

Museum And Gallery Lighting

Kevan Shaw

Adapted from an article written for the UK periodical "Lighting Equipment News"

Contents:

[1. Introduction](#)

[2. Daylight](#)

[3. Artificial light sources](#)

[4. Dichroic reflector lamps](#)

[5. A flexible system](#)

[6. Lighting outwith display areas](#)

[7. Theatrical lighting techniques](#)

[8. Lighting techniques providing a context](#)

[9. Case lighting](#)

[10. Temporary exhibitions](#)

[11. Finally](#)

LIGHTING for Museums and Art Galleries has a unique set of priorities, those of conservation and effective display. In many ways these two requirements conflict as there is a necessity to restrain lighting levels to promote the former whilst the latter requires sufficient light of a high quality to provide optimum viewing conditions. The process of lighting design becomes something of a balancing act to provide an effective compromise between these conflicting requirements. To attain this balance we need to look to the entire armoury of the lighting designer, specifying only the best equipment available, and we should consider all aspects of light within the display area. A complete understanding of the reasons for, and requirements of, conservation level lighting is essential and I would strongly advise everyone to read [The Museum Environment \(1\)](#) before embarking on any project. This book explains the factors governing the degradation of materials in light and will allow the designer to discuss proposed lighting levels from a position of knowledge.

THE first light source to consider is daylight. Although in terms of its excellent colour rendering it is ideal, the naturally large variation in level and the high [ultraviolet \(UV\) content \(2\)](#) make it difficult and expensive to control. This however is not an argument for starting from a windowless *black box*. The recently completed [St. Mungo Museum of Religious Life and Art](#) in Glasgow, Scot-

land, is a good example. This museum is housed in an existing building with large windows in the main gallery space which have been used to display stained glass exhibits. In conjunction with the architects [Page & Park \(3\)](#) and Linda Cannon, Glasgow Museums stained glass conservator, we specified a neutral density tinted glass for the double glazed windows and the glass surround to the stained glass panels. This allowed a reduction of some 80% in light levels within the gallery space without losing the psychologically important view to the outside. An additional filter reduces the ultraviolet content to acceptable levels. From this point it is possible to provide controlled accent lighting for display purposes whilst retaining the daylight feel of the space.

GIVEN the wide choice of artificial light sources available to the designer, careful consideration is required to select the most appropriate for the exhibition environment. The constraints on lighting levels, UV emissions, and requirement for highly accurate colour rendition generally point to Tungsten Halogen or high [colour rendering index \(4\)](#), i.e. Ra85 and above, fluorescent sources. For most display applications the cost and ease of control means that Tungsten Halogen light sources are preferable, however although easily dimmed the resulting colour shift of the light can easily lose the accuracy of colour rendition and engender that familiar air of yellow gloominess associated with many conservation level displays.

IN order to maintain optimum colour rendition lamps should be selected by beam angle and wattage to provide the coverage and [lux level required \(5\)](#) with the minimum of dimming. The large range of dichroic reflector lamps available can both help and hinder the achievement of good results. Unfortunately, the variations between lamps made by different manufacturers requires careful specification of lamps and I would state categorically that only lamps with cover glasses should be used in the museum environment. This is firstly to protect exhibits and the public from the euphemistically named, *non passive failure* of the capsule and secondly because reputable manufacturers front glasses are borosilicate which reduces [the high UV emission of the capsule \(6\)](#) to acceptable levels without the need for further filters, this can represent a considerable cost saving over proprietary UV filters. The importance of the lamp specification must be made very clear to the exhibition operators as lamps purchased on a best price basis will almost certainly not conform to the originally specified lamps performance.

HOWEVER it is always important to design a flexible system, even permanent displays change as new objects are acquired, and galleries are often redisplayed because of a change of theme. The advent of reliable self dimming electronic transformers in luminaires and as stand alone items, such as the [Mode Electronics ET-I05-SD \(7\)](#), has been a great advance in this respect, not only allowing a

wide range of lamp wattages in each luminaire type but also allowing for fine tuning of levels and minimal (around 5%) [dimming to greatly extend lamp life \(8\)](#). Soft starting also extends lamp life, in St. Mungos Museum we have used Voltmaster units from [Multiload Technology \(9\)](#) as these also include the ability to stabilise voltage to minimise the visible effects of voltage drop and [cascade failure \(10\)](#) on long runs of low voltage lamps.

GENERAL lighting outwith display areas can play an important part in the overall ambience of a museum and its importance should not be underestimated. The *black box* approach, where lighting is restricted to the objects alone, can provide extremely dramatic rendering of some types of objects as in the [Work of Angels \(external link\)](#) exhibition at The National Museums of Scotland, Edinburgh, Scotland. In this case relatively high levels of light were used as the objects were in general not extremely light sensitive. The result obtained, objects standing out starkly from a dark background, was successful but where lower lighting levels are required this lack of background light can engender a sense of gloom and make the space appear underlit. A little general lighting can help but care must be exercised to prevent it from impinging on displays where the lighting is tightly controlled. Retail style sparkling dichroic backscatter is not appropriate where you need complete control over the direction and colour of sources, therefore only luminaires which shield the back of dichroic lamps should be used. The brightness of backscatter will always make conservation level lighting look relatively dark and dull.

