THE CHANDELIERS OF THE CHÂTEAU DE VERSAILLES: RESEARCH, CONSERVATION AND RE-ELECTRIFICATION

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Abstract

Though often considered primarily in terms of their function in historic interiors, chandeliers are complex composite objects possessing significant cultural and historic information, with varied histories and specific conservation needs. This approach has been adopted as part of a multi-year, comprehensive chandelier restoration project currently underway on the majority of the historic lighting from the Château de Versailles. The impetus for this project is two-fold. First, new European Union (EU) regulations require the implementation of energy-saving lighting in all buildings, including religious and civil historic sites. Second, Swarovski is funding the conservation and rewiring of the château's renowned collection of chandeliers, and in return the company will be able to use the name 'Versailles' for their new Swarovski LED energy-saving light bulb.

Historically, the 'restoration' of electrified artefacts was carried out as part of building maintenance or renovations, under the auspices of the engineer or project architect, by electrical companies or lighting manufacturers who used methods that are not compatible with current conservation practices and ideology. Moreover, the relationship between the building and the original lighting atmosphere was rarely considered. Advances in light sources and artificial lighting have dictated the types of lighting devices created. These new solutions have changed interior atmospheres. In the 19th century, with the shift away from candles and gas to electricity, the essence and overall ambiance of interiors was changed forever. This is certainly the case in the 21st century, and at this moment for the Château de Versailles it means the end of 60 years of incandescent lights with the introduction of one of the newest lighting alternatives: LEDs.

This paper will discuss a range of topics related to chandelier conservation with specific case studies from the Château de Versailles. These include: the history of chandeliers and the use of lighting in Versailles since the 17th century; crystal typology; historic and current chandelier restoration practices; current, more unobtrusive methods of wiring ; and research in energy saving LED lighting. The hope is that this project, being carried out on one of the most well-known and cherished chandelier collections worldwide, will be seen as a seminal study in this underserved area of conservation, influencing the future of how these important artefacts are studied, restored and rewired.

Keywords:
Château de Versailles, Louis XIV, chandeliers, crystals, electrification, wiring, light, incandescent light bulb, LED.

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The new EU lighting codes, and the opportunity to work with one of the most important collections of historically significant chandeliers, together offer an unmatched opportunity. With the current view of chandeliers as functional historic artefacts, a team of conservators, specialised electricians and metalsmiths are carrying out a range of activities on the Palace's collection, including: historical research; crystal typology and production; conservation of glass; and metal and conservation-minded rewiring. Conservators are able to find a compromise between traditional and modern restoration approaches within stringent laws related to the safe wiring of these functional cultural heritage objects.

Introduction

The Versailles chandelier project involves the examination, restoration and rewiring of lights in the Palace collection that were restored previously in the 1960's. Several factors played a role in making this work possible: new European Union laws regulating energy consumption; the obsolescence of incandescent light bulbs currently used; and financial support by the Swarovski crystal company.

In 2009, Swarovski approached the Palace with a special prototype LED lighting system with the hope of being able to call it 'Versailles'. After discussion and changes, the candle was accepted with the caveat that funding be given for restoration and rewiring of the lights chosen to receive the new candles.

To mount the Swarovski candles and modernise the electrical wiring, light fixtures would be de-installed, presenting a perfect moment to restore and study the collection. From their inception, lighting fixtures have been seen as decorative or functional. Either way, they undeniably influence a room's ambience.

Historical context

The royal residence

During the reign of Louis XIII (1610-1643), the building seen today was much smaller and used as a hunting lodge. When Louis XIV, the Sun King, took the throne in 1643, extensions to the extant structure began and 40 years later the building became the official permanent site of the monarchy, an event that occurred on 6th May, 1682. During the reigns of Louis XV (1723-1774) and Louis XVI (1774-1793) changes to the palace focused mainly on interior adjustments.

During the construction phase, Versailles, a veritable city, was a place of prestige and a massive building site. The cohabitation of aristocrats, ministers, servants, construction workers, artists and artisans was complex and necessitated diligent organisation. In this period, it is estimated that over 7,000 people consistently lived or worked in the new hub.

The royal family and their servants lived in the Palace. On the first floor were the King and Queen's ***Grands Appartements*** that included official and private suites. The remainder of the building accommodated the rest of the royal family and close acquaintances of the King, including his mistress. (It should be noted that Versailles's organisation and daily life has been well described in the publications of Mathieu Da Vinha, Scientific Director of the Centre de Recherche du Chateau de Versailles (Da Vinha, 2009).)

