



Motion Representation of Images in Dunhuang Flying Apsaras Murals

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Abstract. Dunhuang Murals are historical treasures of China. Among all figures of Dunhuang Murals, Flying Apsaras which shows the dancing, gentle and stretching images of flying freely in the sky is the most representative. The images of Flying Apsaras in Dunhuang Murals are very rich and are often extracted by researchers from Dunhuang Mogao Grottoes and Yulin Grottoes. However, because of the changeable images and the flexible and elegant postures, Flying Apsaras is always a bottleneck in the field of animation. In this study, the image of Double Flying Apsaras in the 305th grotto of Mogao Grottoes was analyzed and motion displayed through preliminary graph extraction and using the package Duik on AE, which thereby integrated murals and animation.

Keywords: Dunhuang Flying Apsaras Murals · Motion Graphic

1 Introduction

Dunhuang Murals are precious historical relics of China and are witnesses of history and cultures. The extensive themes and massive and profound contents of Dunhuang Murals have created many classic images. Among all Dunhuang Murals, the most famous image is Flying Apsaras, which appeared in 270 of the totally 492 Mogao Grottoes of Dunhuang. However, the derivative products of Dunhuang Flying Apsaras murals are mostly dependent on graphic design. Motion representation of the flexible Dunhuang Flying Apsaras murals is the research theme of many Chinese artists.

In this study, the image of Double Flying Apsaras in Dunhuang Murals was motion represented by using the package Duik on Adobe After Effects (AE). The package Duik of AE achieves the motion effect by rigging skeletons and can be used to create the images of figures in motion graphic animation. This study targets at the image of Double Flying Apsaras and presents the preliminary findings on image disassembly, graphic layering, import into AE, central point alignment, figure skeleton rigging, and figure motion representation.

2 Status of Flying Apsaras in Dunhuang Murals

2.1 Dunhuang Murals

Dunhuang Murals, listed as World Cultural Heritages, are painting art works drawn on the inner walls of Dunhuang grottoes, Gansu province, China. Within a total area of over 50000 square meters, Dunhuang Murals involve 522 grottoes from past dynasties, including Mogao Grottoes, West Qianfo Grottoes, and Anxi Yulin Grottoes. Dunhuang Murals mainly portray the images of deities, activities of deities, deity-deity relations, and deity-human relations in Buddhism, conveying spiritual wishes and conciliating hearts. The Dunhuang grotto murals contain massive information of history, cultures and arts, and visually recorded the religious beliefs, social systems and folk-custom events in different eras [1]. The categories of murals include statue images, classic story paintings of Han Nationality, categorized paintings, historical paintings of Buddhism, figure paintings, and graphic decoration paintings. The contents described in the murals include patterns, figures, animals, plants, clothing, traffic vehicles and buildings. These murals integrate massive colors, lines and other elements, which are distributed to create art syntheses. Shapes of the murals are comprised of forms that are created by lines. Color spreading is applied to create a gorgeous color effect and to finally represent the art forms of murals.

2.2 Flying Apsaras

Among all Dunhuang Murals, the most famous image is Dunhuang Flying Apsaras, which was presented in 270 of the totally 492 Mogao Grottoes of Dunhuang. From the temporal aspect, the image of Flying Apsaras in Dunhuang Murals spanned ten dynasties and lasted over 1000 years [2]. This image gradually vanished by late Yuan Dynasty when Dunhuang grottoes were accomplished. As a result, the images of Flying Apsaras with different era-specific characteristics were created. During the evolution over 1000 years, the representative eras include early era in North Liang Dynasty, the pioneering era in Sui Dynasty, the flourishing era in Tang Dynasty, and the gradually downfallen era in Song Dynasty. Especially, the images of Flying Apsaras from Tang Dynasty are the most lively and elegant. The images of Flying Apsaras from Tang Dynasty are rich in types and diverse in details, and the sculptures of figures are closer to the general public and closer to common customs.

The figures of Flying Apsaras have the theurgy of flying in the sky and thus have graceful and spectacular sculptures and flexible and beautiful dancing postures. The images of figures are mostly half-naked with flying ribbons and half-closed eyes [3]. Some figures are recumbent in the sky, some are rising and shuttling in clouds, and some are pitching, writhing and flying free in the sky. The Flying Apsaras in Dunhuang Murals was converted in Tang Dynasty to a more feminine image, and the figures of Flying Apsaras were mostly elegant and dancing fairies who wore peibo on the top and long skirts below, and their clothes were designed with fluent and diverse patterns. Peibo [4], an ornament of the clothing in Tang Dynasty, was long ribbons worn on the arms of women in Tang Dynasty. Peibo, also called 'ribbons', is the most variable part of all compositional elements in the images of Flying Apsaras and is the punch line. The

images of Flying Apsaras have strong esthetic representation and decorative colors. The luxuriant portray of figures and the display of flexible clothing provide rich inspirations for the exhibition design and cultural/creative design in China nowadays. However, the derivative products of Dunhuang Flying Apsaras murals are mostly dependent on graphic design. Motion representation of flexible Dunhuang Flying Apsaras murals is the research theme of many Chinese artists.

