

Seeing the Difference

The Importance of Quality Lighting in the Workplace



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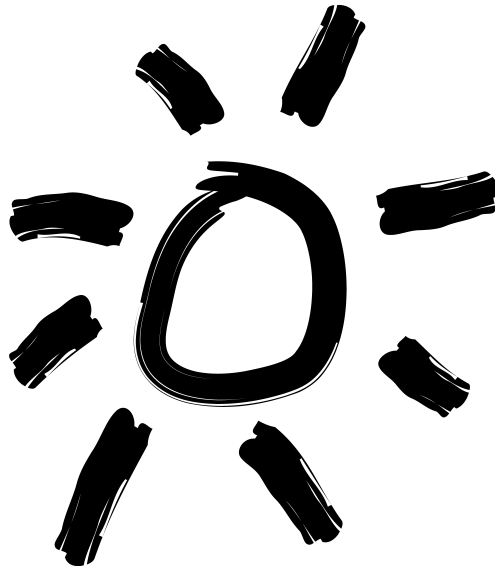
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From the moment we are born,
light defines and punctuates our lives.
It inspires and motivates us.
It frames our experiences
and illuminates our memories.
We use light to describe what we see,
how we feel, and what we do.



Lighting: why it matters.

Research demonstrates that light has a profound impact on people — on their physical, physiological, and psychological health, and on their overall performance — particularly in the workplace. And yet, despite having an intuitive understanding of the importance of light, as well as research-based data that proves its significance, we often fail to give it adequate consideration when planning for the workplace.

A smart investment

Like many other elements we take for granted — such as air — we just don't think about lighting. We assume it's been designed and planned to provide the best results. Unfortunately, while there have been significant developments in lighting technology, much of it hasn't been applied to support how people currently work.

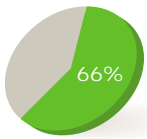
Computers are universal work tools today. While computers bring an ease and speed to work, they also can create some physical challenges, particularly because most office lighting systems primarily support paper-based work. Consequently, we struggle with adjusting our eyes as we move from computer screen to white paper to glossy magazine — and make those adjustments hundreds of times a day. The result? Headaches, physical stress, and lost productivity.

You can invest a great deal in your facility — in high-profile architecture, in furniture, in state-of-the-art technology. You can invest in all of these things... but without a quality lighting solution, you still may not realize the full value of your workplace investment.



How light affects us.

When we think about lighting in the workplace, the first thing that comes to mind is the obvious physical effect it has on us. Inappropriate lighting can lead to a host of problems, ranging from eyestrain to serious musculoskeletal injuries. In fact, more than two-thirds of those responding to a Steelcase Workplace Survey (April 1999) indicated that they experienced serious physical problems associated with a poorly lit workplace. This isn't new. These responses are consistent with what people have been saying in studies and surveys for years.



The results are in.

Two out of every three people who responded to a Steelcase Workplace Survey said they had experienced physical problems resulting from a poorly lit work environment.

The physical effects

- Workers surveyed by the Kensington Technology Group (1998) listed eyestrain as a leading cause of physical stress in their workplace.
- According to a 1997 study sponsored by the American Society of Interior Designers (ASID), 68 percent of all office workers were concerned about their lighting. Office workers consistently rated poor lighting as the first or second concern that needed to be addressed. In addition, they rated the physical workplace third, after compensation and benefits, in the list of factors that influenced whether they accepted or left a position.
- The *Steelcase Worldwide Office Environment Index* conducted by Louis Harris and Associates (1991) found that 64 percent of computer users listed eyestrain as the number one health hazard in the workplace.

These aren't just isolated complaints. The experiences of these people reflect genuine patterns of user discomfort and dissatisfaction that translate into the potential for substantially reduced productivity. Historical studies reinforce this strong relationship between light quality and productivity. ☞

Measurable differences

The Cornell University Study (1989-1990) of a Xerox facility in upstate New York found that 24 percent of the workers in a poorly lit environment reported a loss of work time due to vision problems and discomfort. In most cases, the time lost was well over fifteen minutes per day — a two percent productivity loss per individual, per year. To help measure this, it would be equivalent to giving everyone in an organization an extra week of paid vacation per year.

