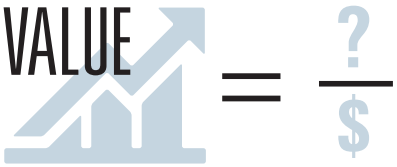
By Mark Rea

Good intentions and discussions of lighting quality are important, but to engineer lighting value we have to be able to measure benefits as well as costs

What is value? Simply put, value can be defined as benefit per cost. The costs of lighting are usually well defined—initial, operation, maintenance. So, value can be increased by reducing cost. But just because something is cheaper doesn't make it more valuable. Often the opposite is true—examples can be readily found from cars to coffee.

"Value engineering" as it relates to lighting has become synonymous with cost reduction. The reason the numerator in the value ratio is ignored is because, implicitly, one needs to meet a recommended illuminance level (the presumed benefit) and the only way to value engineer the lighting is to reduce its cost. Thus, our collective obsessions in the specification community with lighting energy, maintenance and life.

But what if a recommended standard does not reflect the expected benefit? Meeting an inappropriate standard while reducing costs can make the actual value of a lighting system lower, not higher. For example, in the early 1980s, Georgia Power—in its zeal to demonstrate lower energy costs—installed high pressure sodium lamps into its corporate office.[1] They met the recommended illuminance levels and reduced the energy costs, but brought the value of lighting to a point where people refused to work in the building.



What's interesting about this example is that Georgia Power never questioned the recommended illuminance level (the presumed benefit). With a few exceptions (uniformity, color rendering, explosion protection), higher recommended standard illuminance levels are synonymous with greater benefits. We recommend 500 lx for office work such as reading a print document with small type, but only 100 lx for sweeping floors.[2] Reliance on illuminance level as the primary measure of delivered benefit is like the old saying, "If the only tool you have is a hammer, everything looks like a nail." If one must adhere to a recommended illuminance level, every application looks like a cost (energy, life, maintenance) reduction story.

BROADER MEASURES

The eye converts light into neural signals that enable humans to process information about potential threats and opportunities in the environment and to support non-visual functions like circadian entrainment to our local position on Earth. Although light is officially defined in terms of the photopic luminous efficiency function [V(λ)], it actually represents the eye's spectral sensitivity to light by only one of several channels discovered by neuroscience research. V(λ) was all we really knew about the eye's response to light in 1924, but we know a lot more now. Remarkably, however, we as a lighting community have functionally ignored neuroscience for nearly a century. By making our lighting recommendations based upon the hammer of photopic illuminance levels, rather than a broader and deeper understanding of our visual and non-visual responses to light, we devalue lighting for society and, indeed, for ourselves as lighting professionals. In fact, because we

ignore neuroscience, we waste energy, create light pollution, and perhaps more importantly compromise human safety, health and well-being.

If we are to make real progress in lighting, we need to focus on value, where the benefits we deliver are just as important and quantifiable as the costs. Good intentions and discussions of lighting quality are important, but to engineer lighting value we have to be able to measure benefits as well as costs. If we can't define the benefits, and if we can't measure the benefits, the old definition of value engineering will persist, namely, to meet an illuminance recommendation at the lowest cost.

In my recent book, *Value Metrics for Better Lighting*, I describe several tangible benefits provided by lighting and a set of metrics rooted in neurosciences to characterize those benefits. The important point of the book is that new benefit metrics can be measured and prescribed as easily as we presently measure and prescribe photopic illuminance levels. This new approach to value engineering, one where benefits as well as costs are formally considered, opens up untold opportunities for lighting companies and professionals and, more importantly, for human welfare and the environment. If the benefits as well as the costs are considered, we will be able to better meet societal expectations for lower energy expenditures, with fewer negative impacts on our environment and better personal security, driving safety, color quality and circadian regulation as it affects health.

In future essays under this banner, more detailed discussions of new metrics aimed at increasing the value of lighting will be described by experts in neurosciences.

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REFERENCES

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