



The Paradox of Artificial Lighting in Historic Structures

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Abstract

When historic interiors are open to the public as museums, the usual intent is to present the interiors as they would have appeared when in use. Unfortunately, preserving the collections and providing good visibility for viewers looking into rooms both require that daylight coming through windows be reduced, and this is in sharp contrast to what would have occurred in original use (when activities would have centred around the windows because the incoming daylight was the most economical source of light). This, then, is the paradox of attempting to reproduce 'original' lighting schemes in historic interiors: museums try to create lighting for visitors that is better than what the original users would have had. Museum lighting is also of a lower colour temperature than daylight and lacks the variation of both daylight and flame sources.

Once the basic paradox created by conflicts among authenticity, viewing requirements, and conservation standards is acknowledged, finding appropriate solutions requires interdisciplinary discussions at a sophisticated level. Modern lighting controls and sophisticated light sources make it possible to create more than one lighting scheme for the same space.

Introduction

The 'historic interiors' that are being discussed in this conference were not intended to be historic interiors when they were created. It is only our current cultural views, working with the vagaries of time, that have deemed them somehow worthy of preservation and interpretation for contemporary society and for the future. Although some may have been considered important spaces at the time they were created, and some may even have been designed with posterity firmly in mind, our terminology already expresses a central paradox. We are working to present historic interiors in something resembling their original state when at that time they were not considered historic interiors at all.

The transformation of the inside of a building or room from its original or current state to that of an 'historic interior' involves physical changes that are tied to changes in use. This is true for both house museums and buildings (commonly government structures) that remain in their original use but have one or more rooms set aside for visitation. Major changes usually attempt to bring the space *closer* to its original state but sometimes (e.g. when changes are necessary to allow access to the interior by groups of visitors or to protect fragile objects or materials) move the interior *away* from its original appearance. Even as the planning group works toward greater authenticity, the act of exhibition requires measures that run counter to this intent.

Lighting is the aspect of interpretation where this paradox is most pronounced, whether for reasons related to preservation of collection material or to the improvement of visibility. Such changes are often made with the best intentions but, despite this, can make interpretation misleading. This paper discusses aspects of lighting (both daylight and electric light) that illustrate this paradox, and proposes methods to deal with them when planning lighting for historic interiors.

Original use

Most historic interiors were originally lit primarily by daylight entering the spaces through windows. Various window treatments (e.g. curtains and draperies, venetian blinds, and fixed and moveable shutters, both interior and exterior) were used to control the amount of daylight entering individual rooms. The original inhabitants of these interiors were well aware of the deteriorating effects of daylight on textiles and other light-sensitive materials, and they kept daylight out of interiors when they were not occupied. Because daylight was often restricted to an area immediately adjacent to the windows, especially during certain months or when trees and shrubs were in leaf, tasks requiring high light levels (such as reading and needlework) were accommodated by pulling furniture closer to the windows. The varied arrangement of furniture was dictated by the changing needs of the inhabitants rather than by a fixed plan suitable for a single activity or for decorative effect.

Until the advent of electric light at the end of the 19th century, lighting to supplement daylight came from the combustion of organic materials supplied as a solid (wax in candles), liquid (whale oil, kerosene, etc.), or gas (from coal, etc.). As daylight faded during the late afternoon and early evening, supplemental lighting was placed in appropriate locations within each room. These locations changed according to the need for task lighting or social illumination.

These changes made to accommodate shifts in natural light meant that the appearance of historic interiors in original use was dynamic rather than the fixed 'arrangement' of furniture we accept as authentic today, and one of the most dynamic aspects of the original appearance was certainly the changing light. One window might be opened to daylight for a single user, or all the windows of a room (or of the entire house) opened for a party. The daylight might be warm noonday sun or gray morning light. Artificial light sources provided warmer light, but would have been used in most cases only when daylight was insufficient. Wood or coal burning in fireplaces would also produce a distinctive colour, as well as adding movement.

