

Production and Optimization of 3D Animation Garage Kits – Taking “Sound of Pipa” as an Example

Weina Yan^{1*}, Di Zhang²

¹School of Design, Leshan Normal University, Leshan 614000, Sichuan Province, China

²Chengdu Mohua Rongchun Culture Media Co., Ltd., Chengdu 610000, Sichuan Province, China

*Corresponding author: Weina Yan, 986743011@qq.com

Copyright: © 2022 Author(s). This is an open-access article distributed under the terms of the Creative Commons Attribution License (CC BY 4.0), permitting distribution and reproduction in any medium, provided the original work is cited.

Abstract: The most popular 3D animation garage kits are SD dolls and ball-jointed dolls (BJDs), which are shaped like 3D figure sculptures. Since garage kits such as SD and BJD are expensive, new materials such as PVC and clay have been introduced as there are still many fans. This paper takes the antique clay-making garage kit, “Sound of Pipa,” as an example and elaborates its design, production, as well as optimization ideas and methods to provide reference for beginners to create 3D garage kits. The garage kit industry, on the other hand, should pay close attention to the latest developments in technology and materials, both at home and abroad, and incorporate them into the creation and production of works on a regular basis.

Keywords: 3D; Animation garage kit (GK); Material; Technology

Online publication: April 28, 2022

1. Introduction

3D is a relative concept. Compared with 2D objects with just length and width, there is a sense of depth in 3D objects. Garage kits originally refer to unpainted resin model kits, which are semi-finished products without color requiring them to be manually colored or assembled and polished. They are considered a type of animation merchandise ^[1]. Therefore, 3D garage kits can be defined as a type of DIY craft that reflects a popular person or thing, presenting it in a three-dimensional form. As can be appreciated, the quality of 3D animation garage kits is inextricably linked to the artist’s manipulative ability. Its independent production means differs from mass production by machines. Hence, there are only a few garage kits available, and they reflect more emotions from the producers and difficulties faced in crafting. Therefore, the cost of 3D animation garage kits is higher than that of ordinary crafts ^[2].

3D animation garage kits are shaped like three-dimensional figure sculptures; they have the three-dimensional, touchable, and visible artistic features. Currently, the most influential 3D animation garage kits are SD dolls and BJDs. SD dolls specifically refer to movable ball-jointed dolls launched by the Japanese company VOLKS (V, for short) in 1998. Dollfie is its trademark, which can be translated as “perfect human.” As the company had high expectations for the brand, “Super” was added to the brand name; hence, it became “Super Dollfie.” SD is the abbreviation of this trademark. The abbreviation of BJD is derived from the initials of “ball-jointed doll,” which can be translated as “球型关节人偶.” BJDs originated from Europe. The joints of the doll are connected by ball-shaped parts. Such a special structure enables the dolls to achieve unprecedented richness in movement and form, which can better stimulate

people's imagination and creativity. It is obvious that SD dolls are included in a category of BJDs. The SD dolls developed by VOLKS are the standard and model of many BJD products. Currently, the size and body shape of BJDs in Japan and South Korea are mostly based on SD dolls. Therefore, SD dolls have absolute authority in the design concept and production technology of doll garage kits ^[3].

The features of SD dolls and BJDs are that they can be refitted by players. Their eyes, hair, body joints, hands, feet, arms, and legs can be separated. In addition to the entire doll, many parts are provided, such as hands with various movement forms, so that the players can create more movements for these dolls by selecting specific parts according to their preference. Furthermore, the cosmetic products of SD dolls and BJDs, such as eyebrows, eyeliners, eyelashes, blush, lipstick, etc., allow players to express their creativity. Therefore, two completely identical dolls when leaving the factory will have different temperaments after being transformed by different owners. Certainly, the cost for these doll garage kits is relatively high, ranging from several thousand yuan to several hundred thousand yuan ^[3].

Life cannot be separated from art; hence, any traces of the times will be reflected in the works of art ^[4]. Since garage kits such as SD dolls and BJDs are expensive, new materials such as PVC, resin clay, and ultra-light clay have been introduced on the market, considering the large number of fans they have. These dolls with new materials are pleasing to the eye and more affordable. However, their skin color, hair, and makeup are all fixed. The resulting psychological expectations are stimulated in various ways, including visually, psychologically, physiologically, and some other objective needs ^[5]. The price of PVC garage kits ranges from 400 to 2,000 yuan, with no cap. The pricing of these garage kits corresponds to their size, appearance, collection value, material, etc. Among clay garage kits, ultra-light clay is the cheapest raw material, but it will easily crack and swell after completion; thus, it can only be made into the cartoon version, the price of which is about 100 to 200 yuan. Resin clay is relatively expensive, but it does not deform after shaping and can be stored for a longer period of time. It costs between 200 and 500 yuan. Beginners can get started with inexpensive clay materials. For example, 500 grams of ultra-light clay costs about 6 yuan, while resin clay costs about 10 yuan. In the following sections, the methods and optimization ideas for creating a 3D garage kit ("Sound of Pipa") out of clay will be discussed.

