# Analysis of Color-Perspective Composition and Design Considerations in Digital Media (Post-Print)

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## Abstract

With the development of Information Technology (IT), Big Data technology (BigDate), and Virtual Reality (VR), digital media is bound to achieve substantial development and become the new favorite of the era. Digital media is a modern media technology that accomplishes the recording, processing, dissemination, and application of media information based on binary systems. To render digital media more visually compelling and appealing to audiences, this paper analyzes and investigates color presentation, digital media design principles, and pertinent design considerations from the perspective of digital media color composition, offering personal insights and perspectives for digital media design, with the objective of positively contributing to the advancement of digital media.

## Full Text

## Preamble

**Abstract:** With the development of information technology (IT), big data technology, and virtual reality (VR), digital media is poised for tremendous growth and is becoming the new favorite of the era. Digital media represents modern media technology that records, processes, disseminates, and applies media information based on binary systems. To make digital media more eye-catching and appealing to audiences, this paper analyzes and examines color presentation, digital media design principles, and key considerations in design from the perspective of color composition in digital media. It offers personal insights and understanding to contribute positively to the advancement of digital media design.

**Keywords:** Information Technology; Big Data Technology; Virtual Reality Technology; Digital Media; Color; Design Analysis

Digital media, a product of computer technology reaching a certain stage of development, represents the convergence of media technology and information technology. Unlike traditional media, digital media is characterized by its digital nature, integration, interactivity, and 趣味性, representing a fusion of digital technology and art [1]. As digital media hardware technology matures and information technology advances, digital media is becoming mainstream in media communication and integrating into human life. LED screens, mobile apps, HTML websites, and television media are everywhere, gradually replacing traditional "paper media." The emergence of digital media has made human society more colorful, rendering media high-definition, intelligent, and engaging. To create visually pleasing and attention-grabbing digital media, this paper analyzes and investigates digital media design from a color perspective.

## 1. Digital Media Color Modes

The birth of the Color Graphics Adapter in 1981 marked the transition of computer displays from monochrome to a colorful world. The development of digital color has benefited from computer technology' s ability to process, manipulate, and transform digital data, presenting the results of digital color computation on digital terminals for human vision. Digital color simulates and presents real-world colors through computer 0-1 encoding technology, representing a form of virtual color expression [2]. Based on differences in color encoding, principles, storage, and presentation, color modes can be categorized into RGB, CMYK, HSB, Lab, indexed color, grayscale, and others. To present high-quality digital media, we must understand the suitable scenarios, advantages, and disadvantages of each color mode. The following sections analyze the primary digital media color modes.

### 1.1 RGB Color Mode

The RGB color mode is an additive color model based on the three-primary-color principle. RGB does not rely on external light sources; it is self-luminous, with the three colors being Red, Green, and Blue. This mode is designed for computer monitors and other digital display devices. The process of increasing values from zero to maximum represents an additive color mixing process. Taking 8-bit color depth as an example, the value range for R, G, and B is 0 to 255. When R, G, and B values are all 0, the display device emits no light, resulting in black. When all three values reach the maximum of 255, the result is white. The transitional colors between black and white are grays. Smaller R, G, and B values produce lower brightness, deeper grays, and colors closer to black, while larger values produce higher brightness and colors closer to white. RGB can represent 256^3 color varieties, approximating natural colors but unable to represent all natural colors [3].

### 1.2 CMYK Color Mode

The RGB color mode only applies to light-emitting colors and not to non-luminous printing colors. Consequently, the CMYK printing color mode emerged. CMYK printing colors are created by mixing Cyan, Magenta, Yellow, and Black in different proportions. CMYK is a subtractive color model, with each component ranging from 0 to 100%. When C, M, and Y are all 0%, the paper remains blank. When C, M, and Y are all 100%, the paper shows a highly mixed color approaching black. However, mixing three colors multiple times during printing can smudge the paper and produce impure black, so black (K) is printed separately to achieve true black.

[Figure 1: see original paper] Relationship Between GB and CMYK Color Modes

### 1.3 HSB Color Mode

The HSB color mode simulates human visual perception of light colors. Its three elements are Hue, Saturation, and Brightness. Hue represents colors perceived by human vision, expressed as a color wheel from 0 to 360 degrees. Saturation refers to the vividness or purity of colors perceived by human vision, ranging from 0% (gray) to 100% (fully saturated). Brightness indicates the lightness or darkness of colors perceived by human vision, also ranging from 0% (pure black) to 100% (full brightness). The HSB color mode is derived from RGB conversion to Lab mode and designed based on human visual perception [4].

### 1.4 Lab Color Mode

The Lab color mode serves as a bridge between RGB and both HSB and CMYK. Based on calculations from the RGB color mode, L represents luminance, a represents the red-to-green axis, and b represents the yellow-to-blue axis.