DUE to the preponderance of glazed surfaces within gallery spaces, glare is also an important factor to consider when designing lighting. Often the best way to introduce general lighting is by means of continuous runs of concealed fittings designed to bounce light off ceilings and walls, alternatively concealed wall washing of vertical surfaces at quite low light levels provides the suggestion of a lit environment with a minimum of light and potential glare sources. Providing large diffuse sources of light can be useful in displaying highly sensitive artwork especially where close inspection is required. It also provides a solution where sloping glass cases are used as they frequently cause problems by reflecting the light sources directly back at the viewer, however diffuse lighting is only a good idea for two dimensional exhibits, three dimensional objects lose their depth and texture without any form revealing directional light.

ELEMENTS of display lighting in museums now often include requirements for a more dramatic style of presentation which sometimes require theatrical lighting techniques and equipment to provide particular points of emphasis, or dynamic moving effects to enhance the presentation of displays. With these techniques lighting can perform an interpretive or context providing role in displays. In [Jersey Museum \(external link\)](#), UK, there is an exhibition area focussing on the sea as an important element for the island. The curator wished to show the constantly changing look of the

sea and the changing weather patterns in the sky and these effects were all created with lighting. In conjunction with exhibition designer Colin Milnes we created two projection screens in the form of canvas sails which were lit using ripple boxes from [Howard Eaton Lighting \(11\)](#) and [DHA Animation Discs \(12\)](#) on [CCT Minuette lanterns \(13\)](#), the lighting was controlled by a theatre lighting board programmed to execute a looped series of cues. In addition there was a requirement to display a body of text and a collection of Victorian photographs, these were displayed on the screens by means of specially constructed *rolling credits* projectors. The constantly changing composition proved very successful in retaining the visitors interest with the result that many read through all the text which, had it been presented as conventional graphics would not have been the case.

ANOTHER example of lighting techniques providing a context is the [Fish Gallery \(external link\)](#) at the National Museum of Scotland. Here the exhibits are fine examples of fish taxidermy arranged to show different fish types, habitats, food chains etc. The cases were constructed using coloured stained glass in the top box to portray a water surface. The exhibits were lit from above the glass with a combination of low voltage and fluorescent sources to create differing underwater feels according to the habitat being portrayed. The texture of the glass created ripple patterns throughout the case. In the centre of the gallery sharks and other large fish are displayed, here the intention was to involve the visitors in the display so animated water ripple effects were extended into to the viewing area as well as the cases. Again this effect was created by animation units on Minuette luminaires. Whilst on this subject, when specifying this type of equipment it is important to ensure that it is, or can be made suitable for the extend periods of use common in the museum environment. The daily hours of operation are long, also the life of displays can be up to, fifteen or twenty years in some museums therefore long term reliability and maintenance support are essential factors to be borne in mind when specifying all display and effects lighting as well as track and control systems.

CASE lighting is also a key component in most museums. With a display case all the preceding points are condensed into a very small space and it is therefore important to discuss case lighting with the exhibition designers early on in a project to ensure that there will be enough space for the lighting. There can be no general rule as to what is the correct solution as this will depend on the nature of the objects to be displayed and their positions within the case. What can be said is that the box full of fluorescent tubes at the top of the case is rarely satisfactory. Low voltage dichroic lamps can be used to great effect from within a top box providing they are freely positionable, however undimmed direct light from even a 20W dichroic lamp will exceed most conservation levels. The trick is to use careful focussing to spill light onto delicate objects rather than light them directly as this allows you to minimise dimming and so retain a good colour temperature.

When it comes to larger or undercut three dimensional objects top box lighting on its own is very limited and in these situations it is often necessary to introduce light within the case from other angles. Putting any light source in the same airtight space as the exhibit is unacceptable due to the inevitable heat rise within the case. This is where Fibre Optics are at their most useful as it is possible to position the fibre ends inside the case without risking heat build up or unacceptable Ultra-violet and lighting levels. The most economic use of Fibre Optics is to use short, high quality harnesses with a low voltage tungsten halogen light source, these will provide acceptable light levels and blend in with other T.H. sources: although, Fibre Optics tend to give a slight green tinge to the light. Fibre Optics can also be effectively used within the top box of a display case, alongside low voltage lamps, where there are particularly light sensitive objects such as paper or textiles. This approach was used extensively in The St. Mungo Museum.

