Poster

The Perception of Brightness at Conservation Light levels in Museum Environments

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Introduction

Despite continued improvements in the quality of LED sources, tungsten halogen is still the dominant light source in museums and galleries around the world. The $74m refurbishment of the National Museums of Scotland (completed 2011) uses over 1,000 low voltage TH spotlights to illuminate the exhibits. The dim, warm glow of conservation lighting remains the norm. However, as energy legislation is tightened and LED technology becomes more affordable, LED luminaires will become standard. Should/could these LEDs emulate TH sources? For museums that adopt LED, what is the best colour temperature for low light conservation galleries?

The author's empirical experience from 20 years of lighting conservation galleries is that TH sources with a higher colour temperature enhance the perceived brightness of exhibits. Could this empirical evidence be replicated experimentally and could it be used to identify the best colour temperature for LED sources in low light galleries?

An Experimental Gallery

A faux exhibit was set up with two identical monochrome prints side by side. A dimmed 50w low voltage TH source illuminated the left hand 'target' print. The right hand print was illuminated by a user dimmable 20w TH, (producing a relatively cooler light for equal illuminance). After a period of adaption, 22 subjects viewed both prints and adjust the 20W source to match the 'brightness' of the left hand 'target' print. This task was carried out with nominal target illuminance of 50lux and 100lux (presentation order was randomised).

The tests were then repeated with high quality remote phosphor LED spotlights.

Results

For the nominal 50lux tests, 21 of 22 subjects set the cooler light source to a lower illuminance to achieve an 'equal brightness'. The mean illuminance of all 22 results was 22% lower than the target source. For the nominal 100lux tests, all 22 subjects set the cooler source to a lower illuminance with a mean illuminance 31% lower than the target source.

Although it was expected that this effect would be replicated with warm and cool LED sources, the tests with dimmable 3,000K and 4,000K LED sources had no consistent pattern and displayed no correlation with the TH results. Furthermore, many test subjects reported having great difficulty in brightness matching the two LED sources.

Conclusions

For museums and galleries using TH, illuminance can be reduced, or perceived brightness of sensitive exhibits can be enhanced, using the cooler light of low wattage less dimmed TH sources.

LEDs sources cannot be considered as simple like-for-like replacements for TH in conservation lighting. Further work is required is required to determine the most effective colour LED temperature range and spectral power distribution to enhance brightness perception in low light galleries.

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Further information

For graphs showing results and further information contact: m.innes@napier.ac.uk or visit: www.lightartist.info/brightness.