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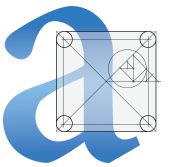

SCIENTIFIC PAPER

The influence of digital channel modifications on perception in mood photography

Ratko Knežević[1], Krunoslav Hajdek[2], Miroslav Mikota[1], Ivana Žiljak Stanimirović[1]

[1]Faculty of Graphic Arts, University of Zagreb, Getaldićeva ulica 2, 10000 Zagreb, Croatia
[2]University North, Trg dr. Žarka Dolinara 1, 48000, Koprivnica, Croatia

Correspondence: khajdek@unin.hr

ABSTRACT:

Mood photography is one of the most common motifs in tourism promotion. It usually depicts a destination or landscape whose imagery encourages viewers to visit the promoted location. The most frequent motifs include sunsets, snowy landscapes, and landscapes in general. These photographs may have a documentary character, serve as image photographs with symbolic value, or sometimes advertise a product that is not explicitly emphasized. Mood photographs convey information and influence the viewer's perception. In the transmission of digitally recorded visual information, they function as a medium in which consumers place their trust. Every digital reproduction consists of blue, green, and red channels of digital data. This research paper investigates the impact of changes to the blue, green, and red channels of digital data on the perception of mood photographs. It examines the influence on the photograph's acceptability, the boundaries for maintaining a realistic appearance, and the interpretation of these boundaries. The research is conducted on two groups of respondents: expert participants and consumer participants, who assess acceptability based on visual evaluation. Alongside participant assessments, characteristic color tables are defined for specific types of promotional photographic images, and the CIE Lab* color values and total color differences (ΔE00) are determined. The study proves that by intervening in the blue, green, and red channels of the digital record—i.e., by altering them—we affect the perception of mood photography. The evaluation results of mood photograph digital files show different thresholds of acceptability. Changes to individual digital channels determine varying acceptability limits when assessing the degraded digital image data.

KEYWORDS:

Blue, green and red channel, Mood photography, Visual assessments

1. INTRODUCTION

Photography as a medium can also be understood as a form of representation that reflects a particular aspect of reality, serving as a sign that refers to a specific object. A widely used classification of signs and their meanings today divides them into three categories: iconic, indexical, and symbolic signs [1]. A particular type of photography that heavily relies on semantic elements and fits within the realm of

illustrative photography is advertising or promotional photography. Its main purpose is to capture the consumer's attention and, in addition to delivering information, motivate the purchase or use of a certain product or service.

To effectively draw attention, promotional photography employs techniques such as close-up shots, direct eye contact, altered reality, and shock value. Common types of promotional photography include: mood photography, persuasive photography, explanatory photography, and product photography [2].

Mood photography, in particular, requires high-quality visual communication, as influencing the viewer's perception can directly impact their decision-making process regarding the advertised product or service. The promotional message—central to integrated marketing communication—aims to encourage consumer engagement with a product or service. A crucial aspect of mood photography is the editing and standardization of the image for consistent reproduction.

This type of photography plays an essential role in presenting products and services in a way that not only attracts attention but also shapes consumer choices and emotional responses. Most people spend about 80% of their time looking at the picture and just 20% reading the words [3].

Mood photography enhances the consumer experience and encourages consumption by capturing attention, facilitating communication, and delivering meaningful content. Research shows that manipulating the red, green, and blue channels in a digital image can alter perception, with each channel having its own threshold of acceptable manipulation.

These findings highlight the significance of mood photography in attracting consumer attention and influencing perception [3].

2. EXPERIMENTAL PART

The research in this experiment is based on the visual comparison of mood photographs defined as the original and the degraded photographic images of that same original mood photograph (Figure 1.).

Figure 1 *Original mood photograph*

This study explores how the perception of mood photography can be influenced by adjusting the red (R), green (G), and blue (B) channels in the digital version of promotional images. It also examines how changes in each individual channel affect the viewer's assessment of the image's acceptability. Additionally, the research aims to define the limits within which an image still maintains a realistic appearance. The realistic or iconic nature of the promotional mood photograph is evaluated in comparison to the original version, which serves as a reference point [4, 5].

