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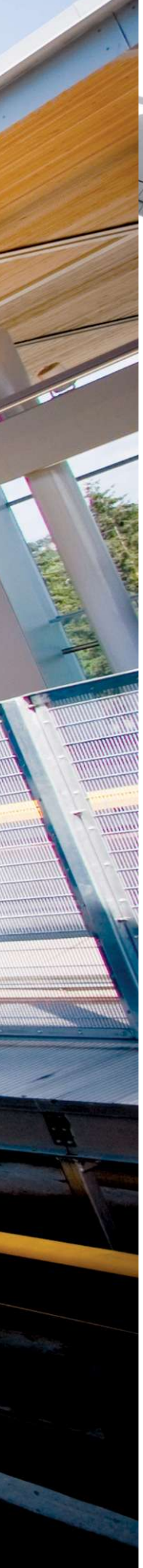

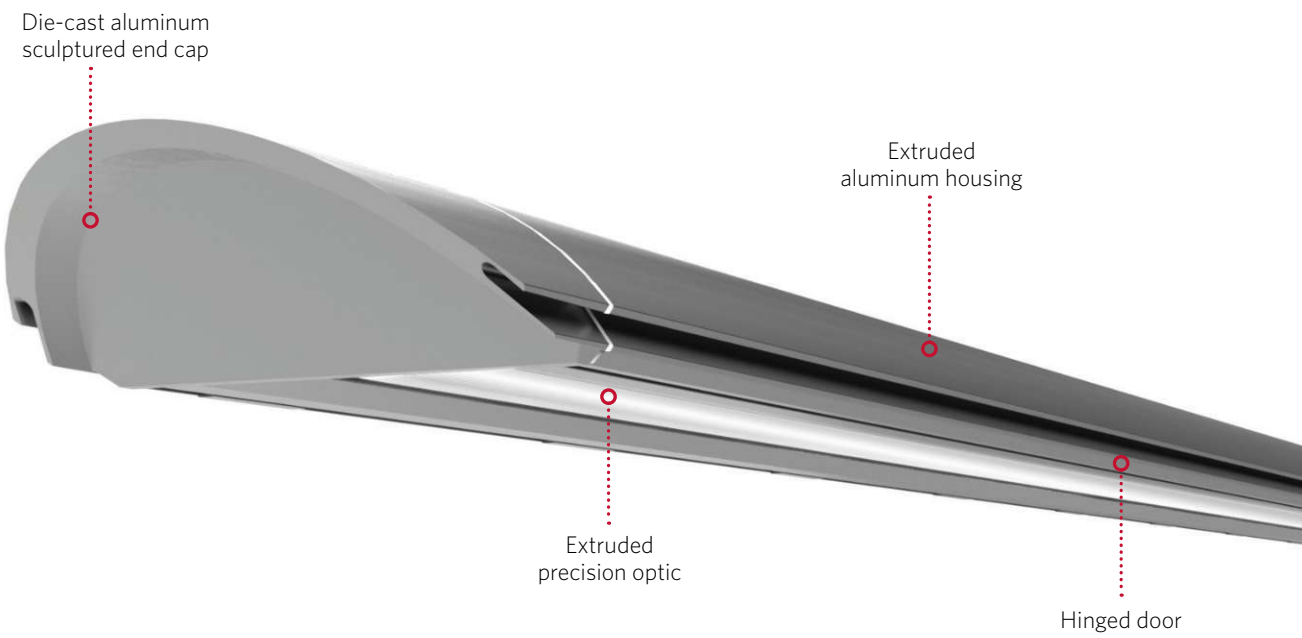

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A•L ARCHITECTURAL LIGHTING (Vol. 25, No. 1 USPS 000-846, ISSN 0894-0436) is published seven times per year (bimonthly, except monthly in May and June) by Hanley Wood, LLC, One Thomas Circle, N.W., Suite 600, Washington, DC 20005. Periodicals postage paid at Washington, DC, and additional mailing offices. Printed in the USA. Postmaster: Send changes of address to ARCHITECTURAL LIGHTING, P.O. Box 3494, Northbrook, IL 60065-9831.

Canada Post Registration #40612608/G.S.T. Number: R-120931738. Canadian return address: Pitney Bowes Inc., P.O. Box 25542, London, ON N6C 6B2.

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LETTER FROM THE PUBLISHER

Thank You! Thank You! Thank You!

Most magazines never make it past their first year, and here we are 25 years later defying all odds. That is only made possible by an incredible editorial team, passionate and dedicated readers, and you, our partners on the manufacturing side.

In 1986, more than 50 of you, all leading manufacturers, recognized the unmet need in the lighting industry and chose to support a fledgling new magazine called ARCHITECTURAL LIGHTING. Twenty-five years later, we stand here shoulder-to-shoulder successfully leading the lighting industry into the 21st century. In celebrating this 25-year milestone, we invite our friends in the lighting manufacturing community to join us in a full-year celebration. Starting with the Jan/Feb issue, we will draw from the magazine's rich content over its 25-year history and share it with readers through the introduction of the "From the Archive" article. We have also created several sponsorship opportunities that recognize manufacturers as a lifetime partner with ARCHITECTURAL LIGHTING, which can be included in all your advertising and promotional activity. The year will culminate with a blowout party in New York with members of our readership across the lighting industry. (Details to come in the coming months.)

While this year promises to be one of the most exciting in our history, we stop again to say thanks for the past 24. We look forward to a fabulous 25th year with you!

All the best,

Russell S. Ellis
Publisher, Commercial Design
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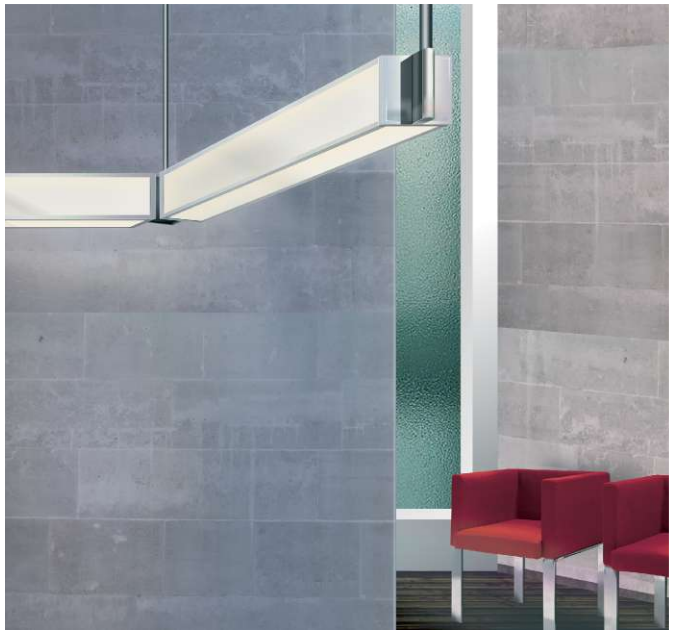

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"When you read ARCHITECTURAL LIGHTING magazine, it should make you feel proud to be a member of the lighting community, a community that is engaged, passionate, and curious."

