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The Influence of Light and Color in Digital Paintings of Environmental Issues on Emotions and Cognitions

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Abstract: This study aimed to examine the use of light and color in digital paintings and their effect on audiences' perceptions of environmental issues. Five digital paintings depicting environmental issues have been designed. Digital painting techniques created black-and-white, monochrome, and color images. Each image used utopian and dystopian visualization concepts to communicate hope and despair. In the experiment, 225 volunteers representing students in colleges were separated into three independent groups: the first group was offered black-and-white images, the second group was offered monochromatic images, and the third group was offered color images. After viewing each image, participants were asked to complete questionnaires about their emotions and cognitions regarding environmental issues, including identifying hope and despair and the artist's perspective at the end. The analysis showed no differences in emotions and cognitions among participants. However, monochromatic images were the most emotionally expressive. The results indicated that the surrounding atmosphere of the images created despair, whereas objects inspired hope. Artists should emphasize the composition of the atmosphere and the objects in the image to convey the concepts of utopia and dystopia to raise awareness of environmental issues.

Keywords: digital painting; coloring; emotion; cognition; environmental issues

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1. Introduction

Environmental issues are problems or concerns related to the impact of human activities on the environment. These issues can include pollution, climate change, habitat destruction, and depletion of natural resources. Every year since the industrial revolution, the average global temperature has risen. Human activities are responsible for global warming [1], particularly the combustion of fossil fuels that release greenhouse gases into the atmosphere. The consequences of global warming are being noticed worldwide. In recent decades, intense heat waves have caused ten thousand deaths worldwide [2]. There were debates over whether climate change has been halted or slowed [3]. However, several studies have disproved these assertions, and the effects of global warming have already harmed people on every continent [4]. Without addressing global warming, we will face the worst consequences: severe droughts, wildfires, floods, tropical storms, and other disasters. Everyone is affected, but poor people are affected the most. Climate change is frequently the primary cause of poverty, displacement, starvation, and disturbance [5]. Sustainable development is an approach to achieving the needs of the present without compromising future capabilities. It aims to balance economic, social, and environmental goals to create a better quality of life for everyone, now and in the future [6].

Art can be a powerful tool for supporting sustainable development by raising awareness, engaging communities, promoting social change, and providing an outlet for creativity. The arts have become a driving force of social consciousness, changing the world by motivating people to act on social issues. Many artists have used paintings, photographs,

installations, and experiences to convey environmental and climate information [7]. The arts can contribute to the concretization of scientific data by enabling audiences to visualize climate change and establishing personal and emotional connections with audiences [8,9]. According to the survey [10,11], 86% of academics and scientists considered using the arts to communicate climate science positively, but only 24% decided to use this approach.

However, research on climate change reveals that abstract artists have trouble communicating with their audiences [12]. The research compared information visualizations, news photographs, digital arts, and cartoons. Photographs of the environment contributed more than any other artistic medium to a deeper awareness of global warming because they are more visible than abstract works of art. Visual arts usually require clarification or explanation when addressed to non-artist audiences [13]. It is interesting to see what allows the artist to better communicate global warming arts to audiences. The artist's communication is essential for audiences. Especially in artworks about global warming, the artist can communicate a message of hope and despair to audiences and raise their awareness. The arts can invite audiences to contemplate alternate perspectives on hope and despair [14]. Depending on the audience's perspective, the same piece may reflect both hope and despair. Ultimately, the artwork aims to make the audience aware of global warming, and the question is how to present that work.

This paper studied the perspectives of hope and despair in three different colored digital paintings: black-and-white, monochrome, and color. We asked the artist to design five paintings illustrating the impact of environmental issues, beginning with a painting approach using a permanent black bi-marker acrylic pen on a 180 cm $\times$ 150 cm canvas, then transferring to A3 size in Adobe Photoshop. Using Photoshop, the black-and-white image was digitized and converted to monochrome and color images. This research examined emotions, awareness of environmental issues, and the artist's perspective. Subjects were groups of university students in Thailand who commented on their feelings and perspectives, and expressed their hopes and despair from the image. The study's results enable digital artists to comprehend color selection and composition for communicating environmental concerns to their audiences.

2. Concept of Artwork

The arts can apply the concepts of utopia and dystopia to environmental issues. Visual ideas from utopia and dystopia can be used in digital art to show hope and despair. With this concept, digital paintings can inspire a good environment if people save the world and the terrible consequences we may face if global warming is allowed to continue. Moreover, the light and color used in digital paintings might change how people see art [15,16] about the environment and global warming. Understanding these ideas is better for showing how environmental issues affect people through digital art design.

2.1. Utopia and Dystopia

The futuristic society utopia is derived from the Greek term, which means no place, and from the English term "Eutopia", which means a good place defined as an imagined society characterized by goodness, justice, regularity, and a friendly population [17]. It is comparable to an ideal society for many people, with the prosperity of science preparing individuals for every part of life. Utopia is the ultimate aspiration of humans to envision a virtuous society that would change the actual world into something we can only imagine [18]. Therefore, the threat to humans in this society is not the social structure or other humans, but an extraterrestrial creature [19].

Dystopia derives from the prefix "Dys", which often has a negative meaning, and the Greek word "topia" meaning place. Thus, dystopia translates to a bad place. Dystopia's futuristic society is a derivation from the different concepts of utopia, which describes a brutally governed society as a world populated with darkness, sorrow, and despair. It is a place where all the bad things come with human doubts about science that has led to the decline of humanity. Instead of being a good and comfortable world, it leads to disaster

for humans. It is a totalitarian society, reflecting the problem of authenticity that requires manipulation, and people become victims of the wicked social system. It primarily depicts a terrible future in a harsh society or an environment in which humanity faces pressure, isolation, and risk, including the collapse of the environment [20].

The artist can reflect the ideas of utopia and dystopia in relation to environmental issues. Utopia is a perfect environment often imagined as a place without pollution. On the other hand, dystopia is the opposite of utopia and is often imagined as a degraded environment or disaster. In the case of digital painting design, we can place a character in relation to a symbol or focal object [21,22] because it can lead the audience into the story and concept. The character can symbolize feelings and the passage of time [23]. Another way to express utopia or dystopia in an image is to place a composition representing balance or distortion [24]. These concepts can reflect the issues experienced by the characters and convinces the audience to consider them.

2.2. Light and Color

Light and color directly affect humans, stimulating bodily functions. Psychologically, it can activate emotions, decision-making, and the subconscious and influence human equilibrium [25]. The use of colors to induce a calm mood can be applied to various contexts, including clothing, ambiance creation, interior design, etc. Each shade conveys a distinct meaning and emotion. Psychologists have studied it and come up with a wide range of applications to select the appropriate color [26]. There are around ten hues, and various color combinations have varying mental impacts. In psychology, there are four primary colors: red, blue, yellow, and green, intimately associated with the human body and mind. Different hues have various connotations [27].

Light and color are elements of the production of all art forms including the design. Lighting and coloring are designed to be aesthetically appealing and represent the storytelling for the viewer's satisfaction, resulting in the completion of the artwork. Light and color are essential for expressing the appropriate emotion and establishing the desired ambiance for the targeted users. Frequently, utopian or dystopian painting design involves light and color as significant components of a scene that can communicate with and enhance the viewer's emotions. To increase the diversity of creative works, lighting and coloring can convey emotion, tell a story, and generate an atmosphere in addition to the characters' conversation. As a result of these factors, defining color tones is essential for establishing mood and story. Different hues and intensities of light can elicit a variety of emotions.

Light and colors are perceived by the audience faster than objects or shapes [28] because they interact directly with audiences' feelings and emotions and are quickly processed [29]. In addition, the effect of the audience's vision enables quick identification and differentiation of distinct colors, lights, objects, and atmospheres [30,31]. The background's lack of light and color can evoke feelings of loss or sadness. On the other hand, using a light background evokes feelings of happiness and hope [32].

