

Psychological Examination of Positive and Negative Feelings That Art Inspires in People Simultaneously

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Abstract. Art appeals to people because of its beauty but can inspire awe. This suggests that art can induce both positive and negative emotions in people. In this study, we conducted a psychological experiment to verify that art appreciation has the potential to cause positive and negative emotions in people simultaneously.

An immersive space was constructed in which images were projected onto the floor, and video art created by one of the authors was projected onto it. Then, twenty-seven subjects viewed and evaluated the art from three different positions. The results showed that differences in position had no effect on the results. Next, when the evaluation results by the evaluation items were compared, the nine evaluation items related to impressions were classified into two types: items that received high evaluation values and items that received low evaluation values. Furthermore, it was found that the items with high evaluation values were those related to evaluation as art, or in other words, "extraordinary pleasure." In contrast, the items with low evaluation values were those related to the evaluation of ordinary pleasure and displeasure, or in other words, "everyday pleasure." These results indicate that the art contents used in this experiment simultaneously give "unusual pleasant" and "every day unpleasant" feelings to people's minds.

Keywords: Fluid art, Psychological experiment, Pleasant and unpleasant feelings.

1 Introduction

Art can calm people's minds and reduce stress [1][2][3][4]. This can be attributed to art's beauty, which positively influences people's minds. In other words, this is because art inspires awe in people's hearts. At the same time, art can also give people feelings similar to fear and anxiety. Munch's "The Scream [5]," for example, gives the viewer a

feeling of insecurity that is hard to describe. Based on this, most good art can simultaneously inspire positive and negative feelings. This is the unique value of art.

If this were confirmed, art could be used in more situations than ever before. For example, art could be used for disaster prevention. Based on the assumption that art has a positive and negative emotional impact on people, the authors have attempted to create disaster prevention signs that use art to arouse people's awareness of disaster prevention and install them in places where many people can see them [6]. At the same time, the authors conducted a psychological experiment to confirm that art can give people positive emotions, which can effectively reduce stress and recover from depression [7].

Based on the results of these studies, we hypothesized that art appreciation would simultaneously produce positive and negative emotions in people's minds, and we decided to confirm this assumption through psychological experiments. As the art content, we used the video artwork "Genesis" [8] created by Naoko Tosa, one of the authors of this study, which will be described in detail later. This artwork is created based on fluid phenomena. It is considered suitable art that inspires a sense of awe because of its association with natural disasters such as floods and tsunamis. Through the basic concept of the experiment, the contents of the psychological experiment, and the results of the analysis of the experimental results, this paper clarifies that art gives people a dualistic sense of positive and negative feelings in their minds simultaneously.

2 Related Research

2.1 Research on complex emotions

Many studies have been conducted on the influence of art on people's emotions. It is known that the complex interplay of emotions brought about by artworks can simultaneously evoke various feelings in viewers and listeners, which is called "mixed emotions."

Vincent et al. [9] showed that people simultaneously feel positive and negative emotions during the COVID-19 crisis. This study confirmed that mixed emotions are strongly associated with preventive behavior against pandemics.

In a study conducted by Brehm et al. [10], an experiment was conducted with a procedure in which participants were induced to feel a specific emotion (e.g., joy) and then given an inhibitory factor that negated the reason for feeling that emotion (e.g., being told sad news). They found no evidence that participants felt mixed emotions at the same time. The new emotion replaced the original one when the inhibitory factor was very high.

Berrios et al. [11] measured the magnitude of mixed emotions and showed that both dimensional and individual approaches to emotion also cause mixed emotions. The study confirmed that different combinations of emotions, such as happiness and sadness, fear and happiness, disgust and amusement, and hope and fear, had medium to large effect sizes.

Cotter et al. [12] analyzed the impact of art museum visits on people's emotional experiences. The study shows that art simultaneously causes visitors to experience positive (e.g., gratitude and joy) and negative (e.g., sadness and fear) emotions, contributing to overall well-being.

