Let There be Light
Winterthur's Lighting Project
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Introduction

There have been many times in the course of my career when Karen Finch's aphorisms have resonated in my mind, but one in particular that I have had many opportunities to remember concerned preventive conservation. Karen, with her usual aplomb, told us that if we were seriously intending to preserve the textiles in our care we should never, ever allow them to be shown except, perhaps, once a year for maybe half an hour on New Year's Eve. Of course, as earnest young students, we were all horrified that anyone should even dream of exposing our fragile and overwhelmingly important textiles to any significant amount of light, let alone dust, atmospheric pollutants, moisture, or insects. And then we went out to work in the real world.

In this paper I intend to review very briefly some of the work done on issues of light damage over the past 25 years, and to discuss approaches and compromises that have been made in the display of textiles at Winterthur and other historic houses. Finally I will describe the current lighting project at Winterthur Museum which aims to satisfy both conservation requirements as well as the need for our visitors to be able to see the collection in our period rooms. My aim is not to be comprehensive, but to use my own anecdotal experience to show the practical application of this fundamental research at Winterthur Museum.

Light damage over the years

The Museum Environment by Garry Thomson, the bible for conservators concerned with preventive conservation, was first published in 1978 followed by a second edition in 1986. Although research on light damage to organic objects had been going on for some time, this book provided the rules of the game for conservators around the world (see the extensive bibliography in Thomson 1978). Stefan Michalski, one of the current gurus of preventive conservation, has discussed the development of the rigid 50 lux rule for light-sensitive objects, as well as the reasoning behind it (Michalski 1990, 1997). Many of us experienced something of an epiphany as Stefan proclaimed from the podium in Dresden that museum directors were, by definition, old, and that it is therefore not surprising that they would insist on higher light levels.
because older people need higher levels of illumination than younger people (for example conservators) in order to see anything. (I may be paraphrasing a bit but that is the gist of his remarks as I remember them.) It is somewhat sobering to realise that now work in an institution where the director is younger than I am.

It is my belief that one of the reasons why conservators fixated on 50 lux was because of the demands of curators and exhibition designers for 'an answer'. Most of us knew that reality was a little more complicated. We had learned about the 'reciprocity law', and realised from our own experience with historic textiles, as well as from published research, that some dyes were more lightfast than others, and that some fibres were more easily damaged by light (Brill 1980; Saunders and Kirby 1996). But today it is easy to forget how difficult it used to be to get many curators, designers, and particularly museum directors even to admit that textiles could be damaged from exposure to light. Gradual and cumulative damage seemed to be invisible to them. The knowledge and experience of generations of homeowners and housekeepers seemed to have been completely lost. At that time conservators in general (and textile conservators in particular) were only just beginning to make headway in the quest to be recognised as fellow professionals within the museum field. To achieve that status we had to sound precise and authoritative. We had to have 'the answer'. And the answer seemed to be 50 lux (or, as it is so quaintly measured in the United States, five foot-candles).

Many conservators and scientists worked on methods of quantifying cumulative and long-term light damage to textiles. Robert Feller and Ruth Johnston-Feller developed a means of measuring the cumulative light exposure of light-sensitive objects using the ubiquitous blue wool standards (Feller 1978, 1979). Norman Tennent, Joyce Townsend and Anthony Davis developed an inexpensive dosimeter using the blue wool standards and a UV-sensitive plastic film to measure exposure to both visible light and ultra-violet radiation, which sadly was not available to us for very long (Tennent et al. 1982). But with this work behind us, textile conservators could brandish a set of faded blue wool standards as visual evidence of cumulative damage, and the attitude of our museum colleagues gradually began to change.

Today with the use of integrating light monitors and computer software systems we are becoming more sophisticated in our approach to the measurement of light, especially in historic houses (Museums Association 1987). Of particular note is the work done by Sarah Staniforth and others in the English National Trust (Staniforth 1987). Experiencing the problem of being buried beneath a mountain of individual measurements, they have extrapolated the amount of cumulative light exposure in historic houses lit primarily by natural daylight using daily and seasonal variables, rather than by rigging out every corner of every room with a permanent monitoring device.