Environmental psychologists have also found a range of variables associated with environmental and behavioral activation. Most of the variables were associated with art influenced by climate change and its effect on the viewer [33–37]. It can be utilized as a psychological questionnaire stimulated by environmental art based on the variables [38]. There are studies on the impact of art on the environment [39–41], but there are no direct comparisons of the use of light and color in environmental painting.

In this paper, we present the use of different colors (black-and-white, monochromatic, and color) in digital paintings to study emotions and perspectives on environmental issues. The concept of utopia and dystopia was expressed in five paintings that depicted how environmental issues impact living. This study related aesthetics to psychology, environmental psychology, and environmental art by analyzing the psychological mechanisms of art that affect the audience's emotions using environmental psychology questionnaires [42]. The analysis results of using different colors illustrate the emotional and psychological

connections made by the audience. The results were discussed according to design concepts of utopia and dystopia, including light and color and suggestions for environmental artists.

3. Artwork Design

Painting is an artistic medium used to depict hope and despair in the environment. The images of the environmental issues were designed using five images, beginning with the smallest animal and continuing to the biggest one (from the bird, the eggs, the hermit crab, and the turtle). The final image is a composite with a significant focal point in the center. In the design, the artist intended for the animals depicted in the painting to show suffering and the rubble caused by environmental issues to express the artist's concept and dystopia perspective. For the artist's concept of utopia, the artist deliberately painted and shaded the light to show brightness in the image. Representing a new day waiting, including trees and a lotus to represent the existence of life.

This study proposes paintings of environmental issues that depict hope and despair in the environment. Every master black-and-white image was painted on canvas with acrylic and chemistry pens, drawn from a collection and sketching of several prototypes, and then photographed. Monochrome and color images were made using digital painting techniques. Monochrome images use monochromatic color with gradations similar to black and white images. The use of color consists of hue (the primary color on the color wheel), shade (the color produced by adding black), tone (the color produced by adding gray), and tint (the color produced by adding white). Each painting was displayed in a distinct hue with the following details.

3.1. The Wooden Cage (Comfort Zone)

The wooden cage (comfort zone) is a landscape of environmental change-related occurrences. The picture shows the message from the dark to the light area, like a backlit photo. The violence in the area shows that dystopia is where bad things happen, such as natural disasters. It was a loss that did not go as expected. In a visual sense, the bird stands for life, whereas the bright light of the setting sun stands for renewal and hope. The use of black and white in the image contrasts the dark of the ground with the white of the sky by using light from behind the sky. It shows the history and effects of climate change, which messes up things such as homes, roads, trees, power lines, and nature. Using color tones in this approach generates contrast between the light and dark areas.

Black-and-white concept (Figure 1a): the image enhances the audience's perception of texture without distracting them with color. In addition, the characteristics of textures in black-and-white images, such as wood, rocks, metal, trees, and even plants, make the image appear interesting, three-dimensional, and captivating. Sidelight sources also illuminate textures effectively.

Monochrome concept (Figure 1b): dark brown and medium brown are the only colors on the ground, whereas light brown makes up the higher part of the sky. Due to the absence of color diversity, the surroundings appear dry, dull, and lifeless. It told the audience about the problems of dust, smoke, and broken pieces of buildings, roads, and trees in the area. This catastrophic reflection is scattered throughout the space within the image.

Color concept (Figure 1c): the split-complementary color scheme was used to cover the ground and sky. The orange-red (shade), the yellow-orange (tone), and the light blue (tint) of the sky were used as contrasting combinations. This makes it easy to tell the difference between the ground's dull colors and the sky's bright colors. Similar ground colors can reduce the strong contrast of the sky color. We used many colors and dust to show how bad the pollution problem was. There was debris from residential buildings in the foreground, roads and trees in the middle distance, and smoke clouds in the background.

(**a**) (**b**) (**c**) (**d**)

Figure 1. The image depicts a wooden cage representing the comfort zone, with a bird symbolizing life: (**a**) Black-and-white concept; (**b**) Monochrome concept; (**c**) Color concept; (**d**) Color wheel concept of each image.

3.2. The Following Day (Tomorrow)

The following day (tomorrow) was induced by observing the environment and recognizing the change. Prosperity does not lead to safety or a better quality of life. In terms of egg imagery, it is a utopia that inspires the vision of a world soon filled with hope for life, growth, and family reunion. Images of trees represent hope, life, water, food, air, and exuberance. The later white light near the horizon brought hope and possibly a better environment. It is a dystopia in the sense of a terrible or uncomfortable area caused by a storm.

Black-and-white concept (Figure 2a): in the image, black and gray cover the bird's nest and the ground, whereas white is located in the highest part of the sky and distributed across the image. This use of color enables the audience to notice the black-and-white weight with the contrast of the brightness of the sky and the ground in the front, conveying a sense of desolation, aloneness, gloom, and despair for the future.

(**a**) (**b**) (**c**) (**d**)

Figure 2. The egg imagery inspires life and growth, whereas technology does not guarantee safety or a better life: (**a**) Black-and-white concept; (**b**) Monochrome concept; (**c**) Color concept; (**d**) Color wheel concept of each image.

Monochrome concept (Figure 2b): the artwork is intended to depict a backlit sun approaching the horizon, giving the sense that sunrise or sunset is imminent. The bird's nest and the ground were painted in shades of dark yellow and medium yellow, whereas the sky was painted in a light-yellow hue. This color scheme can induce feelings of insecurity, inferiority, and pessimism. The yellow hue can cause one to lose faith in the upcoming situation. The monotone makes the landscape appear dry and dull. It gives a sense of apprehension for the upcoming events for the creatures awaiting their parents' return. It

is the imagery of an abandoned being without protection. In the center of the image is a significant event, which is an approaching windstorm.

Color concept (Figure 2c): the split-complementary color scheme was used to cover the ground and sky. The orange-dark red (shade), the yellow-medium orange (tone), and the light blue (tint) of the sky were used as contrasting combinations. The contrasting color scheme allows for the separation of the environment in the foreground, where the bird's nests and the ground appear desolate and lifeless in contrast to the vivid colors of the sky. Adding various contrasting colors brings to light an important event in the image. The wind blows the tree around, bringing it close to the large nest with three eggs in the center of the picture.

3.3. The Migration (Homeless)

The migration (homeless) illustrates an abandoned animal struggling for existence and attempting to adapt to its environment. The artwork depicts a hermit crab in a broken energy drink bottle. Even though this image depicts the suffering of living creatures (dystopia), the upper half is a utopia, with the horizon continuing into the sky. Waiting for a path to hope and a new beginning can be compared to the upcoming arrival of better days.

Black-and-white concept (Figure 3a): black and gray are applied to the sea's surface, whereas white is diffused across the sky and the top of the image. This allows the audience to distinguish between the light and the object.

(**a**) (**b**) (**c**) (**d**)

Figure 3. The artwork depicts the struggle of an abandoned hermit crab living in a broken energy drink bottle: (**a**) Black-and-white concept; (**b**) Monochrome concept; (**c**) Color concept; (**d**) Color wheel concept of each image.

Monochrome concept (Figure 3b): the deep orange and medium orange tones cover the sea surface. The light orange part is in the upper part of the skylight. This tone makes viewers feel tired and down, encouraging them to feel hopeless and helpless with the situation. However, the positive aspect of using this tone is the expression of energy, strength, and excitement.

Color concept (Figure 3c): the split-complementary color scheme of blue-green was used to cover the sea and sky, whereas the hermit crab inside the energy drink bottle was orange-red. This makes the scene in the image's foreground stand out against the vivid hues of the sky. It reveals the problems that are occurring.

3.4. The Turtle (Hopeless)

The turtle (hopeless) is a dystopian concept of loss that does not go as expected. Before the final breath is taken, death separates us from everything and causes immense sorrow and suffering. Everyone's greatest wish is not only immortality but also a painless death. The essence of the image is the absolute truth, which is death. This artwork represents the idea of utopia, as shown by the lotus leaf at the top. It is a ray of light representing

hope, faith, and the belief that utopia will be found in other realms, leading to a new life of goodness and virtue.