Reproducing this original set of circumstances is impossible for many reasons: furniture cannot be moved constantly, light focused on only one area (as if for task lighting) will not give visitors an adequate view of the rest of the room, and lit fireplaces and candles require the participation of professional staff.

The change from house to museum: Viewing and preservation

When historic interiors are shifted from original use to display/exhibition, they undergo many changes. Often the shift will have occurred many years ago, perhaps without the participation of professional staff. In these cases, changes made to foster visitation may have included the alteration of furniture arrangements to allow visitors to view rooms more easily and to reduce the possibility of damage to decorative elements. To meet the perceived needs of viewers some of the original lighting fixtures may have been electrified and new ones added, perhaps over doorways into rooms where they cannot be seen or as 'neutral' torchères.

Another change that can occur during the transition from original use to museum is a shift in the expectations for preservation of the structure and its furnishings. All original fabric immediately assumes increased importance, and measures are needed to assure its preservation for the future. What was once considered acceptable (if unfortunate) deterioration of textiles and other light-sensitive materials becomes unacceptable, as do changes in furniture finishes due to light exposure.

In addition to the preservation of light-sensitive artifacts, the reduction of light infiltration from windows is also important to improve visibility for visitors. Visitors usually view historic interiors from a position opposite the windows. One common arrangement is to restrict access to a room to a small area near the door, so the room essentially becomes a large exhibition case with the viewer at the front end of the case and windows at the back wall. Another common mode of access is for visitors to be led through a series of rooms (often on a modern runner placed to protect period carpets), again usually in an area opposite the windows. As the windows have the highest apparent brightness of anything in the room, the visitor's gaze naturally falls on them first and all other objects in the room (most with an apparent brightness far below that of the windows) have to fight for attention. If the windows are the major source of light, objects in the room are primarily backlit and are seen mostly as profiles rather than in three dimensions. Therefore, visitors will find the contents of the interior much easier to view if light infiltration from the windows is diminished.

Many methods to reduce light infiltration through windows have been discussed and published. The simplest is to use shades, blinds, or draperies that can be kept shut when the room is not on display. Films adhered to glass are also common, but have several drawbacks (e.g. potential hazard to glass from removal, difficulty in application, and the later formation of bubbles). The films most often used are also (unfortunately) the ones that filter ultraviolet wavelengths only so they do nothing to reduce visible light infiltration. Tinted films can be useful in some applications although they have some of the same drawbacks as non-tinted films. Many types of films are available: different tints (neutral gray, bronze, etc.), different densities (85–10% transmittance), and different methods of filtration (short-lived dyes and long-lived particulate inclusions). Films made into roller shades eliminate most of the drawbacks.

Tinted Plexiglas can also be a useful method of filtration, and incorporates a similar variety of types as discussed above. It can be installed as small sheets cut to fit individual panes of historic sashes fixed in place with glaziers' points, or as large sheets that cover an entire window, either hanging from hooks at the top, screwed into the sash, or mounted in existing storm windows.

Whatever type of window covering is chosen, it is essential that all windows visible from locations within the room be treated with material of the same density, and that no unfiltered areas are visible around the edges or anywhere else in the visitor's visual field.

The elimination of ultraviolet light and the reduction of daylight make the addition of artificial light necessary. Electrified period fixtures, as noted above, are common

solutions. The use of fibre-optic lighting is a newer means of providing artificial lighting that gives more control over the distribution of light, as well as easing the problems of heat and the practical issues of re-lamping.

Whether changes are made for the purpose of protecting collections or aiding vision, the result is a loss of authenticity. If substantial natural light is excluded from a room, it must be lit by artificial light. When visitors view an historic interior during the day under artificial light, they are seeing something doubly false to original use, not only the existence of the artificial light but also its identity (an unchanging source of a colour different from natural light). If the light is from wired period fixtures, only those objects that happen to fall within the pools of light they supply will be seen. If the light is from added modern fixtures, the direction of the light, the shadows cast, and the colour temperature will all be different from original schemes. The fact that interior light levels provided by modern means can produce adequate viewing conditions on cloudy days or in late afternoons (when original visibility would have been unsatisfactory) is likewise false to original conditions. Visitors do not see objects as they would have looked, and also miss the educational opportunity of experiencing pre-industrial living conditions. Authenticity is out the window.