The development of the CCI slide rule (Canadian Conservation Institute 1988) enabled conservators to predict and quantify levels of light damage to objects. Work has also been done to measure colour shifts in the objects themselves as a result of light exposure (Ford 1992; Bede 1993). A recent but not yet widespread development is a micro-fading test using fibre-optic light source and a spectrophotometer interfaced to a computer to measure the lightfastness of the actual colours on specific objects (Whitemore et al. 1998). Although the published abstract relates to paint films, Paul Whitemore brought his contraption to Winterthur and allowed us to experiment on a variety of other materials. The results enabled the Library Conservator, Lois Price, to decide on realistic parameters for the rotation of printed materials on long-term exhibition (and to remove one particularly light-sensitive book from the exhibition list). The textile technicians (Joy Gardiner and myself) were able to get some idea of the ferocity of exposure to direct sunlight suffered by a silk fabric used to upholster a chair in one of our period rooms.

The combination of the means to quantify variable exposure coupled with an ability to accurately predict damage on specific objects represents an enormous advance in the preservation of textiles and other light-sensitive objects.

The history of preventing light damage at Winterthur

A variety of methods has been used to cut down light exposure on textiles in historic interiors. Some houses are only open for part of the year which automatically cuts down significantly on the cumulative light exposure of sensitive objects. In some instances the historic practice of using case covers has been revived, with perhaps only one of a suite of chairs exposed at any one time. In other instances, reproduction fabrics have been used. Venetian blinds, sun curtains and shutters have also aided conservators in their quest to reduce light exposure.

The history of preventive conservation at Winterthur is an interesting one (Fikioris 1981, 1985, 1990). Winterthur Museum was originally the family home of the founder, Henry Francis du Pont. He considerably enlarged the original structure in the 1920s to house his enormous collection of American furniture and decorative arts. He bought textiles from antique dealers literally by the truckload, and had them stored by colour. As he came to decorate a room, Henry du Pont would select a fabric and it would then be cut up and used to cover a chair, or to make window or bed hangings. In some cases he was aiming for historic accuracy but more often he was creating sympathetic interiors for his collection of American furniture. He was not alone in this practice - many American collectors and, sadly, a number of American museums have used historic textiles in this fashion.

Henry du Pont's intention at Winterthur was to 'evoke an atmosphere of an old house' (Lamden and Kirschner 1995). This involved natural daylight coming through the windows as well as the use of electrified candles in period lighting fixtures to provide points of light. The whole
effect was achieved through low light levels. He was something of an innovator as well as being a perfectionist, experimenting with various flame-shaped bulbs, going so far as to suggest painting them with shellac to tone down the light. He even had special wax candles hand-made that would look right in the rooms. He loved to experiment with new technology — as well as his numerous experiments with the electrification of lighting devices, he installed elevators, electric dumbwaiters and soundproofing in the bowling alley.

When the Henry Francis du Pont Winterthur Museum opened in 1951, guests would be taken through some of the rooms in the morning, have lunch in the dining room (served by the family butler) and see another set of rooms in the afternoon. Someone would precede the tour raising the roller blinds and opening shutters, and the shades were pulled down again and shutters closed afterwards to prevent damage to the collection from light (Fikioris 1985). Many mid-twentieth-century roller blinds are still in place. When they are unrolled, however, the smell of degrading plastic is somewhat overpowering so they are no longer used.

One method that Henry du Pont suggested to compensate for the relative darkness in the period rooms was to use photographer’s floodlights to help visitors see details of the carving on the furniture. He insisted that these lights were not to be turned on until visitors had seen the aesthetic effect of the ‘atmospheric lighting’. This proved to be unfeasible and guides were equipped with flashlights, which they used continuously from the opening of the museum in 1951 to the completion of the first phase of the current lighting project at the end of 1998 (Lamden and Kirschner 1995).

Other projects also affected the light levels in the period rooms. In the 1960s tinted storm windows were installed to cut down on the energy load in the building at the suggestion of engineers working on the air conditioning project at Winterthur. The tinted windows gave a transmittance of 31% visible light but initially there were few complaints about visibility in the collection, although the rooms were thought to look somewhat gloomy. It is interesting to note that the main purpose of the air conditioning was to care for the collection rather than for visitor comfort. Harold Plenderleith from the British Museum Research Laboratory was a consultant on this project, measuring humidity levels in some of the textile storage areas as well as in the period rooms. He did this by measuring the amount of water drawn out of the rooms using dehumidifiers; note that this was well before the invention of any of the equipment that make these measurements so easy today.