Black-and-white concept (Figure 4a): most of the water in the image consists of black and gray shades, with a white scattering in the sky's top part. The heavy use of black and low light in this image gives it a threatening and terrifying feel, giving it a feeling of suffocation, heaviness, coercion, and confinement.

(**a**) (**b**) (**c**) (**d**)

Figure 4. The turtle represents the sorrow and suffering caused by death, but the lotus leaf at the top uses the remains to regenerate: (**a**) Black-and-white concept; (**b**) Monochrome concept; (**c**) Color concept; (**d**) Color wheel concept of each image.

Monochrome concept (Figure 4b): this artwork depicts the possibility related to the loss of life using monochromatic blue. The deep and medium blue tones cover the water and the lotus leaves, whereas the light blue is in the upper part of the sky. This tone conveys to the audience a sense of aloofness, coldness, and carelessness. Using this tone can also cause anxiety.

Color concept (Figure 4c): the split-complementary blue-green scheme covered the water and sky. The lotus stems and the lifeless turtle within the cracked eggshell on the mud were colored orange-red. Thus, the environment and aquatic life were distinguished in the image's foreground. It was observed that the contrasting sections of differing hues made it easier to see the problem that was occurring.

3.5. The New World (Eden)

This artwork depicts a vivid dream of a fertile environment in the form of a cracked eggshell. It is a utopia of coexistence, depicting the forest entirely with all creatures living in harmony. However, it introduced a dystopian concept of a dark space surrounding a cracked eggshell into the composition (it could be a positive thing or a negative area). The interior is decorated with trees, leaves, and flowers representing optimism and renewal. The exterior of the eggshell signified unknown and undiscovered darkness. This composition emphasizes the infinite cyclical nature of existence while simultaneously presenting a utopian and dystopian society.

Black-and-white concept (Figure 5a): the exterior was rendered in black. The white light was positioned in the image's center, a vast space that diffused light over the entire image. This scheme provides a contrast between black, gray, and white. The audience can differentiate the weight of light and shadow, the image's distance, and the image's narrative.

Monochrome concept (Figure 5b): dark green, medium green, and light green tones were selected to cover the forest, river, and sky in the middle of the image. Green represents confidence, which is derived from primal instincts. Wherever there is greenery, there is food and water, which are essential for life. Green is located in the middle of the color spectrum, and our eyes require less effort to perceive it. Consequently, it is the perfect color for relaxation. It is a color that signifies balance and harmony. Too much or the

wrong shade of green might cause us to feel stale and monotonous. If one end of the green spectrum can signify development and life, the other can signify decay and death.

(**a**) (**b**) (**c**) (**d**)

Figure 5. The artwork depicts a fertile environment inside a cracked eggshell where all creatures coexist harmoniously: (**a**) Black-and-white concept; (**b**) Monochrome concept; (**c**) Color concept; (**d**) Color wheel concept of each image.

Color concept (Figure 5c): this artwork appears heavenly with the vivid hues of its fertile surroundings reflected in the eggshell. It is a picture of living together, showing an image full of happiness and hope. The exterior of the eggshell is covered with a dark green-black (shade). The blue-green (tone) appears inside the eggshell. The light orange (tint) arrangement in the center represents the forest and sky. The split-complementary color scheme was utilized to distribute contrasting hues throughout the image. It creates harmony between the colors, lessens the intensity or contrast of colors, and makes the work more appealing by using a wider range of colors.

4. Research Methodology

Our study investigates the effects of light and color design and the concepts of utopia and dystopia on environmental artworks. Five images of environmental issue impact were designed from the small animal to the larger animal as the focal point and the final image with a large center of interest. The order of images may influence the perspective of the audience. Therefore, we sorted based on the image's focal point. We designed the research protocols according to the following process.

4.1. Hypotheses

The audience perspectives were measured in categories of positive emotions, negative emotions, environmental cognitions, hope and despair, and the artist's perspective. In this regard, we have developed the following experimental hypotheses:

H1. *Environmental digital paintings with different colors result in different levels of emotion.*

The study was based on the results of positive and negative emotions in the questionnaire.

H2. *Environmental digital paintings with different colors result in different cognitions and perceptions of environmental issues.*

The study was based on the results of the cognitions and perceptions of environmental issues in the questionnaire.

H3. *Environmental digital paintings with different colors result in different perspectives toward the artist.*

The study was based on the results of the audience's perspectives toward the artist in the questionnaire. The difference between H2 and H3 is about the perceptions and perspectives of the artworks. H2 is the audience's perception of environmental issues, whereas H3 is the audience's perspective toward the artist.

H4. *Environmental digital paintings with different colors result in different perspectives of utopia (hope) and dystopia (despair).*

The study was based on the audience's expressions of hope and despair from the questionnaire by categorizing expressions into three groups: the expressions of things depicted in the image, the expressions of atmosphere in the image, and the feelings that the audience expressed.

4.2. Questionnaires

The first part of the statement described the experimental design and research protocols. The consent form was provided to obtain information and identified gender, age, education level, and arts-related educational institutions. The emotion definitions were provided alongside a YouTube link that demonstrated the utopian and dystopian themes of the many works of art. Five digital paintings representing environmental issues were included in the questionnaire for participants to assess.

Following this, participants were asked about emotional and cognitive factors, as well as their perspectives on hope and despair. Finally, the artist's perspective questionnaire was administered. These factors were rated on a seven-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree) (strongly agree). The questionnaire was implemented in accordance with previously reported experiments [38], which was Climate Change Art at the ArtCOP21 Event in Paris. The first questionnaire focused on emotions and feelings, with the first five questions related to positive emotions and the last five to negative emotions. After that, it was a question about cognitions and perspectives on environmental issues.

How do you feel about this artwork?
Q1: Happiness
Q2: Hope
Q3: A sense of awe
Q4: Surprise
Q5: Inspiration, enthusiasm
Q6: Guilt
Q7: Sadness/disappointment
Q8: Apathy, or a sense of helplessness
Q9: Anger
Q10: Anxiety
What is your perception of this artwork?
Q11: The artwork has something unusual that caused me to stop and look at the details.
Q12: The artwork makes me think and consider its meaning.
Q13: The artwork is relevant to daily life.
Q14: The artwork illustrates how environmental issues might impact me.
Q15: The artwork makes me feel like a member of a community of like-minded people.
Q16: The artwork is a confrontation with a traumatic and cruel society.
Q17: The artwork reminds me of environmental issues.
Q18: The artwork reminds me of my role in this environmental issue situation.
Q19: The artwork made me aware of behaviors that affect the environment.
Q20: The artwork challenges the rules and standards of our society.

Then, participants were asked their opinions about each artwork to identify what expresses hope and despair. This was a short explanation of what the participant sees in the artwork. What is your opinion on this artwork?

O1: What do you think the "hope" in this artwork is?

O2: What do you think the "despair" in this artwork is?

Finally, there were questions about the perspectives of the artist. What kind of person do you imagine the artist to be?

Q21: Someone like yourself

Q22: Someone thinking and living differently than most people.

Q23: Someone with values similar to yours.

Q24: Someone expressing the view of the public.

Q25: Someone expressing the views of a minority.

4.3. Participants

The sample consisted of male and female participants without visual impairment residing in Thailand. The level of education is at least a bachelor's degree in a relevant arts field or a related field. Volunteers must have completed a course in line art, composition, digital drawing, and painting, or a similar discipline. They can express their views on the art of expressing the consequences of environmental changes.

The experiment was approved by Walailak University's Ethics Review Committee with approval number WUEC-22-213-01. This research used an online questionnaire to announce volunteers through social media and public relations through art lecturers. There were 225 participants from Walailak University, Rajamangala University of Technology Phra Nakhon, Silpakorn University, and Prince of Songkla University aged 18 to 39 years old involved in the study, which was divided into three independent groups.

