

Injection Molding of an Antique Ballerina Sculpture

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Received: July 9, 2015

Accepted: October 30, 2015

ABSTRACT

This paper aimed to describe the molding technique used for recreation of an antique ballerina sculpture. It was mandatory for the artist to avoid impairing the original sculpture while carrying out the molding process. Furthermore, it was important to retain the detailed intricacies of these sculptures when following the molding procedure. Finally, once the mold was removed it was necessary for the recreated sculpture to be completely similar to the original one. Before discussing the molding process, history of import during the Qajar's reign was described. Due to Qajar kings' several travels to Europe as well as emissaries' and tourists' visits to Iran, a lot of artistic antique objects were imported to the country, making Iranians highly affected by western art and culture. So, they needed to get more familiar to subtle molding techniques in order to be able to duplicate those antique objects. Molding is generally believed to be an industrial work, but was considered in this paper to be a combination of art and industry. Indeed, such an approach to molding of museum or collection antique objects serves as a bridge between art and industry.

KEYWORDS: Qajar Exports, Ballerina Clothing, Qajar Women's Skirt, Ballerina Sculpture, Molding, Casting.

INTRODUCTION

The Qajar was a Turkmen tribe that held ancestral lands in present-day Azerbaijan, which then became part of Iran. In 1779, following the death of Mohammad Karim Khan Zand, the Zand dynasty's ruler of southern Iran, Agha Mohammad Khan, a leader of the Qajar tribe, started trying to reunify the country^[1]. During Qajar era¹ Iranians became acquainted with western world. Advent of technology from western equipment and techniques, establishment of printing and photograph studios and publication of newspapers first took place in this period of time. A headline of Vatan, a national newspaper of those days, was: "We seek dialogue with western intellectuals to shed the light of western factualism on Iran"^[2].

Qajar dynasty ruled in Iran from 1785 to 1925AD, with seven kings including Nasser Al-Din Shah -the fourth king(1831-1896 AD) –who made most of the developments in culture and art of Iranian history. He was the first king of Iran to travel to Europe three times^[3], which made him familiar with European culture and art as he realized the value of modernization as well as the acquaintance with the gateways to western commercial markets.

Playing a significant role in the Silk Road, Iran was considered as a popular middle land for merchants. Commodities of any kind such as luxury items, jewels, and precious objects were transferred from far eastern countries such as India and China to western countries through part of the silk road located in Iran^[4]. As the capital city of Iran, Tehran had become the center of upheavals since the Qajar era, particularly with regard to substantial financial tradings that caused the city to undergo some gradual alterations. Tehran played host to a large number of rich people either as citizens or immigrants. It can be even deduced that trading of luxury commodities was experiencing growth since trades people were travelling from various parts of the world to Tehran and vice versa^[5].

Following the cessation of Iran – Russia prolonged war during the Qajar era, Russian traders took advantage of the peace pact and thus commodities of various kinds were shipped to Iran. Among these were artistic and decorative objects that were, in some cases, considerably valuable with respect to their material and artistic design whereas nowadays historic value has been also added to their current worth^[6].

Travelling to the west for the first time, Qajar kings drew inspiration from the western countries and modernized Iran, causing tremendous transformations in social atmosphere and subsequently art and culture of the country during the Qajar era. The consequences of these changes are well-observed in that time's artistic sculptures, due to the profound impact that the commodities imported to the country by emissaries, travelers, sightseers or even kings had on the domestic sculpture industry. Some of the objects imported during the Qajar reign were ceramic or pseudo-ceramic sculptures which made their way towards museums and palaces.

¹The Qajar dynasty, also called Ghajar, Kadjar, Qachar, was a Persianized native Iranian royal family of Turkic origin^{[9][10]}. Qajar era differs from other historical kingdoms of Iran, in that it inflicted numerous changes and transformations as compared to other dynasties.