By the late 1970s visitors to Winterthur were complaining more frequently about poor visibility in the period rooms. In 1978 a lighting consultant was asked to evaluate the lighting problem in the museum, funded by a grant from the National Endowment for the Arts. Lemar Terry, a well-known lighting designer with extensive museum experience, carried out the study and suggested the installation of low voltage track lighting. Although the Museum Affairs Committee of the Board approved these recommendations, lack of funds prevented the museum from implementing the recommendations. To give some idea of the extent of this problem, Winterthur currently has 175 period rooms (there used to be 195 but some are now being used as teaching spaces, conference rooms, and study/storage areas).

Meanwhile, members of the conservation staff were very concerned about the cumulative damage to lightsensitive objects on permanent display in the period rooms, and formed a committee to study the problem. While the museum had not been able to provide funds to improve the internal lighting, conservators felt they could at least do something about the natural daylight streaming in the windows. The Committee on Outside Light consisted of Margaret Fikioris (textile conservator), John Krill (paper conservator), John Melody (furniture conservator) and George Reilly (museum scientist). Based on the work done by Robert Feller and Ruth Johnston-Feller, a series of tests with British blue wool standards was begun in July 1978, a second set done in December 1978 and a third series in 1981 (Krill 1980).

To cut down the unacceptably high levels of light falling on light-sensitive objects, the Committee on Outside Light recommended that the windows of 104 period rooms be fitted with 1/8 in thick Rohm & Haas Natural Density Gray Plexiglass™. Tests had shown that this would cut down the light intensity by 66–75%. The Committee made it clear that interior lighting would be required to enable visitors to see the collection. Installation of the gray Plexiglass™ (Perspex™) went ahead without additional interior lighting, however, because of the overwhelming concern over the documented light damage of collection objects.

Although trials for various lighting systems were undertaken throughout the late 1980s and early 1990s none of them were felt to be completely successful. By this time it was estimated that at least 30% of the museum visitors were dissatisfied with the lighting in the period rooms. A new mission statement adopted by the museum in 1994 focused on improving visitor satisfaction, and in May 1995 the first stage of the development of a comprehensive plan was started by reviewing the history of lighting at Winterthur.

The Lighting Project

The stated goals of the Lighting Project were to improve the lighting in the period rooms to enable visitors to see the collection while maintaining the ambience and sense of drama created by Henry du Pont, as well as achieving the light exposure standards as developed by the Conservation Division. The standards state that the annual exposure of highly sensitive materials should not exceed 50,000lux hours, sensitive materials should not exceed 180,000 lux hours, and moderately sensitive materials should not exceed 730,000 lux hours, which would mean
spot readings of 14 lux, 50 lux and 200 lux respectively.

Winterthur staff reviewed recent lighting installations in various museums and historic houses, and wrote a comprehensive request for proposal, requesting bids for the design phase. After reviewing various proposals, Winterthur hired George Sexton Associates to develop a lighting plan initially for the fifth floor. This floor is where many of the important public rooms at Winterthur are located, and forms the general introductory tour taken by most visitors. The proposed system was installed as a pilot project in the McIntire bedroom, which was approved by Winterthur staff and a lighting subcommittee of the Board of Trustees. It was decided to extend the first phase to cover 70 rooms that were rewired at that time (the rewiring project is another story altogether). And then, in January 1998, the fun began.

The system chosen combined a track lighting system, recessed into the ceiling to be as invisible as possible. This avoids the visible clutter of surface-mounted track fixtures while still being able to handle the needs of changing room layouts. This is needed because of the annual Yuletide Tour whose room settings may be different every year. The Slotlux system is manufactured by Nulux, Inc. and is being used together with a computerised control system, the Graphic Eye 6000, from Lutron Electronics Co. Inc. For Phase II we are also purchasing equipment from LightLab in Buffalo. Where tracks cannot be recessed into the ceiling a system termed Spotlux is being used. A lighting design firm, Hefferan Partnership Inc., was retained to design the specific installation of Slotlux and Spotlux in each period room.