The first group completed a black-and-white painting with questionnaires and consisted of 75 participants (34 males, 37 females, and 4 unidentified; average age: 20.48). The second group completed a monochrome painting with questionnaires consisting of 75 participants (23 males, 50 females, 2 unidentified; average age: 20.63). The third group completed a color painting with questionnaires consisting of 75 participants (26 males, 48 females, 1 unidentified; average age: 19.23). Only data from participants who signed consent forms and completed all questionnaires were considered.

5. Results

A study examined black-and-white, monochrome, and color images. We collected data from a total of 225 participants, divided into three groups of 75. We have independent samples of three groups, then we tested the parametric assumption. The Kolmogorov–Smirnov Test was used for normality testing and all data with respect to non-normal distributions then a non-parametric Kruskal–Wallis test was used for comparing three independent samples of equal sample sizes. The results of each hypothesis are described as follows.

5.1. Emotions

The analysis was based on the results from Tables 1 and 2 of positive emotions and negative emotions in the questionnaire (Q1–Q10). The following are the experimental results from all five digital paintings used to test hypothesis H1:

Table 1. The median results of emotions and cognitions of each image (BW = black-and-white, MN = monochrome, CL = color).

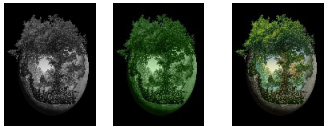
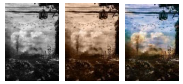
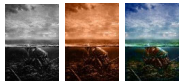
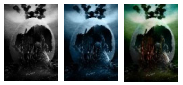
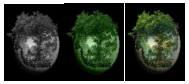
	The Wooden Cage			**The Following Day**			**The Migration**			**The Turtle**			**The New World**		
															
	BW	**MN**	**CL**	**BW**	**MN**	**CL**	**BW**	**MN**	**CL**	**BW**	**MN**	**CL**	**BW**	**MN**	**CL**
Emotions															
Q1: Happiness	2	1	3	4	4	5	3	1	3	2	1	3	7	7	7
Q2: Hope	3	3	4	6	6	6	4	3	4	3	3	4	7	7	7
Q3: A sense of awe	4	4	5	5	5	6	5	4	5	5	5	5	7	7	7
Q4: Surprise	5	5	5	5	5	5	5	5	5	6	6	6	6	6	6
Q5: Inspiration, enthusiasm	5	5	5	5	5	5	5	5	5	5	5	5	6	6	6
Q6: Guilt	6	6	5	4	4	4	6	6	6	5	4	5	3	2	3
Q7: Sadness, disappointment	6	7	6	4	5	4	6	6	5	6	6	6	3	3	2
Q8: Apathy, or a sense of helplessness	6	6	5	4	4	3	5	5	5	6	6	5	3	3	2
Q9: Anger	4	4	4	2	3	2	4	5	4	4	4	4	2	1	2
Q10: Anxiety	6	6	6	5	5	4	5	5	5	6	6	5	2	2	2
Cognitions															
Q11: Potential to make people stop	6	6	6	6	5	5	6	6	6	6	7	7	6	6	6
Q12: Contemplation	7	7	6	6	6	6	7	7	6	7	6	6	7	7	6
Q13: Relevance for daily life	6	6	5	5	5	5	6	6	6	5	5	5	5	6	5
Q14: Personal consequences of environmental issues	7	7	7	5	5	5	6	6	6	5	5	5	4	4	4
Q15: Sense of belonging to a group	6	6	5	5	6	5	6	6	6	5	5	5	6	5	5
Q16: Confrontational and challenging social norms	6	7	6	5	5	5	6	7	6	6	6	6	4	4	3
Q17: Reflections on environmental issues	7	7	7	5	5	4	6	7	6	5	5	5	4	4	4
Q18: Personal role within environmental issues	6	6	6	5	5	5	6	6	6	5	4	5	4	4	4
Q19: Awareness of personal impact	6	7	6	5	5	5	7	7	7	5	5	5	4	5	5
Q20: Challenging social norms	5	5	6	5	4	4	5	6	6	5	5	5	5	5	5

Table 2. The Kruskal–Wallis H test results of emotions and cognitions according to different types of color (sig. * $p < 0.05$, ** $p < 0.01$).

	 Mean Rank			Kruskal-Wallis H	Asymp. Sig.	 Mean Rank			Kruskal-Wallis H	Asymp. Sig.	 Mean Rank			Kruskal-Wallis H	Asymp. Sig.	 Mean Rank			Kruskal-Wallis H	Asymp. Sig.	 Mean Rank			Kruskal-Wallis H	Asymp. Sig.
Emotions																								
Q1: Happiness	115.61	90.57	132.82	17.618	0.000 **	106.91	106.17	125.93	4.588	0.101	122.69	96.31	120.01	7.953	0.019 *	119.35	94.09	125.57	10.574	0.005 **	109.86	111.39	117.75	0.766	0.682
Q2: Hope	104.87	109.93	124.19	3.647	0.161	104.21	121.85	112.94	2.951	0.229	115.71	109.73	113.56	0.334	0.846	117.11	100.93	120.96	4.128	0.127	123.26	106.19	109.55	3.749	0.153
Q3: A sense of awe	117.31	95.9	125.79	8.587	0.014 *	112.15	108.01	118.84	1.119	0.572	113.46	104.33	121.21	2.601	0.272	117.45	106.76	114.79	1.135	0.567	120.87	105.79	112.34	2.604	0.272
Q4: Surprise	115.59	118.61	104.81	1.939	0.379	115.67	117.13	106.19	1.302	0.521	114.74	112.04	112.22	0.084	0.959	106.88	118.26	113.86	1.303	0.521	118.71	107.97	112.32	1.101	0.577
Q5: Inspiration, enthusiasm	110.14	115.17	113.69	0.244	0.885	114.53	115.6	108.87	0.485	0.785	105.65	114.94	118.41	1.59	0.452	110.29	107.69	121.02	1.819	0.403	117.53	106.43	115.04	1.318	0.517
Q6: Guilt	122.5	113.13	103.37	3.407	0.182	118.67	115.67	104.66	1.992	0.369	102.66	120.79	115.55	3.294	0.193	115.17	107.99	115.84	0.695	0.706	115.95	108.45	114.6	0.589	0.745
Q7: Sadness, disappointment	109.77	131.72	97.51	12.782	0.002 **	113.86	124.44	100.7	5.127	0.077	112.98	124.79	101.23	5.28	0.071	118.97	114.75	105.28	1.845	0.397	115.11	113.59	110.3	0.224	0.894
Q8: Apathy, or a sense of helplessness	120.23	116.64	102.13	3.407	0.182	118.41	113.61	106.98	1.201	0.549	111.97	117.77	109.26	0.691	0.708	118.61	113.64	106.75	1.308	0.520	111.88	115.68	111.44	0.206	0.902
Q9: Anger	110.78	117.47	110.75	0.546	0.761	112.06	118.96	107.98	1.154	0.562	105.06	121.71	112.23	2.545	0.280	104.57	118.87	115.56	2.03	0.362	113.16	111.44	114.4	0.09	0.956
Q10: Anxiety	114.04	131.14	93.82	13.112	0.001 **	118.37	130.28	90.35	15.296	0.000 **	112.24	120.52	106.24	1.901	0.387	114.16	123.86	100.98	4.904	0.086	113.23	115.01	110.76	0.174	0.917
Cognitions																									
Q11: Potential to make people stop	108.53	116.84	113.63	0.664	0.717	122.68	109.25	107.07	2.644	0.267	112.71	114.31	111.98	0.056	0.973	110.63	117.17	111.2	0.546	0.761	114.57	104.85	119.59	2.231	0.328
Q12: Contemplation	116.99	122.25	99.76	5.619	0.060	120.37	120.73	97.89	6.607	0.037 *	115.77	114.58	108.65	0.596	0.742	120.07	109.7	109.23	1.486	0.476	116.13	117.79	105.08	2.003	0.367
Q13: Relevance for daily life	118.61	112.29	108.1	1.062	0.588	115.89	116.35	106.75	1.091	0.580	116.13	116.78	106.09	1.424	0.491	111.61	109.23	118.16	0.788	0.674	105.12	119.81	114.07	2.039	0.361
Q14: Personal consequences	108.01	118.97	112.02	1.382	0.501	111.61	121.59	105.8	2.338	0.311	106.74	119.88	112.38	1.711	0.425	106.92	114.16	117.92	1.15	0.563	111.61	114.31	113.09	0.066	0.967
Q15: Sense of belonging to a group	112.39	120.61	106	2.018	0.365	112.77	118.2	108.03	0.961	0.619	104.36	113.45	121.19	2.704	0.259	116.21	112.54	110.25	0.334	0.846	115.04	113.23	110.73	0.173	0.917
Q16: Confrontational and challenging	105	128.64	105.36	7.669	0.022 *	125.13	113.09	100.78	5.437	0.066	105.73	123.61	109.67	3.559	0.169	110.51	123.01	105.49	3.079	0.214	117.57	110.58	110.85	0.57	0.752
Q17: Reflections on env. issues	114.68	111.88	112.44	0.094	0.954	117.79	116.15	105.05	1.761	0.415	113.74	114.85	110.41	0.214	0.898	109.59	112.28	117.13	0.535	0.765	109.29	116.77	112.94	0.507	0.776
Q18: Personal role within env. issues	113.49	111.45	114.06	0.071	0.965	116.44	116.2	106.36	1.217	0.544	107.69	113.99	117.32	0.912	0.634	108.71	108.13	122.17	2.313	0.315	110.41	112.82	115.77	0.262	0.877
Q19: Awareness of personal impact	113.79	119.73	105.48	2.109	0.348	121.09	114.23	103.69	2.836	0.242	107.21	119.83	111.97	1.732	0.421	106.48	118.35	114.17	1.339	0.512	104.01	116.19	118.79	2.261	0.323
Q20: Challenging social norms	116.53	99.65	122.82	5.329	0.070	119.34	113.59	106.07	1.623	0.444	101.99	112.45	124.57	4.793	0.091	111.31	111.01	116.68	0.375	0.829	117.09	110.59	111.33	0.462	0.794