A NEW DAY, A NEW LIGHT

Twenty-five years is a significant milestone no matter the circumstance. And as ARCHITECTURAL LIGHTING enters it's 25th year, it seems a particular accomplishment for a magazine dedicated to so specialized a topic—architectural lighting.

Even now, lighting is a relatively young profession, but in November 1986, when AL was founded, the discipline was barely out of its adolescence. To devote a publication to it was a bit risky. There was nothing like it at the time, and it is quite amazing that a quarter-century later, with the changing nature of design practice and the evolution of information delivery, we are still here. The persistence of AL is a testament to the critical role that lighting plays in architectural discourse and to the talented designers and manufacturers whose work has clarified and celebrated wonderful architecture through light.

Reading through the magazine's archive, I am struck by how ahead of its time ARCHITECTURAL LIGHTING has been. From its beginning, the publication discussed daylighting, energy issues, and new lighting technologies, and it presented the work of leading designers. The content was prepared by the preeminent voices of the day as well as by future thought leaders of the profession. In fact, many AL readers have "grownup" with the magazine.

Ultimately though, no discussion is really new. The challenges that practitioners and the industry faced and discussed in the early issues of the magazine—how to reconcile code requirements while maintaining the design integrity of a project, how the lighting designer integrates him- or herself into the project team, how the emergence of new lighting technologies steers the industry—are all still issues we deal with today. There is something reassuring in that continuity, which has been at the heart of the magazine's editorial mission since the beginning.

But AL has never rested on its laurels. Over time, the magazine has continued to evolve as it brings its readers the most compelling coverage of architectural lighting topics. Today is no exception. The magazine you hold in your hands looks very different than it did in the past. It's been nearly seven years since the magazine underwent a major overhaul, and on the occasion of this anniversary we thought it appropriate to take the next step.

ARCHITECTURAL LIGHTING's readers are smart, sophisticated, and design savvy. We know that you expect a lot from this publication, and the changes to AL are more than cosmetic. Yes, there is a refreshed logo, but editorially we're thinking about how we can deliver the most dynamic presentation of lighting in a publication that appears in both print and online. We've made a conscientious effort in the following pages to expand upon our core content and present supplemental information that speaks to the issues at hand. That information might take the form of a link to a website, a reference to a video or a book, or a mention of a product. Most importantly, our inclusion of this information reinforces the fact that there are amazing resources at every turn.

AL starts its 25th anniversary year not only with a new design, but with a new series of articles, "From the Archive," and a new template for our monthly online newsletter, e-notes. In the coming months we will share more about our plans for the year, including our Nov/Dec 2011 anniversary issue and gala celebration.

When you read ARCHITECTURAL LIGHTING, I hope it makes you proud to be a member of the lighting community, a community that is engaged, passionate, and curious. AL's role as a publication is to ask questions, to promote dialogue, and, on occasion, to step forward and encourage the architectural lighting community to move in new directions.

I have no doubt that 2011 will be an extraordinary year for the magazine and the profession. I hope you will join our celebration, and our celebration of light.

Elizabeth Donoff
Editor

"This is more promising news that the design and construction industry is continuing to move toward a recovery. However, historically December is the most unpredictable month from a business standpoint, and therefore the most difficult month from which to interpret a trend. The coming quarter will give us a much better sense of the strength of the apparent upturn in design activity."

— Kermit Baker, AIA chief economist

CLOUDY WITH A CHANCE OF OPTIMISM

Quarterly economic fluctuations continue to drive consumer caution.

text by Elizabeth Donoff

Consumers and companies remain cautiously optimistic as the metrics for economic recovery continue to fluctuate.

In the architecture and construction arena, 2010 ended on a positive note with the American Institute of Architects' Architecture Billings Index (ABI) jumping more than two points from November to a score of 54.2. The December posting is the index's most favorable score since 2007. The ABI reflects a nine-to-12-month lag time between demand for design services and architecture billings and construction spending. It is used by the industry, as well as related design fields such as lighting, as one of the main gauges for recovery.

But recovery remains slow. The commercial sector continues to lag behind the residential sector in making progress, as evidenced by the ABI's sector index breakdown: multifamily residential (60.1); commercial/industrial (52.7); institutional (50.6); and mixed practice (47.8).

The association of electrical- and medical-imaging-equipment manufacturers, NEMA, also saw positive movement at the end of 2010 in its Electroindustry Business Confidence Index for North American. The index rose 5.5 points to 68, its highest level since June 2010.

In terms of lighting, NEMA's Lighting System Index (LSI) made a slight gain of 0.9 percent on a 2010 quarter-to-quarter basis. Although this is an improvement, the index remains low overall, hovering at a score of 75 on a scale of 110. According to NEMA, "Significant weakness in both the residential and commercial markets continues to hamper demand for lighting equipment." NEMA is predicting only modest gains for 2011.

In the meantime, demand for lighting equipment continues to be driven by retrofit projects and the desire for energy savings. Change in lamp purchases will also come with the impending phaseout of general-service incandescent lamps, which will start in 2012. (California has introduced the measures a year early.) The Freedonia Group, a Cleveland-based industry research firm, reports that U.S. demand for lamps is predicted to increase by 3.8 percent through 2013 to $6.8 billion. They also see the purchase of compact fluorescent lamps increasing by 20 percent through 2013, and halogen lamps are also expected to see rapid growth as a result of the incandescent phaseout.

Long term however, and to no surprise, LEDs are expected to gain significant market share over conventional lamps, as the industry as a whole makes a paradigm shift. •

ABI ↑

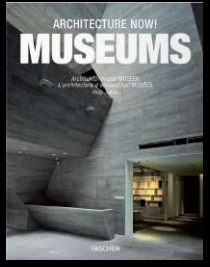
AIA's billings index for Dec. 2010 is 54.2 (up from 52).

LSI ↑

Lighting System Index improved by 0.9 percent in 3Q 2010 to just over 75 points (on a scale of 110).

EBCI ↑

Electroindustry Business Confidence Index for current North American business conditions climbed for a second consecutive month in December, rising 5.5 points to 68.



A recent addition to Taschen's *Architecture Now!* series, this volume by Philip Jodidio surveys more than 50 new museum projects around the world. Representing heavyweight architects such as Zaha Hadid, Frank Gehry, and Renzo Piano, the book also profiles the work of architects who don't always get the spotlight for their work, such as Cambridge, Mass.–based Preston Scott Cohen and Portuguese architect Eduardo Souto de Moura. The color photographs and drawings remind readers how far museum architecture has come in creating cultural buildings that support much more than just the housing of art.