For the purposes of this research, a mood photograph was taken using a Canon EOS 5D Mark III camera. The image was captured in high-quality JPEG format within the Adobe RGB color space. It was then converted to the sRGB color space to create a perceptual reference image, establishing the original mood photograph. Further editing involved modifying the RGB channel values within a range of ±12%, using 3% increments applied uniformly across the entire image. Adobe Photoshop was used for all image processing (Figure 2) [6].

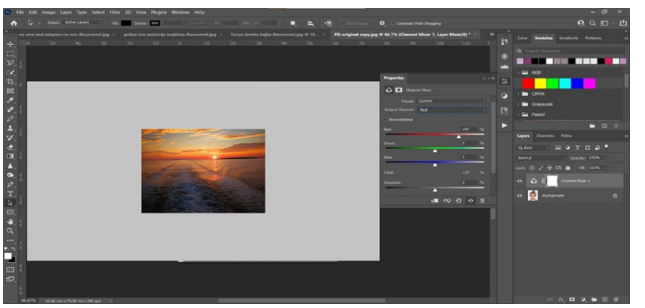

Figure 2 *Adobe Photoshop processing of the original mood photograph*

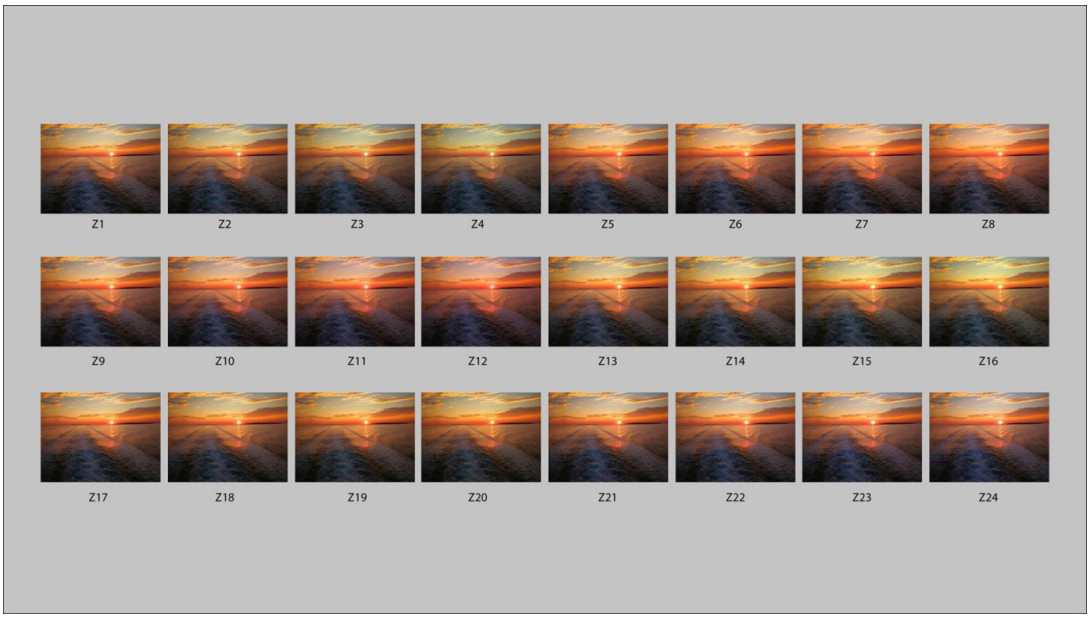

Figure 3 *Degraded mood photograph of the original within the range of +/- 12% with a change step of 3%.*

After degrading the original photograph for each individual RGB channel within a range of +/- 12% with a change step of 3%, we obtained 24 degraded photographs (Figure 3.).

All the photographs were adjusted to fit the format and examined on TCL 55" P615 4K Android TV monitors, set against a neutral gray background that was tailored to match the screen format. This ensured the highest quality reproduction for evaluating the promotional mood images. To facilitate accurate comparison, each altered mood photograph was assigned a unique code consisting of a combination of letters and numbers.

The experimental study involved two distinct participant groups. The first group consisted of experts with experience in creating and selecting promotional images, particularly product photography. The second group was made up of consumers with limited expertise in the field, primarily students. The expert group included 5 participants, while the consumer group consisted of 44 participants, with an average age of 21 years and an equal gender distribution (22 males and 22 females). All participants took the Ishihara color recognition test [7, 8]. For the interpretation of the altered mood photograph samples, experts used the method of simultaneous comparison, while consumers employed the method of memory comparison due to their limited expertise. Participants rated the photographs on a scale from 1 to 5, with 1 indicating the least acceptable image and 5 representing the most acceptable [9]. The online survey was created using Google Forms, which participants accessed through links sent to their mobile devices. Data from the photograph assessments were recorded on a server and analyzed for the research.