2. Steps in the design process of "Sound of Pipa"

This work reflects an image of a young lady holding a pipa in her arms and playing music at ease in the courtyard. In addition to the reference to SD doll and BJD design ideas, it is also a reference to the local puppet show. Puppet shows in China have a long history, dating back to the Han Dynasty, rising to prominence during the Tang Dynasty, and becoming popular during the Song Dynasty. There are many different types of puppet shows, among which Beida's puppet style is unique ^[6]. In this work, the lady is sitting on a stool, with a tea table and tea set beside her. The courtyard is presented by different elements, such as white walls, a small pond, a parterre, and the ground. In the spirit of art, Wassily Kandinsky wrote, "Form is the external expression of content ^[7]." Therefore, the design of this work takes into account not only the character's appearance, posture, clothing, temperament, and so on, but also the surrounding environment. Together, these "forms" create a detailed and vivid, lingering charm of handmade works.

2.1. Choice of colors for the dress

In the "Sound of Pipa," the lady playing the pipa is at the age of thirteen; hence, it is natural that the color of her dress should be lively and refreshing. It is possible to choose a color combination on a white background with one color as the main color and another as the supplement, both of which are lively and harmonious. This is consistent with people's long-term understanding of colors, which progresses from intuition to experience and subjective association before reaching the process of rational judgment ^[8]. Several combinations are attempted based on this scheme.

(1) Yellow + white + pink (Figure 1)

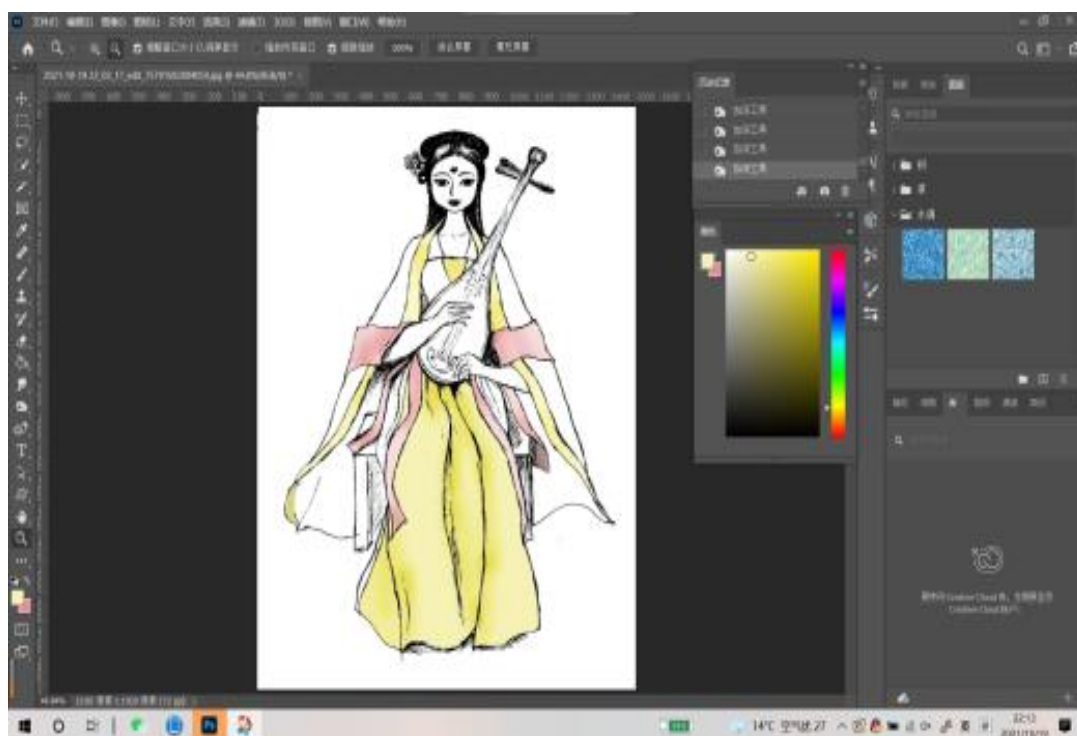


Figure 1. Clothing color scheme (1)