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The Milstein Hall of Ocean Life at the American Museum of Natural History in New York City. Renovated and relit in 2002–03, the 6,000-square-foot skylight provides the perfect ocean-like backdrop for the Hall's main feature—the 94-foot-long model of a blue whale.

Denis Finnin © American Museum of Natural History

SHOW & TELL: MUSEUM LIGHTING

From the Archive presents articles from the past 25 years of content, with new commentary from the original author.

text by David Clinard
edited and excerpted from the 2002 original

CLINARD'S THOUGHTS:

The first thing that strikes me after rereading this article for the first time in almost nine years is that so many of the issues discussed are still the same today. This shouldn't be surprising since much of the article touches on topics such as visitor experience, design process, and conservation issues, which are every bit a part of today's museum environment.

Lighting is an integral part of the storytelling process of museums. Today, more than ever, there are a greater variety of museum types, each one distinct in its own "story," mission, collection, and method of representation. Traditionally, museums have addressed the presentation of collections as the most important criteria in exhibition design. The visual environment surrounding these works of art and specimens usually plays an important yet supporting role, with the collections as the "stars" of the show, so to speak. In addition to these more traditional institutions, there are other types of exhibition spaces where the visual environment may be as much a part of the viewer's experience as the objects on display. New methods of presentation by architects and exhibition designers are increasing the variety of gallery-space typologies, which in turn, challenge the lighting designer to find solutions that go beyond the traditional body of museum lighting approaches and techniques.

UNDERSTANDING THE DESIGN CONCEPT

Understanding the exhibition design concept is integral to designing and integrating lighting design in museum exhibitions. Museum exhibitions sometimes focus on specific objects from a collection, while at other times, there are no objects and the story is presented through audio-visual and textual narratives. In either instance, lighting designers need to acknowledge both the content and context in order to make informed design decisions that support the overall exhibition design concept.

ISSUES TO CONSIDER

Exhibition content and architectural context are not the only design issues facing the museum lighting designer. Conservation, facilities maintenance and flexibility are all concerns that affect lighting design decisions.

Conservation. An issue of critical importance that is unique to museum lighting is the extent of controlled light-level requirements established by conservators. Almost every museum has specific objects in their collection that are susceptible to light degradation over time. Organic materials such as wood, textiles, leather and paper, are just some of the more vulnerable items. Designing to recommended light levels, eliminating dangerous UV light and reducing exposure to lighting-related heat emissions are key considerations that need to be addressed in order to lengthen the life of

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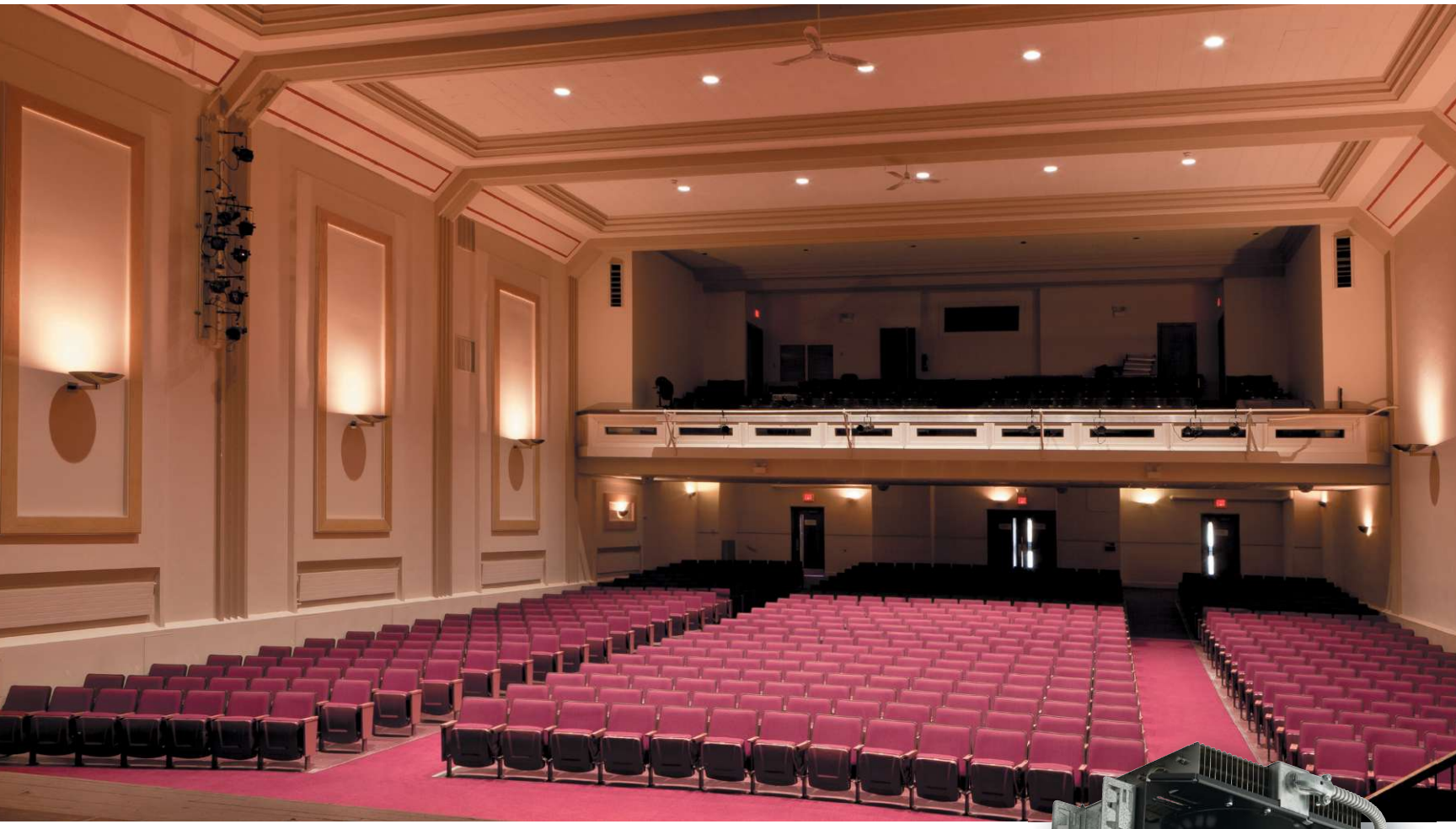

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the object. Conservation issues should be a priority for any lighting designer working on a museum project.

Relative Brightness. Another important component of museum lighting is the concept of relative brightness (we are concerned about relative luminance levels here—not illuminance). In order to view works on display with visual comfort, the viewer expects controlled luminance levels between the objects and the surrounding visual environment (using luminance rations). A white marble sculpture illuminated to only 5 fc may actually appear brighter (higher luminance) than an adjacent dark bronze sculpture illuminated to 15 fc simply by the change of finish. This concept is helpful when making decisions about architectural and exhibition finishes.