A color chart specific to the mood photograph was also created, marking three distinct colors with white dots, which highlighted the exact measurement points for the respective colors, as shown in Figure 4.

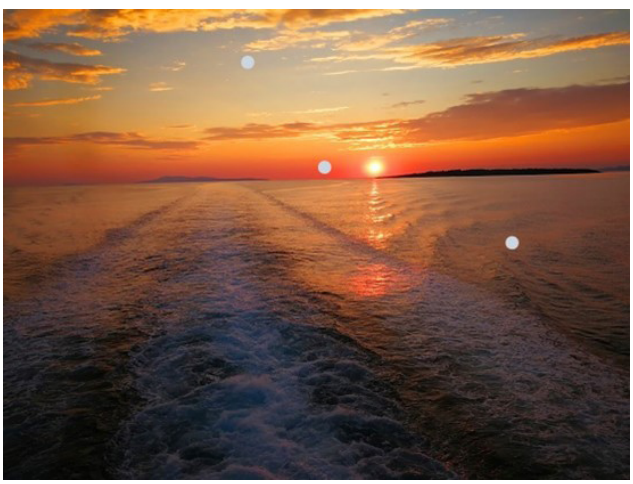

Figure 4 *Display of measurement locations for specific colors in the mood photograph*

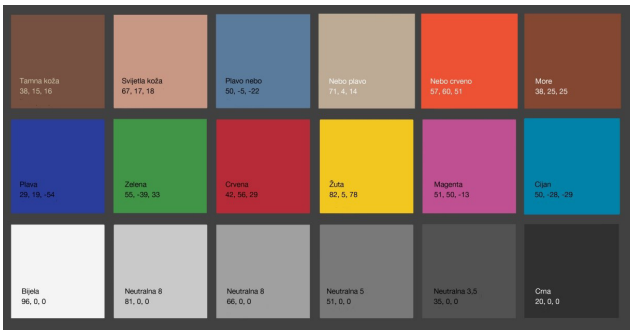

Figure 5 *Characteristic color table with three specific colors from the product photograph and other standard colors*

The three distinct colors in the mood photograph, identified by measuring at specific points, were labeled as "Blue sky," "Red sky," and "Sea." The color chart also featured standard primary and achromatic colors from the reference color table (Figure 5.) [10].

The characteristic color table for the mood photograph underwent degradation across the RGB channels, with each channel being altered within a range of ±3% to ±12%. This adjustment was applied individually to the R, G, and B channels, with the same deviation limits (±3% to ±12%) for each channel [11].

In the subsequent phase of the study, the color changes in the digital records of the characteristic color tables—previously established for the mood photograph—were analyzed. Using the CIE Lab* values calculated via Adobe Photoshop 2020, the total color differences (ΔE00) for each segment of the color table were determined [12, 13].

3. RESULTS AND DISCUSSION

The method of simultaneous comparison, employed by the study's authors with expert participants, involved evaluating the original mood photograph alongside the degraded versions. Experts rated each image on a scale from 1 to 5, where 1 signified an entirely unacceptable reproduction and 5 indicated an exceptionally acceptable reproduction. These results are presented in Table 1. The ratings from the consumer participants, who have limited expertise but are familiar with the topic, were based on a memory comparison of the original mood photograph with the degraded versions. Their results are shown in Table 2 [14, 15].

