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Influence of History of Art Learning on Understanding of Beauty and Ugliness in Painting

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ABSTRACT

Japanese elementary school teachers can teach arts to their students even without prior background education in arts. Therefore, no standard evaluation is followed by all art class teachers. Instead, most of them create their own evaluation criteria and assign grades. In children's art education, teachers teaching art should understand the beauty and ugliness of paintings. In this study, we conducted an experiment to understand the differences in the beauty and ugliness of paintings between students majoring in art and those of the same age who have never studied art. Participants were asked to judge the beauty or ugliness of various pictures, ranging from simple to complicated, from various periods of Western art history. Fractal analysis was used for this study, considering fractals in color tones and structures. Consequently, art majors could clearly highlight the beauty and ugliness of complicated paintings. Students not studying fine arts saw complicated paintings as beautiful and could not point out their clear beauty or ugliness. Students who had not studied art described the beauty and ugliness of simple paintings in a large and general way. The fractal analysis showed that the beauty/ugliness points reported by art majors maintained a medium fractal dimension. Finally, the fractal dimension of the beauty/ugliness points by the students who had not studied art maintained a high fractal dimension, indicating that they perceived beauty/ugliness in more complex areas. As a result, the advantage of studying art was recognized.

Keywords: Fractal analysis, Box counting, Differential box counting, Western art history, Art education

INTRODUCTION

Japanese elementary school teachers can teach their students the arts even without prior education in the field. Therefore, art class teachers do not follow a standard evaluation method. They create their own evaluation criteria and assign grades. These criteria rely on the individual teacher's inherent hobbies, suggesting that the children may not receive a proper and fair evaluation. This could foster in children a dislike towards art classes. A dislike of the arts from an early age can lead to a lack of imagination and originality. Moreover, the global birth rate has been rapidly declining in addition to an aging population. Thus, each individual is expected to contribute to a sustainable society and create new values to develop a mature society with qualitative affluence. The drastic evolution of artificial intelligence (AI) is a prevalent change in a mature society. AI is beginning to analyze and understand knowledge by itself and is predicted to change the workforce scenario and the meaning of knowledge acquired in schools substantially. However, regardless of the evolution of AI, human beings' greatest strength is their ability to think and judge the goodness, correctness, and beauty of the various purposes of life. Receiving a school education requires children to actively face various changes and work as teams to solve problems. In addition, school education aims to inculcate in students the ability to find the purpose of life through complex situational changes, such as identifying various types of information, realizing a conceptual understanding of knowledge, and reconstructing the information to connect it to a new value (Ministry of Education, 2018). For these reasons, art education is considered paramount, and teachers should understand how art education specialists analyze pictures and arrive at specific evaluations. Limited studies have been conducted on art education; therefore, sufficient information pertaining to the requirements, objectives, methods, and significance of art education cannot be found in the existing literature. Furthermore, only a few studies have focused on establishing scientific methods to better understand and evaluate the arts. As a result, criticism of art has declined to the extent that the direction of art education cannot be discussed with certainty (Kaneko, 2017).

Therefore, in this study, we use fractal analysis to evaluate whether the structural beauty of a painting changes with each period of Western art history. We aim to understand whether a difference in the idea of beauty exists depending on whether a person receives art education. Fractals can be seen in several art works. In particular, abstract expressionist painters show accidental or inevitable fractals. Furthermore, fractals are prominent in Jackson Pollock's works as a representative artist of abstract expressionism. In particular, fractals and art are closely related (Saito and Mori Toshio, 2013).

MATERIALS AND METHODS

Purpose of the Experiment

People have their own idea of what is beautiful in a painting. Thus, art works are considered beautiful by all people. Although various attempts have been made to clarify why people find beauty in paintings, the reasons have not been clarified. Whether aesthetic sense is acquired through education or whether it is innate has not been clarified. Thus, we conducted an experiment where we gave scores for beauty and ugliness to those who had received art education and those who had not studied art education. After the scores were given, participants were asked to indicate why they thought the painting was beautiful.