Lighting

In the official residence, two primary groups were responsible for organisation and function, namely ***L'Intendance*** (stewardship) and ***La Surintendance des bâtiments du Roi*** (superintendent of the King's buildings), each managing subsidiary sectors. ***L'Intendance*** oversaw the daily tasks and ***La Surintendance*** was the ministry in charge of decoration and maintenance of all the royal residences.

Under ***L'Intendance*** was ***La Fruiterie,*** historically the supplier of produce. However, in the 17th century this division became the sole purveyor of candles and maintained basic lighting elements.

Under the auspices of ***La Surintendance*** were ***Le Garde Meuble Royale*** (Guard of the Royal Furniture), the principal provider of chandeliers, who also administrated the royal collections and artistic commissions, and ***Le Service des Menus Plaisirs*** (Entertainment Co-ordinator), in charge of ceremonial and political events as well as temporary lighting displays. The pageantry of the Royal Court's festivities demanded a constant need for innovative decorations, including lighting, all newly created for every occasion.

Illumination of such a grand palace was an important and expensive task, requiring numerous staff and diligent management of candles. ***Ciriers*** and ***ciergiers*** (candle makers) produced ***bougies***, candles with a cotton wick, coated with beeswax (Duhamel du Monceau and Patte, 1762). This type of candle was used only by the royal family. They were an expensive import, easier to maintain yet burned faster than ***chandelles,*** the common type. These were made from tallow, by the ***chandeliers,*** and had disadvantages in the form of smoke and an unpleasant odour (Duhamel du Monceau and Patte, 1764).

The light produced by candles is not very powerful, so large quantities were necessary to illuminate the enormous spaces. The servants whose charge it was to change the candles were busy, as the average lifetime of a candle was only a few hours. Activities in the Palace such as balls, theatre, and opera occurred day and night, making artificial light an essential part of court life.

The Sun King's influence on taste cannot be underestimated. The ***Marchands Merciers*** (interior designers) worked closely with the aristocracy to decorate their estates with exotic imports, merging styles to create novel decorative objects. At this time, new materials were introduced from around the world, inspiring developments in interior design that included lights. Talented ***bronziers*** (metalsmiths) worked with the designers to create light fixtures, typically from mercury-gilded copper alloys (Merle, 1979). These innovative styles became popular and were reproduced and sold widely. Chandeliers and light fixtures served both functional and aesthetic roles, contributing to the beauty and grandeur of interiors, creating harmony with the surrounding decorations.

Chandeliers

Hanging ceiling lights are historically called chandeliers or lustres. At the end of the 17th century, the style began to change with the introduction of rock crystal and glass. What began as the addition of small, glass-beaded chains evolved and the metal structures were mounted with crystal forms of different shapes and sizes until the crystals became the prominent feature.

The most expensive chandeliers were decorated with the highest quality rock crystal. This stone was emulated and replaced by crystal, a very clear, white pure glass produced in France (Haudicquer de Blancourt, 1697) or imported from Bohemia (Lacombe, 1782). The crystal forms were both ornamental and optical with cut and polished components that acted as prisms to catch and disperse the light emitted from candle flames.

Until the reign of Louis XV, historic texts describe only three chandelier forms (Lacombe, 1782): ***À lacés,*** the oldest model (Fig. 1) covered with interlacing stands of small glass beads; ***en consoles*** or ***en lyre***, shaped like the instrument; and ***à tige découverte*** (Fig. 2), wherein the central shaft is visible.

On the ***consoles and à tige découverte*** types, the crystals were large with ***rocaille*** (rococo) style shapes (Fig. 3). During the reign of Louis XVI, other models appeared with smaller crystals having simple geometric shapes (Fig. 4). Crystals were still the most important elements but the glass bead strands became used more abundantly.

Chandeliers are either fixed to ceilings with hooks, or suspended by a hoist and rope. The latter configuration allows the massive lights to be lowered for candle replacement. Often ***passementerie*** or a gold chain decorates the static models.

Sconces

Bras de lumière or ***appliques*** are attached to the wall. Fabricated as single or multiple pairs, they are designed to reflect light off the wall or an associated mirror (Verlet, 1987).

Standing lights

Bougeoirs (candleholders) or ***flambeaux*** (candlesticks) are mobile and diverse, often used for task lighting. The more elaborate ***girandoles*** and ***candélabres*** (candelabras) are larger, heavier fixtures, placed upon furniture or mantles for ambient light. The latter are often confused; the ***girandole*** is likened to a standing, pyramidal chandelier (Fig. 5*)* and the candelabra is typically ornamented with stones and crystals and can be made of porcelain (Fig. 6) (Verlet, 1987).