The Reno Post Office Study (1986) suggests that quality lighting is more than a luxury. When the Reno Post Office set out to trim their energy costs by replacing their direct lighting with an indirect lighting system, they saved on electricity and also realized an unexpected benefit of a sustained six percent increase in worker productivity. This increase was enough to recover the cost of the new lights in less than a year.

The physiological effects

While the physical impact of lighting is obvious, its physiological and psychological impact can be just as strong. Light sends a visual message which can affect mood and motivation levels. Light also affects our biological clocks in the following manner. It is well known that *circadian rhythms*, such as sleeping or waking cycles, are influenced by light. Many business travelers use melatonin in tablet form to help them maintain their work efficiency and performance when they travel to locations in different time zones. What many people don't realize is that simply increasing their exposure to light could also help them naturally alter their melatonin levels.

In addition, researchers suspect that *Seasonal Affective Disorder (SAD)* is associated with a disruption in circadian rhythms. Though researchers don't know exactly why, light therapy appears to relieve the depression and lack of energy associated with SAD.



Balancing your internal clock.

Light is believed to have a strong synchronizing effect on our *circadian rhythms* — the patterns of activity that occur within a 24-hour cycle. The hormone melatonin also helps keep the body's circadian rhythms, or biological clock, in balance.

“In the future, research on light’s physiological and psychological effects will lead to the development of new workplace lighting products and applications that not only provide physical comfort, but also improve health, motivation levels, and ultimately, work effectiveness.”

Angela Nahikian, Manager of Market and Business Development for Lighting, Steelcase Inc.

Achieving light quality.

Understanding the importance of light quality is one thing, but achieving it in your own environment is something else. To get there, you need to understand what it means to have quality lighting, and how to plan for it.

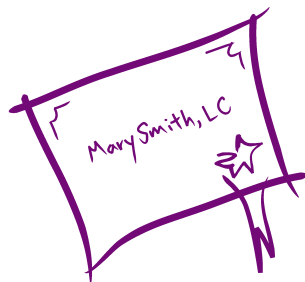


Pick up the phone.

There are several ways to find a professional lighting consultant. Contact a well-respected, full-service architectural firm in your area to help identify a reputable, professional lighting consultant. You can also get in touch with a lighting consultant through the Illuminating Engineering Society of North America (IESNA) or the International Association of Lighting Designers (IALD).

Make lighting part of initial architectural and interior design discussions. Too often, lighting is treated as an afterthought in facility and design planning. Once the overall architectural design and interior layout have been established, opportunities to provide a well-integrated, quality lighting solution are severely limited. Early decisions such as ceiling height, window size, and placement of offices are all critical to the effect lighting will have on a space. Surface finish choices also have a significant impact on lighting design.

Engage a lighting professional. One of the best ways to ensure a quality lighting plan is to arrange for the initial and ongoing collaboration between your architect, interior designer, *and* a lighting professional — a role that is frequently overlooked. Depending on the expertise of your design team, a lighting specialist can either manage the actual lighting design or serve as a consultant to the team. Either way, a lighting professional brings unique and valuable skills to the design process.



Credentials count.

Ideally, lighting designers and consultants should be Lighting Certified (with an "LC" after their name), or be actively pursuing certification. Ask them to show you qualified references for projects similar to the type and scale of your project. It's a good idea to interview a few candidates and visit environments where their designs have been installed and operating for at least a few months.

Ten things a quality lighting solution should deliver.

Several factors must be addressed when developing or evaluating your lighting plan. Your goal is to create a final design solution that reflects your unique priorities and objectives.

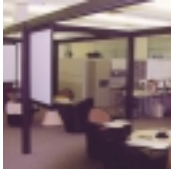
A quality lighting solution should...