(2) Blue + white + yellow (Figure 2)



Figure 2. Clothing color scheme (2)

(3) Green + white + purple (Figure 3)

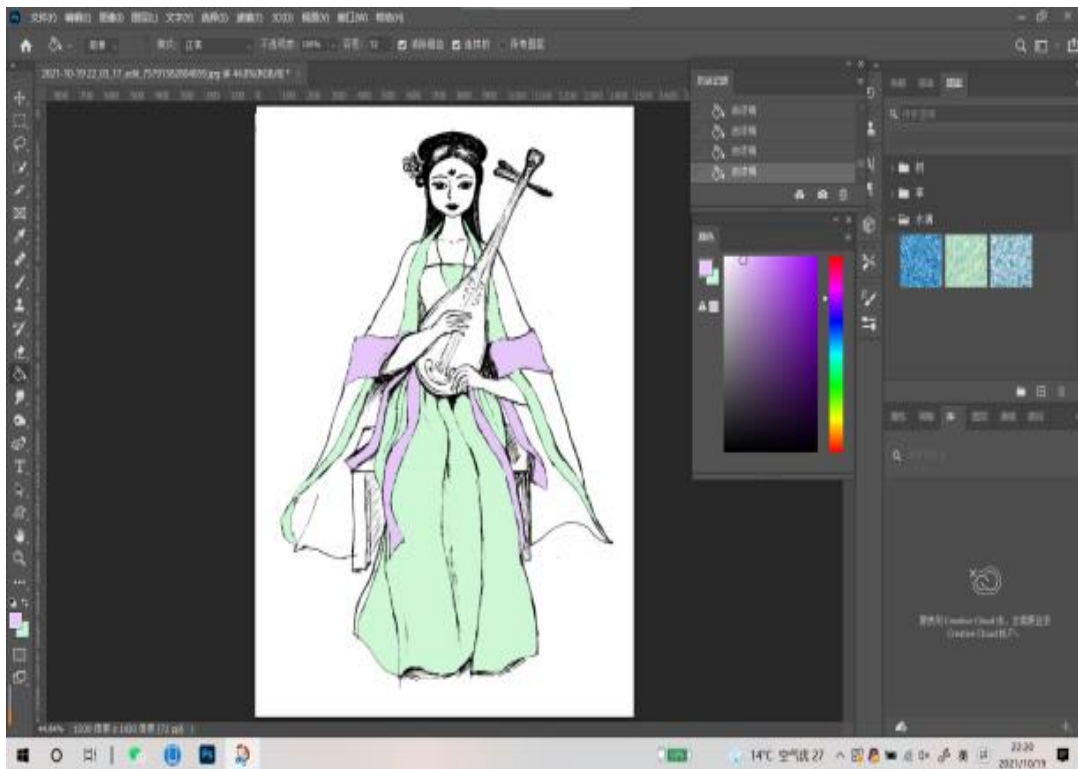


Figure 3. Clothing color scheme (3)

(4) Purple + white + pink (Figure 4)