From top:

Fig. 1 Two different styles of chandeliers, Grand Appartement du Roi: (a) à lacés, (b) en console or en lyre.

Fig. 2. Two different styles of chandeliers: (a) à tige découverte, Appartement intérieur du Roi, b) Louis XVI style, Appartement de Mesdames.

Fig. 3 View of glass pendants (roses and plaques) on a Louis XV style chandelier. Appartement de Mesdames.

Fig. 4 Detail of cut crystal rock pendants (olive and almond shapes with brass wire ties), Louis XVI style. Appartement de Mesdames.

Revolutionary era

The French Revolution (1789-1799) changed life permanently at Versailles. However, the building endured as a symbol and national emblem (Sire, 1996). Any signs of the monarchy were destroyed, looted or sold, and auctions of surviving artefacts were held from 25th August 1793 to 11th August 1794. Nationalism and patriotism were on the rise with the era of the Enlightenment and the birth of the Republic and with it a renewed appreciation for French cultural heritage. Collections were disseminated and materials found their way to new public institutions, such as the *Musée Central*, today the *Musée du Louvre,* and other administrative buildings. The hope was to educate the people about the history of their country.

19th and 20th centuries: A national symbol becomes a museum

The beginning of the 19th century saw the re-emergence of the Monarchy. Louis-Philippe (1830-1848) decided that Versailles would be reinvented. In 1837 the Palace was inaugurated as the *Musée de l'Histoire de France* and since then Versailles has again been a significant cultural and political site (Sire, 1996).

When Versailles became a museum, the general gallery concept was that the rooms should appear inhabited. There was an effort to refurnish the galleries with original objects; however, limited materials survived and for this reason different stylistic periods are represented. Original objects that endured belonged to institutions such as *Musée du Louvre* and the *Mobilier National,* who agreed to permanent loans. The impressive curation continues and Versailles is actively acquiring artefacts when available and commissioning the fabrication of historic copies if originals are not accessible. Thanks to its popularity and importance, the Palace has received national and international gifts and funding.

Conservation and electrification

Chandeliers have a complicated existence as both decorative art and functional objects. In French law, chandeliers are described as movable, but immobilised by purpose (Cornu and Mallet-Poujol, 2001). In other words, chandeliers are viewed similarly as permanent architecture, intrinsic to the building. For this very reason, chandeliers have historically fallen under the care of architects and building departments. As such, chandeliers were perceived as a building material, the most important aspect being electrical, not historical.

In recent history, to whom these artworks are charged has been changing. There is now a shared role between the curator and the architect. Curators view the pieces as art objects, prioritising documentation, preservation and proper restoration. Architects see the pieces as functional devices, focusing on technical servicing and electrical safety. The common goal of the two different ideologies is an understanding of what is best for these multi-use, historic objects.

Restoration to conservation

Lighting conservation is a speciality that requires a range of knowledge. As chandeliers are basically monumental sculptures, special logistical expertise related to safe handling, movement and transport is required. An advanced understanding of electricity and light engineering is necessary for safe rewiring. The conservators must be versed in treatment techniques for composite objects.

Fig. 5 Louis XV style Girandole, Salon d'Apollon, Grand Appartement du Roi

Fig. 6 Louis XVI style Candelabra, Salon des jeux de Louis XVI, Appartements intérieurs du Roi

In France, ***les lustriers*** or light fabricators are often employed to fix and update chandeliers. Their view of restoration is focused on repair and reconstruction, often without consideration of historic value or original materials, the goal being simply aesthetic. This traditional approach is contradictory to current conservation best practices. Permanently damaging and invasive methods are typically used to attach wires, including the addition of new drill holes and the introduction of non-reversible, damaging adhesives. Additionally, aggressive metal polishing, complete re-gilding, reassembly of disparate parts, and the surreptitious replacement of crystals is also standard practice. All of these actions irreversibly damage the historic integrity of the artworks.

Over the last decade, conservators have introduced new restoration processes wherein chandeliers are treated as electrified historic material, following the ethical guidelines put in place by the field's guiding bodies. It is necessary to mesh traditional fabrication methods with conservation standards, the outcome of which can redefine and reshape past protocols to attain an acceptable contemporary approach.

A project of this size requires the participation of many different specialisations. The Versailles art handlers are in charge of logistical operations, de-installation and packing, a contracted company is responsible for electrical maintenance, and restoration and rewiring is being carried out by an established chandelier restoration company that specialises in conservation of metal work and electricity.