Participant Information

The experiment was conducted with 20 participants:10 with art education and 10 without art education. The art-educated students had received specialized art education at the university level. The art-educated students had an average age of 22.2 (±0.7) years and 3.2 (±2.3) years of art study experience. Students with no art education had a mean age of 24.4 (±1.6) years.

The reason for conducting the experiment was explained to the participants, and prior consent was obtained. The Saitama University Ethics Review Committee approved the experiments.

Experimental Apparatus and Paintings Used in the Experiment

In this experiment, assuming that a universal fractal dimension exists regarding what is or is not beautiful in paintings of any period, we asked art education specialists to select 35 paintings from each period of Western art history from two perspectives: abstract and representational paintings. The paintings were from 18 periods: Northern Renaissance, Renaissance, Mannerism, Baroque, Classicism, Rococo, Neoclassicism, Romanticism, Realism, Impressionism, Post Impressionism, Les Nabis, Symbolism, Art Nouveau, Naïve, Cubism, School-Of-Paris, and Abstract expressionism. The paintings of each artist were used (Only Jackson Pollock was used for Abstract expressionism). Figure 1 shows the 35 selected paintings. A 12.9 inch multifunctional tablet was used in the experiment. The resolution of the tablets was 2048 × 2732 pixels. The participants were asked to draw pictures on

Figure 1: Thirty-five western art paintings used in the experiment.

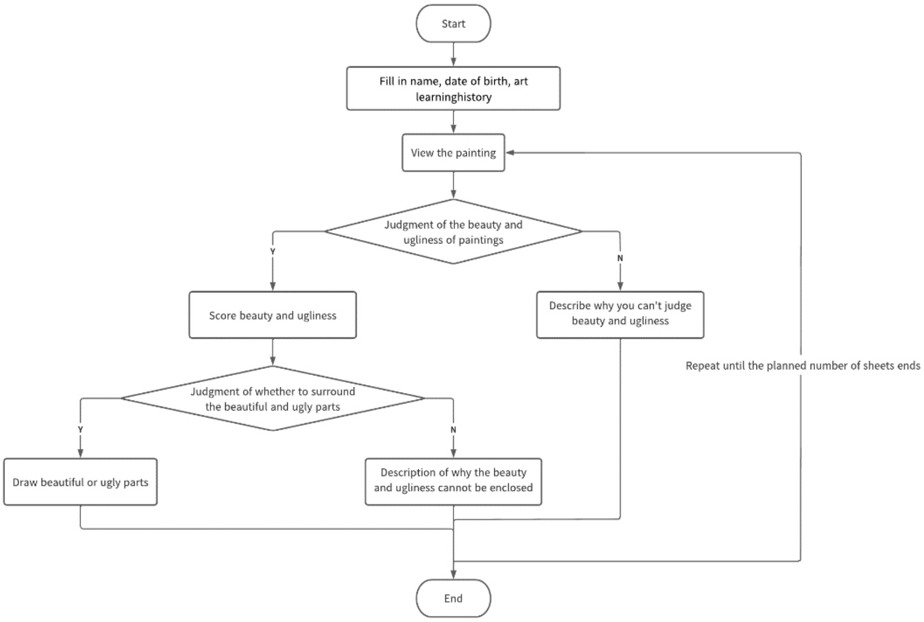

Figure 2: Flowchart of the developed app used in the experiments.

the screen using a stylus pen attached to the tablet. Moreover, the participants were asked to type by flicking the tablet or typing on an attached keyboard.

Apps Used in the Experiment

An experimental application was created using the Swift UI. In the experiment, the participants were first asked to view and score a painting. Scores were given on a visual analog scale, with a maximum of 3 points for beautiful paintings and -3 points for less beautiful paintings. When they could not evaluate the painting (i.e., when the score was zero), they were asked to describe why they could not evaluate it. Subsequently, when the participants evaluated the painting, they were asked to circle its beauty or ugliness points using a stylus pen to indicate what they thought was beautiful. If they could not identify beautiful or ugly points, they were asked to report the reason. Figure 2 illustrates the app flow.