2.2 Relationship between previous studies and this paper

Much previous research has addressed whether mixed emotions exist and whether positive and negative emotions exist simultaneously. Their research has taken simple combinations of emotions, such as happiness and unhappiness or joy and sadness, and studied whether their combination occurs. However, human emotions are often considered to be more subtle than such simple combinations of emotions. Especially in higher-order experiences such as art appreciation, it would be better to use evaluation items that correspond to more abstract expressions, such as impressions rather than emotions. Of course, there is a fear that the evaluation of impressions during art appreciation using such abstract evaluation items may not show a clear difference from the evaluation of direct emotional expressions such as mixed emotions, in which two conflicting emotions are mixed. However, this study focused on the art appreciation experience, prepared evaluation items suitable for evaluating art appreciation, and conducted a psychological experiment to see if a difference between positive and negative sensations could be found.

Therefore, the main focus was on creating an evaluation environment suitable for art appreciation, and an immersive experimental environment was created in which art was displayed in large size on the floor using a projector. Since the art content to be projected is a critical experimental condition, we carefully considered the type of art content to be used. This will be discussed in detail in the next chapter. The viewer's position is essential when viewing art in an immersive environment. While ordinary artworks, such as paintings, are viewed from an appropriate distance facing the artwork, the position and posture of the viewer are essential factors when viewing video art in an immersive environment. As discussed in the next chapter, factors such as whether the viewer enters the projection space, sits in a chair, or sits down to view the work may have a significant impact.

Therefore, in addition to studying mixed emotions in art viewing, this experiment aims to clarify how subjects feel when they view video art in an immersive environment suitable for art viewing and, in particular, how differences in position affect their sensations. The study's results determined how the subjects felt when viewing video art in a suitable immersive environment. As a result, we aim to clarify the differences among the evaluation items and what kind of positive and negative sensations people have when viewing art.

3 Fluid Art “Genesis” Used in the Experiment

3.1 Fluid art

A video artwork titled "Genesis," created by Naoko Tosa, one of the authors of this study, was used as the art content to be appreciated by subjects [8]. "Genesis" is an artwork created using fluid phenomena. The behavior of fluids, especially when there are obstacles in their flow paths, is extremely beautiful. Figure 1 shows an example of visualization of "laminar flow [13]," in which the fluid flow is steady in the presence of an obstacle.

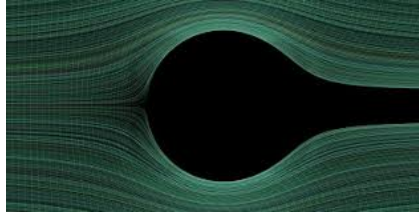


Fig. 1. An example of laminar flow.

3.2 Fluid art “Genesis”

As shown in Figure 1, when the shape and position of such obstacles are fixed, they do not change over time, and the generated artwork is unsatisfactory from an artistic point of view. Therefore, obstacles should change their position over time for beautiful and unexpected modeling rather than remain in fixed positions. Even more desirable is that the shape of the obstacles should not be fixed but rather deformable and that the deformation itself should be unpredictable. After repeated experiments, we concluded that dry ice should be used as an obstacle.

Dry ice is a solid form of carbon dioxide that sublimates into carbon dioxide gas when placed in water or air. It is often used to create smoke effects at events, especially when placed in water, as it sublimates violently and emits carbon dioxide gas. We observed the behavior of dry ice in water with a high-speed camera and found that bubbles containing dry ice were actively formed, which changed their shape and rose to become carbon dioxide gas at the water's surface. Furthermore, it was found that each bubble of dry ice has a different shape and always transforms into an unexpected shape due to water resistance as it rises through the water.

Thus, dry ice fits well with the abovementioned function of an obstacle that behaves unexpectedly. When paint is injected into water filled with dry ice, the paint visualizes the movement of the water caused by the dry ice bubbles. It produces an image that gives the viewer a mysterious and majestic sensation as if it were showing the birth of a life form out of water. Tosa created a video artwork named "Genesis" from the images that were obtained [8]. Figure 2 shows several scenes of the “Genesis.”

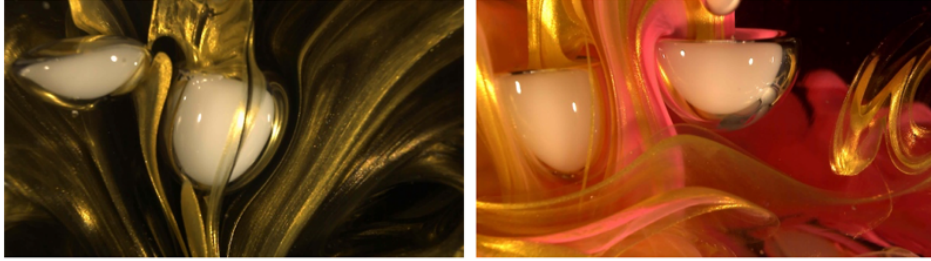


Fig. 2. Scenes of “Genesis.”