As the last restoration campaign took place in the 60s, thorough conservation of the selected objects is necessary. The first step is to provide photographic and written documentation with the inclusion of diagrams. These complex objects, with no true orientation, must be diligently documented, as when removing hundreds of crystals and dismantling the metal structure it is vital that the reassembly is correct. Depending on the size of the chandelier, disassembly is carried out either on-site or in the conservation studio. Special attention is paid to how the crystals are attached, as there are many fastening techniques. After the chandelier has been brush vacuumed to remove loose dirt and debris, the object is taken apart. Images of each crystal type and metal component are taken. These images also augment on-going cataloguing and typology documentation.

Each component is labelled according to an alphanumeric system to track parts as they go through the stages of conservation treatment (Fig. 7*)*. This ensures that materials do not get mixed up. Often metal parts have original marks stamped on to the elements that aid in correct reassembly. All of the fixtures have multiple institutional inventory numbers, but the metal structures are rarely signed.

The materials are treated according to their needs. Most of the mercury-gilded copper alloy components are of excellent quality and in very good condition. The pieces are cleaned by mechanical or chemical methods with the application of solutions by compresses, gels or by immersion. The longest operation, adhesive removal, is carried out by the application of steam, mechanically and water and/or solvent. Cleaning methods for the crystal components are aqueous or solvent-based with the addition of surfactant.

After cleaning, the objects are reassembled and the structural stability of the metal structures is verified. If necessary, hardware is replaced, taking into consideration the original threading as screw fabrication methods can help in dating.

The crystal plaques are then reattached. The majority of the metal wires are removed as they are typically found to be in poor condition, corroded and brittle. This affects object preservation and could impact public safety. New ties are fabricated with wire that closely resembles, physically and aesthetically, those removed. If needed these wires are patinated, silvered or gilded and are attached systematically using historic techniques. If missing or broken, crystals can be replaced by a similar type from the company's vast collection. A note is always made if new materials are introduced. Finally, before the crystals are transported, they are individually wrapped and placed in specially made protective bags (Fig. 8).

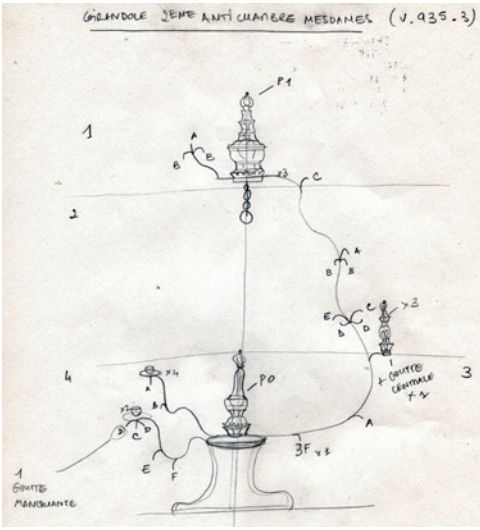

Fig. 7 Diagram of alphanumeric labelling system of the crystal components on a girandole. Appartement de Mesdames.

Fig. 8 Packaging of the crystals of a girandole in specially made bags. Appartement de Mesdames.

Electrification and lighting

The first large-scale chandelier electrification and restoration campaign was undertaken in 1961 for the arrival of the Belgian King (Royer, 1973). The chandeliers of the ***Grands Appartments*** were entrusted to a significant Versailles light designer, M. Klotz. He installed his '***Comme Autrefois***' (Like Before) incandescent light bulbs that are low wattage and reproduce the flickering intensity of a candle flame (Fig. 9). They are short and thin, warm white and have a colour temperature of approximately 2,000 K. The 'candles' used were made of polypropylene and closely resemble wax candles. A conservation forerunner, the light designer did not drill new holes to wire the chandeliers. Instead, the electrical wires, wrapped with a gold-coloured textile sheath, were applied with adhesive along the outer surfaces of the metal armature, visually integrating with the support.

The low lumen output of the bulbs required the installation of additional gallery lights. Although the desired ambience is one emulating that of the 17th century, it is difficult to strike a balance between historically correct interior settings and visitor comfort, but Versailles was successful. The '***Comme Autrefois***' bulbs are still in use in numerous apartments, and give the Palace its pleasing and unique light quality. These bulbs are becoming more difficult to buy and will soon cease to be fabricated. In addition, the socket used is extremely rare and EU regulations have forced the Palace to invest in a new, long-lasting alternative.