- 1. Support the task at hand.** Lighting needs vary based on the type of work being performed at any given time. Working with files and paper documents, working on a computer, and working face-to-face in teams — all these activities require distinct lighting conditions. People should be able to see their work without suffering under insufficient or excessive illuminance and glare. To that end, the IESNA (Illuminating Engineering Society of North America) has established quantitative lighting criteria for specific tasks and environments. These criteria provide a good foundation for a quality lighting solution and are covered in greater detail later in the paper.
- 2. Accommodate the individual.** People have a fundamental desire to control their environment — having control over their lighting conditions is no exception. Our personal lighting preferences are shaped by the number of hours and the time of day we work, as well as our ages, personal styles, and even our work cultures. Introducing task lighting and lighting controls such as dimmers are two good ways to help people adjust lighting to meet their individual needs and preferences.
- 3. Integrate lighting controls.** Lighting controls are the nerve center of a lighting system. What once was a combination switch and a dimmer is now a pre-programmed lighting control system designed to support multiple work tasks and activities in an environment. Centralized building lighting systems integrate daylighting and allow entire building complexes to be controlled on-line from anywhere in the world. Occupancy sensors, which automatically turn on lights only when someone is present, are employed more liberally throughout both open plan and private offices to save energy and dollars. ☞

Ten things a quality lighting solution should deliver.

(continued)

A quality lighting solution should...



Lighting success story: AOL

America Online worked with Steelcase to find a cost-effective way to minimize glare, create a comfortable working environment, and anticipate future space changes.

4. **Be energy efficient and environmentally sensitive.** Protecting the environment is good for business. According to the Energy Efficient Lighting Association (EELA), lighting is responsible for 20-25 percent of the country's energy consumption. Commercial and industrial buildings are responsible for 50 percent of the lighting bill. In leading states like California, energy codes are becoming increasingly restrictive in an effort to reduce light-related energy use. Keeping ambient light levels lower and making better use of task lighting will help minimize energy consumption by concentrating light where it is needed most — close to the worker. Combining this with the use of energy efficient sources and intelligent lighting controls will allow the creation of a lighting plan that supports worker performance and the environment while improving the organization's bottom line.
5. **Be maintainable and sustainable.** A good lighting environment on day one is of little value if it is not or cannot be maintained over time. A quality lighting plan considers the location, durability and serviceability of lighting components. It also considers the building owner's overall commitment and ability to maintain the lighting system over its lifecycle.
6. **Be well-integrated.** Lighting orients us. It helps us define and understand our environment. Effective lighting solutions should be completely integrated with the architecture and support the design intent of the space. Lighting equipment should address performance objectives and reinforce the aesthetic, but not dominate the space.
7. **Reinforce an organization's image and culture.** Light forms the perception of space and gives visual clues as to what happens there. A well-designed lighting environment supports a professional, positive workplace atmosphere and reinforces an organization's image and culture. ☞

A quality lighting solution should...

8. Consider both initial and lifecycle costs. Establish a lighting budget proportionate to the total cost of your building. Skimping on your lighting solution will diminish the return on your overall investment. Carefully consider lifecycle costs. Often solutions that provide the lowest first cost are more expensive to operate and maintain in the long run.

9. Integrate natural light. Natural daylight can reduce the demand on the electric lighting system. Windows provide the added benefit of exterior views and the ability to connect people to the outside world. This connection can provide significant psychological and physiological benefits. However, controlling glare and excessive light levels from daylight is as important as integrating it into the plan.

10. Be re-evaluated periodically. The nature of your lighting system will dictate how often you need to revisit and re-evaluate your lighting plan. A good rule of thumb is that you should revisit your lighting plan whenever there is a substantial or significant change in your:

- workplace environment (e.g., remodeling)
- work process (e.g., paper-based work to computer-based work)
- work force (e.g., an aging work population)
- workplace technology (e.g., larger computer monitors)
- lighting technology (e.g., advancements in lamp technology)



Lighting success story: AvMed

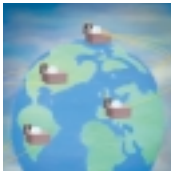
AvMed Health Plan, an \$800 million non-profit HMO, needed a lighting plan for their new facility. Steelcase showed AvMed how to minimize glare and create a healthy and comfortable visual environment for employees.

The key components of quality lighting.