Flexibility. Museums often demand a certain degree of flexibility, which may assist the lighting designer in determining appropriate lighting solutions. Temporary galleries, for example, typically support all types of exhibitions including both in-house installations and traveling exhibitions and therefore require maximum flexibility.

CHOOSING A LIGHT SOURCE

The selection of appropriate light sources for museums is always important. Traditionally, color quality has been and still is one of the most critical concerns for displaying art objects and specimens, but the word "quality" opens the door to philosophical questions about which types of color temperatures are appropriate. Fine art museums today, for instance, use natural light and halogen sources, separately or mixed, with success. For accent lighting, museums frequently use halogen line- and low-voltage sources because of the variety of wattages and beam spreads available on the market and because of low initial costs. For conceptual types of exhibitions, the variety of possible sources to consider is greater, including colored light that can be used to emphasize a certain exhibition design concept. As with other types of lighting projects, lamp choice should be informed by a variety of qualities and characteristics including CRI, lamp life, efficacy and lamp replacement cost.

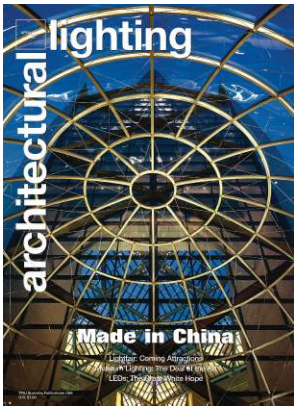
Source selection, of course, will inform the appropriate type of lighting equipment. Adjustable fixtures, such as accent lights, should be able to accept different types of lighting media, such as glare-reducing louvers and a variety of spread lenses and color filters. All lighting fixtures for exhibition spaces must be able to accept UV filters. Additional criteria that are equally significant include aesthetics and scale, as fixtures and equipment can either support or distract from the design attitude of the space.

In museums, it is sometimes desirable to provide local, internal illumination for display cases. This type of illumination delivers an internally luminous quality and can help to reduce reflections and glare associated with the glass or acrylic vitrines or case windows. Traditional light sources for case lighting are fluorescent and halogen. These light sources are usually located above the objects on display in an enclosed light attic that must be accessible for relamping. Adequate ventilation and heat exhaustion is required for all case-lighting methods in order to prevent raising heat from entering the display case cavity. Fiber-optic lighting systems are used in display cases illumination as well. The advantage here is that the light source can be remotely located, allowing more freedom in the design of the physical display cases. Furthermore, the access panel for relamping can be located in a less conspicuous location and the individual fixtures can be adjusted without ever being touched by the lamping staff. Another advantage to fiber-optic systems is the design potential to create a miniature "stage set," using tiny spots and floods that can be aimed anywhere within the case. The systems are also ideal for displaying light-sensitive materials because the UV light and heat associated with an internal light source (typically halogen or metal halide) are removed from the case interior.

There are also disadvantages to fiber-optic systems such as light intensity. They typically do not have enough light intensity to deal with the surrounding ambient light levels and require galleries to be fairly dark in order to

There have certainly been a few changes since the original article was written. Lighting technology, for example, has made what I would consider modest advancements in the museum sector. The article mentions that museums consider color quality a key issue in electric light-source selection and that halogen sources (both line- and low-voltage) were generally preferred for accent lighting. These halogen sources are still the dominant choice for accent lighting in museums today. However, other types of light sources have become more prevalent in all types of museums and galleries. Many of these changes have been driven by the need to meet new codes and standards or by interest from museums to reduce energy and maintenance costs. Manufacturers have been offering even lower wattage ceramic metal halide (CMH) lamps and fixtures that provide optics and intensity levels that are more suited to museum environments. The color quality of these CMH lamps has also improved steadily. And, just in the last few years, there are now some credible white LED accent and tracklight fixtures available on the market. White LED fixtures have been utilized for display-case lighting for many years now. Although these LED fixtures have taken a considerable market share from fiber-optic lighting when it comes to case lighting, in some applications fiber optics still offer a competitive solution when one is looking for specific optical performance and elimination of heat. In addition, the integration of daylight and sophisticated control systems have increasingly become an integral part of museum projects.

This article originally appeared as the Technique column in the Apr/May 2002 issue.



"Traditionally, color quality has been and still is one of the most critical concerns for displaying art objects and specimens, but the word 'quality' opens the door to philosophical questions about which types of color temperatures are appropriate."

— David Clinard, 2002

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"Even after extensive planning, exhibitions almost always require object-adjusting and fine-tuning in the field."

— David Clinard, 2002

be successfully integrated. They can also be more costly than fluorescent and halogen fixtures for case lighting.

Interactive exhibits, display panels and other exhibit elements for permanent and traveling exhibitions frequently incorporate internal illumination. A variety of lighting sources and fixtures is appropriate depending on the specific lighting application. Luminous or glowing elements often use fluorescent sources because of their broad distribution, long life, and low heat emission. LEDs are increasingly being used for these types of applications due to their small size, range of color, controllability, low heat and extended lamp life. They can be controlled to mix colors and even programmed to sequence custom lighting patterns and movements. White LEDs can be used for certain applications such as rear-illuminate display panels. However, at the time of this publication, the color-rendering quality of white LEDs is still not appropriate for illuminating many types of museum-quality objects on display.

Even after extensive planning, exhibitions almost always require object-adjusting and fine-tuning in the field. In temporary exhibitions, the focusing can easily make or break the overall desired lighting effect. Adequate light coverage and proper aiming angles that avoid shadows and reflected glare are just a few issues that the lighting designer must address during almost every installation.

THE MUSEUM'S PERSPECTIVE

In order to reduce lighting-related energy and maintenance problems, when appropriate, use natural light as a source—it's free and daylighting can drastically reduce energy costs over time. However, the ability to have daylighting requires higher initial costs due to the architectural impact and the additional expense of installing passive and active light control systems for light intensity and UV protection. For museums where daylighting is not an option, the lighting designer must look for opportunities to use more-efficient light sources. This is often difficult in both new construction and retrofit projects due, in part, to the viewer's expectation for light characteristics typical of halogen sources as traditionally found in most museums. But there are many opportunities nonetheless. For instance, fluorescent sources can be used for ambient light and select metal halide sources for accent lighting. When halogen sources are the only option, a dimming system can extend the lamp life many times over and also provide a time-clock control to more efficiently monitor the operational hours of exhibition scenes. •

This article was written by David Clinard when he was chief lighting designer at the American Museum of Natural History in New York City. Today, Clinard is principal of Clinard Design Studio in New York City.