ANALYSIS METHOD

Fractal analysis was used to analyze the results of this study.

Box Counting Method

First, only the beautiful and ugliness areas surrounded by paintings were cut out and binarized. The fractal dimension was calculated for the binarized images and calculated using the box-counting method. The procedure for the box-counting method is as follows:

(a) Figure covered with a grid.
(b) The number of grids where the components of the figure were present was counted.
(c) The number of grids was counted in the same manner while changing the grid size.
(d) The size of the lattice and the number of lattices counted on a logarithmic graph were plotted to obtain a least-squares curve.
(e) The multiplier represents the fractal dimension.

Figure 3 shows the division process.

Differential Box Counting Method

The differential box counting method is as follows: a square image of size $M \times M$ pixels is partitioned into non-overlapping grids of size s × s pixels, where s is an integer and varies from 2 to $M/2$. The related scale (r) of a grid of size $s \times s$ pixels with respect to the image size M is denoted by $r = s/M$. If s is not a divisor of M, the non-image pixels of the grids on the boundary are treated as zero. On each grid, there are a number of boxes of size $s \times s \times h$ to cover the rough gray-level image intensity surface over that grid. These boxes are assigned with a number as shown in Figure 4, where, $\lfloor \cdot \rfloor$ denotes the floor function and

$$h = \frac{(s \times G)}{M} \tag{1}$$

where G is the total number of gray levels in a grayscale image, that is, 256. The total number of boxes of size $s \times s \times h$ required to represent the rough surface over the (i, j)th grid of size s × s pixels, $n_r\left(i, j\right)$, is as follows:

$$n_r = \left\lceil \frac{g_{\max}}{h} \right\rceil - \left\lceil \frac{g_{\min}}{h} \right\rceil + 1 \tag{2}$$

where, $\lfloor \cdot \rfloor$ denotes the ceiling function. In addition, $g_{\max}$ and $g_{\min}$ are the maximum and minimum gray levels present on the (i, j)th grid, respectively,

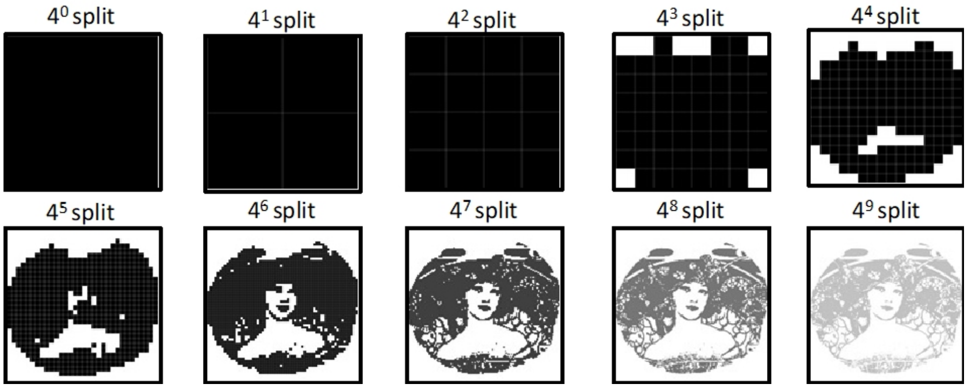

Figure 3: Segmentation process followed in the box counting method.

