Comparative Study Examining Various Approaches to Reducing Exposure to High-Energy Visible Light from Digital Devices

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Purpose:

To evaluate the effectiveness of various available methods to reduce exposure to high-energy visible (HEV) blue light emitted from digital screens.

Methods:

- The spectroradiometer PR-670 (ver. 3.18) was used to acquire transmittance spectrum data, as well as photometric, colorimetric and color temperature measurements.
- Screens measured: handheld digital device (Iphone 6s plus) and a laptop monitor (2015 Macbook Pro 15). A white screen (RGB: 255,255,255) was used as the target display.
- Measuring distance was set at 16 inches from the target with a 0.5 degree aperture.
- Three different lens setups were used: no lens, a standard lens with anti-reflective coating (Nikon SeeCoat Plus), and a lens with blue-light blocking properties (Nikon SeeCoat Blue).
- Software condition settings: default and either Night Shift© (iOS 9.3.1) mode or f.lux© (ver. 36.6).
- Each lens was tested under 0%, 25%, 50%, 75% and 100% brightness settings.

Results:

- The peak wavelength measured on the digital device screens was 448nm with a color temperature of 6900K.
- At maximum brightness, the lens with anti-reflective coating resulted in a 1% reduction in luminance while the blue-light blocking lens caused a 3-4% decrease.
- Night Shift© and f.lux© software decreased luminance by 29% and 39%, respectively, at maximum screen brightness settings.
- A shift in color temperature was measured for all HEV light-reducing methods, with f.lux © showing the greatest amount of shift from 6900K to 3550K.
- Adjusting the screen brightness to lower settings produced the greatest reduction in HEV light; a moderate reduction was seen by blue-light reducing software compared to blue-light filtering lenses.

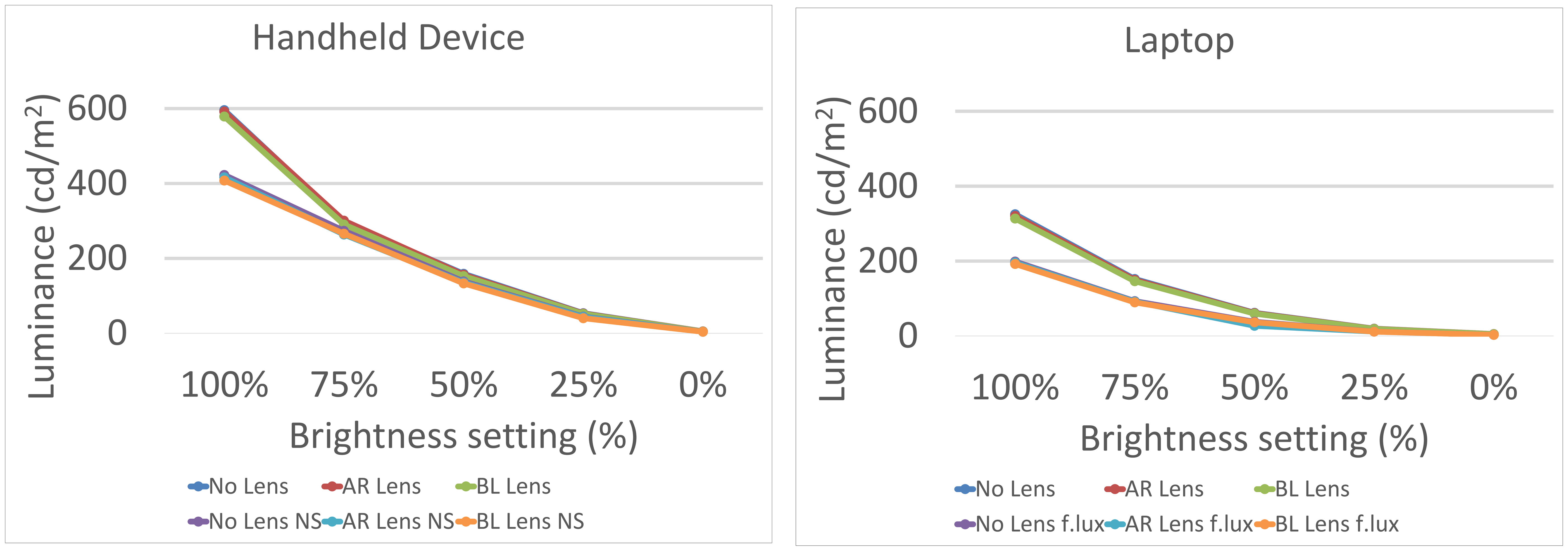

Figure 1. Luminance (cd/m²) plots for a handheld device and a laptop.