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A closer look at the ideas behind the work.

text by Glenn Shrum

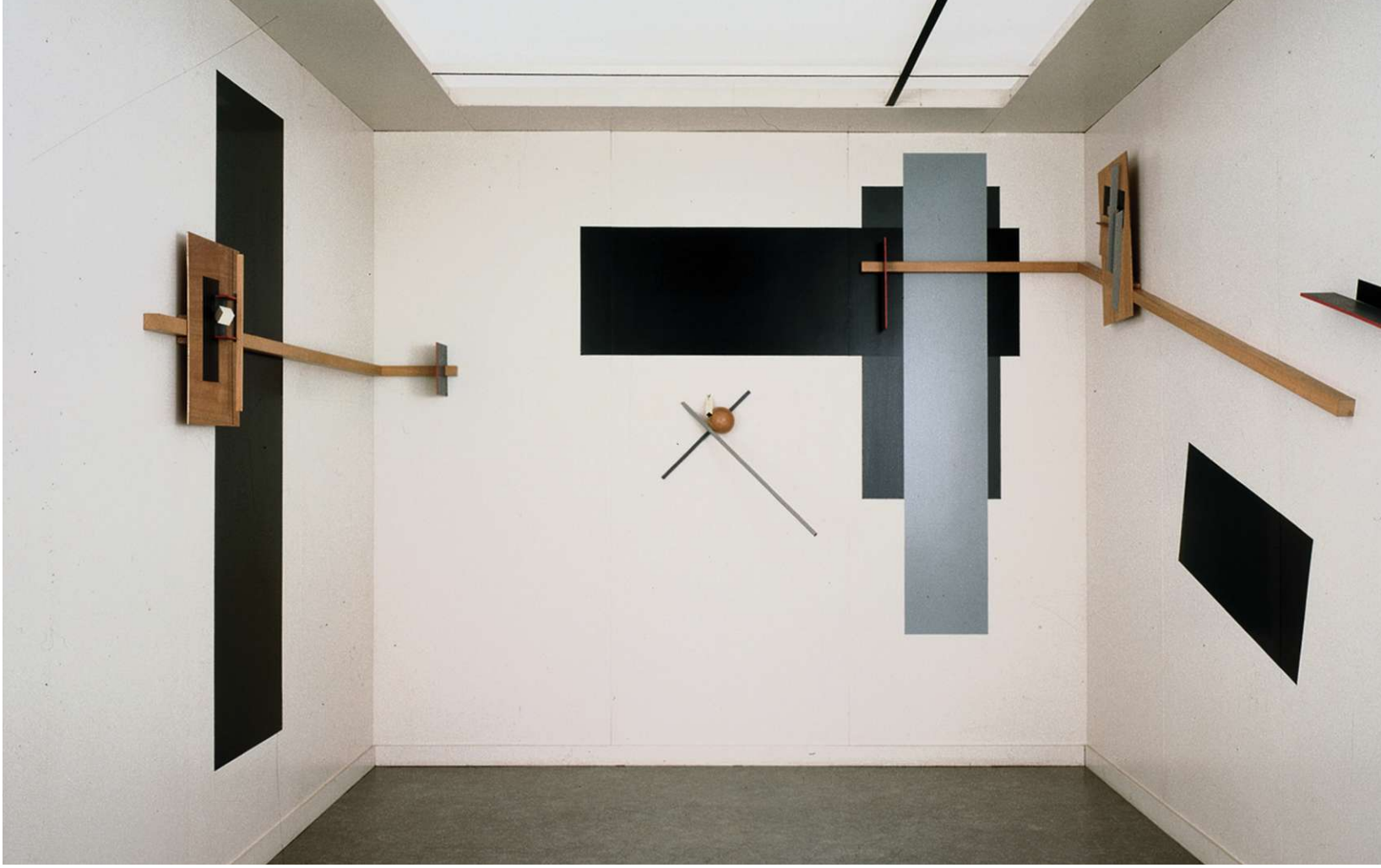
In 1969, as part of an experimental program at the Los Angeles County Museum of Art, Robert Irwin and James Turrell outlined a new direction for art, identifying viewer experience as the critical outcome of an artist's creative production and establishing viewers' visual perception of the environment as a principal concern. For Irwin and Turrell, light was the primary medium for investigating these ideas.

Artists have long used light, but, thanks in large part to the pioneering work of Irwin and Turrell, the dedicated field of light art emerged in the late 20th century. Light artists create environments specifically to explore the perception and experience of light itself and to change the way people perceive their everyday visual environment.

To better understand light art's influence on architectural lighting design, it is important to consider the two different approaches that light artists take to affect viewers' experience and perception. Some artists, such as the late Dan Flavin, place familiar lighting conditions in a new context, while others, such as Turrell, create unfamiliar environments in order to induce heightened perceptual awareness. An artist's choice to conceal or reveal lighting systems therefore has a considerable influence.

***Line Describing a Cone*, Anthony McCall, 1973**

By displaying the 16mm projector along with the projected image, artist Anthony McCall invites viewers of his avant-garde film *Line Describing a Cone*, to turn their backs on the screen and consider the phenomena of light found in the typical cinema environment.

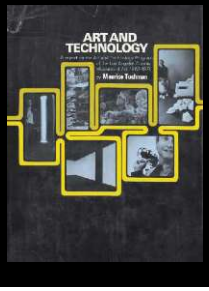


Environments that require the viewer to fully immerse themselves in a space are very different from the lighting conditions we typically experience. With such installations, artists often limit sensory stimuli, leaving themselves free to manipulate the viewer's perception of a few remaining lighting elements. This kind of enigmatic experience is less likely to occur when lighting systems remain visible. By hiding devices such as light fixtures, daylight apertures, reflectors, and screens, the artist can focus an observer's attention on the illusory characteristics of light.

In contrast, light artists such as Turrell and more recently Olafur Eliasson endeavor to intensify the perceptual field without completely removing viewers from everyday conditions. By exposing the mechanics of the artwork, as Flavin famously did with fluorescent lamps, the artist can lead viewers into an analytical frame of mind by allowing them to consider lighting effects alongside the devices and techniques that create them.

While architectural lighting design and light art share an interest in their exploration of space, experience, and perception, the issues associated with budget, life safety, energy use, maintenance, and coordination with other design and engineering disciplines often become the focus of attention on architectural lighting projects. Unleashed from these restrictions, light artists have developed a body of work and a range of approaches to viewer experience and visual perception of the environment that provides the architectural lighting design community with a valuable reference point for examining these issues in their own projects. •