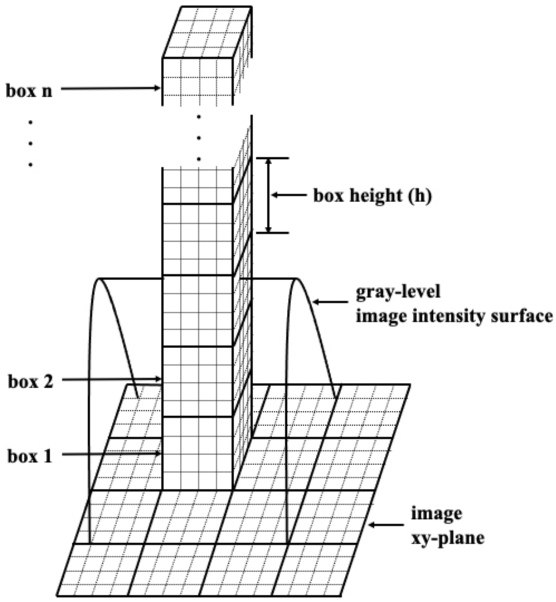

Figure 4: Segmentation process followed in the differential box counting method.

and $\left\lceil \frac{g_{\max}}{h} \right\rceil$ represents the box number containing $g_{\max}$. Moreover, $g_{\min}$ is located in a box denoted by box number $\left\lceil \frac{g_{\min}}{h} \right\rceil$.

The total number of boxes N_r at scale r required to cover the rough intensity surface of an image can be computed as follows:

$$N_r = \sum_{i,j} n_r(i,j), \text{ where } \frac{2}{M} \leq r \leq \frac{1}{2} \tag{3}$$

Subsequently, the fractal dimension of an image or the slope of a line was computed by fitting all points ($1/r$, N_r) using Linear Least Squares.

RESULT

Figure 5 shows the results for a particular participant. Moreover, many participants surrounded objects in the beauty/ugliness area. In the case of portraits, various participants surrounded faces and hands.

Next, the results of the box count method for fractal dimension and evaluation values for art learners are presented. The mean value of the fractal dimension was 1.77 when positive evaluation values were obtained. No correlation was found between the evaluation values and fractal dimensions of the beauty and ugliness areas. The results are shown in Figure 6.

The results of the box count method, fractal dimension values, and the evaluation values of the participants are described. The mean value of the fractal dimension was 1.76 when positive evaluation values were obtained. No correlation was found between the evaluation values and fractal dimensions of the beauty and ugliness areas. The results are shown in Figure 7.

The evaluation values and box count method fractal dimensions show the average for each chronological period of Western art history for those who

Figure 5: Beautiful and ugly areas enclosed by one participant.

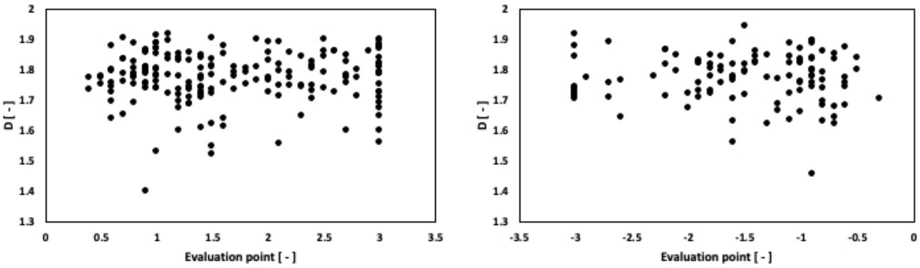

Figure 6: Results for participants who have not studied art (left: positive ratings and fractal dimension; right: negative ratings and fractal dimension).

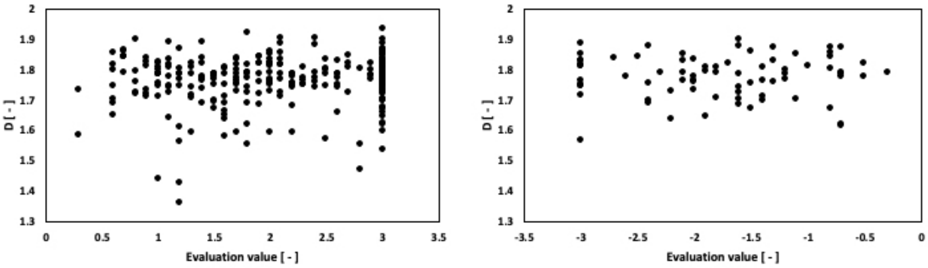

Figure 7: Results for the participants who have studied art (left: positive ratings and fractal dimension; right: negative ratings and fractal dimension).