Quality lighting design is a layering of light to create optimum comfort, safety, and delight for the individuals working in a particular space. A quality lighting solution has three key components: ambient, task, and accent lighting. The successful blending of these three lighting components creates a holistic workplace lighting solution.

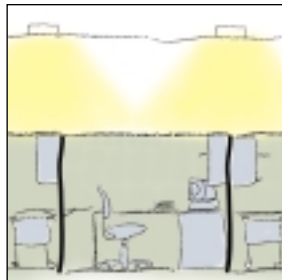
Ambient lighting

Ambient lighting provides the overall illumination in the work environment. There are two types of ambient lighting:



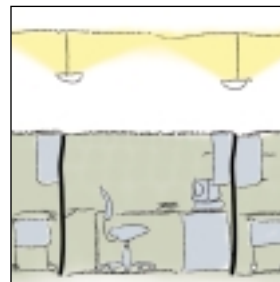
Need a light?

Every year, Steelcase Inc. provides lighting for 500,000 people in offices worldwide. If placed end-to-end, these lights would stretch nearly 500 miles — the distance from Paris, France to Munich, Germany or from Bogotá, Columbia to Panama City, Panama.



Direct ambient lighting distributes light directly downward. Lights with parabolic louvers help reduce some glare, but their effectiveness depends on where you happen to be positioned relative to the light source. These lights often create shadows and computer screen glare, and can contribute to an overall sense of dimness in a space.

Indirect ambient lighting distributes light upward and reflects off the ceiling. When applied, it can reduce direct and reflected glare to an absolute minimum. Its soft, diffused illumination has proven to be more comfortable for computer users than direct lighting sources like deep cell parabolics. Indirect lighting can create an overall sense of brightness. ☞



Task lighting

Task lighting supplements ambient lighting by filling in shadows and provides additional light needed for focused work that requires higher light levels. Task lighting is playing an increasingly important role as ambient light levels are reduced due to the prominence of computer usage and the ecological importance of saving energy.

Accent lighting

Accent lighting completes the lighting environment and is a powerful element of a lighting system. It can be used very practically to provide fill light to finish and balance the ambient light. It can be used artfully to highlight unique objects or reinforce an aesthetic tone. It can draw people through a space or provide visual relief in areas without daylight. Skillfully applied, accent lighting can transform the perception of space.



**Lighting controls:
saving energy
and money.**

According to the Energy Efficient Lighting Association, using lighting controls such as occupancy sensors can reduce workplace energy use by 20-50 percent. Lighting controls add to the efficiency and customization of a workplace lighting plan — and today, this technology is more advanced and affordable than ever before.



A holistic lighting solution. Indirect ambient lighting and task lighting, combined with carefully selected surface materials, create an inviting, comfortable work environment.

Performance criteria for quality lighting.

Lighting criteria are a universal set of lighting performance objectives established by the Illuminating Engineering Society of North America (IESNA). These criteria provide quantitative lighting standards based on the needs of specific tasks. Lighting designers use these criteria, along with qualitative criteria, as the basis for creating comfortably lit work environments without glare or extreme contrast.

Three key criteria

Horizontal illuminance is the amount of light on horizontal surfaces, such as work surfaces. Light must be sufficient and uniform enough to allow you to read printed text, review drawings, and perform other tasks. Horizontal illuminance is effectively achieved by combining ambient and task light.

Vertical illuminance is the amount of light on vertical surfaces, such as office walls, computer screens, and paper placed on document holders. Lower and more uniform levels within the immediate work area are generally recommended because high vertical illuminances can cause *veiling reflections* on computer screens. Higher levels at strategic locations within the architectural environment are often recommended to contribute to a brighter, more pleasant workplace.

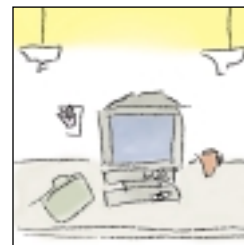
Ceiling luminance uniformity is the degree to which the light across the ceiling appears even. The more even it appears, the less chance you'll see it as reflected glare on your computer screen.