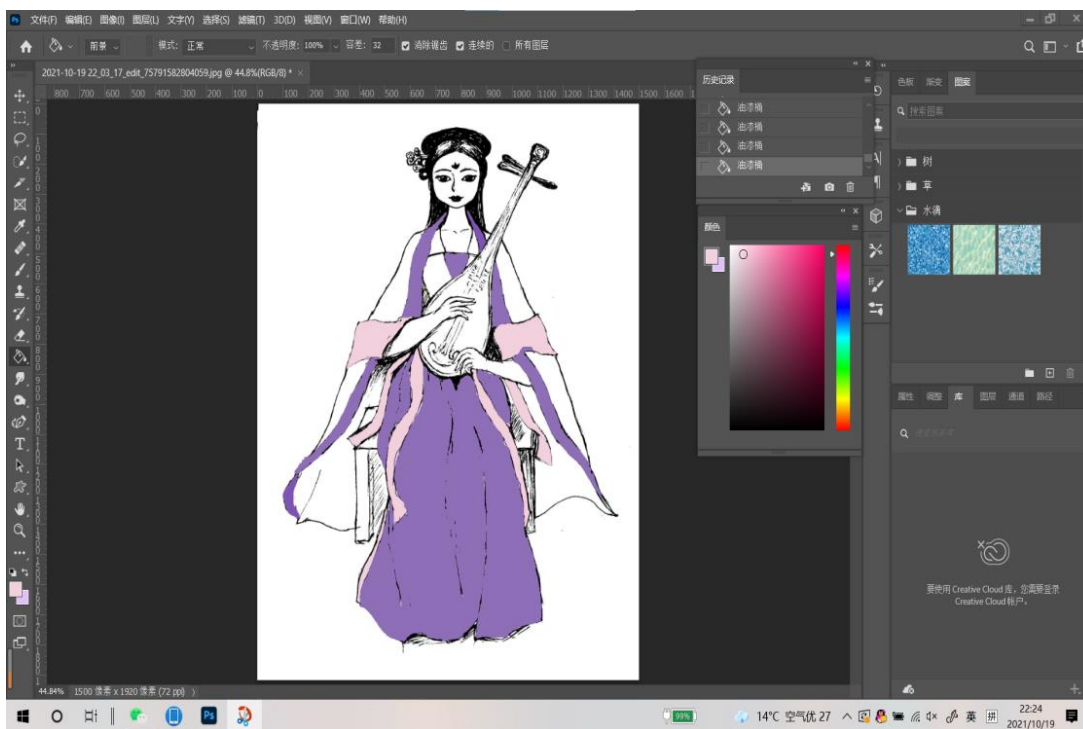


Figure 4. Clothing color scheme (4)

By using digital media to fashion clothing colors, color overlay has become very common, even the separation and combination of patterns have become simpler^[9]. By comparison, the “green + white + purple” scheme in **Figure 3** produces the best effect. It is delicate and gorgeous yet lively; hence, this color combination is chosen.

2.2. Choice of colors for the environment

The overall environment is pre-set to be plain and natural, and several colors are selected.

(1) Red wall + green tiles + gray ground (**Figure 5**)

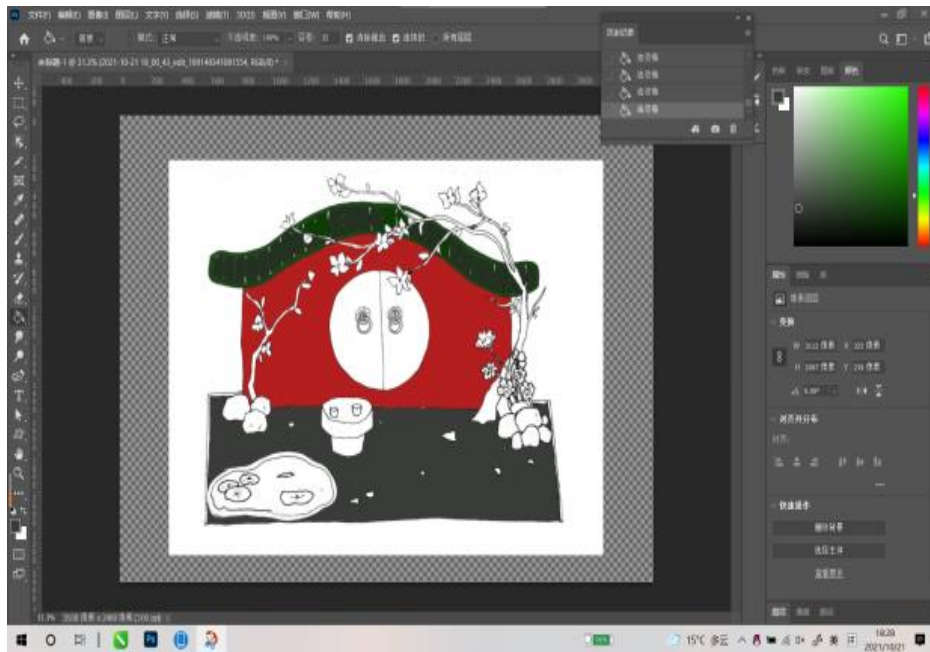


Figure 5. Environment color scheme (1)

(2) White wall + gray tiles + beige ground (**Figure 6**)

