Title
Architectural Lighting Vs. Horticultural Lighting – are they related??

Authors
Manju Dileep, Hussain Burhani & Dr. Amardeep M. Dugar

Abstract
This poster describes a two-part research, which aims to explore the relationship between architectural lighting and horticultural lighting. In providing generalisations about architectural lighting to ensure the appropriate functioning of human visual and circadian systems, researchers have identified characteristics such as quantity, spectrum, timing, duration and spatial distribution. Interestingly, horticultural lighting also identifies characteristics that include quantity, spectrum, timing, duration and spatial distribution to ensure the appropriate growth of plants. LED technology has revolutionized architectural lighting in a never before seen manner with innovations such as miniaturization, Bluetooth mesh, real-time data, Internet of Things (IoT), LiFi, etc. Horticultural lighting is LED technology's most explosive new market, revolutionizing the future of farming with innovations enabling year-round sustainable fruit, vegetable and flower cultivation. Additionally, LED technology for horticulture can help overcome the global food crisis and scarcity of land available for farming and utilizing unused indoor spaces. So is there a relationship between architectural and horticultural lighting? If yes, how can designed LED lighting meet the diverse requirements for both humans and plants within the same space?

The first part of the research explores the use of full spectrum white (4000K) LED light sources for growing plants in available indoor spaces. As the popular belief prevalent is that plants grow best under daylight, this first part of the research hypothesizes that full spectrum white light (4000K) which mimic the qualities of daylight are best suited for plant growth. To support this hypothesis, the growth of three different vegetable species – namely lettuce, parsley and tomato – was compared under four different experimental LED lighting conditions – namely typical grow lights of specific red and blue spectrums ranging from 460-660nm, a combination of grow lights and white lights containing full range of spectrums from 380-730nm, white lights (4000K) containing continuous spectrum of 400-750nm, and natural daylight. The results of this first part provide substantial evidence that the chosen species of vegetative plants lighted under full spectrum (4000K) white sources reported faster growth and better health. Therefore it can be concluded that LED light sources used for architectural lighting applications can also be used for horticultural lighting applications.

The second part of the research explores how LED lighting can be designed to meet the diverse requirements for both humans and plants within the same space. As the popular belief prevalent is that plants grow best under grow lights, this second part of the research hypothesizes that luminaires used of architectural lighting applications can also be used for horticultural applications. To support this hypothesis, two live experimental installations of plants illuminated with architectural luminaires (3000K and 4000K) were setup within usable interior spaces inaccessible to daylight – namely an office meeting room and a residential corridor. End-users of both these spaces were interviewed before and after the installation in order to understand their behavioral response. The results of this second part provide evidence that while the luminaires

used for architectural applications can be also used for horticultural applications, specific measures have to taken to ensure the lighting meets the diverse requirements of both humans and plants. While plants require a specific high illumination levels ranging between 500-1000lux, the luminaires have to be appropriately shielded in order to prevent glare for humans. Also the spatial distribution of the lighting has to be such that while catering to the biological needs of the plants it also provides visual interest for users of the space. The poster provides further avenues for research is this realm to arrive at lighting design models and standards that can cater to both human and plant needs in interior spaces inaccessible to daylight.