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After the death of Mohammad Shah in 1848, the succession passed to his son Naser Al-Din, who proved to be the most powerful Qajar king^[1]. He was the most interested, among Qajar kings, to travel to Europe in order to improve the culture of his nation, so took several trips to European countries. His travels resulted in a major impact on Persian cultural development during his reign, and Iran witnessed plenty of cultural and social changes from his first journey to Europe 1873 AD through to the end of his kingdom in 1896 AD. European ballerina choreographers' clothing style was one of the evident instances of the European influences on Iranian clothing which became prevalent in that period of time. European-style costumes inspired by the style of European women's skirts, referred to as "Shaliteh" in Iran, became the most dominant female fashion of that period while it is rarely used in local areas around Iranian Plateau at the present time^[7]. Attraction of Qajar kings' wives with the short-style skirts of Parisian ballerinas in 1873 AD made some changes in the Iranian traditional customs. These women barely appeared outdoors unless they sought to see either a tailor or a doctor. Shaliteh was very popular among Naser Al-din Shah's wives in his court, serving as one of the first feministic milestones towards modern costume^[8]. Combination of this type of skirt with the other women's cloths first appeared in Qajar kings' wives harem. Shaliteh was so matched with the Iranian clothing fashion that created a new style in Iranian costume.

Naser al-Din Shah was one of the biggest supporters of holding Ta'zieh² rituals in Iran as these plays were performed under the direct support and supervision of his majesty. Thousands of people in groups were congregating and participating in these ceremonies^[11]. Thanks to Ta'zieh rituals which were partly inspired by western operas, Iranian people observed Shalitehs which had been already used by the king's wives in harems and followed this wearing fashion.

Table 1. Qajar women in Shaliteh skirt mixed with traditional Qajar dress

 <p>Image a: Western style in a photo of Qajar woman, Anis Al-Dole, Nasser Al-Din Shah's favorite wife^[12]</p>	 <p>Image b: A photograph of Nasser Al-Din Shah's wife, Shams Al-Dole^[12]</p>
 <p>Image c: Shaliteh mixed with traditional Qajar dress, Qajar Woman^[13]</p>	 <p>Image d: Shaliteh mixed with traditional Qajar dress, Nasser Al-Din Shah's wife^[14]</p>

² The Iranian Ta'zieh, or religious play, is a unique dramatic performance within Islamic culture, occurring during the annual ten day mourning period observed by the Shias' sect during Muharram, the first month of the Muslim lunar calendar. The main subject of this performance is how Imam Hussein was martyred by Islam's enemies^[15].

Naser Al-Din Shah was also highly interested in taking photographs and personally took so many photographs of his wives in harem^[12]. In fact, he was one of the pioneers of photography industry in Iran, causing Shaliteh fashion to spread out of harem by these photographs. Images a and b in table 1 show two photographs of Naser Al-Din Shah's wife and mother, both dressed in Shaliteh skirt. He tried to draw inspiration from western neo-classic art in which women were naked making his act seemed to be extremely adventurous, considering the religious atmosphere of Iran during Qajar reign. Images c and d present Shalitehs mixed with Qajar traditional dress.

Not only was Iranian dress affected by western ballerina, but also painters and sculptors used ballerina as a subject, and such types of paintings and sculptures were also imported to Iran.

The sculpture studied in the present research is a ballerina wearing a short skirt or Shaliteh in Iran, which belongs to a collection owned by Ms. Faezeh Salahshour³. One of the main reasons behind selection of this sculpture was that it would not seem to be impaired as a result of molding process. Moreover, high degree of its delicacy and details of this sculpture are considered as an artistic challenge for molding process in this manuscript.

A Brief History of Molding

Methods for creating objects such as ceramics and pseudo-ceramics figures have been developing as a mainstream in visual arts since the ancient times^[16]. Ceramics have had a great variety of applications, especially in the recent 75 years^[17]. Modern technology has introduced different methods for shaping and making use of ceramics. Based on type of the raw material of an item and its particular shape, the molding approach may vary either as traditional or modern technique^[18]. An endless variety of molding processes for durable and antique artifacts has been already developed^[19]. The molding art and industry is very extensive, having a large number of advancements achieved in the recent past.

Among the artifacts made of ceramics, museum items are of high degree of importance since a considerably delicate method of crafting is employed when making those commodities. Such valuable items are owned or under surveillance either in the museums or by aristocratic strata. Recrafting of such commodities, conservation of them in particular, has witnessed novel techniques since 1996AD^[20].

