It can not only be used as a unique design style logo, but also as a means to convey nostalgic feelings and values. It has a wide application prospect and content expansibility in modern design.

The extensible application of the design content of flexible use of pixel art style is far beyond the modules mentioned in this study. With the development of the new media industry and digital media in the future, pixel art style will also be more applied in various subdivisions of the design industry. For modern designers and artists, understanding and mastering pixel art styles will help them better express their creativity and communicate with the audiences. Based on this study, we hope that researchers and practitioners can continue to explore the development potential of pixel art style content design in more emerging fields.

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