#1 The wooden cage (Comfort zone)

There are five significant differences in the outcome of audience expressions as follows:

Happiness (Q1)—The monochrome image is significantly different from both the black-and-white and color images. The happiness level is lowest with the monochrome image.

A sense of awe (Q3)—The result is the same as happiness. The monochrome image is significantly different from the black-and-white and color images. The monochrome image gave the least sense of awe.

Sadness (Q7)—The result is the same as happiness and a sense of awe. The monochrome is significantly different from the black-and-white and color images, but the monochrome has the highest level of sadness.

Anxiety (Q10)—The color image is significantly different from both the black-and-white and monochrome images. The anxiety level is lowest with the color image.

#2 The following day (Tomorrow)

Anxiety (Q10)—The same as image #1—The wooden cage (Comfort zone). The color image is significantly different from both the black-and-white and monochrome images. The anxiety level is lowest with the color image.

#3 The migration (Homeless)

Happiness (Q1)—The same as image #1, the monochrome image is significantly different from both the black-and-white and color images. The happiness level is lowest with the monochrome image.

#4 The turtle (Hopeless)

Happiness (Q1)— The same as images #1 and #3, the monochrome image is significantly different from both the black-and-white and color images. The happiness level is lowest with the monochrome image.

#5 The new world (Eden)

There were no emotional differences between the black-and-white, monochrome, and color images.

From Figures 6–10, considering the average of the first five questions (Q1–Q5)—happiness, hope, a sense of awe, surprise, and inspiration (positive emotions)—and the average of the last five questions (Q6–Q10)—guilt, sadness, apathy, anger, and anxiety (negative emotions)—we found that:

(a) The line graphs showed the lowest average of the monochrome images in positive emotions (Q1–Q5) compared to the average of the black-and-white and the color images.
(b) In contrast, the line graphs showed the highest average of the monochrome images in negative emotions (Q6–Q10) compared to the average of the black-and-white and the color images. It suggested that monochrome images might trigger negative emotions in audiences.
(c) On the other hand, the line graphs showed the highest average of the color images in positive emotions (Q1–Q5) compared to the average of the black-and-white and the monochrome images.
(d) In contrast, the line graphs showed the lowest average of the color images in negative emotions (Q6–Q10) compared to the average of the black-and-white and the monochrome images. It suggested that color images might trigger positive emotions in audiences.

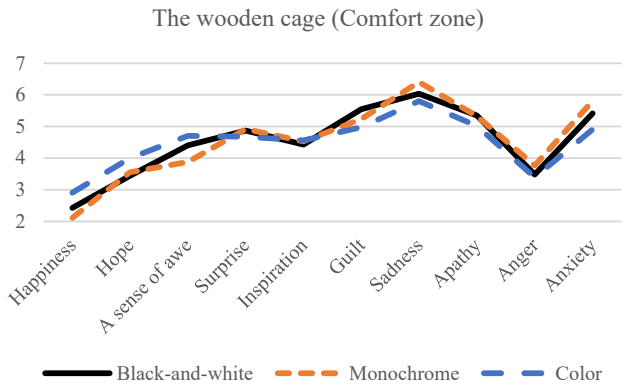


Figure 6. The line graph shows the average emotions of different colors in #1 image.

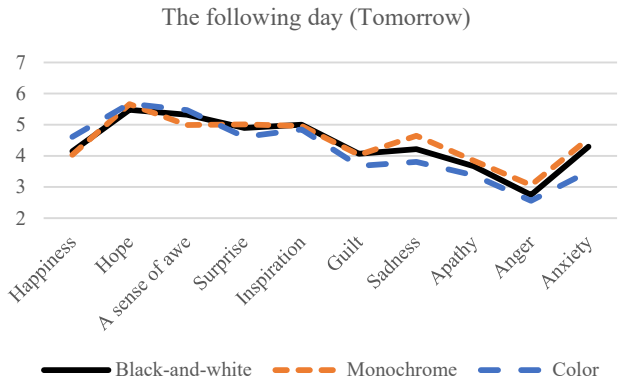


Figure 7. The line graph shows the average emotions of different colors in #2 image.

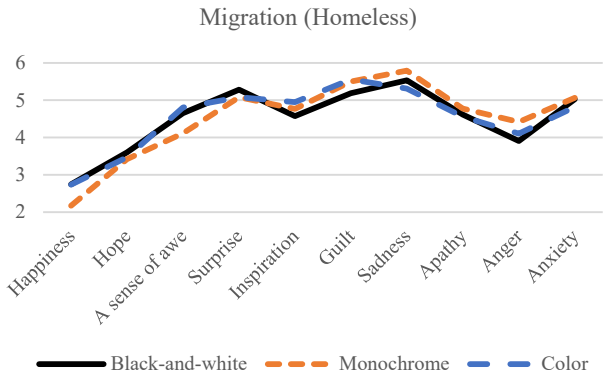


Figure 8. The line graph shows the average emotions of different colors in #3 image.

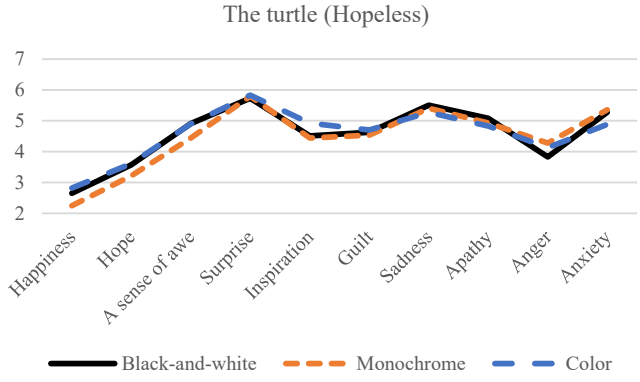


Figure 9. The line graph shows the average emotions of different colors in #4 image.