Implementation of the abovementioned methods is not often straight insofar as the crafter, in some cases, encounters problems manufacturing real artifacts^[21]. Depending on its form and shape, each object requires specific creativities to be molded. It is a crafter's responsibility to choose what creativities to apply in order to make that object go through molding stages in the best way.

Furthermore, it may get the artist in trouble in case the technique should be selected with precision^[22]. Delicate modeling of famous artists or other well-known individuals has attracted and motivated many artists to create sculptures of famous people. There are several anthropologists interested in such an art around the globe, who have preserved such sculptures since 17th century^[23]. Sometimes face of a person was used as the main subject of the molding process, and body molding is not of high degree of importance in this process⁴.

Molding of each sculpture is carried out substantially based on the particular conditions of the sculpture and thus the decision making on the method of molding differs from one sculpture to another. In the following section, the molding methodology used in this research to recreate a ballerina sculpture imported to Iran during Qajar era has been described in details. In this manuscript, body and face moldings were carried out simultaneously.

RESEARCH METHODOLOGY

In this paper, the following topics have been studied using library references, books, articles, and websites: Qajar dynasty's history, commodities import into Iran during Qajar dynasty, Russia's impacts on Iran, impact of Iranian kings' travels to the west and east, impacts of these travels on Qajar women's clothing, impacts of Russian ballerina on Qajar women's clothing, holding Ta'zieh simultaneous with opera rituals in Europe, photography and its impacts on fashion propagation, a brief history of objects molding.

The research methodology is of both qualitative and quantitative type, with the method used for molding an antique ballerina sculpture discussed, taking a step-by-step approach and supported by pictures.

³Born in 1943, Faezeh Salahshour is a collector of paintings, photographs and sculptures remaining from Qajar era. The author would like to acknowledge her contribution to this research lending the sculpture from her collection.

⁴To prevent the adhesion of materials to the face, some lubricant cream was applied to the face prior to the casting and molding processes. The face molding methodology aforementioned is totally different from the relevant body molding approach. In this case, the face should be built and molded carefully for the purpose of making a similar copy of face like what is seen in Madame Tussauds museum in London. But, the body of these sculptures has been built and molded less carefully than their face, as it has been finally covered with clothes specific to the relevant character. From this point on, it is the tailoring art that is somehow responsible for the process of duplicating the sculpture.

Stages of molding⁵ of an antique ballerina sculpture

The various stages of molding of a figurative ballerina are described as follows:

First of all, the surface of the work desk in molding process should be smooth and clear. The QV511 wax was used after cleaning of the surface with alcohol in order to prevent the molding materials from adhering to the surface. It should be noted that dish washing liquid or Vaseline may be used instead of wax.

QZ1, short for QZ5101⁶, is a blue colored chemical liquid that is used in molding. By using QZ1, the finest details of the object will be reflected on molding material. It puts a thin layer onto all the pores and details of the sculpture, and hence a very fine molding can be achieved. For example, a similar copy of platter with the same results is derived by using QZ1 on platter and molding it, such that the music on the copied platter can be heard as in the original one. Sometimes the blue color of QZ1 may be absorbed into the sculpture itself, causing some changes in its color. So before applying it to the object, it should be tested by being applied to a small invisible section of the sculpture. Water is able to completely remove the QZ1 after it is applied to the object. In case water could not remove QZ1, it should not be applied to the sculpture. QZ1 has a positive effect on china and ceramic, stone, and high quality polyester, but is not recommended to be applied to leather, plastic, semi plastic, and wood.

The sculpture used in this manuscript is a type of ceramic with an opaque glaze. The entire surface of the sculpture was covered with QZ1 using a brush and it was brushed again after drying process so as to cover all the pores on the face, hair, hands, and clothes of the sculpture as well as all the pleats on the skirt. In the following stage, the plasticine paste was flattened using a rolling pin.

In a molding procedure, it is necessary to split mold into two parts. Therefore, attention needs to be drawn to choosing the best angle for the ballerina to be inserted in the mold. When the molding process finishes and molding materials are hardened, the first part of the mold will be ready, making us able to start building its second part. In the first stage of molding, care should be taken to where exactly to choose for molding⁷. By choosing an invisible section of the sculpture, the seam would be situated under the hairs wave and behind the ears.