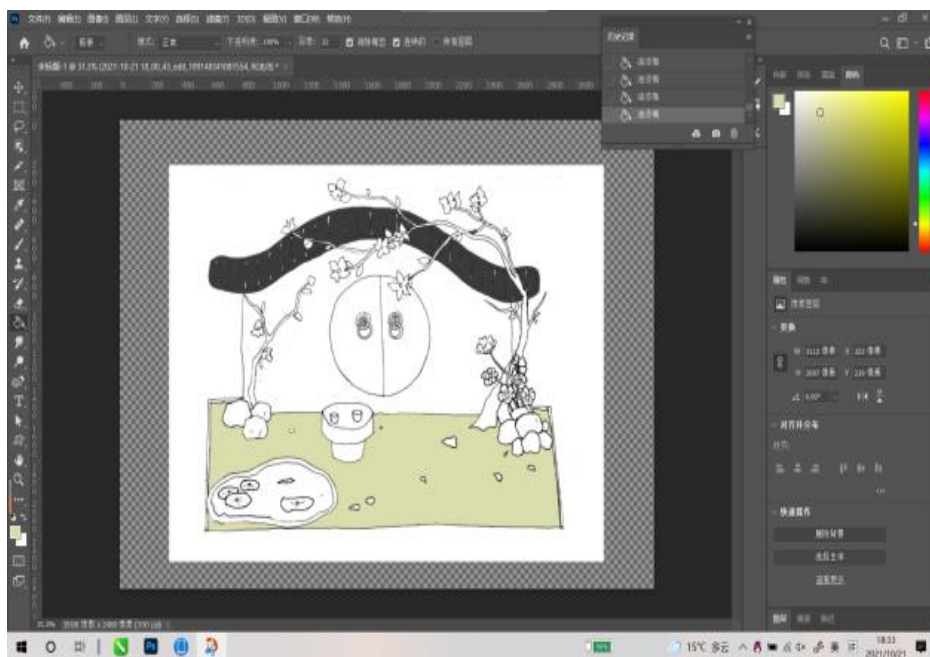


Figure 6. Environment color scheme (2)

(3) Red wall + yellow tiles + white ground (Figure 7)

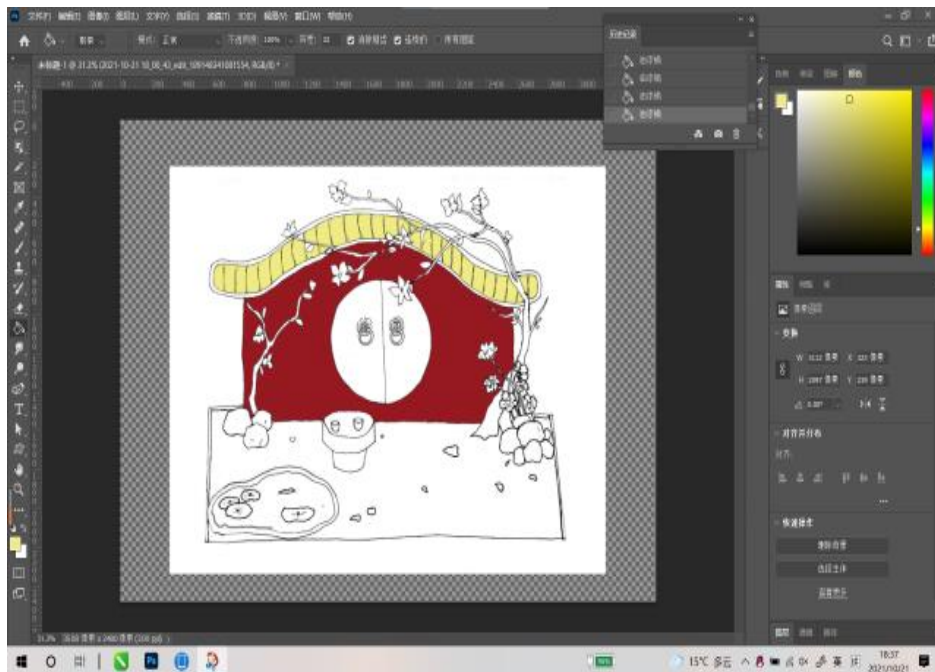


Figure 7. Environment color scheme (3)

(4) Gray wall + black tiles + earthy yellow ground (Figure 8)

