

The Orikao Method: 3D Scene Reconstruction from Japanese Beauty Portraits

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For more than 1,300 years, beauty portraits have continued to be painted in Japan and virtually all have been stylized to a very unrealistic extent.

This paper discusses a method for the transformation into a 3D scene that has the characteristics of stylized exaggeration found in Japanese beauty portraits. To develop this method, we quantitatively identified the characteristics of stylized exaggeration of facial features in Japanese beauty portraits and created a program for generating the facial image feature of the stylized exaggeration of various Japanese beauty portraits from a volunteer's photograph automatically.

This research will suggest a new and simple method for transformation of facial images based on Japanese art history and also make a contribution to the non-photorealistic techniques.

Characteristics of Stylized Exaggeration in Japanese Beauty Portraits

Analyzing 200 images of Japanese beauty portraits from 8th century to the present with particular focus on the shape of the eyes and cheek, we understand that the history of stylized beauty portraits in Japan can be divided into four periods:

In the 8th century (1st period), beautiful women drawn on murals and *byobu* screens are portrayed with narrow eyes and full cheeks. In the late 17th century (2nd period), *ukiyo-e* woodblock prints featured up-angled eyes, closer to the center of the face. In the 1900s (3rd period), beautiful women in illustrations began to feature drooping eyes positioned far apart. In the 1950s (4th period), beautiful women in girls' comic books began to feature large eyes and small cheeks.

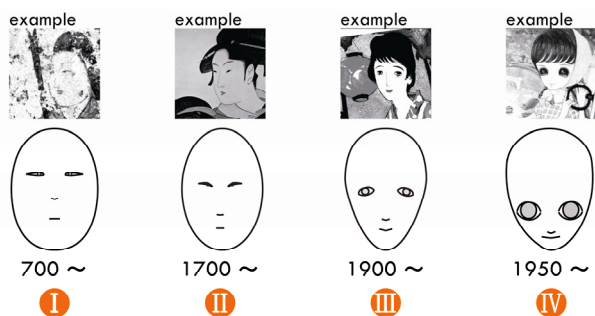


Fig.1 Characteristics of stylized exaggeration

The Orikao Method for Reconstruction from Various Beauty Portraits

The Orikao Method is inspired from "Origami". Origami uses a "folding" method to turn a 2-dimensional single sheet of paper into a variety of 3-dimensional shapes. Similarly, the Orikao Method uses a "folding" approach to transform a basic human face drawn on 2-dimensional paper into a 3-dimensional scene reconstruction from four types of faces, each of which has the characteristics found in Japanese beauty portraits. The Orikao Method is as follows:

In order to reproduce the characteristics of a beauty portrait from the 1st period, we need to fold along the folding lines as shown in Fig. 2-I. Similarly, in order to reproduce the characteristics of a beauty portrait from the 2nd period, 3rd period, and 4th period, respectively, we need to fold along the folding lines as shown in Fig. 2-II, Fig. 2-III and Fig. 2-IV.

To determine the folding angles, we derive the rotation matrix on the folding axis, that maps out the equivalent characteristic points in the original facial image to the characteristic points in the target beauty portrait images.

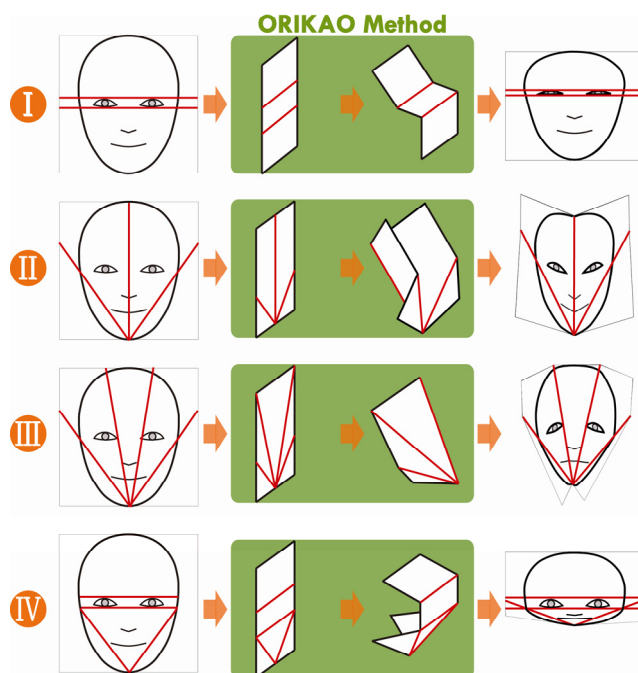


Fig.2 Process of the Orikao Method

The Orikao Method Program

The process of the program is as follows: First, read in the original photograph and identify the characteristic points. Second, read in a beauty portrait you wish to use as the target image and identify its characteristic points. Then, the original photograph is folded along the folding lines by angles that are derived automatically from the target beauty portrait. This results in the generation of the face that has the characteristics of stylized exaggeration as found in Japanese beauty portraits.

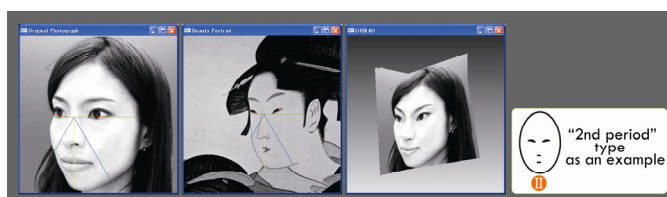


Fig.3 Operation screen of the Orikao Method Program