After specifying the hypothetical line on the sculpture, the sculpture was laid down on the flattened plasticine paste. The empty holes among the fingers of the sculpture can make the removal phase difficult since they may stick in the mold. So they are filled with some plasticine paste in order to facilitate the removal of sculpture from the mold. In addition, the empty space among hairs is also filled with paste. In general, any pores causing the sculpture not to be removed from the mold easily are covered more precisely using plasticine paste, as shown in Figure 1.



Figure 1: Inserting ballerina sculpture into the plasticine paste while opting for the best angle to avoid creation of the possible seam^[24]

⁵ The author would like to acknowledge Ghaffari Chemical Industries Corporation's valuable contribution to this manuscript, and especially thank to Mr. Niv, the master coordinator in the molding process section of the corporation, without whom and his efforts it was not possible to complete the present work.

⁶ Mold sealer QZ 5101

⁷ After the second part of the mold is built and matched with the first part and that the casting process is done, it is necessary for the seam between the two molds to be situated in the most invisible place on the sculpture.

As shown in figure 2, the small gap between the sculpture and paste, as appeared under the left foot of the sculpture, should be filled using some extra paste so that the paste fills the small pores and, in form of a strip, becomes tangent to the sculpture, as in the case for the right foot.

Other parts of the sculpture that were not intended to be inserted into the mold were separated using cellophane, as presented in f

Figure 3. The remaining part of the surface of the paste was flattened using a suitable tool.



Figure 2: Applying extra paste to fill the gaps^[24]



Figure 3: Using cellophane to separate the non-molded parts^[24]

After ensuring the complete insertion of the sculpture into the paste, three large holes were carved in the paste so that they would play the role of fixing the plug holes in stages after the completion of molding. These holes were initially in form of hollow spaces whereas they would be projected following the molding process, as illustrated in Figure 4.



Figure 4: Carving out three holes in the paste to achieve interlocking purpose^[24]

Figure 5 shows four L-shaped heavy retaining walls used in the molding process. The retaining walls prevent the molding materials from leaking out of the mold. Molding material is dense and heavy, so the retaining walls must be sufficiently solid and heavy not to be affected by the density of molding material. In order to prevent the quiver or overspill of molding liquid once cast in the mold, the retaining walls were fastened two by two using four clamps. All of the gaps located on the outer surface of the retaining walls were covered with the plasticine paste to prevent the leakage of molding liquid, as presented in Figure 6.



Figure 5: Using retaining walls to create a bounded space for the molding process^[24]



Figure 6: Covering the gaps using plasticine paste^[24]

Then, the whole surface of the sculpture was lubricated using Vaseline so as to facilitate the removal of the sculpture from the mold. It should be noted that the thickness of the vaseline layer used should not be as much as to cover the details of the sculpture and, thus, the extra amount of vaseline was removed using ear cleaning sticks.

In the present work, RTV2 was used as the molding liquid. For each 5grams of catalyst, 100grams of RTV2 were added to the mixture, and the resulting material was kept in a vacuum system in order to remove any existing air bubbles. The obtained molding material was then slowly cast in the ballerina sculpture. In this case, a thin piece of wood can be used to lower the rate of casting, making it happen without creating any air bubbles, as shown in figure 7.



Figure 7: Casting materials in the mold^[24]

It is absolutely necessary to cast material in such a low rate that no bubbles can be formed. Bubbles can impair the form of the molded sculpture and ruin its delicacy. The liquid took a couple of hours to be transformed into solid while taking the shape of the sculpture. Next, the clamps were unfastened and the L-shaped walls removed. Removal of the retaining walls was facilitated owing to the use of vaseline, and finally the prepared mold was removed from the ballerina sculpture, as shown in

Figure 8.



Figure 8: The first part of the mold ^[24]

The obtained mold was cleaned using compressed air pressure and placed on the smooth surface of the work desk. The L-shaped walls were installed around the mold again and the molding procedure was followed for the second time. The liquid material (RTV2) was first weighed and then mixed into the catalyst with the ratio of 100 to 5. The amount of the material used in the second part of the molding process was the same as that used in creating the first part of the mold. Like the first stage, the obtained material was placed in a vacuum system in order to remove the air bubbles.