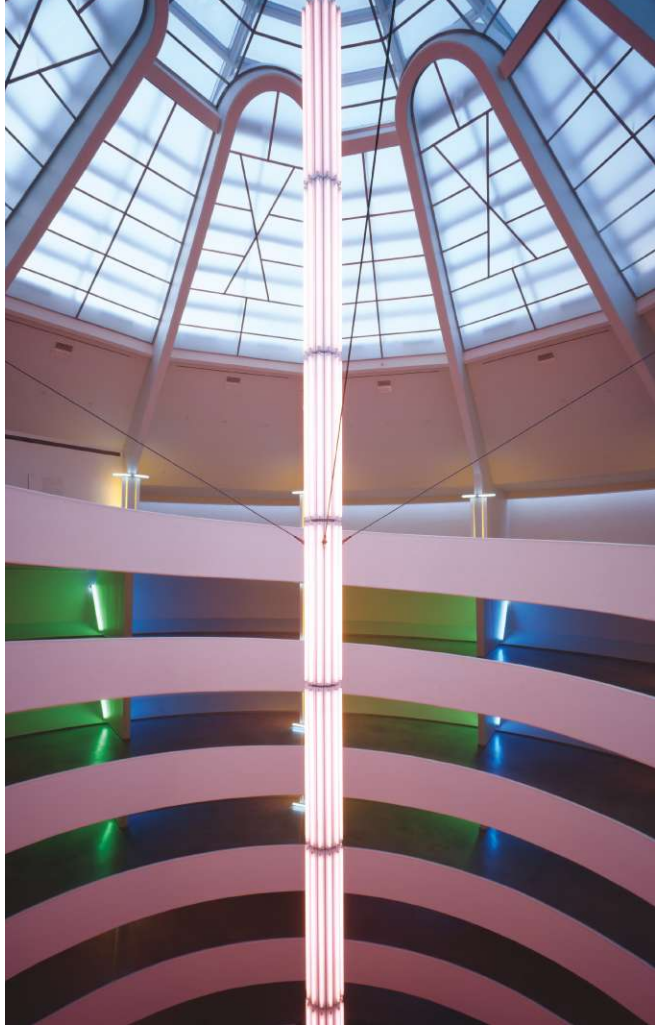
Glenn Shrum, a new ARCHITECTURAL LIGHTING *contributor, is founder and principal of Flux Studio, which is based in Baltimore, Md. He is the U.S. coordinator of the Professional Lighting Designers' Association and a part-time faculty member at the lighting program at Parsons, The New School for Design, School of Constructed Environments in New York City.*

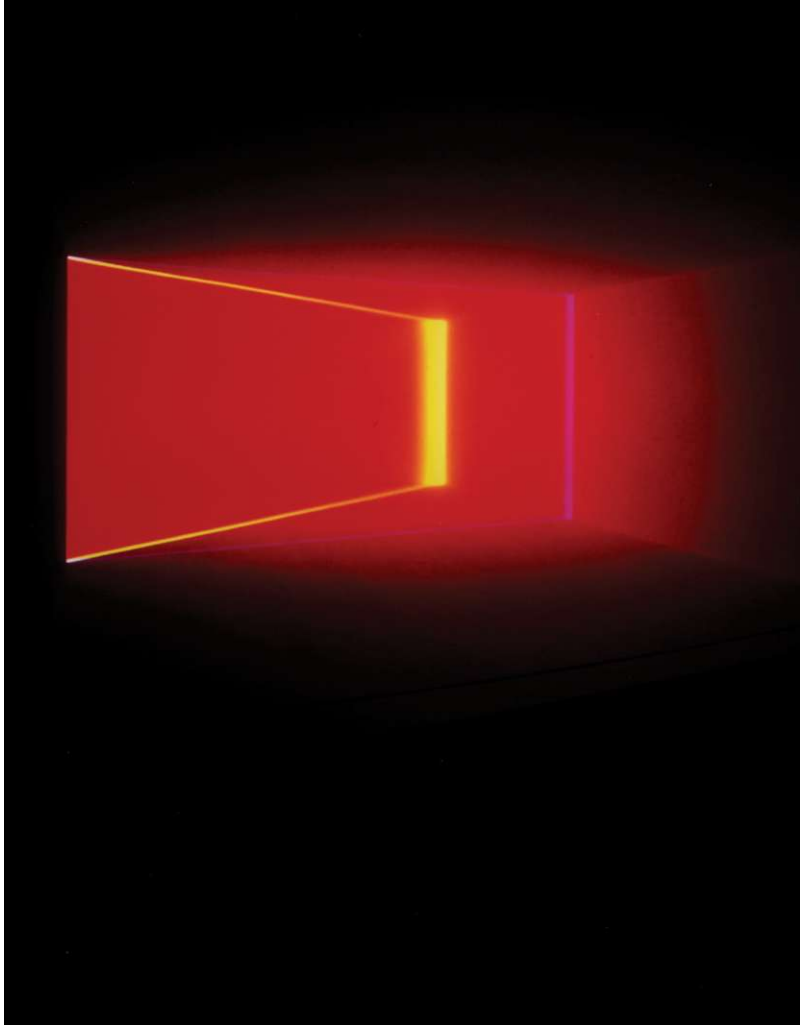


The Origins of Light Art

In 1966, Maurice Tuchman, curator of modern art at the Los Angeles County Museum of Art in Los Angeles, conceived of the Art and Technology Program. The goal of the program, which ran from 1967 to 1971, was to promote an exchange between artists and corporations. Robert Irwin and James Turrell were teamed with psychologist Edward Wortz of Garrett AiResearch, an aerospace manufacturer; their collaboration focused on perception conditioning and included a series of sensory-deprivation experiments conducted in the anechoic chamber at the University of California, Los Angeles. One lasting outcome is a rare 387-page catalog, A Report on the Art and Technology Program of the Los Angeles County Museum of Art, 1967–1971 *(left). Another is the ongoing exploration of art, light, technology, and perception known as light art.*

Previous page: Courtesy Sean Kelly Gallery, New York;
Left to right: The Soloman R. Guggenheim Foundation; Courtesy Van Abbemuseum Museum;
Courtesy Hirshorn Museum





Above left: *Prounenraum* (proun room), El Lissitzky, 1923 (reconstruction 1971)
El Lissitzky's *Prounenraum* (proun room) is considered by many art historians to be the first time an artist incorporated architectural lighting elements as a component that is integral to his work.

Above: *Untitled (to Tracy, to celebrate the love of a lifetime)*, Dan Flavin, 1992
Flavin asserted that we should look more closely at the objects and lighting conditions that surround us every day. His work adheres to this principle by the exclusive use of low-tech, off-the-shelf lighting equipment.

Above right: *Milk Run*, James Turrell, 1996
Many of Turrell's works, including this one, are fully comprehensible only after the observer's eyes have adjusted to low light levels. This period of perceptual adaptation reinforces the disconnect that these visually experiential artworks have from everyday lighting conditions.

Current Debate • Is it art or is it lighting? *The Art Newspaper* has reported that the European Commission has reversed a U.K. tax ruling classifying works by Dan Flavin and Bill Viola as "art." Instead, the pieces are considered electrical devices and are subject to a 20 percent value-added tax, instead of 5 percent. This has caused an uproar in the art world and could seriously limit the import and export of works that use light as a medium. See *The Art Newspaper* article at *bit.ly/fgAekc*.