4 Method of the Psychological Evaluation Experiment

4.1 Basic concept of the experiment

Since "Genesis" is based on fluid phenomena, it evokes the image of flowing water in the viewers' minds. When they view the "Genesis" up close, they feel like they are viewing a stream of water up close. Moreover, when the viewers enter the space where the "Genesis" is projected, they feel like they are in the flow of the water. Therefore, we constructed an immersive space where the "Genesis" is displayed all over the floor. The subjects were asked to watch the video and then psychologically evaluate it.

4.2 Subjects

Twenty-seven Kyoto University students were used in the experiment.

4.3 Experimental environment

The "Genesis" was projected on the floor using a projector, and subjects were asked to evaluate it subjectively. Figure 3 shows the experimental environment.



Fig. 3. Experimental environment (Left: Projector and its setting frame, Right: Projector and projection area).

The subjects were asked to view the artworks under the following three conditions in the experimental environment.

Condition 1 (Outside, on a chair): The subject sat on a chair outside the projection space. This condition is considered to simulate a situation where the subject looks at a stream of water nearby.

Condition 2 (Inside, on a chair): The subject sits on a chair inside the projection space, simulating the situation swept away by a current in a small boat.

Condition 3 (Inside, floor): The subject sits on the floor in the projected space. This is considered to simulate being swept away in a stream.

Figure 4 shows how a subject viewed art images in the three experimental conditions.

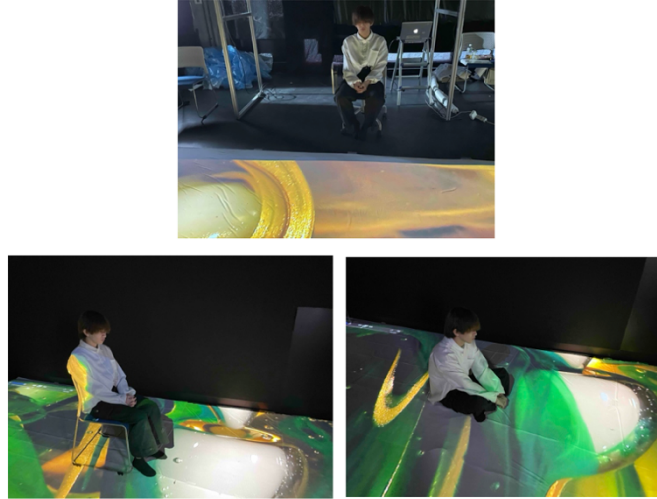


Fig. 4. A subject viewing art (Top center: Condition 1, Bottom left: Condition 2, Bottom right: Condition 3).

4.4 Contents

As mentioned earlier, the "Genesis" [8], a fluid art created by Naoko Tosa, one of the authors, was used as the art content for the projection. The appropriateness of using the "Genesis" in terms of content for psychological experiments is as follows.

(1) The "Genesis" is an artwork in which paint of various colors is injected into a liquid (viscous water) containing dry ice. The interaction between the paint about to diffuse and the dry ice bubbles rising upward creates various shapes, and a high-speed camera captures the scene. This natural phenomenon does not involve human

manipulation compared to a painting created with a paintbrush. Therefore, the artist's arbitrariness can be eliminated.

(2) The "Genesis" has various works depending on the paint color. Since these works have similar characteristics but give slightly different impressions, they effectively eliminate the adverse effects of repeatedly using the same content in psychological evaluation experiments. Repeating the experiment multiple times with the same content under different setting conditions is common in psychological experiments. If the same content is used in such experiments, the subject's degree of concentration may decrease due to habituation to the content, which may affect the results. On the other hand, if the experiments are repeated multiple times with entirely different content, the differences in content may affect the results more than the differences in the setting conditions. Using different colors based on the same production method and having the same properties, such as the "Genesis," can eliminate such adverse effects.