The surface of the first part of the twofold mold created in the previous stage was lubricated using vaseline. For the purpose of creating the second part of the mold belonging to the rear of the sculpture, it was installed inside the first part of the mold. The rear part of the sculpture was also completely lubricated. The liquid material was cast in the sculpture slowly and precisely similar to the preceding stage, as shown in

Figure 9.



Figure 9: Pouring material into the mold in order to create the second part of it ^[24]

After being kept for a couple of hours in room temperature, the liquid material turned into solid form. The clamps were then unfastened and the L-shaped retaining walls were detached. As a result, a twofold mold was

created which should then be cleaned to remove any surplus materials. Figure 10 shows the second part of the mold which belongs to the rear part of the ballerina sculpture.



Figure 10: The rear part of the ballerina sculpture^[24]

The elastic mold obtained had two parts which were attached to each other. Gaps between the two parts of the mold were covered and sealed by paste. Polyester was mixed with its specific hardener and injected into the mold through a hole. The hole was embedded in the lowest part of the mold extending through the foot of the ballerina sculpture to the other parts of its body including head and hands in order to facilitate the injection of material into the mold and thus formation of the new sculpture.

The polyester injected into the mold gradually hardened and was converted to a solid phase in a couple of hours. Since it does not adhere to the mold, there was no need to lubricate the mold prior to the injection of the material. Next, the mold was fastened to the work desk using a screw clamp, as presented in

Figure 11.



Figure 11: Injecting polyester and hardener and fastening the mold to the work desk^[24]

After the two parts of the mold were separated from each other, the polyester ballerina sculpture was formed. There was a little extra polyester stuck to the body of the sculpture, which were cut using a cutter, as indicated in **Error! Reference source not found.** In this stage, care should be taken not to damage the sculpture while cutting out the extra polyester.



Figure 12: Cutting extra polyester stuck to the ballerina sculpture^[24]

Then, the gap line created around the sculpture due to the separation of the two parts of the mold was slowly smoothed using a sand paper and finally disappeared.

In this stage, some Gouache color was mixed with some wood glue. Glue made gouache color easily adhere to the sculpture. The painting process was carried out in two similar stages to increase the absorption of paint; in the first stage, a colored background is created on the sculpture, and in the second stage, the colors come to be more colorfully displayed. The obtained sculpture was painted using the same colors as those used in the original one. Some water color was also applied to the gouache color on the face, hair and skirt of the sculpture. The gouache color gave an initial color to the sculpture and the water color made it animated and elegant.

Paraloid B72 is some kind of color-fixing resin that is used as a glue for polyester as well as for stabilizing paintings or painting on polyester. It is solid in nature and can be solved in Acetone, Toluene and Thinner in order to be converted to a liquid phase^[24]. Therefore, it was applied to the ballerina sculpture using a brush so as to fix the colors, as presented in figure 13.



Figure 13: Sculpture obtained after painting and paint-fixing by Paraloid^[24]

Conclusion

Since the ceasefire in Iran–Russia prolonged war during Qajar era came into force, commodities of various kinds started to be imported to Iran. Among these were artistic – decorative items which were, in some cases, regarded considerably as valuable due to their material and artistic design. Some of the objects imported during the Qajar era were ceramic or pseudo-ceramic sculptures which made their way towards museums and palaces. On the other hand, Iran was among countries located on the Silk Road pathway, playing a role as the center of international

trade. Qajar kings' frequent travels to Europe, European emissaries' visits to Iran and other visitors to Iran caused Iran to get close to western art and culture. Naser Al-din Shah's visits to Russian operas made him interested in Russian ballerina so that he was inspired a lot by ballerina dress, making him change Iranian national costume. He even revived several Ta'zieh rituals as he was impressed by opera saloons in Europe. As well, Iran welcomed a lot of sculptures and paintings with western designs such as ballerina. Since there was a small number of this type of sculptures, it seemed necessary to move towards high-quality molding techniques in order to duplicate these sculptures.

The injection molding method was used in this research to reproduce a ballerina sculpture dating back to Qajar era when such a valuable object was being imported to Iran. This molding procedure required the artist not only to abstain from inflicting any damage to the original sculpture but also to make an attempt to duplicate the recreated sculpture through delicate coloration and regeneration of details. While considering an industrial feature, molding in this research served as a thin border between art and industry, the integration of which resulted in the molding of a ballerina sculpture.

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