

Pictorial Expression Techniques Used in the Wall Painting of Each Thai Dynasty Period

Kanakarn Ruxpaitoon^{1*}, Naokazu Aoki² and Hiroyuki Kobayashi²

¹*Color Research Center, Faculty of Mass communication Technology,
Rajamangala University of Technology Thanyaburi, Thailand.*

²*Graduate School of Advanced Integration Science Chiba University, Japan*

*Corresponding author: kanakarn@yahoo.co.jp

Keywords: Thai dynasty periods, Wall paintings, Representative colors, Impression of color arrangement, Perspective techniques, Depth feeling.

ABSTRACT

Thai dynasties consist of Ayuthaya(1351-1767) and Bangkok(1782-Present).The culture and diplomatic features were different in each dynasty. Most historical wall paintings of Thailand were drawn in the temple. In the present study, colors used in Thai wall paintings of various dynasties were measured and plotted in the L*a*b* color space. Representative colors were obtained by K-means clustering in combination with 2 step clustering, and their characteristics were discussed by comparing with Pompeii (first century) and Renaissance fresco (15th century). It was found that Thai wall paintings in Bangkok dynasty were influenced by Europe and the way of using color was very similar to European way at renaissance time. In addition, impressions of the color arrangement of these paintings were obtained by a color image scale.

INTRODUCTION

In Thailand, people's life or the traditional art are strongly connected to Buddhism, and it can be said that the wall paintings drawn in the Buddhist temples represent the Thai art. In Ayutthaya era, the influence of China was greatly received, and a lot of wall paintings of the Buddhism story came to be drawn in the inner wall (UBOSOT) and main temple (VIHARN) of the Buddhist temples. At that time exchange with not only China but also with Europe took place, but there seemed to be little influence on picture. Because pigments in Ayutthaya were made from natural materials the color of Ayutthaya had few kinds. In Bangkok age the Bangkok dynasty is divided into three ages, the first term (Rama 1 – 3 generation), the middle term (Rama 4 – 6 generation), and latter term (Rama 7 – 9 generation of the present age). In the time of the Rama 1 (1782-1809) the feature of wall painting just kept influence of Ayutthaya culture. The influence of Chinese art was strongly received in the age of Rama 3 generations (1824-1851). At that time pigments were imported from China. The western countries started to exchange with Rama 4 generation (1851-1868) and the influence appeared to the wall painting. The shadow method, perspective drawing, spatial placement, and split plot design were adopted. The Rama 9 (1946-present) who made effort for maintenance of the infrastructure of his country and planned improvement of the living environment of the nation. Enlightenment for knowledge took place and culture and art of the original style aroused in Thailand. In this study the wall painting of the period of each dynasty was analyzed. The representative colors were derived from the color distribution in L*a*b* space, which were taken from photo books for the wall painting in Pompeii (one century) and Renaissance (about the 15th century). Their feature of the coloring was investigated and was compared with the wall painting. Perspective expression technique used in wall paintings of each Thai dynasty period was investigated. The use of aerial perspective was discussed with the help of the difference in

lightness, chroma, and contrast among short-distance view, middle-distance view, and long-distance view, and the use of linear perspective was discussed with the help of distance dependence of the object size (here limited to figures), comparing them with Renaissance and Baroque paintings.

Analysis of coloring

The coloring in the wall painting of each age and color information were acquired from the picture collection by a suitable size, and the representative color was taken by k-means clustering method. The method used is as follows.

1. The wall paintings were captured and digitized by using an image scanner (EPSON10000G). The resolution was 96dpi, which was not influenced by the printing dots of the print and adequate color information was obtained.
2. Color information was calculated as sRGB color space. Average size of a 5x5 color information for each selected pixels. The visibility distance in visual MTF as best seen from a 2x2 pixel size (0.5x0.5mm) would be reasonable to do, and even in the most detailed picture seems to be a pattern in this analysis, these two different sizes, color distribution, there were no differences for a representative color, the less amount of calculation for 5x5 pixels.
3. X, Y, Z tri-stimulus values and L*, a*, b* values were calculated on sRGB color space, and were plotted on L*a*b* space to obtain the distribution of colors used in each mural.
4. Based on the color distribution in L*a*b* color space of wall paintings from each era, the IBM SPSS Statistics software package for statistical analysis (IBM Co.) was used to determine the number of clusters K through two-step clustering based on distance (color difference) in L*a*b* space. Using the K, representative colors were automatically determined via the K-means method.
5. The color distribution on L*a*b* space was analyzed by k-means clustering and the representative color was found and color patches were presented as the representative color by Adobe Photoshop.

RESULTS

Impressions imparted by color combinations (classification using color image scale for color combinations)

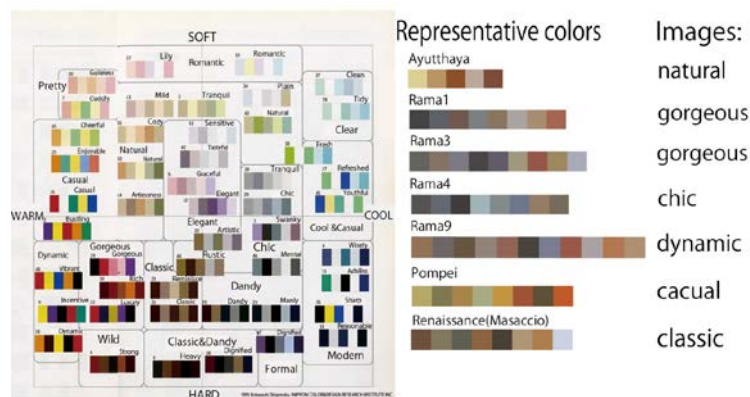


Fig. 1 Determination of the emotion associated with representative colors of each era by using a color combination image scale.