Table 1 *Expert ratings for the product photograph code Z on a scale from 1 to 5, where 1 is entirely unacceptable and 5 is extremely acceptable*

Picture Code	Expert 1 Re-sponse	Expert 2 Re-sponse	Expert 3 Re-sponse	Expert 4 Re-sponse	Expert 5 Re-sponse	Degra-dation
Z1	4	5	2	5	4	- 3% R
Z2	4	4	2	4	4	- 6% R
Z3	4	4	2	3	4	- 9% R
Z4	4	3	2	1	4	- 12% R
Z5	3	5	2	5	3	+3% R
Z6	4	5	2	4	3	+6% R
Z7	4	5	2	4	2	+9% R
Z8	4	4	2	4	2	+12% R
Z9	2	5	2	5	4	- 3% G
Z10	2	4	2	4	4	- 6% G
Z11	2	3	2	3	2	- 9% G
Z12	2	2	2	3	2	- 12% G
Z13	3	2	2	4	5	+ 3% G
Z14	3	2	2	1	5	+ 6% G
Z15	3	1	2	1	2	+9% G
Z16	3	1	2	1	2	+ 12% G
Z17	4	5	2	4	4	- 3% B
Z18	4	3	2	4	4	- 6% B
Z19	4	3	2	2	3	- 9% B
Z20	3	3	2	1	3	- 12% B
Z21	4	4	2	4	4	+ 3% B
Z22	4	5	2	3	3	+6% B
Z23	3	5	2	2	3	+ 9% B
Z24	5	4	2	1	3	+ 12% B

As presented in Table 1, the evaluations made by the five experts under standardized viewing conditions, using memory comparison, reveal variations within the acceptable limits of changes to individual channels of the digital images. These assessments show a strong correlation with the results from the consumer group, displayed in Table 2, who have a higher level of expertise in photography.

Table 2 *Ratings of consumer participants with less expertise for the product photograph code Z, where 1 is entirely unacceptable and 5 is extremely acceptable.*

Image code	Degradation	5 - 3% R	5 - 6% R	5 - 9% R	4 - 12% R	4 +3% R	4 +6% R	4 +9% R	4 +12% R	5 - 3% G	5 - 6% G	5 - 9% G	5 - 12% G	5 + 3% G	5 + 6% G	5 +9% G	5 + 12% G	5 - 3% B	5 - 6% B	5 - 9% B	5 - 12% B	5 + 3% B	5 +6% B	5 + 9% B	5 + 12% B
1																									
2	Z1	5	5	5	4	5	4	5	5	5	4	5	5	5	4	5	5	5	4	5	5	5	4	5	5
3	Z2	5	5	4	3	5	4	4	5	5	4	4	5	5	4	4	5	5	4	4	5	5	4	4	5
4	Z3	5	5	4	3	4	4	4	5	5	4	4	5	5	4	4	5	5	4	4	5	5	4	4	5
5	Z4	5	4	4	3	5	4	4	5	5	4	4	5	5	4	4	5	5	4	4	5	5	4	4	5
6	Z5	5	5	4	3	5	4	4	5	5	4	4	5	5	4	4	5	5	4	4	5	5	4	4	5
7	Z6	5	5	4	3	5	4	4	5	5	4	4	5	5	4	4	5	5	4	4	5	5	4	4	5
8	Z7	4	5	4	3	5	4	4	5	5	4	4	5	5	4	4	5	5	4	4	5	5	4	4	5
9	Z8	4	5	4	3	5	4	4	5	5	4	4	5	5	4	4	5	5	4	4	5	5	4	4	5
10	Z9	5	5	4	4	5	4	4	5	5	4	4	5	5	4	4	5	5	4	4	5	5	4	4	5
11	Z10	5	5	5	4	5	4	4	5	5	4	4	5	5	4	4	5	5	4	4	5	5	4	4	5
12	Z11	4	1	1	1	3	2	3	4	4	3	3	4	4	3	3	4	4	3	3	4	4	3	3	4
13	Z12	3	1	1	2	3	1	2	4	3	2	2	4	3	2	2	4	3	2	2	4	3	2	2	4
14	Z13	4	5	4	3	5	3	4	5	5	4	4	5	5	4	4	5	5	4	4	5	5	4	4	5
15	Z14	4	4	3	1	2	2	3	4	4	3	3	4	4	3	3	4	4	3	3	4	4	3	3	4
16	Z15	3	2	2	2	3	2	3	4	4	3	3	4	4	3	3	4	4	3	3	4	4	3	3	4
17	Z16	2	1	2	1	2	1	2	3	3	2	2	3	3	2	2	3	3	2	2	3	3	2	2	3
18	Z17	4	4	3	2	4	3	4	5	5	4	4	5	5	4	4	5	5	4	4	5	5	4	4	5
19	Z18	4	4	3	2	4	3	4	5	5	4	4	5	5	4	4	5	5	4	4	5	5	4	4	5
20	Z19	3	2	3	2	3	2	3	4	4	3	3	4	4	3	3	4	4	3	3	4	4	3	3	4
21	Z20	3	2	3	1	4	2	3	4	4	3	3	4	4	3	3	4	4	3	3	4	4	3	3	4
22	Z21	5	2	4	2	4	3	4	5	5	4	4	5	5	4	4	5	5	4	4	5	5	4	4	5
23	Z22	5	2	4	1	4	3	4	5	5	4	4	5	5	4	4	5	5	4	4	5	5	4	4	5
24	Z23	4	2	3	1	4	3	4	5	5	4	4	5	5	4	4	5	5	4	4	5	5	4	4	5
25	Z24	4	1	2	5	4	3	4	5	5	4	4	5	5	4	4	5	5	4	4	5	5	4	4	5