2.3 Significance in Motion Representation of Flying Apsaras Image

Flying Apsaras is the most characteristic and representative image of Dunhuang Murals. The mainstream view of the Dunhuang academic field is that the images of Dunhuang Flying Apsaras resulted from the gradual integration between Flying Apsaras of Buddhism and local winged men. As time flew by, the final figure images of Flying Apsaras were deprived of wings, which were replaced by the more floating and flexible peibo. Such processing of replacing the real with the imaginary and entrusting wishes in shapes largely improved the esthetic realm of Flying Apsaras, and expanded the art developing space of Flying Apsaras, making the images of Flying Apsaras more flexible and plump. The necessity in motion representation of Flying Apsaras images can be explained from three aspects. First, Flying Apsaras relative to other murals are richer in forms, and the fascination in their floating clothing and elegant body shapes can be more easily exhibited in the motion form. Second, the images of Flying Apsaras represent the images of fairies and flying immortals in Chinese myths and legends. The images of Flying Apsaras are characteristic of 'flying' motions, and this characteristic can be more embodied in the motion form. Third, the motion representation of Flying Apsaras is a breakthrough for other relevant industrial pillars. Along with the gradual promotion of the culture creativity industry recently, the cultural and creative designs focusing on Dunhuang Murals are also continually derived and largely demanded. Hence, motion representation of Flying Apsaras images helps the transition of relevant cultural and creative products from the 'static' form to the 'mobile' form.

3 Motion Construction of Images of Dunhuang Flying Apsaras

3.1 Graphic Decomposition of Figures of Flying Apsaras

Figure animation was conducted on Duik of AE. First, usable figure motion graphics were created. With the Double Flying Apsaras in the 305th grotto of Mogao Grottoes (Fig. 1) as example [5], to establish figure animation, the figures in the murals shall be graphically processed first. The original pictures were matted on Adobe Photoshop (PS), and the figure sculptures and the background were separated. This step was aimed to differentiate figure animation and the background. To make the motion effect of the figures more vivid, all the figure body parts that can be motionally represented shall be layered. For instance, for animation of hands, all the fingers and even knuckles must be layered. For motion representation of Flying Apsaras figures, all joints to be motionally represented must be layered. As for the head, the right and left eyes, the right and left eyebrows, the mouth, and the nose were separated. The body and four limbs were layered



Fig. 1. Double Flying Apsaras in the 305th grotto of Mogao Grottoes.

into the left and right forearms, the left and right rear arms, the left and right thighs, and the left and right shanks. These parts were named and classified, which facilitated the subsequent action design. Then the layering tool of PS was opened, and the figure joints were matted using pens. Then each joint was added as a single layer.

3.2 Skeleton Creation in Duik

AE is a type of high-performance graph and video processing software and is among the main tools for manufacturing of motion graphic (MG) animation. Figure animation is an indispensable part of MG animation, and its skeleton rigging technology is the key of figure animation making. The first thing of figure skeleton rigging is to install the package Duik, which is a skeleton script that can be used in AE. This package has built-in inverse kinematics, skeleton and C tools, adaptive operation, and other functions. Duik can be used to automatically create the controllers of a mobile background layer and a covering layer, and can simulate the functions of cameras, without the need of a 3D layer. During inverse kinematics (e.g. the making of walking, running or machinery animation), Duik can automatically execute and create figure animation that obeys common rules. With the bone and puppet tools, the local animation of figures can be realized by rigging. During adaptive control, all skeleton lines rigged together can control the rigging contents, so that the animation effect can be repeatedly made only after one rigging. With the operating tools in Duik, the animation of figure expressions can be realized by rigging different graphs.

The layering file of Flying Apsaras figure images from PS was opened on AE. Then Layering - Preserve layer size was chosen in the opened file. After that, a new synthesis was created, in which the complete figure animation can be realized.