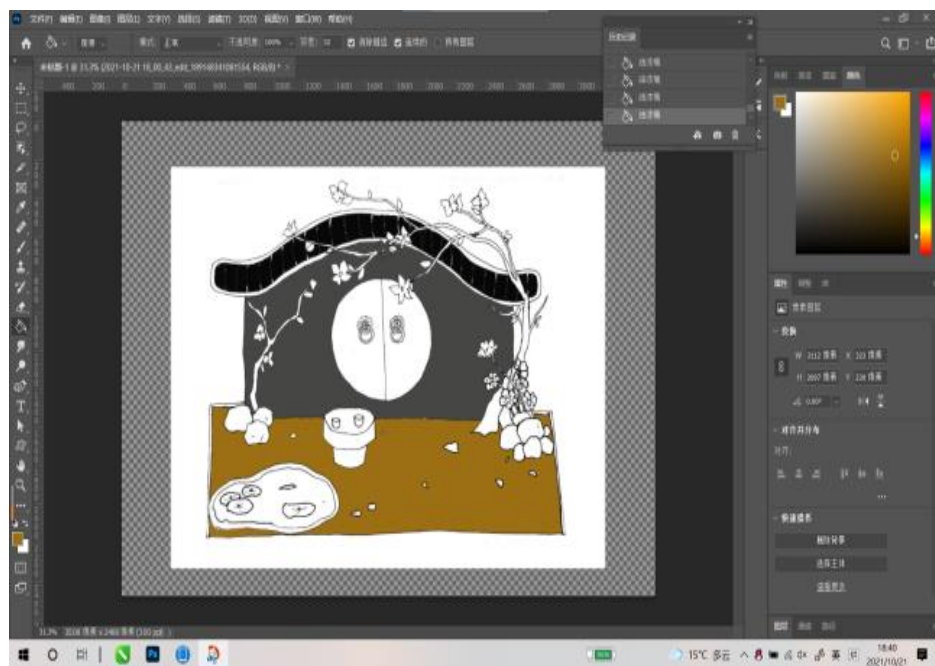


Figure 8. Environment color scheme (4)

By comparison, **Figure 5**, **Figure 7**, and **Figure 8** are either too serious or too gaudy, which does not match the character of the lady, who is plain and graceful. The color combination of “white + beige + gray” in **Figure 6** well matches the character; hence, the second combination is selected. The three standards of color application derived from the color experiment using the computer are freshness, ingenious, and aesthetic feeling. “Freshness” refers to the novel and unique combination of colors in reflecting the charm

of the character's personality; "ingenious" refers to the idea of being flexible and resourceful as well as the ability to use color relations skillfully; "aesthetic feeling" refers to the harmonious and aesthetic effect of colors from their combination, emitting a harmonious feeling visually ^[10]. After determining the design plan, the next step is to carry out the actual production according to the sketches. The production process requires patience and excellence. Only in this manner can an exquisite and impressive 3D animation garage kit be created.

3. Steps in the production process of "Sound of Pipa"

3.1. Building the frame

Gravity still exists to some extent due to the size and dynamic structure of 3D animation garage kits. Without any frame, the doll will tilt or even collapse due to uneven gravity. A sitting posture is more stable than a standing one, but in order to preserve the work for a longer time, it needs to be embedded in a fixed frame. The specific process is as follows: (1) make a hole in a small piece of three-layer board; (2) insert a wooden chopstick into the hole; (3) drip super glue into the hole to fix it. The length of the wooden chopstick should be slightly shorter than the sum of the height of the stool and the girl's body. While waiting for the glue to dry, the doll's head can be made separately, as it can be inserted into the frame after completion.

3.2. Making the head and face

The face, face, and the five sensory organs are the most distinctive parts of a doll. Flaws in these parts will directly affect the artistic effect and value of the work. The uniqueness of oriental aesthetics makes the facial features and face shapes of the figures different from those of the west. The so-called intention thinking, as its name implies, refers to the artist's thought process, which includes analyzing and deconstructing the image of objective things, adding his or her own feelings and cognition, and finally forming a concrete work of art ^[11]. The production method is as follows: (1) take a small piece of white clay and knead it into a sphere of moderate size; (2) insert a short wooden stick into it to make it easier to hold and to serve as the neck's skeleton; (3) use a spherical needle to indent two symmetrical depressions on the spherical clay, which are the eye sockets; when kneading the two eyes, the clay in the middle will naturally arch, which can be taken as the prototype of the nose; (4) use a needle-shaped pen to clearly sketch the shape of the eyes, including the inner and outer canthi, double eyelids, and eyeballs; present the undulating changes of the eyes and eye sockets by adding and removing clay; (5) add clay to the prototype of the nose to shape the root, bridge, and wings of the nose; do not blindly pursue a high nose bridge in nose making, but instead, pay attention to the undulating lines of the nose when it is viewed from the side, as well as the natural connection between the nose and the surrounding structures; the girl playing the pipa does not have a high-bridged nose, reflecting a child-like look; (6) the girl's mouth should be small and fine, so only a small amount of clay is required; use the needle-shaped pen to fix the clay in the appropriate position, and then press the corners of the mouth to make them slightly sunken but still blending with the cheeks, so as to enhance its three-dimensionality; the lip beads and lip line need to be shaped and carved with an ultra-thin carving knife; (7) while constructing the face, it needs to be rotated at times to observe the shape of the mouth from different angles as well as its relationship with the nose and chin; any defects should be addressed in time in order to avoid the inconvenience of modification after drying; (8) the ears of animated characters are mainly in the shape of wind ears or elf ears; it is important to pay attention to the symmetry and three-dimensionality of both ears when shaping them; since the character has two strands of hair covering her ears on both sides, just a simple presentation of the ears is required.