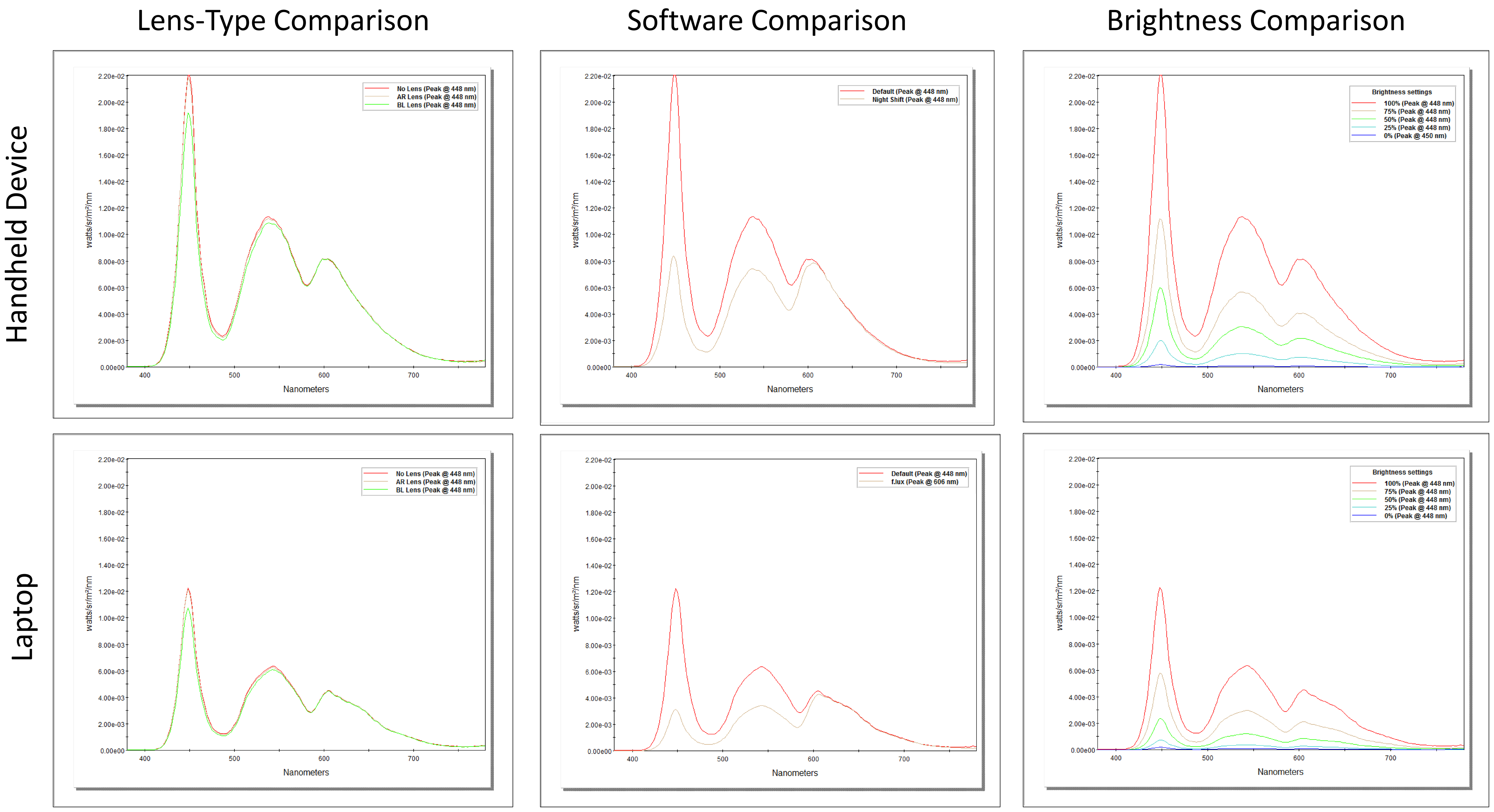

Figure 2. Spectral radiance graphs of the various study design methods.

Conclusion:

Reduction of HEV blue light from digital devices can be achieved by dimming the screen brightness, using applications to change the screen colour temperature and wearing lenses with blue-light reducing coatings / filters. The greatest reduction in HEV light was achieved by adjusting the screen brightness parameters.

References:

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Acknowledgements: Special thanks to Dr. Jeff Hovis for loaning the spectroradiometer for use in this study.