3.3 Control Point Tool and Central Point Creation

The control point tool is built-in in AE and is applicable to simple skeleton rigging operation, especially local rigging. With the arms of MG figure animation as example, control point rigging was needed at the three joints of each human arm, including the joint connecting the hand and the forearm, the joint connecting the forearm and the rear arm, and the joint connecting the rear arm and the body. After placement, the positions of the anchors (central point) in the graph must be adjusted. Normally, the default anchor positions of AE are the central points, but to make the motions of figures more vivid during figure animation making, the anchors of all layers must be manually adjusted to the joints. With the images of Flying Apsaras as example, the joint points to be adjusted include the joint connecting the head and the body, the joint connecting each hand and the forearm, the joint connecting the forearm and the rear arm, the joint connecting each foot and the shank, the joint connecting each shank and the thigh, and the joint connecting each limb and the body. The figure skeletons cannot be rigged until the anchors were adjusted.

3.4 Parent and Automatic Skeleton Rigging

Parent is an important tool in AE and is divided into the parent level and the child level. To use Parent, all the key frames at the parent level before and after the time axis will affect the child-level frames. After the parent-level and child-level key frames are determined, the child-level frames will inherit the parent-level attributes and change consistently [6]. During figure animation making on AE, the most important important step is to set parent-child relations in the figure graphs. If this step of rigging were ignored, the whole animation figure layer positions would be altered and wrong. To build parent-child relations, the palms, arms and other layers of animation figures are rigged to corresponding skeletons. Specifically, palms and arms are the child-level connections, and the corresponding skeleton layers are parent-level connections. Then affiliations will be formed between the child-level connections (Fig. 2) and the parent-level connections, and the child-level layers will change along with the variation of the parent-level layers.

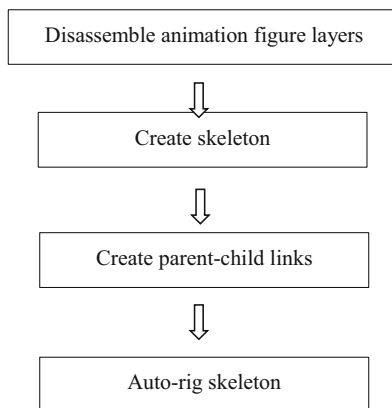


Fig. 2. Character Graphic Construction.

After the above steps, bone rigging is applied. First, the skeleton layer is chosen all. Then the 'Auto-rig and create inverse kinematics' under the second option 'Link and constrain' in the menu 'Auto-Rig' on the face of Duik is selected. After that, the figure layer will be automatically rigged according to skeletons. In the rigged figures, the palms and soles can be dragged to control the changes of limbs. Through the time axes of the palms and soles, key frames can be established to finish the figure animation with different actions.

4 Motion Display of Flying Apsaras Images

The artists of Mogao Grottoes in Tang Dynasty created the most beautiful images of Flying Apsaras, which endowed the murals then with new life. Flying Apsaras at that time was an embodiment of youth, health and beauty, which were manifested by the skilled and elegant dance postures, gentle body postures, natural and unrestrained attitude, and floating clothing. The Dunhuang Murals and the images of Flying Apsaras were summarized. The operations of using Duik in AE to extract the images of Double Flying Apsaras in the 305th grotto of Dunhuang Mogao Grottoes were described. The motion display can maximally show the practicability, extensibility and richness of graphs or figures, and their intimacy with the audience, which made it more possible to display the formerly fixed images. Through interaction with the audience, motion display endows the audience with the satisfaction from independent selection. With the display of motion pictures, modern tools are used to alter the most important elements in the original pictures, and to exhibit the merits and attitudes of the original static images. The motion display of Flying Apsaras images can be realized in all electronic media, including museums, mobile APPs and the computer terminal, and can be presented in the form of popular science, or can be jointly shown with a certain commercial Ad. It offers another clue and way for the static display that is familiar to the public.

5 Conclusion

The image of 'Flying Apsaras' in Dunhuang Murals originated from the worship for bird totem and the thoughts of immortals among ancestors in ancient times, and were integrated during the interaction between Buddhism cultures and Han nationality cultures, which resulted in the image of flying in conventional arts. After thousands of years of inheritance and variation, the image of 'Flying Apsaras' still is the source of creation for us and still can be sublimated largely nowadays. The animation of this flexible and floating image through skeleton rigging on Duik was elaborated, the graphic disassembly of 'Flying Apsaras' was described, and Duik as well as rigging was introduced. This study is expected to help researchers and fans in this field and can be referred to during animation of figure images from Dunhuang Murals. It is hoped that more researchers and designers will develop Chinese traditional cultures and use modern technology and tools to improve the design of traditional cultures.

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