

Lighting efficiency or lighting effectiveness

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As Spanish lighting designer Rafael Gallego has said, lighting efficiency is not everything. He states that he would much rather have lighting that was effective instead of lighting that was simply efficient. This statement strikes at the heart of what it is to be a designer. He recognises that good design is multifaceted and often cannot be easily quantified with simplistic measurements. Calculating the amount of energy used by a light source to create a given quantity of visible light will give you some measure of how efficient that particular light source may be. (Rea 2013, p.7) Efficient light sources that use relatively low amounts of electrical power are rightly considered to be desirable, but this quantification has no context. The light source is intended to be installed in a light fitting which, in turn, is installed into a building to illuminate an object or a space. It is only in the context of how the light source is ultimately used that it becomes truly effective. The most efficient light source in the world could be rendered useless if it is badly used. If it is inside a deep black recess or hidden behind building structure or opaque materials, the effective light will be severely diminished. Mark Rea, director of the influential Lighting Research Centre in New York, has noted,

“Those sources or fixtures that emit more lumens per watt of electric power are often considered ‘energy efficient’, but... this measure of ‘energy efficiency’ can easily obscure the efficacious application of light.” (Rea 2013 p.7)

Also implicit in Gallego’s use of the words ‘effective light’ is the notion that the intended function of the light is a critical factor. If the design intent is to illuminate a small sculpture so that it stands out clearly from its surroundings, then an indiscriminate wash of unflattering light from a super efficient LED floodlight luminaire is not going to be as effective in that task as a small narrow beam spotlight. The light source used in the spotlight may have a much lower efficiency, but if it puts all of its light only where we want it to be, it is likely to be the most effective solution.

The experienced designer may prioritise the efficacy of the whole installed design over the simplistic and contextless quantification of the efficiency of the light sources used in the design. In this way, real energy efficiency is achieved through the use of effective light - only using light where it is needed, when it is needed and only for the intended purpose. Effective lighting design appreciates the contribution that each source of light makes to the whole three dimensional composition. As architect Louis Khan said, “Even a space intended to be dark should have just enough light from some mysterious opening to tell us how dark it really is.”

Thinking about the contrast between effective and efficient lighting begins to

cut to the core of what it means to be a lighting designer. It begins to remove the fog that surrounds that most thorny of questions: What is lighting for?

If architectural lighting exists simply to allow people to see, then maximising visual acuity seems like the most sensible action. As is explained in countless textbooks, visual acuity is broadly proportional to the quantity of illuminance in the scene. So, within the boundaries of comfortable viewing conditions (i.e. not excessively bright), more light means better vision. Even in the Renaissance, this fact was clear, as Leonardo da Vinci noted, "Since we see that the quality of colour is revealed by means of light, it is to be deduced that where there is more light will be seen more of the true quality of the illuminated colour."

This empirical knowledge about light appears to support a quantified engineering approach that has illuminance levels as its main preoccupation. But, what about the quality of light? What about the direction of light? What are the qualities of the shadows created, the brilliance of shafts of sunlight, the subtle colour shifts between sunlight and skylight, the contrast? All the aspects of a natural scene that inspire us deeply and bring joy to our eyes are the kinds of lighting effect that tend to be written out of quantitative lighting practice.

In my own work, I have come to realise that I constantly use natural lighting conditions as a yardstick to qualify my design ideas. It is not that I am always striving to perfectly replicate natural lighting conditions, but I can rationalise a design approach based upon its similarity or divergence from natural lighting. As natural lighting conditions are a ubiquitous part of the human experience, this gives me an insight into how other people may respond to my lighting design proposals. In this context, the bland uniformity of light that we regularly experience in office spaces is reminiscent of an overcast sky - perhaps not the most inspiring or joyous of natural lighting conditions. The selection and arrangement of lighting in this mythical office may be efficient at putting a desired quantity of light on the desktop (and at creating an overcast effect), but does the lighting really deliver everything that it could? Could it be more effective?

Designers recognise that there are no simple answers to any challenges. This is partly because, ultimately, we are designing for people and the one thing that defines different people is the difference. We all have our own preferences and desires, so one size of design rarely fits all. And yet, we do rely on guidance, probably built upon solid experimental evidence, to tell us what may serve the majority well. Nevertheless, it is the designer's role to always question the applicability of any guidance, standards or codes of practice. As Harvard University psychologist Rudolf Arnheim said, "A most common form of unintelligent behaviour consists precisely in the misuse of constancy, that is, the assumption that what was true before must be true this time." This is a pervasive feature of most use of lighting guidance, the idea that what worked in one situation should automatically work in another, the idea that for each type of built environment, there is a single solution that will work for all viewers, or at least

average viewers.

Lighting guidance documents are not devoid of the idea that the end users are individuals and, as such, preference may have some role in lighting. The SLL Code for Lighting (Boyce & Raynham 2009) acknowledges that: “While it has been shown that people can identify better quality lighting and prefer it, there is no effect of lighting quality on task performance other than where there are differences in task visibility.” This seems to suggest quite clearly that lighting quality has no impact upon performance, however, no measurable positive effect must conversely mean no detrimental effect.

If users are recognising an aesthetic improvement in the lighting, there has been some quantifiable difference in the perception of their lit environment. Whilst, in lab based studies, this may not translate into measured improvements in productivity, other workplace based studies do place value on the aesthetics of working environments where, “perceived environmental attributes, neighbourhood and workplace design characteristics are associated with well-being and job satisfaction” (Schell et al. 2012, p.1430) Indeed, in their study of over 1,900 workers, Schell et al. (2012) concluded that, “the findings indicate an independent role of ‘aesthetic’ needs as an important work-environment factor.” Furthermore, they note that, “health management may benefit on-the-job productivity if expanded to target aesthetics.”

So, it becomes clear that, if we choose to look beyond the narrow confines of lighting guidance and orthodoxies, we can find evidence that begins to explain what designers feel to be right - lighting effectiveness and efficiency are not the same thing and that lighting aesthetics are important. It may be much harder to quantify lighting effectiveness or aesthetics, but that does not mean that it is the wrong approach. In the research quoted in the SLL Code for Lighting, users can identify and prefer better quality lighting, this is all we really need. After all, the role of design is to deliver a better experience, whether that improvement is tangible or not. Just because we don’t have a way to measure effectiveness (yet), does not mean that light source efficiency is a good indicator of quality.

References:

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