Figure 1 shows the swatches of representative colors for each era. On the far left of the diagram, the color image scale for color combinations is shown for comparison. Emotion words for representative color patches were found by comparing with image scale. At this time, colors with high percentages were stressed.

This study analyzed color usage in Thai paintings which was not investigated previously. Important temple paintings representing each dynasty were selected as the subjects of the research. The characteristics of Thai paintings were elucidated by comparing them with European paintings from Pompei and the Renaissance.

In the Ayutthaya Era red and yellow pigments were used without mixing, and this imparts a warm and natural impression. In the Bangkok Era, during the reigns of Rama 1 and Rama 3, powerful black backgrounds were adopted, and color combinations incorporating red impart a new, gorgeous emotion. In the reign of Rama 4 cultural exchange with Europe began, and color materials began to be imported. Color usage became richer and the expression itself began to exhibit a European influence. The artist Khrua In Khong, a representative of that era, used black and blue as his base colors, and left wall paintings which impart a chic impression characterized by extremely low chroma. In the reign of Rama 9 Thailand's distinctive Benjarong painting style was established. This style imparts a dynamic impression with greater power by adding a strong orange color to the color combinations used in the reigns of Rama 1 and Rama 3.

In comparison with Western painting, wall paintings from the Ayutthaya Era impart an extremely warm impression due to their use of highly saturated yellow and red. The impression is similar to that of the wall paintings of Pompei. The wall paintings of Khrua In Khong during the reign of Rama 4, which are said to have been greatly influenced by Western painting, have low saturation compared to Renaissance wall paintings. Black and blue account for a large percentage of the color combination, and the paintings impart a cool emotion. The color combinations for Rama 1, Rama 3 and even more so Rama 9, are warm and hard, and similar in impression to Renaissance wall paintings.

The pigments used in each era of Thai and Western art

Few pigments were used in the Ayutthaya Era, and mixtures of pigments were not used. Therefore the distribution of color usage was narrow. In the Bangkok Era, gradation of dark tones appeared due to the mixture of achromatic and chromatic pigments. On the other hand, there was a broadening of color usage because pigments began to be imported from China. The rich color usage of the Bangkok era became "Benjarong"—the color combination method using black, white, red, yellow, blue and green which became the basic color usage of Thailand. Basically, the pigments used to produce Thai wall paintings are the same as those used in the West, but Thai art is characterized by its method of applying paint, color usage techniques and other factors.

Depth perception expression technology of wall painting □

The contrast and the chroma of the wall painting in the Ayutthaya and Bangkok Dynasties of Thailand were examined. The use of aerial perspective was discussed with the help of the difference in lightness, chroma, and contrast among short-distance view, middle-distance view, and long-distance view, and the use of linear perspective was discussed with the help of distance dependence of the object size (here limited to figures), comparing them with Renaissance and Baroque paintings[3,4].

The experiment method for linear perspective

Measurement was done for the position (distance from the place which the painter was drawing) where very thing was arranged in the height (pixel count) from the edge under a picture, and for the relation between the size of what was drawn, and the distance of arrangement. The following steps were taken for the investigation.

- 1) Wall paintings of each dynasty period of Ayutthaya and Bangkok dynasties were analyzed in a manner as follows.
 - a) Obtained the correlation between the position on the screen and the size of the person drawn, then introduced the linear perspective.
 - b) The existence of introduction of aerial perspective was examined by measuring and comparing the lightness, chroma, and contrast of a close-range view, a middle-distance view, and a distant view which were drawn.
- 2) Clear linear perspective was used only with the wall painting of Khrua In Khong of the Rama 4 in the pictures of Thailand. It could not be found in the wall painting of other dynasties.
- 3) In the corridor wall painting of the Rama 3 which introduced the bird's-eye view method a strong depth perception was given. It was comparable to the pictures of the Renaissance age which introduced clear linear perspective.
- 4) In the wall painting of Main hall of Wat Bowonives Voramahavivah of the Rama 3 and the wall painting of the Rama 9, a strong depth perception was brought about according to the effect of height peculiar to the pictures of Asia as compared with the wall painting of the Rama 4.
- 5) It was shown that introduction of aerial perspective is performed on the Rama 3 and the column on the Rama 4.

These results are summarized in Fig. 2.

	Era	Ayutthaya	Rama1	Rama3 (Corridors)	Rama3 (Main hall)	Rama4 (Column)	Rama4 (Wall paintings)	Rama9	Renaissance (Wall paintings)	Renaissance (Oil paintings)	Baroque
Techniques											
Aerial perspective		x	x	Δ	Δ	Δ	x	x	Δ	○	○
Linear perspective		-	x	Δ	x	-	○	x	○	-	○

Figure 2: Presence or absence of introduction of perspective techniques
 ○:present; Δ:present but not clear; ×:absent; -:unmeasurable

REFERENCES

1. M.Kobayashi, "Towards mathematical analysis of color expression in painting" University of Electro-Communications Bulletin, vol 19, pp 57-63(2006)
2. Shigenobu Kobayashi, "Colorist ", Kodansha, Tokyo (1997)
3. Naoto Kawamura Fumitaka Ono, "Color management technique" Institute of Image Electronics Engineers of Japan, 117 - 123 (2008)
4. Mikio Takagi, Akihisa Shimoda, "Image-analysis handbook", 62-66, University of Tokyo (2004)