Horizontal illuminance



Vertical illuminance



Ceiling luminance uniformity

A quick summary.

Here's a brief recap of the major points discussed:

To fully realize your investment in both your people and your facility, don't overlook the importance of quality lighting.

Light has a significant impact on our performance in the workplace. Research shows conclusively that when you get it right, a quality lighting program can boost productivity and performance, reduce fatigue and eyestrain, and increase an organization's opportunity for success.

There are two steps to achieving a quality lighting plan in your own environment. First, make lighting an integral part of your initial architectural and interior design discussions. Don't allow lighting to become an afterthought. Second, engage a lighting professional to guide these initial conversations. A professional lighting consultant brings unique skills and knowledge to the design process and can help you find the best mix of ambient, task, and accent lighting to support the work your people perform.

With your consultant and project team, examine the role lighting can play in your environment. Carefully consider your lighting decisions. Anticipate the effect these decisions will have on your employees, your customers, and your business. In addition, be certain that the lighting plan integrates with the other systems at work in your building and that it supports the different kinds of work people do in the space.

Ultimately, lighting is about meeting the individual's needs.

When people see well and feel better they work more effectively.

And when people are more effective, your organization is more effective.



Glossary of lighting terms.

accent lighting: Directional lighting which emphasizes a particular object or draws attention to a part of the field of view. One of the three critical components of a complete lighting system.

ambient lighting: Primary lighting throughout an area that provides general illumination. Ambient lighting can be provided through a direct, an indirect or a direct-indirect lighting system. One of the three critical components of a lighting system.

diffused lighting: Lighting, provided on the worksurface or on an object, that does not appear to come from a specific direction or source.

direct lighting: Lighting which distributes 90 to 100 percent of the emitted light in the general direction of a specific surface, usually the worksurface. The term usually refers to light emitted in a downward direction.

direct-indirect lighting: A variation of general diffused lighting in which the luminaires emit little or no light at angles near the horizontal.

directional lighting: Lighting, provided on the worksurface or on an object, coming from a specific source.

fill light: A type of accent lighting which reduces shadows or contrast.

fluorescent lamp: A type of electric discharge lamp in which a phosphor coating transforms ultraviolet energy (created by electric discharge) into visible light. Fluorescent lamps are the most common lamp used in commercial office applications. Often chosen for its ability to combine energy efficiency with good color rendering.

glare: A sensation caused by light within the visual field that is brighter than the level of light to which the eyes are adapted. Causes annoyance, discomfort, and a loss in visual performance and visibility.

glare, direct: Visual discomfort caused when the source of light (electric or daylight) is within the field of view.

illuminance: The level of illumination on a surface.

incandescent lamp: Generates visible light by heating a filament until it radiates. Incandescent lamps come in standard voltage and low voltage versions. They produce a significant amount of heat, are less energy efficient, and have a significantly shorter life than fluorescent lamps. Incandescent lamps are used liberally in retail and entertainment applications as well as commercial lobbies, conference areas, and theatres.

indirect lighting: Lighting by luminaires distributing 90 to 100 percent of the emitted light upward.

lamp: A general term for a man-made electric light source. Often referred to as a *light bulb*.

luminaire: A complete lighting unit consisting of a lamp or lamps and ballasting (when applicable) together with parts designed to distribute the light, to position and protect the lamps, and to connect the lamps to the power supply.

luminance: A measurement of light at a point on a surface. Most commonly associated with the perception of brightness of a surface.

photometry: The measurement of quantities associated with light. Photometry may be visual, in which the eye is used to make a comparison or physical, in which measurements are made by means of physical receptors.

task lighting: Lighting directed to a specific surface or area that provides illumination for specific tasks. One of the three critical components of a complete lighting system.

task-ambient lighting: A combination of task lighting and ambient lighting within an area such that the general level of ambient lighting is lower than and complementary to the task lighting.

veiling reflection: A reflected image superimposed on a glass window, computer screen, glossy magazine, or other reflective surface. This reflected image partially or totally obscures views through glass, screen text, or printed text by reducing contrast. Also called *reflected glare*.

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