3.3. Shaping the body

The body is the part that accounts for the largest proportion in an animation garage kit. An ethereal void

may be created by the succinct processing technique ^[12]. First, use a large piece of clay to tightly wrap the wooden chopstick that has been used as the frame, and then roughly divide it into the main body and the stool. Next, use the carving knife, the needle-shaped pen, etc. to shape the stool and the doll's body in a sitting posture separately. The ratio of the doll's body is different from that of a real person. Since the concept of "loveliness" is pursued in the character, the total length of the body should be about three to five times the length of the head. In the "Sound of Pipa," the length of the girl's lower body is about three times the length of the upper body, which not only preserves the cute anime style, but also exhibits the posture of a lady; the character's arms can be made separately. After the completion of both arms, insert a thin iron wire into the middle part of the upper arm and insert another piece of iron wire under the shoulder before the clay dries up; use super glue to help fix them.

3.4. Clothing production

Clothing contains three elements: color, shape, and material; for the same reason, people's image is defined by these three elements. In order to create a perfect image, it is necessary to integrate people's "shape, color, and quality" with the decorative elements of "shape, color, and quality" to form a coordinated and unified style, which is the most basic principle of designing clothing ^[13]. Since the main character in "Sound of Pipa" is a young girl, her dress should be designed as plain and simple as possible, rather than too serious or complicated. Using a glass rod, flatten the clay into thin slices, splice the rough parts by cutting and superimposing, and then readjust it after dressing the doll. Costume lines are essential for figurines because the shape, rhythm, and density of lines will directly affect the art piece, creating a new three-dimensional space ^[14]. As for hair accessories, products with metal finishing can be directly purchased to reflect the elegance of the dress.

4. Optimization of 3D animation garage kits

4.1. Color painting and texture

Colored painting is used to enhance the character's facial features. Since the three-dimensional effect of the character's facial features has been defined earlier on, colored painting becomes slightly easier at this stage. Dip a delineating pen into black acrylic paint, and use it to outline the eyebrows and pupils, along with using it as an eyeliner; then, finely portray the hairiness of the brows, the color changes of the pupils, and the highlights. When processing the lips, sketch the shape of the lips with dark red; then, mix rose red and red to the lip color, applying it on both the upper lip and lower lip. Dilute the remaining lip color with water, lightly smudge it on the eye sockets and the upper and lower canthi to create an eye makeup that is consistent with the lip color.

Texture is mainly used in clothing, jewelry, and musical instruments, such as the performance of Zanhua Lefen, the use of plastic and metal with clay, as well as a more realistic simulation of texture with musical instruments. In the process of aesthetic appreciation, people often acquire unique visual aesthetic satisfaction from the rich variations in texture, which brings thrill to the audience; that is to say, as the form of the texture becomes more plentiful, it is much easier to evoke a visual aesthetic experience ^[15].

4.2. Creating the background atmosphere

Tolstoj once said, "There are two main tools for the advancement of human civilization – the first is the exchange of ideas through language, the other is the exchange of emotions through art ^[16]." The background atmosphere is mainly reflected in the environment, such as outlining the effect of tiles on a white wall with gray paint, pressing the shape of tiles on the roof with a carving knife, sticking antique metal buckles on a red door, and processing the texture of objects, such as those on tea tables, tea sets, peach trees, and small ponds. As a large area of backdrop color, white walls carry a "blank" role. A "blank" space reflects the

traditional Chinese aesthetic ideas and interests, utilizing the combination of virtual and actual methods to leave a certain space for reverie ^[17]. In addition, a retro metal frame is added to the exterior of the entire work, heightening the poetic and magnificent artistic conception of the work. Although there are many minor details in the backdrop, their colors are harmonized in the grey tone, which serves as a suitable foil for the colorful clothing the character has on. As the ancients once said, “Among the five colors, there will be a primary color, and the colors related to it ^[18].” The final product is shown in **Figure 9**.