The application is very complex. Separate circuits control the light levels on different types of objects to enable the designers to set different levels for the illumination of light and dark objects, for objects with greater or lesser sensitivity to light and for electrified fixtures and windows in order to give the impression of natural daylight. All of these circuits are controlled by the computer, enabling a number of different settings overall.

When visitors enter the museum the lighting in each room is set at the 'naturalistic setting'. This low level creates the impression of natural lighting as desired by Henry du Pont. The computer control has also allowed the designers to compensate for the weather, creating natural-looking settings for both darker and lighter days automatically using photo cells placed throughout the building. After visitors enter a room, the guide raises the light levels using a remote to the 'guest viewing level'. This brings the lighting levels up to create more even lighting, enabling visitors to see the collection better but still well within the standards set by the Conservation Division. The ambient light levels are raised without changing the contrast that natural light provides within the rooms; areas of light and shadow continue even with the introduction of artificial light. A third 'study' setting turns off the electrified historic fixtures and raises the overall light levels in the room without spotlighting individual objects to enable housekeeping staff, for example, to work in the rooms, or for in-depth study of individual objects. This level is only intended for use for short periods, and it is accepted that some of the most sensitive objects may be illuminated above the ubiquitous 50 lux. It has been interesting to see that most television and film crews have been able to use this setting without additional lighting for their work. The last setting turns everything off except the emergency lighting.

The installation of this new system is a very labour-intensive process. Each room has been inventoried, packed and moved to temporary storage elsewhere in the museum. Many of the plaster ceilings have been demolished to facilitate installation of the Slotlux tracks. The ceilings are then replastered, and the objects reinstalled. Whole sections of the museum have had to be closed during this work, which proceeds floor by floor. Temporary barriers of plastic and blue board have been erected to protect historic architectural features. Barriers have been constructed around each section of construction to prevent the spread of plaster dust and construction debris.

Recessed lighting fixtures are not the solution for every historic house, but many of the period rooms at Winterthur are part of the 1920s construction. Many of the rooms have historic architectural elements but the majority of the ceilings were quite modern. In fact, many had recently been replaced during the installation of a sprinkler system in the early 1990s. Alternative solutions have had to be devised at Winterthur for the three rooms where the ceiling depth was not adequate or where period ceilings from other historic structures had been installed.

The designers working in conjunction with architects retained by the museum decide the location of each track. Once objects have been reinstalled in the rooms, each light is set individually by the designers working with lighting staff in the museum. Many people, including conservation staff, review the end result when changes necessary for conservation or interpretation purposes can be made.

The Lighting Project has resulted in an enormous amount of work for the Conservation Division. All the objects in each room have had to be surveyed by conservation staff to determine whether any treatment is needed. By the end of the project over 60,000 objects will have been assessed, with most of them requiring at least surface cleaning. Each conservation laboratory has had to develop a method of determining treatment priorities, with the aesthetic appearance of the objects becoming more important once visitors would actually be able to see them. Twenty-seven full and part-time employees have been hired to assist with all aspects of this project, including art handlers, housekeeping, registrars, curatorial assistants and conservators.

Phase I of the Lighting Project (70 rooms on the first, second, fourth and fifth floors) is now complete. The second phase (the remaining 105 rooms) began in May 1999 with completion scheduled for mid-2001, in time to celebrate the museum's 50th anniversary. As well as scurrying to keep up with the tight construction and reinstallation schedules, conservators are working towards determining how best to monitor the actual light exposure of sensitive collection objects.

Reactions to the new lighting have been very positive,
from both visitors and conservators. Visitors delight in the sparkling crystal chandeliers and wall sconces, while conservators have been amazed that the levels of illumination on light-sensitive objects can really measure only 20 to 30 lux. Even at this low level these objects appear easily visible, and do not look dark in the overall context of the room. Until we got used to it, we were constantly checking the battery power in our light meters to make sure that they were working.

Conclusion

The Lighting Project at Winterthur represents a current development where the needs of both the visitors and the objects are being considered in tandem. The aesthetic intentions of the founders are being respected using new technology coupled with the designers' theatrical background to create sophisticated lighting that evokes natural daylight and subdued illumination from period fixtures. Visitors can clearly see each object in the period rooms, while the exposure of those light-sensitive objects falls well within the current conservation standards. Conservators, curators, educators, and even the director are all in agreement - the new lighting system is fulfilling everyone's expectations.

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