Session 9: Colour and Environment

Potential uses for spectrally variable lighting in museum environments

Danny Garside[1], Lindsay MacDonald[1], Kees Teunissen[2], Katherine Curran[1], Capucine Korenberg[3], Stuart Robson[1]
[1] UCL, London, UK
[2] Philips Lighting Research, Eindhoven, The Netherlands
[3] British Museum, London, UK

In museum environments current practice is to specify lighting with a high Colour Rendering Index (CRI) [1,2], producing object colours which can be considered as roughly faithful representations of how the objects would appear under natural illumination, or artificial illumination of a rudimentary nature such as candlelight or tungsten filament. Whilst this could serve one potential aim for museum lighting, we ask here how other aims might be served, especially if spectrally variable lighting is considered.

In Viénot's 2011 paper [3] a procedure was presented for enhancing the appearance of faded objects, such that they might better resemble their original appearance. This procedure was demonstrated using a pair of Galapagos finch specimens (from the Muséum national d'histoire naturelle collection) of different ages, such that the older (and more faded) of the pair was made to resemble the newer specimen. This was accomplished through the use of LED combinations which induced predictable colorimetric shifts. Notably, the lights used to create this effect were spatially homogenous (as opposed to other visual restoration projects, see Rothko restorations and Hampton Court Palace tapestry restoration [4]) and metameric to a broadband phosphor white LED. Such lighting would differ from a natural light source by design, and consequently have a lower CRI value.

Whilst still in some ways representing the notion of fidelity, the difference here is that original colours are the target, instead of current colours. This movement away from colour fidelity as it has traditionally been used raises some interesting questions about representation of objects in museums, and the role of museums in making choices regards representation. If an object can appear as it was originally intended, should it be displayed as such? What if displaying it as such was incrementally more damaging to the object, and would shorten its usable life span? Even for the display of modern materials, such lighting has been shown to be preferable in some situations, for its ability to render colours more saturated than would be the case under natural illumination [5,6] and more in keeping with our memories of previously seen colours [7]. The possibility that preferred CCT is object specific has been explored [6].

Currently the cost of using spectrally optimised lighting, both in general and where individual variations are considered on an object-by-object basis, is prohibitive. But it is conceivable that in the near future this type of lighting could become practicable, and it is prudent to consider the potential of the increased flexibility offered by such configurable lighting, in advance of its availability. If one had access to such equipment at a reasonable price, how would it be best used in a museum environment? It is already quite possible to procure light sources which can render specific object colours as more saturated than a reference light source would, but these light sources will have a low colour rendering index, because of the colour distortion they cause. Use of a 'gamut area' type index might help to describe these light sources better, but the specific colours affected would still not be described.

The potential for using spectrally variable lighting in museums to control colour rendering, beyond fidelity, is broad, and warrants consideration. Questions about the role of museums in representing 'truth' are raised by the potential flexibility that spectrally variable lighting provides. The ability of museum curators to cater for aims such as those discussed above will be much enhanced by the development of appropriate colour rendering indices.

References

[1] Chartered Institution of Building Services Engineers. *Lighting Guide 8: Lighting for Museums and Art Galleries.* London: Society of Light and Lighting : CIBSE, 2015.

[2] Museum of London. *Museum of London Lighting Policy*. Advanced draft (2016)

[3] Viénot, F., Guillaume C., and Bertrand L., (2011). "LEDs as a Tool to Enhance Faded Colours of Museums Artefacts", *Journal of Cultural Heritage 12, no. 4:* 431–440. doi:10.1016/j.culher.2011.03.007.

[4] Hecht, J., (2015). "Light Repairs Art: Optical Overlays Restore Faded Masterworks." Optics and Photonics News 26, no. 4: 40. doi:10.1364/OPN.26.4.000040.

[5] Ohno, Y., Fein, M., and Miller, C., (2015) "Vision Experiment On Chroma Saturation For Color Quality Preference", CIE Proceedings, 28th Session. Proceedings Volume 1. Part 1. CIE 216:2015 ISBN 978-3-902842-55-8

[6] Liu, A., Tuzikas, A., Zukauskas, A., Vaicekauskas, R., Vitta, P., Shur, M., (2013) "Cultural Preferences to Color Quality of Illumination of Different Artwork Objects Revealed by a Color Rendition Engine", *IEEE Photonics Journal 5, no. 4*: 6801010 doi:10.1109/JPHOT.2013.2276742.

[7] Bartleson, C., (1960)"Memory Colors of Familiar Objects", *Journal of the Optical Society of America 50, no. 1*: 73. doi:10.1364/JOSA.50.000073.