



Intelligent Tool-Assisted and Computer-Simulated Flat Styles in Contemporary Arts and Crafts Design

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Abstract. During the research period, we collected monographs and articles on 3D digital technology, especially translations and interpretations of foreign literature, including online information, in order to keep abreast of the latest international research findings. We observed and recorded the heirloom works of traditional arts and crafts, including those in the National Museum, the Palace Museum, the Capital Museum and some other pavilions, and observed and recorded different styles of works from different eras. During the research period, the focus was on collecting information on traditional arts and crafts, as well as modern ceramic and glaze design styles and related literature.

Keywords: Intelligent tools · Arts and crafts · Computer simulation

1 Introduction

The reason for choosing ceramics and glaze as design objects is that they are both representatives of traditional Chinese art, especially ceramic art, which is a cultural symbol highlighting the profundity of Chinese culture and art. Although not as influential as ceramic art, glazed art has been passed down for thousands of years with its colourful charm [1]. Secondly, both ceramics and glaze are three-dimensional art forms, and the significance of the subject can be well represented by direct design practice using digital technology [2].

2 Traditional Ceramic Glazing Design Methods

In the traditional ceramic product design process, the designer needs to complete the following tasks: the design of the shape and decoration, the presentation of the rendering, the drawing of the design, the production of the physical model and so on. These design tasks are mainly carried out by hand drawing and hand production, which are all subject to the designer's experience, skills, materials and other factors [3].

The traditional glazing design method is similar to the ceramic design method in some respects [4]. Before designing, the first step is to understand the client's needs and

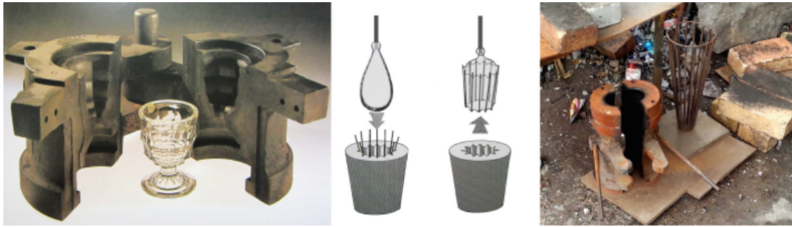


Fig. 1. Split moulds, immersion moulds [shot].

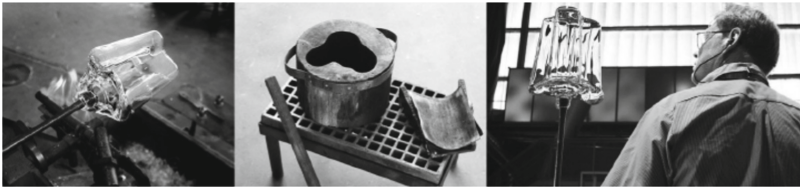


Fig. 2. The “Savoy Vase” mould and state of production[shot].

the actual situation of the target market, to formulate an overall design plan, to prepare processing facilities and materials, and to determine the processing process. The next step is to conceptualise the scheme and draw creative sketches, which are traditionally graphic in nature. Plan drawings include sketches, colour renderings, projected three views and engineering dimension drawings [5]. They pale in comparison to the richly coloured glazed products. Due to the relatively short production cycle of handmade glazes, a “change as you go” approach is generally used until a piece meets the design requirements, which is then used as a standard for batch production [6]. It is also a common practice to “graft” the effect from existing products. The traditional design method requires the production of a seed mould, which has to be made by hand, before the model can be made [7].

Traditional Chinese dewaxed glaze is also known as ancient glaze, and is used to create delicate and exquisite works of art with brilliant and translucent colours. The glass bubble is placed in the mould and blown until it fits the inside of the mould, after which the mould is opened and removed (Fig. 1). The immersion mould is a single concave tool [8], with the downward recessed part being the inner cavity, the shape of which determines the shape of the piece and requires a certain extraction angle [9].

Immersion moulds are easy to make and can be made from fire-resistant plaster or wood for small batches [10]. The famous Finnish designer AlvarAalto designed the Savoy Vase for the Karhula Littal glassware company in the 1930s, using an immersion mould. The moulds were made of wood and could not be reused. With the popularity of this famous Aalto vase, the production moulds were improved to facilitate mass production (Fig. 2) and the piece is still produced and sold by Littal today in dozens of shapes that are much loved by the world. The rotating mould, like the immersion mould, is also an open mould, in which the liquid glaze is poured into the rotating mould at high speed, where it quickly adheres to the inner wall of the mould due to centrifugal