IN FOCUS

THE CUSHING CENTER

Dr. Harvey Cushing's groundbreaking collection of brain specimens is sensitively displayed in a new permanent exhibit at the Yale School of Medicine.

text by Jennifer Bickford

Original leaded-glass specimen jars that contain brain tissue and tumors preserved in formaldehyde are the centerpiece of the Cushing Center's collection.

Yale University's Harvey Cushing/John Hay Whitney Medical Library is home to many significant medical collections, but one in particular stands out—the Cushing Center. Named after 1891 Yale graduate Dr. Harvey Cushing, the father of modern neurosurgery—the exhibit chronicles close to 40 years of Cushing's groundbreaking work studying brain tumors, developing a classification system to document them, and techniques to remove them.

Cushing brought the collection with him in 1934 from the Peter Bent Brigham Hospital in Boston to Yale when he became Sterling professor of neurology, and it remained on view in the medical school until 1979, when interest in the collection dissipated. Relegated to the sub-basement of the medical school, the collection developed somewhat of a cult following among students who were initiated into their medical school experience by going to the basement and "communing with the brains." It was that experience in 1996 that led student Chris Wall to decide to write his dissertation on Cushing and to start the process of finding a permanent home for this historically significant medical collection, which includes 600 preserved brains and tumor specimens, 10,000 glass plates and negatives documenting Cushing's patients, a selection of scientific texts, and Cushing's own writings.

In 2004, New Haven, Conn.–based architect Turner Brooks was hired by the Yale School of Medicine to develop the project. In 2008, permanent space was found in the medical school library to house the collection. Fit into an existing wedge-shaped space, the exhibits are combined with a reading and archive area and a meeting room. Brooks' design wraps the room in finely crafted custom cherry millwork to create a 1,500-square-foot gallery for Cushing's truly unique collection. When Brooks realized that the reading and archive area and the items on display had very different lighting requirements, he solicited the lighting expertise of Atelier Ten, a firm of environmental-design

Christopher Gardner

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Learn more or register at www.csinet.org/certification

General illumination, display lighting, and vitrine lighting address the different conditions in the Cushing Center and provide sufficient ambient light, while being mindful of conservation requirements for this unique medical collection.

Christopher Gardner

consultants and building-services engineers, to assist in illuminating the space.

Tasked with the assignment, lighting designers for Atelier Ten, Chad Groshart and Meghan Smith-Campbell, assessed the program and determined that three layers of light were needed: general illumination, display lighting, and vitrine lighting. Because the center is located two floors below grade, the designers chose surface-mounted compact fluorescent downlights outfitted with two 13W triple-tube lamps for their ease of installation in the concrete slab ceiling and for their tightly controlled optics. Fluorescent T8 strips with a custom valence supplement these downlights and provide vertical brightness to the wall displays. Neutral density sleeves on the fluorescent tubes filter the UV and help balance the lamp brightness.

Arguably the most thought-provoking parts of the collection are the original leaded-glass specimen jars that contain brain tissue and tumors preserved in formaldehyde. (Cushing gathered specimens from patients who had agreed to donate their organs.) For these, the Atelier Ten team wanted to light the jars in a visually interesting way while adhering to conservation light levels. Mock-ups were used to figure out how to illuminate these sensitive materials and the hand-written labels on the jars, many of which were written by Cushing himself.

Since there was nowhere else to hide the fixture, uplighting the specimens from the front of the shelf area provided the best results. Atelier Ten selected concealed 3200K LED strips for their minimal profile, warm color temperature, and integral aluminium reflector (see right). Waist-high horizontal displays of Cushing's manuscripts, books, and print

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LEADERSHIP IN LIGHTING 25 YEARS

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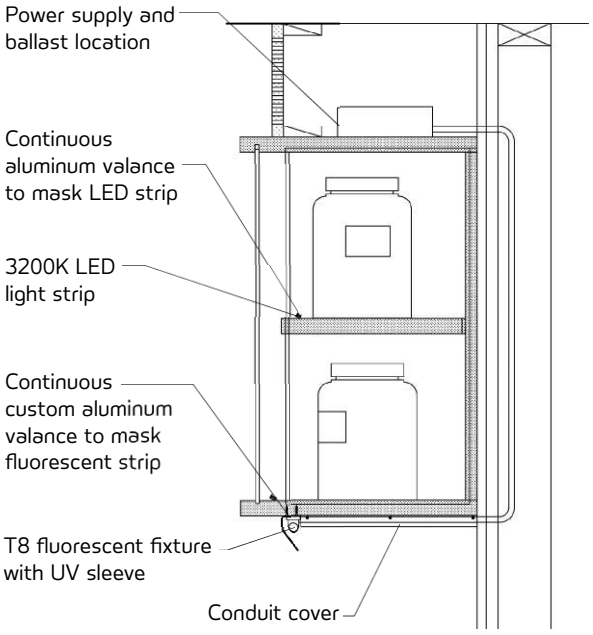
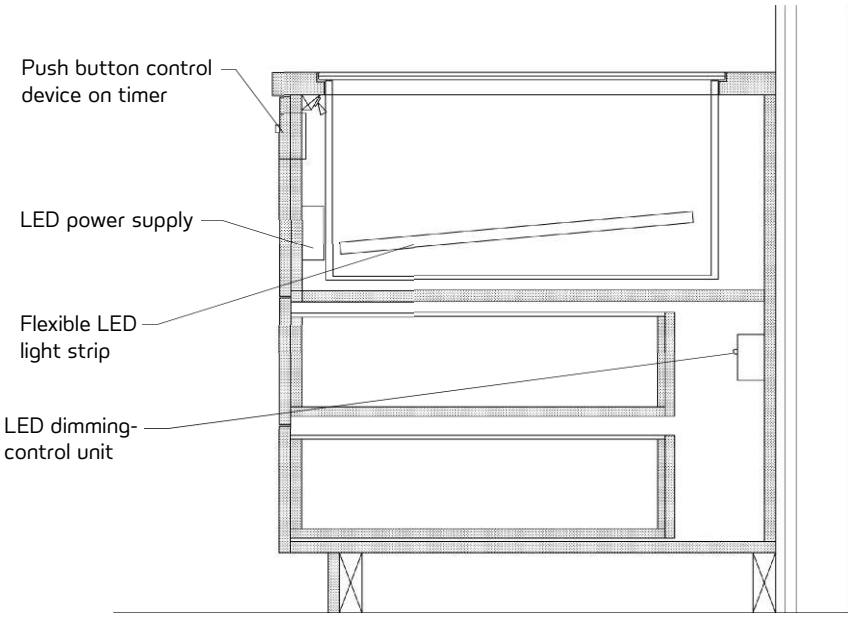
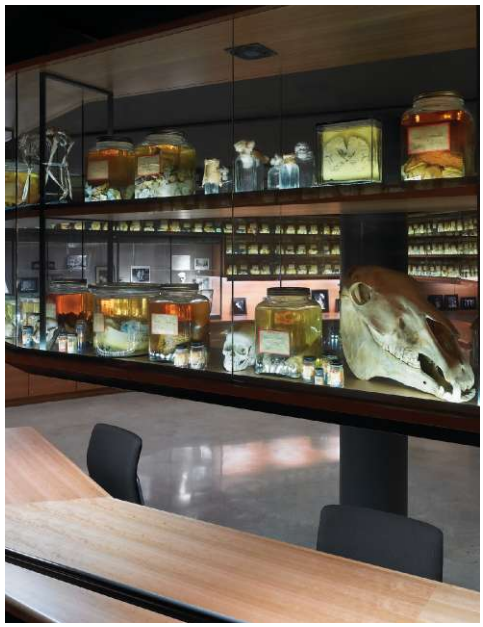
Lighting Valance Locations