For the characteristic color table derived from the tested mood photograph (Figure 5), Lab values were used to calculate the average ΔE00. This research retained only the tables showing the Lab values for specific colors, along with the corresponding average ΔE00 calculations. The following section presents the average ΔE00 results for each color channel (R, G, and B), including the absolute changes in magnitude (3%, 6%, 9%, 12%) and the direction of those changes (positive or negative) [15, 16].

Table 3 *Mood Photograph - R Channel -3%*

	Original				Measured sample		
	L1	a1	b1	L2	a2	b2	ΔE00
Blue sky	71.00	4.00	14.00	71.00	2.00	13.00	2.436
Red sky	57.00	60.00	51.00	56.00	58.00	49.00	1.126
Sea	38.00	25.00	25.00	37.00	23.00	23.00	1.410

Table 4 *Mood Photograph - R Channel -6%*

	Original				Measured sample		
	L1	a1	b1	L2	a2	b2	ΔE00
Blue sky	71.00	4.00	14.00	70.00	-1.00	12.00	6.450
Red sky	57.00	60.00	51.00	55.00	55.00	47.00	2.365
Sea	38.00	25.00	25.00	37.00	21.00	22.00	2.262

Table 5 *Mood Photograph - R Channel -9%*

	Original				Measured sample		
	L1	a1	b1	L2	a2	b2	ΔE00
Blue sky	71.00	4.00	14.00	70.00	-2.00	11.00	7.909
Red sky	57.00	60.00	51.00	53.00	53.00	45.00	4.344
Sea	38.00	25.00	25.00	36.00	19.00	22.00	3.596

Table 6 *Mood Photograph - R Channel -12%*

	Original				Measured sample		
	L1	a1	b1	L2	a2	b2	ΔE00
Blue sky	71.00	4.00	14.00	69.00	-5.00	11.00	11.73
Red sky	57.00	60.00	51.00	53.00	50.00	44.00	4.788
Sea	38.00	25.00	25.00	35.00	18.00	21.00	4,.101

Table 7 *Mood Photograph - R Channel +3%*

	Original				Measured sample		
	L1	a1	b1	L2	a2	b2	ΔE00
Blue sky	71.00	4.00	14.00	72.00	7.00	15.00	3.363
Red sky	57.00	60.00	51.00	58.00	63.00	52.00	1.276
Sea	38.00	25.00	25.00	38.00	27.00	25.00	1.161

Table 8 *Mood Photograph - R Channel +6%*

	Original				Measured sample		
	L1	a1	b1	L2	a2	b2	ΔE00
Blue sky	71.00	4.00	14.00	72.00	8.00	15.00	4,.834
Red sky	57.00	60.00	51.00	60.00	64.00	53.00	2.908
Sea	38.00	25.00	25.00	39.00	28.00	26.00	1.704

Table 9 *Mood Photograph - R Channel +9%*

	Original				Measured sample		
	L1	a1	b1	L2	a2	b2	ΔE00
Blue sky	71.00	4.00	14.00	73.00	11.00	16.00	7.184
Red sky	57.00	60.00	51.00	60.00	65.00	55.00	3.023
Sea	38.00	25.00	25.00	39.00	30.00	28.00	2.459