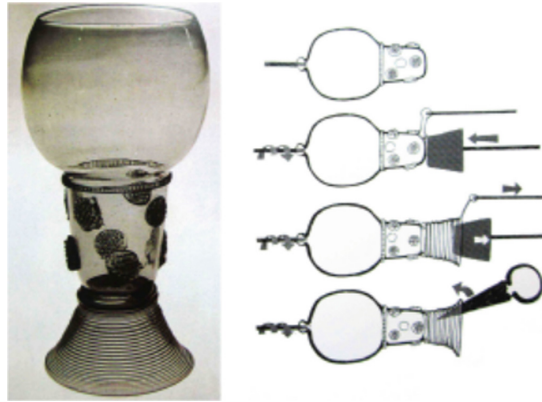


Fig. 3. Winding process [shot]

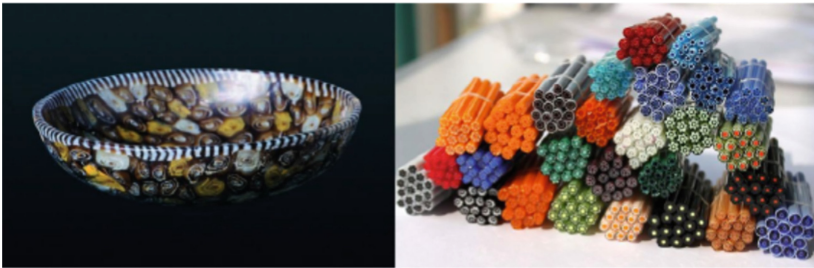


Fig. 4. Thousand Flowers Craft [shot]

action. Inadequate annealing can lead to uneven distribution of thermal stresses causing the piece to blow up, while excessive annealing can cause the piece to melt and collapse [10]. The tools used for shaping are generally metal tweezers, clamps, claps and shears, which allow the maker to shape the piece easily. The blowing and fusing processes complement each other and are not strictly defined in some pieces, but are often used in combination. In practice the processes of overlaying, filigree wrapping (Fig. 3), wrapping in crushed glaze pellets, ‘dipping’ in glaze powder, wrapping in glaze rods, gold and silver foil, the thousand-flower process (Fig. 4), the flush process (Fig. 5) and hot-fusion stitching are often used.

3 3D Digital Technology Interventions in Traditional Arts and Crafts Design

3.1 3D Digital Technology Support Tools

After the Industrial Revolution, design gained an independent status due to the division of labour between design and manufacturing, and between manufacturing and sales. The division of labour in the design industry became increasingly refined and specialised, and

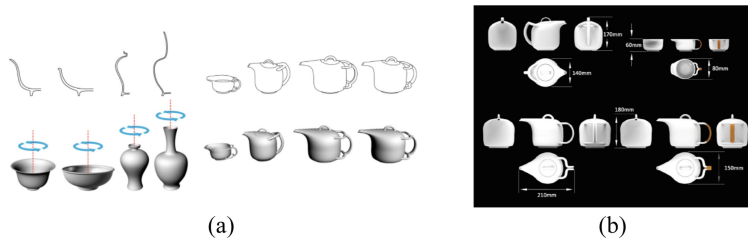


Fig. 5. A: Rotation tool and release tool; B: Programme evaluation of the work [Owner-draw]

at the same time gave rise to a number of software tools serving various design directions, including, broadly speaking, two-dimensional graphic software and three-dimensional modelling software [11]. There are currently many different modelling methods, with three main models: modelling using 3D software; modelling through instrumentation measurements; and modelling using images [12]. Rhino's powerful surface modelling capabilities provide technical support for the design and development of ceramic and glazed products, enabling designers to create more complex shapes.

3.2 Design Methods Based on 3D Digital Technology

The general workflow of the designer to create a three-dimensional model can be divided into: pre-preparation stage, design implementation production stage, programme optimization stage, design in-depth stage. 1 Pre-preparation stage: this stage to prepare the required picture material, including decorative patterns, standard colour cards. 2 design implementation stage: designers according to different design requirements, the designer needs to choose the appropriate three-dimensional software for production. (As shown in Fig. 5).

Optimization phase: In this phase, the designer evaluates the existing design solutions to determine which solution meets the design requirements. The designer is able to quickly and accurately assess the most logical design solution based on a high degree of data validation and visualization.

In-depth design phase: In this phase the final preparatory work is done mainly for the next production step. Modern ceramic products have a lot of subtly curved free-form surfaces, which require very strict curvature specifications. Rhino's surface modelling tools were used to design the pre-production model.

4 Conclusion

A great deal of first-hand information has been collected through theoretical research on ceramics and glaze crafts, as well as field research in Boshan, Zibo and Yuzhou, Henan. The research revealed that the traditional arts and crafts industry is backward in design and single in expression, with comprehensive problems as follows.

1. The flat design approach does not convey the three-dimensional effect well and cannot accurately convey the three-dimensional spatial sense of the work. It is difficult

to express the material characteristics of the work in a hand-drawn way and there is a gap with the final product.

2. The physical model representation is somewhat intuitive, but it is not convenient and time-consuming to produce.

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