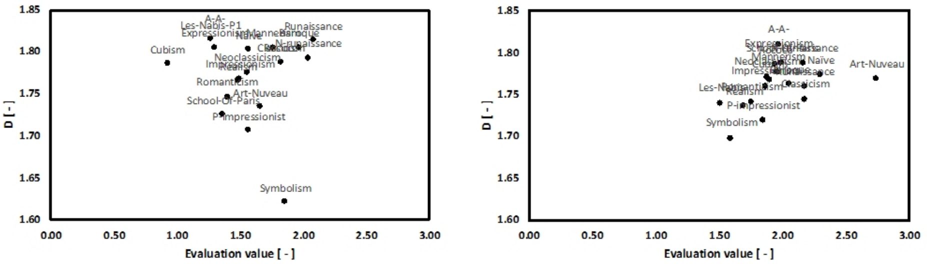

Figure 8: Average results for each western art history (left: group of experimental collaborators who have not studied art, right: group participants who are currently studying art).

have not studied art and those who are studying art. A positive correlation coefficient of 0.45 was found for those studying art. In contrast, no correlation was obtained for those who had not studied art. In addition, the number of cases in which the respondents who had not studied art could not surround beauty or ugliness was 11, compared to 58 for those who had not studied art. The results are shown in Figure 8.

Subsequently, the results of the differential box counting method fractal-dimension values for participants who had not studied art are presented. The mean value of the fractal dimension was 2.06 when positive evaluation values were obtained. No correlation between the evaluation values and the fractal dimensions of the beauty and ugliness areas was found. Moreover, the results of the differential box counting method fractal dimension values of the experimental collaborators during the art study are described. The mean value of the fractal dimension was 2.20 when positive evaluation values were obtained. No correlation between the evaluation values and the fractal dimensions of the beauty and ugliness areas was found.

DISCUSSION

In the beauty/ugliness area, various participants surrounded objects. In the case of the portraits, many participants surrounded the face and hands. This suggests that the judgment of beauty or ugliness in figurative paintings is based on the main object instead of the background.

The mean value of the fractal dimension was 1.76 for both groups of participants who were currently studying art and those who had not yet studied art. Therefore, the areas that are considered beautiful have a higher-order fractal dimension.

The average of the evaluation values and fractal dimension for each period of Western art history for the experimental group who had not studied art and the experimental group who were currently studying art did not show a correlation. In contrast, a positive correlation coefficient of 0.45 was obtained for the experimental group of participants who were currently studying art. The reason might be that the participants who are currently studying art understand the characteristics of each age group and the areas to be evaluated through education, and those who are currently studying art have solid guidelines.

CONCLUSION

This study aimed to understand the differences in the beauty and ugliness of paintings between students majoring in art and those of the same age who have never studied art by calculating the fractal dimensions of areas in paintings considered beautiful or unbeautiful. In addition, to clarify whether the aesthetic sense is fostered by education, we conducted an experiment in which we assigned scores for beauty and ugliness to those who had received art education and those who had not studied art education. The results showed a positive correlation between the scores of those who had received art education and those who had not, suggesting that art education can form the basis for evaluating the arts.

REFERENCES

Kaneko, K. (2017) Problems And Solutions in Art Education Science Through Redefinition by Gift Exchange Theory, Art Education, Journal of the Society of Art Education, Volume 38, pp. 179–181.

Ministry of Education, International elementary school course of study commentary drawing work edition, available from <https://kawasaki-edu.jp/9/2kenkyukai/index.cfm/9,496,c,html/496/kaisetu.pdf>, (accessed on 3 October, 2021).

Saito M., Mori T. (2014) Evaluation of Fluctuation of Landscape, Textural Patterns and Painting Arts Using Frequency Analysis, Department of Home and Life Sciences, Faculty of Home Economics, Gifu Women's University, 80 Taromaru, Gifu, Japan.