Table 10 *Mood Photograph - R Channel +12%*

	Original				Measured sample		
	L1	a1	b1	L2	a2	b2	ΔE00
Blue sky	71.00	4.00	14.00	73.00	11.00	16.00	7.184
Red sky	57.00	60.00	51.00	60.00	65.00	55.00	3.023
Sea	38.00	25.00	25.00	39.00	30.00	28.00	2.459

Table 11 *Mood Photograph - G Channel -3%*

	Original				Measured sample		
	L1	a1	b1	L2	a2	b2	ΔE00
Blue sky	71.00	4.00	14.00	70.00	7.00	12.00	4.203
Red sky	57.00	60.00	51.00	57.00	61.00	50.00	0.765
Sea	38.00	25.00	25.00	37.00	26.00	23.00	1.810

Table 12 *Mood Photograph - G Channel -6%*

	Original				Measured sample		
	L1	a1	b1	L2	a2	b2	ΔE00
Blue sky	71.00	4.00	14.00	69.00	9.00	10.00	7.259
Red sky	57.00	60.00	51.00	56.00	61.00	49.00	1.506
Sea	38.00	25.00	25.00	37.00	28.00	23.00	2.718

Table 13 *Mood Photograph - G Channel -9%*

	Original				Measured sample		
	L1	a1	b1	L2	a2	b2	ΔE00
Blue sky	71.00	4.00	14.00	67.00	13.00	8.00	11.96
Red sky	57.00	60.00	51.00	56.00	62.00	50.00	1.456
Sea	38.00	25.00	25.00	36.00	28.00	24.00	2.704

Table 14 *Mood Photograph - G Channel -12%*

	Original				Measured sample		
	L1	a1	b1	L2	a2	b2	ΔE00
Blue sky	71.00	4.00	14.00	66.00	15.00	6.00	14.49
Red sky	57.00	60.00	51.00	56.00	63.00	49.00	2.089
Sea	38.00	25.00	25.00	36.00	30.00	22.00	4.411

Table 15 *Mood Photograph - G Channel +3%*

	Original				Measured sample		
	L1	a1	b1	L2	a2	b2	ΔE00
Blue sky	71.00	4.00	14.00	72.00	2.00	16.00	3.044
Red sky	57.00	60.00	51.00	57.00	59.00	51.00	0.393
Sea	38.00	25.00	25.00	38.00	24.00	24.00	0.555

Table 16 *Mood Photograph - G Channel +6%*

	Original				Measured sample		
	L1	a1	b1	L2	a2	b2	ΔE00
Blue sky	71.00	4.00	14.00	74.00	0.00	17.00	5.886
Red sky	57.00	60.00	51.00	58.00	58.00	51.00	1.207
Sea	38.00	25.00	25.00	38.00	24.00	25.00	0.599

Table 17 *Mood Photograph - G Channel +9%*

	Original				Measured sample		
	L1	a1	b1	L2	a2	b2	ΔE00
Blue sky	71.00	4.00	14.00	75.00	-3.00	19.00	9.441
Red sky	57.00	60.00	51.00	58.00	57.00	51.00	1.503
Sea	38.00	25.00	25.00	39.00	22.00	27.00	2.811

Table 18 *Mood Photograph - G Channel +12%*

	Original				Measured sample		
	L1	a1	b1	L2	a2	b2	ΔE00
Blue sky	71.00	4.00	14.00	77.00	-6.00	21.00	12.72
Red sky	57.00	60.00	51.00	59.00	56.00	52.00	2.658
Sea	38.00	25.00	25.00	40.00	21.00	26.00	3.339

Table 19 *Mood Photograph -B Channel -3%*

	Original				Measured sample		
	L1	a1	b1	L2	a2	b2	ΔE00
Blue sky	71.00	4.00	14.00	71.00	3.00	16.00	1.924
Red sky	57.00	60.00	51.00	57.00	60.00	51.00	0.000
Sea	38.00	25.00	25.00	38.00	24.00	26.00	1.049

Table 20 *Mood Photograph -B Channel -6%*

	Original				Measured sample		
	L1	a1	b1	L2	a2	b2	ΔE00
Blue sky	71.00	4.00	14.00	71.00	4.00	18.00	2.430
Red sky	57.00	60.00	51.00	57.00	59.00	52.00	0.770
Sea	38.00	25.00	25.00	38.00	25.00	26.00	0.834