Versailles has not escaped the necessity to comply with the upgrades to safer current electrical installations that include energy-saving light bulbs (Darmon, 2011) and the addition of earthing wires. The conservator's challenge is to find methods of wiring that fit the new norms and approved conservation ideology. The use of supplies with physical and chemical stability, that also visually integrate, is the goal. In this area, specialist suppliers tend to disappear. More frequently, conservators work directly with manufacturers to develop reliable, appropriate, adaptable materials for long-term use on historic objects.

New LED candles specially crafted for Versailles by the Swarovski Company will progressively replace the '***Comme Autrefois***' bulbs. The amber colour LED is installed upward into the 'candle', which is composed of off-white painted aluminium, a material that acts to cool the LED. The unidirectional light is oriented to pass through a crystal bulb that is gradually opalised by a specific treatment technically developed by the Swarovski Company. This flame is similar in shape to the '***Comme Autrefois'*** and separates the light from blue to orange and yellow like a real flame (Fig. 10).

These LED candles were chosen because of their reliability, conformity to the EU regulations and their light quality. The institution's expectation with this choice is for beautiful, inexpensive, low-maintenance lighting. The Palace estimates that there are 20,000 chandelier bulbs in use, with 13,000 replaced each year. The new LED bulbs are guaranteed for 20,000 hours, the equivalent of 10 years, for a total consumption of less than 2 watts per bulb. There is no UV output and the limited maintenance means that there is less possibility for damage to occur.

Fig. 9 Incandescent light bulb 'Comme Autrefois' and its candle made of polypropylene

Fig. 10 Warm candle ambiance created by the Swarovski LED light bulb. Salon des jeux de Louis XVI, Appartements Intérieurs du Roi

Discussion

The lights from four Apartments have been conserved and rewired, with four remaining. The majority of the chandeliers are 19th century or later, with the exception of one 18th century fixture.

Three types of chandeliers are predominant: ***En console***, ***à tige découverte*** and Louis XVI. Within each genre, small differences are observed and can possibly be attributed to different workshops. The mercury-gilding shows homogeneity of colour and condition. Screws, often very old, vary greatly.

Dating the pieces is difficult as some are historic structures with new pendants or are a melange of different chandeliers, reassembled to form a whole piece. In addition, reproductions have been commissioned over the last two centuries and it is common to see different crystal styles on the same chandelier. The glass compositions are currently unknown, but many crystals are pink or purple or have a yellow hue. It is possible that the colouration was purposely imparted, but more likely the colour shifted though solarisation or is an alteration product.

For further interpretation, a study of the archives in concert with the collections would be required. In addition, material analysis of the glass and gilding would be useful in answering outstanding questions related to composition. For example, qualitative analysis of the gold could indicate if a chandelier had been re-gilded and knowledge of the glass composition might answer the issues raised above.

Light source investigation continues and with the current museum trend towards LED installation, important new data is consistently available. More long-term research initiated by this project relates to the art of light, an understandable chandelier lexicon, crystal typology, fabrication techniques and a standardisation of conservation of light fixtures.

Conclusion

The lighting experience is an intrinsic part of the galleries at the Château de Versailles, creating a unique atmosphere and impression for the 30,000 and more daily visitors. Chandeliers historically played an aesthetic and functional role at the Palace and their status and value as a cultural heritage is increasing. It is time to develop a new approach towards lighting study and conservation.

Artificial light is one of the most important human discoveries. Without light, life as we know it would not exist. However, the importance of light in our society is taken for granted and the historical context of its use and fabrication has rarely been studied. The comprehension of this type of material heritage needs to start with the history of lights as art. The unique lexicon associated with lights, specific words and names must be preserved. Additionally, the ambiance given by each historical light, from fire to candles to gas to the first electric bulb, must not be forgotten. With standardised electricity, the original light ambience of historic interiors has been lost and the relationship to the objects within is no longer what was intended. There is a parallel between the re-creation of an original light atmosphere and playing a baroque piece of music on a 17th century instrument.

Conservators, curators and architects must work together to come to an understanding about the best approach to these important cultural heritage objects. The conservation needs of lights are both preventive and practical, and should be standardised and published. Adapted methods of documentation, handling, packing and storing should be systematic and restoration methods should take in to account traditional techniques and new conservation procedures, upholding the field's code of ethics.

As electrical objects, lights must be rewired every 30 years as the materials degrade and standards change. This means that it is necessary to adapt to new products that are aesthetically suitable but also compatible with the changing electrical standards. The technological transition from an incandescent light bulb to a more energy efficient alternative is the biggest problem. These technologies are not yet perfected and are constantly evolving. Research for the best lighting solution must be done now. If the needs of historical lighting are defined, the recreation of historical light atmospheres, ecological expectations and long term preservation of the light collections can be achieved.

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