### 1.5 Indexed Color Mode

The indexed color mode, used in GIF animations, is less rich than the RGB color mode, consisting of only 256 colors. Other primary colors can be approximated by computationally selecting similar colors. Additionally, bitmap mode is a 1-bit black-and-white color mode that saves significant space—only 1/22 the size of an equivalent RGB image. In light-emitting modes, grayscale color mode uses gray values between 0 and 255 to represent colors, producing delicate and smooth images. Grayscale mode can also be applied to printing, where gray values indicate ink coverage: 0% represents no coverage (paper color), 100% represents full coverage (black), and intermediate values represent transitional grays from white to black.

## 2. Digital Media Design Principles

Digital media design must adhere to holistic planning, achieving deep integration of imagery, meaning, and atmosphere. Design should consider the audience'

s perspective to achieve information transmission goals, following the principles of "eye-catching and readable," "three matchings," and "dynamic-static complementarity."

### 2.1 The "Eye-Catching and Readable" Principle

As dynamic media, digital media design should balance "eye-catching" and "readable" qualities. "Eye-catching" refers to the visual attraction of dynamic colors to human vision. Human visual interest points are captured by rod cells extending outward from the fovea, which are sensitive to dynamic objects, requiring only minimal movement to attract visual interest [5]. Therefore, digital media design can employ color motion or flickering to capture attention. Digital media content can be divided into non-communicative "emotion" and communicative "meaning." "Emotion" primarily evokes emotional resonance, while "meaning" helps audiences comprehend the communication purpose. In design, "emotion" serves to enhance, complement, and trigger audience feelings, while "meaning" can employ moving, flashing, repetitive, or exaggerated techniques to create lasting impressions.

### 2.2 The "Three Matchings" Principle

The "three matchings" principle refers to matching "content" with "form," "movement method" with "display conditions," and "performance" with "effect." When foreground dynamic colors and background colors are well-matched, they create pleasing visual experiences; otherwise, they cause confusion and comprehension difficulties. Digital media design must consider not only software platforms and technologies but also network bandwidth, screen size, capacity, and refresh rate. Large-capacity, large-size digital media files demand higher performance from playback software. Greater color spatiotemporal differences and faster speeds require higher refresh rates from digital terminals; otherwise, obvious jumping or flickering occurs. Therefore, designers must understand display terminal capabilities and balance digital media software settings to align movement with display conditions for optimal visual presentation. The "performance" and "effectiveness" matching refers to aligning design tendencies across different screens with cognitive effectiveness in dynamic color perception. Cognitive effectiveness design aims to present digital media information according to audience audiovisual perception patterns for effective information reception. Since digital terminals employ different display principles, digital media design must adapt to specific terminals. For instance, computer monitors offer wide color gamut, high resolution, and strong clarity for optimal data display; televisions provide vivid colors suited for dynamic video playback; projectors are more affected by environmental conditions, appearing grayer and fainter with slightly weaker clarity; LED screens require consideration of viewing distance, indoor/outdoor environments, monochrome/full-color capabilities, resolution, refresh rate, and other critical parameters.

### 2.3 The "Dynamic-Static Complementarity" Principle

Digital media design should follow the principle of dynamic-static complementarity. Dynamic and static elements are not isolated but interconnected, representing different manifestations in digital media design. Although moving objects easily attract visual interest, they disappear over time, which static elements can compensate for. Digital media color design should maintain a relative concept, following the principle of dynamic-static complementarity. This principle emphasizes mutual complementarity and enhancement: "dynamic" serves as the point, "static" as the plane, with movement within stillness and stillness within movement, achieving unity through variation [6]. Effective utilization of dynamic and static elements both attracts audience attention and reduces visual fatigue, creating both strong visual impact and artistic rhythm, resulting in a harmonious fusion.

## 3. Key Considerations in Digital Media Design

Digital media design should be based on the principles of "eye-catching and readable,""three matchings,"and "dynamic-static complementarity."This section elaborates on key considerations in digital media design from perspectives such as creativity and conception.

### 3.1 The Source of Creativity

The core and soul of art is creativity. In an era of abundant technical means, many designers rely solely on technical stacking, turning works into showcases of technical skill while neglecting the original essence and purpose—this approach puts the cart before the horse and is undesirable. In dynamic color spatial composition, achieving harmony between functional effectiveness and visual beauty through clever color organization requires designers to possess both high technical proficiency and ingenious creativity. Digital media must rely on creativity for its soul, using appropriate forms of expression to present the charm of media art. The waterfall-like screen effect in *The Matrix* left audiences visually stunned, with flowing digital rhythms becoming the golden key to unlocking the computer bit world in viewers'minds—both illusory and real, imprinting deep digital artistic impressions on audiences' psyche. Similarly, the three-dimensional, magnificent opening animation of *News Broadcast* creates impact, with horizontal and vertical lines 穿梭 around a rotating globe symbolizing news broadcasting reaching every corner of the world.