4.5 Evaluation items

Apart from this study, we have conducted psychological experiments to examine whether art has a motivational effect on the human mind and whether it improves creativity [14][15]. Nine evaluation items grouped into "Impression Factor" were considered appropriate for this experiment (Table 1).

Table 1 Evaluation items (Impression Factor).

Comfortable - Uncomfortable
Friendly - Unfriendly
Beautiful - Not beautiful
Calm - Restless
Interesting - Boring
Warm - Cold
Changeable - Not changeable
Luxury - Sober
Individual - Ordinary

Ratings were on a 7-point scale from 1 to 7, and the results were entered using Google Forms using each subject's smartphone.

4.6 Actual experimental conditions

As mentioned earlier, the subjects had conditions: Condition 1, Condition 2, and Condition 3. The three art contents to be used were the following three types.

- Content 1:** Genesis Red
- Content 2:** Genesis Blue
- Content 3:** Genesis Green

The three conditions and three types of art content for each subject were combined based on the design of the experiment method, and three experiments were conducted for each subject.

5 Results of the Psychological Evaluation Experiment

5.1 Comparison among the three experimental conditions by analysis of variance (ANOVA)

First, to ascertain whether the viewing position affected the results, we conducted ANOVA to see if there were any significant differences among the three experimental conditions (Outside/chair, Inside/chair, and Inside/floor). The results are shown in Fig. 5.

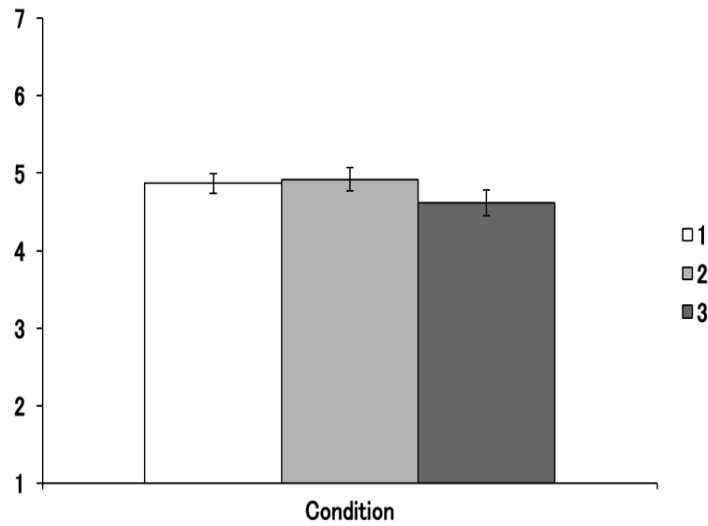


Fig. 5. ANOVA results for the viewing condition.

The ANOVA showed that the main effect of the experimental condition was insignificant ($p=.157$). Therefore, there is no dominant difference in viewing conditions.

5.2 Comparison of evaluation results across evaluation items

Next, we examined the main objective of this study, i.e., whether art has the function of simultaneously having positive and negative effects on people's minds. For this purpose, it is necessary to compare the evaluation items. Figure 6 compares the evaluation values among the nine evaluation items for the Impression Factor. Table 2 shows the

results of multiple comparisons to verify whether there are significant differences among the evaluation items.