Table 21 *Mood Photograph -B Channel -9%*

	Original				Measured sample		
	L1	a1	b1	L2	a2	b2	ΔE00
Blue sky	71.00	4.00	14.00	71.00	3.00	21.00	4.455
Red sky	57.00	60.00	51.00	57.00	5.,00	53.00	1.187
Sea	38.00	25.00	25.00	37.00	25.00	27.00	1.435

Table 22 *Mood Photograph -B Channel -12%*

	Original				Measured sample		
	L1	a1	b1	L2	a2	b2	ΔE00
Blue sky	71.00	4.00	14.00	71.00	2.00	23.00	5.910
Red sky	57.00	60.00	51.00	57.00	59.00	53.00	1.187
Sea	38.00	25.00	25.00	37.00	25.00	29.00	2.430

Table 23 *Mood Photograph - B Channel +3%*

	Original				Measured sample		
	L1	a1	b1	L2	a2	b2	ΔE00
Blue sky	71.00	4.00	14.00	71.00	5.00	11.00	2.660
Red sky	57.00	60.00	51.00	57.00	60.00	50.00	0.440
Sea	38.00	25.00	25.00	38.00	25.00	23.00	1.194

Table 24 *Mood Photograph - B Channel +6%*

	Original				Measured sample		
	L1	a1	b1	L2	a2	b2	ΔE00
Blue sky	71.00	4.00	14.00	71.00	5.00	9.00	4.038
Red sky	57.00	60.00	51.00	57.00	60.00	50.00	0.440
Sea	38.00	25.00	25.00	38.00	25.00	23.00	1.194

Table 25 *Mood Photograph - B Channel +9%*

	Original				Measured sample		
	L1	a1	b1	L2	a2	b2	ΔE00
Blue sky	71.00	4.00	14.00	71.00	6.00	6.00	7022
Red sky	57.00	60.00	51.00	57.00	60.00	48.00	1.331
Sea	38.00	25.00	25.00	38.00	25.00	23.00	1.194

Table 26 *Mood Photograph - B Channel +12%*

	Original				Measured sample		
	L1	a1	b1	L2	a2	b2	ΔE00
Blue sky	71.00	4.00	14.00	71.00	6.00	5.00	7.811
Red sky	57.00	60.00	51.00	57.00	60.00	47.00	1.782
Sea	38.00	25.00	25.00	38.00	26.00	21.00	2.790

Based on the completed research and analysis of results regarding the adjustments and degradation of the RGB channels within a range of ±12% and step sizes of ±3%, it was found that the consumer participants, who had less expertise, tended to choose images with acceptability ratings where the total color difference (ΔE00) was 6 or less. These results indicate that modifications within this range, when applied to mood photographs, stay within the limits of perceptual acceptability.

4. CONCLUSION

The research conducted suggests that digital interventions and modifications, when compared to the original photographic image, lead to informational degradation and the introduction of communication noise. Such interventions can be applied at various stages of the digital photography process; however, the most precise

control over the effect is achieved during the digital record processing phase. In this phase, selective adjustments to individual channels (red, green, blue) can be made while maintaining the integrity of the other channels, allowing for accurate regulation of the image's visual output.

The findings further reveal that modifying the basic RGB channel values within predefined limits can maintain the realism and iconic quality of the photographic image. Much of the prior research has focused on portrait photography, which in the context of promotional photography is seen as a persuasive visual; landscape photography, which conveys mood; and food photography, which often serves as catalog imagery.

Analysis of these categories showed that portrait photography, as a form of persuasive imagery, is most sensitive to changes, with the preservation of realistic impressions closely tied to the acceptable limits of variation in skin tone depiction.

The research on promotional mood photography indicates that optimal image perception and interpretation are achieved by adjusting the intensity of the color channels during digital processing within limits of ±6%. A similar correlation between perceptual image quality and channel value adjustments was observed for other subject matter, with the threshold for color perception changes extending to ±9%. These adjustments, however, are not entirely measurable using standard color tables typically used for evaluating color reproduction in digital production stages.

Furthermore, testing demonstrated that even small changes within acceptable color difference values (as per the ΔE00 criterion) can substantially influence the image's visual perception. A comparison of visual evaluations by experts and end users alongside objective color difference measurements (ΔE00) highlights the need for additional research into the relationship between the quantitative measurements of digital records and their perceptually relevant, realistic characteristics.

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