To sum it up, contemporary lighting schemes designed with appropriate regard for the preservation of original material and for the experience of visitors will always have the unintended consequence of compromising authenticity.

Possible solutions

What is to be done to light historic interiors accurately, preserve light-sensitive material, and still give visitors the chance to see individual objects? It would be gratifying to present a solution but, given the inherent contradictions, no one lighting scheme can possibly fulfill all the criteria at the same time. In addition, a solution satisfactory for one setting is unlikely to be appropriate to any other.

Arriving at a solution for a specific case requires that a process involving a variety of individuals working together as a team (not individual experts called in separately) be used.¹ Team members must be chosen to address the three primary issues: authenticity of interpretation, preservation of original material, and visibility. Such teams ordinarily include curators, conservators, educators, lighting designers, and experts in historic lighting and furnishings.

Reconsideration of the requirements

Even in view of the substantial injuries to authenticity posed by requirements for preservation and visibility, measures that provide for the welfare of collections and

the enjoyment of visitors cannot be abandoned. We therefore have to re-examine absolute requirements and search for areas of leeway. One fundamental decision to be made by the team is the level of deterioration that is 'acceptable' to the guardians of an historic interior. This is obviously a difficult matter to discuss realistically, but some deterioration is inevitable if the interior is to be open to the public at all.^{2,3,4}

One opportunity to protect objects from light that does not compromise interpretation is the complete elimination of daylight at times when the interior is closed to the public. Assuming normal 'museum' hours of opening (i.e. 10 a.m. to 5 p.m., 6 days a week), it has been estimated that approximately one-third of light exposure takes place during hours when the museum is not open to visitors. Thus, keeping exhibits dark during this time would result in an automatic one-third reduction in the deterioration of light-sensitive material. As many historic houses have visitation hours that are shorter than this, the savings may be even more significant.

This can be achieved in historic interiors in a number of ways. If shutters are already in place, they can be closed when visitors are not permitted in. If minor intrusion in the historic fabric around windows is allowable, pull-down opaque window shades can be installed (often in a manner that takes them out of the visitor's view when they are not in use). Venetian blinds or other window treatments can also be used to exclude light. All of these methods require some staff time each day to accomplish. If this staff time is not available, various types of electric window shades (that can be operated from remote locations) could be installed instead. These usually require hard wiring and can be expensive, but they are easy to use and do not require staff time each day. In simple interiors where no window treatments are appropriate, full window inserts of Fomecor or acid-free cardboard can be an effective (although labour-intensive) light-excluding mechanism.

The re-use of original light-excluding measures such as shutters or draperies should always be considered. There are obvious limitations to this approach: constant use of original shutters can in some cases put a strain on original structures, and any original fabric drapes or shades must be protected from light. Decisions must be made based on factual investigation of the original practices used, on the physical limitations of any still extant features, and on the costs and consequences of making new shutters or window treatments that copy old ones.

It should be remembered that the colour temperature of daylight, although it varies somewhat depending on the time of day and weather conditions, is generally much higher than that produced by burning organic materials or by incandescent lamps. Thus, when daylight is either filtered or excluded completely from interiors, and is

supplemented or replaced by incandescent lamps in wired historic fixtures or other fixtures, the interior is seen in a light very different from the original daytime conditions. In addition, sunlight is strongly directional and creates a contrast between shadows and areas of direct beams of light. No pre-20th-century light source could provide the overall wash of bright light that we accept as commonplace today.

The electrification of original fixtures creates light that is brighter and much more steady than candles or gas flames would have been in the same fixtures. Many historic houses make use of flame-shaped lamps, and a small number of companies manufacture sources that mimic the movement of flames (some flicker in intensity while others actually move the filament). None of them is a perfect substitute, but they are worth considering as even a suggestion of movement can be quite effective.