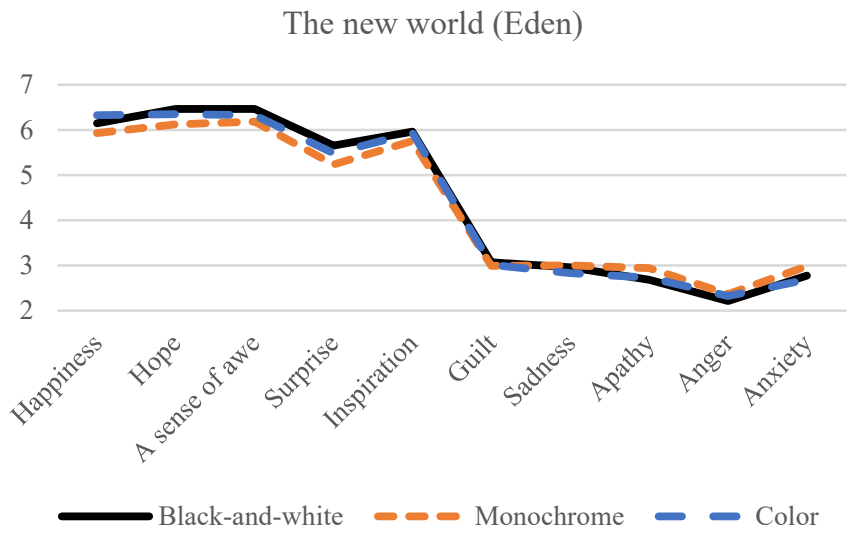


Figure 10. The line graph shows the average emotions of different colors in #5 image.

5.2. Cognitions

The analysis was based on the results from Tables 1 and 2 of cognitions in the questionnaire (Q11–Q20). The following are the experimental results from all five digital paintings used to test hypothesis H2.

#1 The wooden cage (Comfort zone)

Confrontational and challenging social norms (Q16)—The monochrome image was significantly different from both the black-and-white and color images. This cognitive level was highest with the monochrome image.

#2 The following day (Tomorrow)

Contemplation (Q12)—The color image was significantly different from both the black-and-white and monochrome images. This contemplative level was highest with the color image.

#3 The migration (Homeless) and

#4 The turtle (Hopeless) and

#5 The new world (Eden)

There were no environmental cognitive differences between the black-and-white, monochrome, and color images. Although there were differences in some images, the overall results of perceptions on environmental issues were comparable.

5.3. Perspectives toward the Artist

The analysis was based on the result in Table 3 of perspectives toward the artist in the questionnaire (Q21–Q25). All three groups had no different perspectives toward the artist. The result suggested that the coloring has no effect on the audience's perspective of the artist.

Table 3. The Kruskal–Wallis H test results of perspectives toward the artist according to different types of color.

	Mean Rank				
Questionnaire	**BW**	**MN**	**CL**	**Kruskal-Wallis H**	**Asymp. Sig.**
Q21: Someone like yourself.	114.93	111.53	112.54	0.113	0.945
Q22: Someone thinking and living differently than most people.	120.33	110.8	107.87	1.56	0.459
Q23: Someone with values similar to yours.	113.28	121.2	104.52	2.627	0.269
Q24: Someone expressing the view of the public.	113.11	120.48	105.41	2.635	0.268
Q25: Someone expressing the views of a minority.	113.64	111.83	113.53	0.038	0.981

5.4. Hope and Despair Expression

The analysis was based on the audience's expressions of hope and despair from their opinions (O1–O2) by categorizing expressions into three groups: objects, atmospheres, and emotions. The following are the experimental results from all five digital paintings used to test hypothesis H4.

We asked the audience to express their opinions on each of the five images. After completing the questionnaire on emotions and environmental perceptions, we asked the audience to describe the hope and despair they perceived in the image. The questions were open-ended, meaning that viewers could express their thoughts, respond based on what they observed in the image, or respond with nothing. We divided the replies into three categories to facilitate analysis: object, atmosphere, and emotion. The results of the analysis are detailed below.

5.4.1. Black-and-White Images

From the five black-and-white images, when asked to comment on the hopes seen in the image, 56.69% of respondents commented on the object in the image, 30.57% on the atmosphere depicted in the image, and 12.74% on their positive feelings toward the image. The details of the object in the image that audiences have seen as a hope are as follows:

#1. The bird and trees: the audience saw the bird flying out of the cage and the living trees as signs of hope.

#2. The egg: the hatching egg was interpreted by the audience as a symbol of new life.

#3. The hermit crab and bottle: a living hermit crab and a bottle of refuge are signs of hope.

#4. The lotus leaves and eggshell: hope is represented by the lotus leaf, which signifies life, and the eggshell, which represents a place to live.

#5. Animals and plants: animals and plants represent life and hope in the image.

The audience also noticed the light in the sky in each picture, which showed the land and sea as the source of life and a sign of hope. In #5, the audience expressed hope in the form of a collective atmosphere in the eggshell and the Garden of Eden, where life is plentiful.

When audiences were asked to comment on the despair seen in the black-and-white images, 32.71% commented on the object in the image, 48.89% on the atmosphere depicted in the image, and 20% on their negative feelings towards the image. The details of what represents despair (in descending order) are as follows:

#1. Debris, smoke, and a birdcage are related to feelings of despair (the darkness in which everything is obscured)

#2. Negative emotions, windstorms, abandonment, and hostile environments are sources of despair (the darkness in which everything is obscured)

#3. The cracked bottle and underwater debris created an atmosphere of despair.

#4. The broken eggshell, negative emotions, and the dead turtle represent the audience's despair in death and decay.

#5. The incoming surrounding darkness was the looming despair.

The despair that audiences see in black-and-white images is mostly atmospheric. However, in #3 and #4, the audience can see the object in the images better than in #1 causing audiences to perceive the disaster as the struggle and death of these creatures. Furthermore, the audience's feeling of despair in the black-and-white images overrides their feelings of hope throughout the image.

5.4.2. Monochrome Images

From the five monochrome images, when asked to comment on the hopes seen in the image, 40.69% of audiences commented on the object in the image, 28.41% on the atmosphere depicted in the image, and 30.92% on their positive feelings towards the image.

It is observed that the majority of the audience still perceived objects in monochrome images as representing hope, but less than black-and-white images. However, there were

more sentimental responses. What audiences saw as hope in monochrome images (in descending order) are as follows:

#1. The bird, positive emotions, and the sky: the bird that flew out of the cage and soared in the sky is a hope.

#2. The egg and the sky: the egg about to hatch is the hope of a new life.

#3. Positive emotions, sky, and sea: audiences saw light as a symbol of hope.

#4. Positive emotions, sky, and eggshell: the light above the lotus leaf is hope.

#5. Positive emotions, animals, and trees: animals and trees represent life and hope.

Living things are still a sign of hope. However, the creatures in #3 and #4 symbolize death, causing the audience to interpret the light in the painting as hope rather than creatures. Additionally, audiences expressed more positive emotions than black-and-white images. In #2, dull colors caused fewer positive emotions.

When audiences were asked to comment on the despair seen in the monochrome images, 24.65% commented on the object in the image, 37.68% on the atmosphere depicted in the image, and 37.68% on their negative feelings towards the image. It can be seen that the atmosphere and negative feelings were the most despair that the audience expressed. What audiences see as despair (in descending order) are as follows:

#1. Negative emotions, disaster, debris, and smoke are the feelings and atmosphere of despair.

#2. Negative emotions, hostile environments, windstorms, and abandonment are the feelings and atmosphere of despair.

#3. Negative emotions, the cracked bottle represents homelessness, and underwater debris created an atmosphere of despair.

#4. Negative emotions, the broken eggshell, and the dead turtle represent the audience's despair in death and decay.

#5. Darkness, the broken eggshell, and negative emotions.

The monochromatic images drew the most negative feelings from the audience who expressed their despair. However, the atmosphere created by the monochromatic color resulted in more negative feelings. In #3 and #4, the audience expressed despair caused by the struggle and death of the living due to the focus point.