Figure 9. Final product

5. Conclusion

Handicraft is a popular kind of art, and it reflects the development of human civilization. It carries a simple and straightforward artistic style ^[19]. The popularity of 3D animation garage kits among consumers has expedited material development. Designers use various materials, both inexpensive and high-quality, to strike a balance between quality and affordability. The antique clay-making garage kit, “Sound of Pipa,” is taken as an example in this paper to elaborate the ideas and methods of its design, production, and optimization, in order to provide a reference for beginners in this field of art. Without doubt, the operators of animation action figures would want to see these figurines become well-developed products in the domestic market, but they should also learn to integrate all kinds of novel, modern technology and materials. Both traditional handicrafts and modern designs are essentially creative activities that provide products and services to people. Both have their own advantages and disadvantages in terms of “rationality” and “sensitivity,” modern and traditional sense, along with high efficiency and human interest ^[20]. More emphasis should be on reviews and research, especially studies on the experience of foreign developed countries’ transformation in the handicraft industry. It is crucial to take into account of the varying aesthetic preferences of consumers at different times because for garage kit enthusiasts, a doll is more than just a toy, as it is also a bearer of a distinct soul. People devote their love and affection solely to creating a flawless work of their own, gaining joy and tranquility in the process. In the near future, through the innovation of

materials and technology, as well as the joint efforts of practitioners and enthusiasts, 3D animation garage kits will undoubtedly present more diverse effects and affordable prices, catering to consumers' growing enthusiasm for purchasing these products.

Disclosure statement

The authors declare no conflict of interest.

References

- [1] Sougou, 2010, Garage Kit, Sogou Encyclopedia. <https://baike.sogou.com/v430263.htm?fromTitle=%E5%8A%A8%E6%BC%AB%E6%89%8B%E5%8A%9E> (Accessed on January 28, 2022).
- [2] Liu S, 2018, Analysis on the Expansion of “Figure” Sculptures in the Domestic Market. *Daguan*, 2018(08): 46.
- [3] 360 Encyclopedia, 2015, The Ball-Jointed Doll of the Japanese Company Volks, so.com. <https://baike.so.com/doc/5378007-5614174.html> (Accessed on January 28, 2022).
- [4] Chu Q, 2020, Dynamic Presentation Function of Static Works – Take Liudao Group Works as an Example. *Comedy World*, 2020(8): 142.
- [5] Ju Q, 2016, Visual Communication of Animated Character Action. *Research on Fine Arts Education*, 2016(5): 107.
- [6] Shu S, 2019, Modeling and Making Skills of Puppet Image Design. *Popular Literature and Art*, 2019(21): 84.
- [7] Wu Y, Li Y, Luo X, 2012, Design Composition. Northeast Normal University Press, 2012(12): 152.
- [8] Ao F, 2017, Color Psychology in Tea Packaging Design Applied Research. *Fujian Tea*, 2017(09): 107.
- [9] Liu X, 2018, Research on Garment Pattern Processing Based on Digital Media Technology. *Dyeing and Finishing Technology*, 2018(07): 65.
- [10] Yu G, 2019, Easily Understand the Psychology of Color, Sichuan University Press, 1: 178
- [11] Qiu G, 2016, Image Thinking and Image Modeling in Chinese Painting. *Beauty and Time*, 3(3): 120.
- [12] Zheng Y, 2021, A Philosophical Inquiry into Huo Qubing's Tomb Carvings. *Rich Brocade*, 2021(25): 79.
- [13] Li X, 2010, Design and Production of Apparel. Chongqing University Press, 9: 119.
- [14] Qiu G, 2019, On the Traditional Ceramic Sculpture Art of Line Art Analysis. *A Grand View of Art*, 2019(02): 210.
- [15] Zhu X, 2018, On the Expression of Intention in Fine Brushwork Creation. *Beauty and Time*, 2018(11): 121.
- [16] Yang Y, Yang C, 2021, Condensation and Reconstruction: The Spiritual Expression of Pang Maokun's Sketch. *Art Observation*, 2021(06): 77.
- [17] Li Y, Ye Y, 2020, Study on the Form and Connotation of Blank Space in Poetic Animation. *Popular Literature and Art*, 2020(13): 92.
- [18] Zhang L, Yin W, He L, et al., 2011, Decorative Colour. Liaoning Fine Arts Publishing House, 5: 81.
- [19] Wang T, Tu S, 2020, The Art of Paper Carving in Installation Design. *Popular Literature and Art*, 2020(20): 233.

[20] Cheng Y, 2019, On the Reference of Traditional Handicraft to Modern Design and Fusion Innovation. Popular Literature and Art, 2019(21): 152.

Publisher's note

Bio-Byword Scientific Publishing remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.