If the interior is shown with substantially filtered daylight, it is often more appealing to visitors if the light is 'warmed' by using a bronze-tinted material rather than using a neutral density filter that does not change the colour temperature. If supplemental light is required, it should probably be of a higher colour temperature than incandescent lamps. High-quality fibre-optic systems can be used to create a subtle supplemental light that will increase light levels on objects or surfaces seen by visitors without creating noticeable shadows. This light can be filtered at the source (projector) to raise the colour temperature to be closer to that of daylight, and can be controlled so that the shadows cast by the daylight still predominate.

As daylight fails during the day, especially during winter months, light from period or reproduction fixtures can be used to portray a more authentic, time-appropriate appearance. A second fibre-optic system, filtered to mimic the colour temperature of these 'warmer' fixtures, can provide suitable light levels for viewing specific objects or surfaces while again allowing cast shadows from the fixtures to predominate. The fibre-optic systems can be remotely controlled, and might function jointly during periods of mixed daylight and period fixture use. As the daylight fades entirely, the second 'scene' can take over completely. It is even possible to provide visitors with a variety of appearances during their visit, showing them a daylight scheme, followed quickly by a dusk interpretation, and then nighttime view.

This dual system of supplemental light with closely controlled focus and colour temperature, used in conjunction with carefully controlled daylight and period fixtures, can be very effective in reclaiming the authenticity of interior lighting that is so often sacrificed for reasons of preservation.

Light, and its effect on the appearance of historic interiors, is an aspect of interpretation that is often overlooked

during the consideration of authenticity. However, it is crucial that lighting schemes be as carefully planned as other aspects of interpretation and display.

Endnotes

1. Himmelstein, P., and B. Appelbaum. "The Process of Compromise: A Team Approach to Conservation Environments." *APT Bulletin XXVII*, 3 (1996) pp. 8–11.
2. Cuttle, C. "Damage to Museum Objects Due to Light Exposure." In *Museum Exhibit Lighting*. Washington: The National Park Service and the Washington Conservation Guild, March 1996, unpaginated.
3. Michalski, S. "Damage to Museum Objects by Visible Radiation (Light) and Ultraviolet Radiation (UV)." pp. 3–16 in *Lighting in Museums, Galleries and Historic Houses. Papers of the Conference. Bristol, 9–10th April 1987*. London: The Museums Association, 1987.
4. Feller, R.L. "Standards of Exposure to Light." *Bulletin of the IIC American Group* 7, 2 (1967), pp. 8–32.

Résumé

Le paradoxe de l'éclairage artificiel dans les structures historiques

Lorsque des intérieurs historiques sont ouverts au public en tant que musées, l'intention est généralement de les présenter tels qu'ils seraient apparus lorsqu'ils étaient utilisés. Malheureusement, la préservation des collections et l'assurance d'une bonne visibilité pour les visiteurs qui veulent voir ces intérieurs exigent que la lumière du jour pénétrant par les fenêtres soit réduite, ce qui est en contradiction avec ce qui se serait produit lors de l'utilisation originale (alors que les activités auraient été centrées autour des fenêtres, la lumière du jour étant la source la plus économique de lumière). Voilà donc le paradoxe d'essayer de reproduire l'éclairage « d'origine » des intérieurs historiques : les musées cherchent à mettre en place un éclairage qui est meilleur que ce que pouvaient avoir les utilisateurs d'origine. L'éclairage de musée se situe également à une température de couleur plus basse que la lumière du jour, et ne présente pas les variations tant de la lumière du jour que de l'éclairage à la flamme.

Lorsqu'on a reconnu ce paradoxe fondamental créé par les conflits entre l'authenticité, la visibilité et les normes de conservation, la recherche des solutions appropriées exige des discussions interdisciplinaires à un niveau de complexité élevé. Les contrôles d'éclairage moderne et les sources de lumière perfectionnées permettent de créer plus d'un agencement d'éclairage pour le même espace.