5.4.3. Color Images

From the five color images, when asked to comment on the hopes seen in the image, 41.94% of respondents commented on the object in the image, 36.83% on the atmosphere depicted in the image, and 21.24% on their positive feelings toward the image.

As with black-and-white and monochrome images, respondents still see hope as the object in the image. However, the colors increased the perceptions of the image's atmosphere. There were more positive emotions than in the black-and-white images, but still less than in the monochrome images. What respondents see as hope (in descending order) in the color images are as follows:

#1. The sky, the bird, and positive emotions: the vivid colors of the sky give audiences more hope from the atmosphere. However, the bird is still the second hope.

#2. The egg, positive emotions, and the sky: the hatching egg is still a symbol of hope and new life.

#3. The sky, positive emotions, the hermit crab: the colors of the sky inspire hope.

#4. The lotus leaf, the sky, and the eggshell: the colors enhance the clarity of the lotus leaf and the sky.

#5. Inside the eggshell, positive emotions, and trees: the colors enable respondents to perceive the atmosphere and life inside the eggshell.

Despite the fact that the colors attract the attention of audiences, the image's focal point is still an essential element, as in #2, the egg remains the audience's hope even though the sky is colorful.

When audiences were asked to comment on the despair seen in the color images, 29.11% commented on the object in the image, 48.70% on the atmosphere depicted in the

image, and 22.19% on their negative feelings towards the image. What audiences see as signs of despair (in descending order) are as follows:

#1. Debris, negative emotions, disaster, and smoke are the atmosphere and feeling of despair.

#2. Negative emotions, hostile environments, and abandonment are the feelings and atmosphere of despair.

#3. Underwater, the cracked bottle, and the hermit crab are the atmosphere and objects of despair.

#4. The dead turtle, the broken eggshell, and the debris are the objects and atmosphere of despair.

#5. The broken eggshell (object) and the darkness (atmosphere) caused despair.

In #4 and #5, there were objects representing death and decay that made the respondents look differently, despite the fact that the majority perceived the atmosphere as despair.

6. Discussion

From the results of our experiment on the effects of five digital paintings on environmental issues, we found that colors contributed to the arousal of thoughts and feelings in most participants. In addition to arousing positive feelings, color can also contribute to arousing negative feelings. This result was significant for monochrome images (Tables 4 and 5), which caused the most hope or positive emotions (30.92%) and the most despair or negative emotions (37.68%). Even though the black-and-white images in the experiment showed less emotion than the color images (Tables 6 and 7), this does not mean that black-and-white images show less hope or despair than monochrome or color images, depending on their composition.

Table 4. Amount of comments on monochrome images expressing hope and despair.

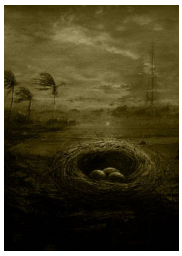
											
Hope	Objects	Bird	34	Egg	50	Hermit crab	2	Lotus	10	Animal	10
		Tree				Bottle	9	Eggshell	12	Trees	19
	Atmospheres	Light and sky	21	Light and sky	19	Light and sky	21	Light and sky	17	Light and river	1
		Ground	0			Sea	12			Garden of Eden	0
		Atmosphere	0							Inside eggshell	11
	Emotions	Positive	26	Positive	7	Positive	24	Positive	19	Positive	35
		No hope	2	No hope	0	No hope	2	No hope	8	No hope	1
		No answer	0	No answer	11	No answer	15	No answer	14	No answer	15
Despair	Objects	Bird cage	8	Electric pole	1	Hermit crab	8	Dead turtle	16		
		Wire	1			Bottle	19	Eggshell	20	Eggshell	14
	Atmospheres	Debris	13	Storm	14	Debris	11	Debris	1	Darkness	17
		Smoke	13	Abandoned	10	Underwater	10				
		Disaster	22	Environments	22						
	Emotions	Negative	33	Negative	34	Negative	28	Negative	29	Negative	9
		No despair	0	No despair	3	No despair	3	No despair	0	No despair	17
		No answer	2	No answer	6	No answer	9	No answer	14	No answer	21

Table 5. Percentage of objects, atmospheres, and emotions on monochrome images expressing hope and despair.

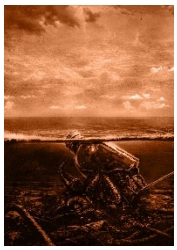
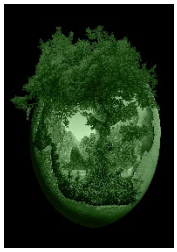
							
Hope	Objects	34 (41.98%)	50 (65.79%)	11 (16.18%)	22 (37.93%)	29 (38.16%)	40.67%
	Atmospheres	21 (25.93%)	19 (25%)	33 (48.53%)	17 (29.31%)	12 (15.79%)	28.41%
	Positive emotions	26 (32.10%)	7 (9.21%)	24 (35.29%)	19 (32.76%)	35 (46.05%)	30.92%
Despair	Objects	9 (10%)	1 (1.23%)	27 (35.53%)	36 (54.55%)	14 (35%)	24.65%
	Atmospheres	48 (53.33%)	46 (56.79%)	21 (27.63%)	1 (1.52%)	17 (42.50%)	37.68%
	Negative emotions	33 (36.67%)	34 (41.98%)	28 (36.84%)	29 (43.94%)	9 (22.50%)	37.68%

Table 6. Amount of comments on color images expressing hope and despair.

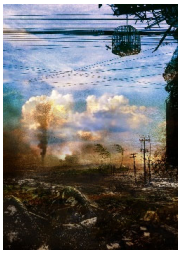
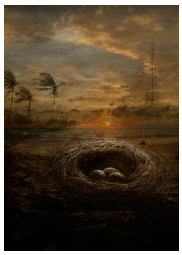
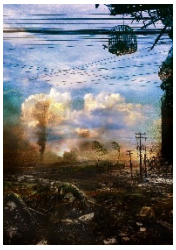
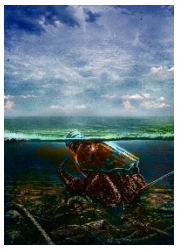
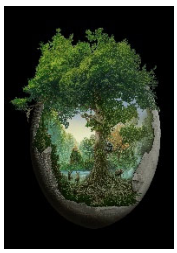
											
Hope	Objects	Bird	26	Egg	52	Hermit crab	10	Lotus	27	Animal	9
		Tree	2			Bottle	5	Eggshell	9	Trees	16
	Atmospheres	Light and sky	38	Light and sky	16	Light and sky	31	Light and sky	10	Light and river	3
		Ground	2			Sea	6			Garden of Eden	0
		Atmosphere	1							Inside eggshell	30
	Emotions	Positive	17	Positive	20	Positive	18	Positive	4	Positive	20
		No hope	1	No hope	0	No hope	7	No hope	4	No hope	0
		No answer	8	No answer	9	No answer	18	No answer	25	No answer	15
Despair	Objects	Bird cage	8	Electric pole	3	Hermit crab	17	Dead turtle	21		
		Wire	1			Bottle	20	Eggshell	14	Eggshell	17
	Atmospheres	Debris	39	Storm	7	Debris	14	Debris	10	Darkness	13
		Smoke	10	Abandoned	15	Underwater	21				
		Disaster	16	Environments	24						
	Emotions	Negative	21	Negative	24	Negative	16	Negative	7	Negative	9
		No despair	0	No despair	3	No despair	2	No despair	1	No despair	10
		No answer	7	No answer	19	No answer	11	No answer	23	No answer	29

Table 7. Percentage of objects, atmospheres, and emotions on color images expressing hope and despair.