A DIFFERENT approach is usually required for the provision of lighting systems for temporary exhibition areas. These can range from small art galleries with a rapid turnover of contemporary art to major exhibition spaces within national institutions, however the key criterion is always flexibility. This is flexibility in light levels, in positions for additional power or additional lighting for touring exhibitions. Conventionally this can be provided by extensive track systems, where track is used it is important to select a system that can mechanically and electrically stand up to the frequent movement of fittings, it is also wise to select a system that accepts more than one manufacturers track adaptor as this will provide the widest possible range of luminaires to choose from. However track is not the only solution. In the [Collective Gallery \(external link\)](#) in Edinburgh, UK, we used a steel ceiling, spotlights with magnetic bases and a grid of socketed power outlets, this provides the ultimate in positioning flexibility. The [Erco Optec spotlights \(14\)](#) we used have interchangeable spot and flood reflectors and also have self dimming transformers which are a great asset to flexibility. Specifying control systems for larger installations requires careful consideration of the daily operational requirements as well as the ease of programming and setting up for different exhibitions.

FINALLY whatever system you design it is essential to ensure that it can and will be maintained as you have designed it. This means specifying high quality equipment that can withstand the amount of use it will receive and carefully recording the relevant positioning and lamp data to enable accurate maintenance. But perhaps most importantly, being willing to provide on-going help and support to the users of the system since training in the use of lighting equipment rarely comes from any other source and even the best system can turn into a disaster after a little well meaning but untrained tinkering.

[© Copyright is retained by Kevan Shaw Lighting Design](#)

Footnotes: these footnotes are hypertext, clicking on the coloured title of the footnote will return you to your place in the text.

1. [...The Museum Environment...](#): Gary Thompson, 1978, The Museum Environment, London, Butterworth-Heinemann. Excellent text book written by a former Scientific Adviser to The National Gallery, London
- 2.
3. [...Ultraviolet \(UV\) content...](#): although exposure to light of any colour or composition affects sensitive material to some extent, the UV content of light is particularly damaging to sensitive exhibits and it should therefore be minimised. All public museums and galleries should be able to specify an acceptable UV level for their collection. This is usually measured in micro watts per lumen (uW/lm) of visible light. We do not believe that this is an appropriate method of quantifying UV exposure, but that is another story.
- 4.
5. [...Page & Park...](#): Page and Park Architects, The Italian Centre, 49 Cochrane Street, Glasgow, Scotland, UK.
- 6.
7. [...Colour rendering index...](#): all artificial light sources create a colour cast to some degree, i.e. they do not produce equal amounts of light all across the visible spectrum. Although the human eye is remarkably good at compensating for these colour casts, the eye cannot fully resolve colour if the only illuminating light is lacking a significant part of the spectrum. The colour rendering index is one method of measuring how accurate a light source is at resolving the true colour of objects. It is signified by the symbol Ra and is measured on a scale of one to one hundred, Ra95 being a near perfect score.
- 8.
9. [...Lux level required...](#): all light damages sensitive objects such as water colour paintings, drawing, prints, textiles, paper and other organic items, plus many more. Therefore, the Conservation staff responsible for collections set maximum light levels for various materials. See Gary Thompson's book for examples.
- 10.
11. [...The high UV emission of the capsule...](#): some manufactures (i.e. Osram) now produce as standard, open fronted dichroic lamps with "UV-Stop" coatings on the capsule. This article was written before "UV-Stop" dichroic lamps were on the market. It should be noted that despite the optimistic naming of these products, they do not STOP the UV but do reduce it, however UV output is still not as low as some manufacturer's borosilicate glass fronted lamps.
- 12.
13. [...Mode Electronics ET-105-SD...](#): after lamps, this is probably our most frequently specified item. It has lots of advantages over other manufacturer's transformers, but to tell you them all would be to divulge too many of our trade secrets.
- 14.
15. [...Dimming to greatly extend lamp life...](#): turn to the tungsten halogen section of most lamp manufacturers catalogues and you will find a small graph which correlates things like % of

rated lamp voltage against % rated lamp life and colour temperature. If you study these graphs they will show that 5% under voltage (i.e. dimming) will produce a much longer average life without significantly affecting the light output or the colour temperature.

16.

17. [...Multiload Technology...](#): Multiload Technology Ltd, London, UK, manufacture lots of equipment to protect and extend lamp life.

18.

19. [...Cascade failure...](#): cascade failure of low voltage lamps happens when there are several lamps all powered from one, unregulated, transformer; if one lamp fails it causes a power surge which can knock out another lamp which causes another power surge etc.

20.

21. [...Howard Eaton Lighting...](#): Howard Eaton Lighting Ltd, Lewes, East Sussex, UK, manufacture many theatrical lighting effects including custom effects.

22.

23. [...DHA Animation units...](#): this system of animated optical effects was designed (by Kevan Shaw when he worked for DHA lighting in London) to be an add on to standard theatrical luminaires. The range of effects possible is only restricted by the imagination and ingenuity of the designer but include running water, reflected water, fire, clouds and abstract effects.

24.

25. [...CCT Minuette lanterns...](#): a compact theatre profile luminaire which takes a 650W Tungsten Halogen lamp, for museum and gallery use this standard lamp has an unacceptably short life, we specify a different lamp which last up to 6 times longer.

26.

27. [...Erco Optec spotlights...](#): a very flexible range of low voltage spotlights with versions to take just about any lamp. The standard version for dichroic lamps should not, however, be used in museum and gallery situations without our custom variation.

28.

© Copyright is retained by Kevan Shaw Lighting Design