### 3.2 The Path of Conception

Artistic atmosphere and emotional 感染力 are indispensable souls in digital media design. Digital media design must not only fulfill information transmission functions but more importantly provide audiences with emotional pleasure and perceptual creative enjoyment during visual engagement. In digital media color

design conception, designers must uphold the concept of local and overall design. For designers, multidimensional thinking is an essential weapon for media art conception in the digital age, requiring creation based on three-dimensional, panoramic perspectives and imagination. Only with creative digital media color conception can audience interest and resonance be triggered. Digital media serves as the "source" of dynamic color creativity. For example, in the closing animation of *Lost in Thailand*, the ecstatic actors' faces are frozen and transformed into cartoons, which then fade into a transparent "囧" character filled with colorful cartoon faces. When the black "泰" character leaps onto the screen, the "囧" character transitions to black. From face to character, from "囧" to "泰", from color to black—the seamless, natural transition reiterates the theme and enhances the effect.

### 3.3 Beyond Spacetime

For audiences, the visible scope of digital media works is limited, yet the works themselves are continuous and infinite. Over time, constantly transforming new content flows into viewers'eyes, requiring designers to showcase infinite creativity on a limited stage. In the opening of *Super Manager*, as the male protagonist dances leisurely against a red screen, the camera slowly pulls back to reveal a complex dance space, followed by a sudden perspective shift revealing the title at the screen' s center. This cross-spatiotemporal design of color and animation provides audiences with unlimited imagination, creating lasting impressions.

### 3.4 Cognitive Effectiveness

Digital media features digital generation, presentation, interactivity, and presentation 偏差, yet human eyes have varying recognition capabilities for different colors. Therefore, design should be based on human cognitive effectiveness. In web design, for instance, visited information titles appear in red while unvisited ones appear in blue. This simple change leverages human sensitivity to color variations, making it easy for audiences to distinguish and understand.

### 3.5 Communication Effectiveness

Based on color' s communication effectiveness, there are short-term and long-term transmission types. Warnings and reminders belong to short-term transmission, characterized by brief duration, high intensity, and concentrated stimulation. In the opening of *Bunshinsaba II*, high-contrast black, white, and red colors are used—white text flying into a black screen with splattering red blood creates strong contrast, intensely stimulating viewers' nerves and rapidly generating a sense of horror that highlights the film' s terror and gloom. Long-term transmission attracts audiences to continue watching beyond instantaneous display, characterized by longer duration, integrated stimulation, and rhythmic color patterns. In the opening of *Curse of the Golden Flower*, slow-scanning white light reveals golden chrysanthemum petals falling profusely, followed by

slowly emerging blood-red subtitles. The entire design features a soothing, orderly rhythm that renders the darkness and bloodiness of court life [7].

### 3.6 Motion Effectiveness

Different digital media terminals employ varying imaging principles, requiring designers to fully consider media presentation carriers and adopt objective, flexible, and multi-layered design approaches for different display media to achieve effective "effectiveness" in digital media color presentation. For example, when digital media from computers is projected onto screens, projectors are more environmentally affected than computers, producing darker, grayer images. Therefore, design should emphasize enhanced color contrast and appropriate use of dynamic objects. Additionally, since projector resolution is lower than computer displays and viewing distances are greater, designers should avoid small, thin fonts that lose detail, instead selecting bold typefaces to increase dynamic text area. For transmission within the same screen medium, software encoding effects on media must be considered. For instance, dynamic media transmitted over networks must account for bandwidth limitations, requiring consideration of network speed, appropriate encoding selection, and compensatory design measures to minimize effect differences. Same-screen transmission must also consider screen dimensions and sizes, such as computer display ratios of 4:3 and 16:9. In digital media design, techniques like outlining and shadowing can enhance appeal, such as red text with white outlines. Additionally, designers must consider dynamic trailing phenomena in LED displays and other equipment [8].

German artist Rudolf Arnheim once stated: "All intuition contains thought, all reasoning contains intuition, and all reasoning contains creation." With the development of information technology (IT), big data technology, and virtual reality (VR), digital media will undoubtedly achieve tremendous growth and become the new favorite of the digital era. As digital media technology advances and technologies like 3D, VR, and multi-display systems mature, new forms of dynamic digital media await our appreciation, discussion, analysis, and research.

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*Note: Figure translations are in progress. See original paper for figures.*