							
Hope	Objects	28 (32.56%)	52 (59.09%)	15 (21.73%)	36 (72%)	25 (32.05%)	41.94%
	Atmospheres	41 (47.67%)	16 (18.18%)	37 (52.86%)	10 (20%)	33 (42.31%)	36.83%
	Positive emotions	17 (19.77%)	20 (22.73%)	18 (25.71%)	4 (8%)	20 (25.64%)	21.24%
Despair	Objects	9 (9.47%)	3 (4.11%)	37 (42.05%)	35 (67.31%)	17 (43.59%)	29.11%
	Atmospheres	65 (68.42%)	46 (63.01%)	35 (39.77%)	10 (19.23%)	13 (33.33%)	48.70%
	Negative emotions	21 (22.11%)	24 (32.88%)	16 (18.18%)	7 (13.46%)	9 (23.08%)	22.19%

The black-and-white images from #1 and #3 received the fewest negative emotion comments (Tables 8 and 9) due to their vivid whites and sharp contrast. When displayed as a monochromatic image, the clarity of distinct objects is enhanced. The substance of smoke and debris can easily approach the audience, causing people to perceive and experience more negativity. When image #3 was digitally painted in brilliant blue, there were fewer negative comments. Black-and-white is a neutral medium because it eliminates all colors to focus on the black-and-white weight, contrast, and symbolic significance of the object. If the contrast between black and white had guided the audience's attention to the light before they observed the harmful objects in the image, the negative emotion would be diminished.

Table 8. Amount of comments on black-and-white images expressing hope and despair.

											
Hope	Objects	Bird	41	Egg	44	Hermit crab	22	Lotus	22	Animal	12
		Tree	6			Bottle	12	Eggshell	7	Trees	12
	Atmospheres	Light and sky	9	Light and sky	17	Light and sky	19	Light and sky	11	Light and river	1
		Ground	1			Sea	5			Garden of Eden	4
		Atmosphere	1							Inside eggshell	28
	Emotions	Positive	9	Positive	10	Positive	10	Positive	11	Positive	0
		No hope	3	No hope	0	No hope	6	No hope	4	No hope	0
		No answer	9	No answer	11	No answer	16	No answer	23	No answer	18
Despair	Objects	Bird cage	11	Electric pole	3	Hermit crab	10	Dead turtle	10		
		Wire	4			Bottle	24	Eggshell	29	Eggshell	14
	Atmospheres	Debris	38	Storm	16	Debris	20	Debris	2	Darkness	22
		Smoke	16	Abandoned	14	Underwater	11				
		Disaster	3	Environments	14						
	Emotions	Negative	1	Negative	18	Negative	9	Negative	23	Negative	9
		No despair	0	No despair	2	No despair	0	No despair	0	No despair	5
		No answer	6	No answer	14	No answer	9	No answer	21	No answer	25

Table 9. Percentage of objects, atmospheres, and emotions on black-and-white images expressing hope and despair.

							
Hope	Objects	47 (70.15%)	44 (61.97%)	34 (50%)	29 (56.86%)	24 (42.11%)	56.69%
	Atmospheres	11 (16.42%)	17 (23.94%)	24 (35.29%)	11 (21.57%)	33 (57.89%)	30.57%
	Positive emotions	9 (13.43%)	10 (14.08%)	10 (14.71%)	11 (21.57%)	0 (0%)	12.74%
Despair	Objects	15 (20.55%)	3 (4.62%)	34 (45.95%)	39 (60.94%)	14 (31.11%)	32.71%
	Atmospheres	57 (78.08%)	44 (67.69%)	31 (41.89%)	2 (3.13%)	22 (48.89%)	48.60%
	Negative emotions	1 (1.37%)	18 (27.69%)	9 (12.16%)	23 (35.94%)	9 (20%)	18.69%

6.1. Utopia, Hope, and Object

The results of the experiment showed that the audience perceived hope from the objects and characters in the images the most. The objects or characters in an image were often living things, such as the bird (#1) and the hermit crab (#3), among non-living or degraded environments, such as wastes and ruins.

On this point, there is a conflict between the artist's and the audience's perspectives. The artist intended for the animals to demonstrate suffering from environmental issues (dystopia) while the audience witnessed the animals' struggle for survival (utopia). If the image's focal object is an animal affected by environmental issues, the artist should convey optimism or adaptation to overcome these obstacles instead of suffering.

6.2. Dystopia, Despair, and Atmosphere

The atmosphere prevailing in the image is the source of the audience's despair. The results of the experiment indicate that color influences audiences' perceptions of objects or environments and can elicit emotions or responses. However, if the focal point is a large object (the turtle (#4)), the audience's attention is drawn away from the atmosphere. Smaller focal points, such as the bird (#1) and the egg (#2), create a more despairing atmosphere. Objects and highlights in the image still influence the atmosphere. Artists should be careful when placing the composition of an image to evoke the audience's thoughts and feelings.

On this point, there is a contradiction of the views presented by the artist in some parts. The artist intended to create an atmosphere such as the sky and stream, using lighting in the image to represent hope (utopia), whereas the audiences perceived the atmosphere in the picture as despair (dystopia). However, the atmosphere's composition in the image may consist of various debris, thus making the audiences feel that way. Therefore, if the artist wants to express hope from the atmosphere, the image should have an object. For example, the sky should be associated with the sunrise, or the stream should be associated with a lotus leaf (from Section 6.1, the audience perceived hope from the object). The artist should use compositions from the overall degraded environment to show the problems that arise by emphasizing the problems in the dark atmosphere and the image's foreground to direct the audience first. The despair of those troubles in the dark leads the audience's gaze to a bright spot of hope.

6.3. Guidelines for Environmental Artists

In attempting to bring awareness to environmental issues, artists should place emphasis on the atmosphere and surrounding environments (despair, dystopia) and then direct to the focal object (hope, utopia). In highlighting solutions to environmental issues,

the artist should emphasize the focal point of the image. The emphasis demonstrates the way to resolve or realize arising troubles. For example, there is still a new day waiting, trees fighting the strong wind, or creatures still struggling. The concepts of utopia and dystopia should be in the image together. If the entire image depicts a dystopian society, the audience will feel hopeless and be unaware of the solution. If there is only utopia in the image, the audience will only see a beautiful world without a sense of impending danger.

6.4. The Use of Symbols and Metaphors to Convey Environmental Issues in Artworks

The use of animals such as hermit crabs, eggs, eggshells, or dead turtles can represent the impact of human activities on the natural world. Using sick or dying animals, for instance, can represent the effects of pollution on wildlife.

Using natural elements such as oceans, trees, or mountains can represent the aesthetic and fragility of the natural world; for example, using images of the ocean to represent the significance of clean water or the use of imposing mountains to represent the significance of conserving natural habitats.

Using man-made elements such as factories, cars, or garbage bins can symbolize the impact of human activities on the environment, such as using smokestacks to symbolize industrial pollution or piles of garbage to symbolize the problem of waste and pollution.

Using the destruction and loss of nature, such as dying trees and barren, desolate, or stormy landscapes, can represent the loss and decay of the natural world and evoke feelings of despair.

The use of timepieces or sunlight can symbolize the sense of dwindling time or the imminence of trouble. Colors define moments and moments can be connected to the audience's emotions.

7. Conclusions

In an experiment using environmental digital paintings with different colors, university students have no different emotional and cognitive responses to the artist. However, the surrounding atmosphere created a sense of despair, whereas objects representing life inspired hope. Artists can use animal images as symbols and metaphors, and monochromatic colors can affect the audience's emotions. Context, target group, composition, light, and color selection must be considered when telling a story.

To bring awareness to environmental issues, artists should start by emphasizing the atmosphere and surrounding environment, portraying dystopia or despair, before directing the audience to the focal object of hope or utopia to highlight solutions. The image should emphasize the way to resolve arising troubles. Utopia and dystopia should be presented together to avoid the audience feeling hopeless or unaware of impending danger. A lack of perspective on one side may cause audiences to lose awareness of the issue.

The study of the sample images with different colors did not make a difference in the feelings and perceptions of the audience. However, in future research, we want to investigate how visual cues with utopia and dystopia elements can stimulate the audience's senses by using different digital media, such as 2D graphics or 3D models, or using virtual reality experiences to guide artists on how to create their artwork and find tools to raise audience awareness effectively.

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