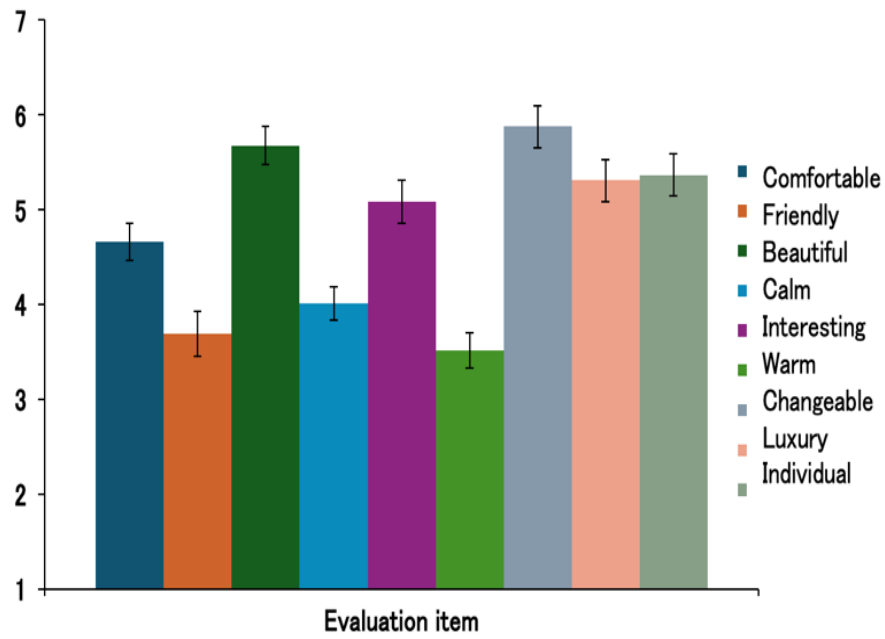


Fig. 6. Results of the evaluation score among nine evaluation items for the Impression Factor.

Table 2 Multiple comparison results for the Impression Factor.

	Beautiful	Interesting	Changeable	Luxury	Individual	Friendly	Calm	Warm	Comfortable
Beautiful						**	**	**	**
Interesting						**	*	**	
Changeable						**	**	**	**
Luxury						**	**	**	
Individual						**	**	**	
Friendly	**	**	**	**	**				**
Calm	**	*	**	**	**				*
Warm	**	**	**	**	**				**
Comfortable	**		**			**	*	**	

**; $p < .01$ *; $p < .05$

5.3 Discussion on the comparison of evaluation results among evaluation items

Figure 6 and Table 2 show that the evaluation items are divided into two groups. Group 1 consists of "Friendly," "Calm," and "Warm." Group 2 consists of "Beautiful," "Interesting," "Changeable," "Luxury," and "Individual." Group 1 is rated at or below 4, the middle ground, while Group 2 is rated at or above 5 in all cases. As Table 2 shows, there are no statistically significant differences among the evaluation items in Group 1 in any combination. For Group 2, there are also no statistically significant differences among the evaluation items in any combination. Furthermore, the differences between any of the evaluation items in Group 1 and any of the evaluation items in Group 2 are statistically significant in any combination.

In other words, Group 1 includes evaluation items that receive low scores from art appreciation, while Group 2 includes evaluation items that receive high scores from art appreciation. The evaluation items in Group 1 are related to "everyday pleasure."

From the names of the evaluation items in Group 2, we can say that these items are related to "extraordinary pleasure" that is felt, for example, when viewing art. In other words, the video artwork "Genesis" used in this study gave subjects an unusually pleasant feeling when they viewed art. At the same time, it also gave them an unpleasant feeling of everyday pleasantness. This indicates that the hypothesis set at the beginning of this study has been proven.

6 Conclusion

Previous studies have shown that artworks on the human mind reduce stress and improve depression. At the same time, people who appreciate art intuitively sense that high-quality art can induce feelings of awe and fear in people's minds. In other words, it may induce a feeling of "beautiful but scary" in the viewer's mind. This study attempted to demonstrate this through a psychological experiment. A video artwork titled "Genesis," created by Naoko Tosa, one of the authors of this paper, was used as the artwork.

A projector was used to project the video artwork onto a wide area of the floor in the experimental room, and an environment was constructed in which subjects could view the artwork by their side or in the space where it was projected. In such an environment, twenty-seven subjects were asked to view the art under three conditions: sitting on a chair outside the projection space, sitting on a chair in the projection space, and sitting on the floor in the projection space. Then, the subjects were asked to rate the art on a seven-point scale using nine items related to the "Impression Factor," which we use to evaluate the higher-order effects of art.

First, the differences among the three experimental conditions were verified using an analysis of variance (ANOVA), and the results showed no significant differences.

Next, we tested whether the differences among the evaluation items were significant. The results showed that the evaluation items consisted of two groups of evaluation items (and one evaluation item that did not belong to any group). The items belonging to Group 1 were related to "everyday pleasantness," while the items belonging to Group

2 were related to "unusual pleasantness," such as art appreciation. Furthermore, the items in Group 2 were found to evoke positive emotions about unusually pleasant emotions, whereas those in Group 1 evoked negative emotions about everyday pleasant emotions. This indicates that the initial hypothesis of this study, that art appreciation simultaneously produces positive and negative emotions in people's minds, was verified to be correct.

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