Fixture Location—Vitrine Lighting





The collection includes a diverse group of objects, including skeletons, 10,000 glass plates and negatives, a selection of scientific texts, and Cushing's own writings and family memorabilia (left). Narrow display shelf depth necessitated using a very thin luminaire profile; the designers selected concealed LED strips to uplight the specimen jars (far left).

material were also illuminated with concealed linear 3200K warm-white LED strips. For the vertical glass-front cabinets, an adjustable point-source LED accent luminaire was selected.

Due to the delicate nature of the items on display, Atelier Ten worked closely with the center's curators to limit the number of footcandle-hours illuminating the brain samples over the course of a year. Rather than risk overexposure if a light switch is accidentally left on, the designers utilized occupancy sensors. When a person enters the space, he or she triggers sensors that turn on the general lighting, upper cabinetry, and vertical display lighting. After five minutes, the display lighting automatically turns off. A reset button allows additional five-minute illumination increments if more viewing time is needed. To see the manuscript material in the horizontal vitrines, a push button turns the lighting on to a preset level for a few minutes at a time. When visitors depart, the occupancy sensors return the space to near darkness.

Designing a space to permanently exhibit Cushing's work and medical specimens was not easy. Gauging the "visual environment was tricky," Groshart says. "Striking the right balance and contrast was the biggest hurdle [we had] to overcome." The architecture and lighting of this new exhibit thoughtfully displays Cushing's life's work on the human brain, and allows visitors to view the contents with admiration and respect for the man—and the patients—who pioneered modern neurosurgery. •

Details • Project: The Cushing Center, Yale School of Medicine, New Haven, Conn. • Client: Yale School of Medicine, New Haven, Conn. • Architect: Turner Brooks Architect, New Haven, Conn. • Lighting Designer: Atelier Ten, New Haven, Conn. • Photographers: Christopher Gardner, Deep River, Conn., and Terry Dagradi, New Haven, Conn. • Project Size: 1,521 square feet • Energy code compliance: ASHRAE 90.1-2004 • Watts per Square Foot: 0.88 (downlights and undercabinet general lighting); 0.96 (display lighting); 1.84 (total connected load) • Manufacturers: Amerlux (LED accents at vertical cases); Bartco (linear fluorescent valence); Edge Lighting (vitrine LED); and KKDC (linear LED at shelving)

For a behind-the-scenes look at the Cushing Center, visit the Center's website for video link: med.yale.edu/library/about/cc.html.

Left: © Terry Dagradi, Yale University;
Right: Christopher Gardner

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TECHNOLOGY

TECHNOLOGY

MUSEUM LIGHTING IN THE SECOND DECADE OF THE 21ST CENTURY

Are LEDs ready for the illumination of art objects?

text by Kevan Shaw
illustration by James White

Museum lighting is in a period of revolution, and lighting designers are facing fundamental changes in their design decisions. This is a result of the International Commission on Illumination's (CIE) publication "Control of Damage to Museum Objects by Optical Radiation," CIE 157:2004 that shifts the focus of the illumination of artworks from illumination levels to total exposure over time. It also reassesses energy use in museums in line with concerns about climate change. Designers are being encouraged to look at new technologies, largely in the form of LED sources, and to address methods of lighting control.

The challenges created by CIE 157:2004 relate to reducing light exposure of objects not solely by illuminance levels but by also paying attention to the duration of exposure. The responsibility to manage this does not rest entirely with lighting designers. It requires curators and conservators to take a more proactive role, and to accept that any exposure to light causes deterioration in light-sensitive materials. Therefore, when and how long an object is exhibited determines the survival of the object more than the specific light levels to which the artwork is exposed. CIE's publication also implicitly challenges the extremely high levels of light used by conservators during condition assessments and at other times when an artwork is in their charge. Light exposure during this time should also be accounted for in the overall history of the object.

LIGHTING CONTROLS

Lighting controls are becoming an essential tool for conservation and they provide significant energy savings. In museums, lighting designers are setting up control systems that turn lights on and off as visitors walk through galleries. The challenge is to create a system that works seamlessly: The museumgoer should be largely

Q+A with Dale Kronkright, head of conservation, Georgia O'Keeffe Museum

Recent discussion in both the museum and the lighting worlds as to whether or not LEDs are suitable for museum-lighting applications, particularly the illumination of objects and artworks, has been spurred on by a letter written by Dale Kronkright, head of conservation at the Georgia O'Keeffe Museum in Santa Fe, N.M. In his March 30, 2010, letter, sent to the Green Task Force of the American Institute for Conservation (AIC) of Artistic and Historic Works, he urges caution when considering LED light sources for light-sensitive materials. ARCHITECTURAL LIGHTING editor Elizabeth Donoff spoke with Kronkright regarding his concerns and the buzz that this letter has generated.

Why did you write the letter?

I wanted to put down my thoughts on where we were clear on the issues regarding damage to light-sensitive materials and where there were still unresolved issues. The letter was written to urge caution before just accepting this new technology.

What are the differences between incandescent sources and LEDs that should be of concern for those working in museum lighting?

LEDs are a discontinuous light source and have larger light outputs than fluorescent. The things to keep in mind are, one, the electromagnetic spectrum. Artworks reflect light, and via the spectrum it's how we see the colors of the artwork. The second thing to consider is the wavelengths that are absorbed. These are the initiators of deterioration. The relationship to the color of the spectrum and the absorption spectra is what you have to be thinking about in terms of conservation issues.

Are LEDs an option for museum lighting?

I am not against LEDs; I love the promise of them, but for museum lighting they are not a slam-dunk right now. Instead, we need to push manufacturers to better understand the conservation issues we are dealing with and help to drive the technology so that there will come a time when we can use LED sources in museum lighting that will address the spectrum issues.

unaware that a control system is in place, except for when the lighting is a part of the artwork or the display technique. Depending on the setup of the exhibit, visitors can be given the ability to control the light in specific cases or displays, or lighting can direct the visitor by using dynamic lighting of specific displays or elements of an object.

One critical component in this equation is the light source itself. As the industry shifts from using incandescent to solid-state sources, the question remains: What are designers being offered as replacements for low-voltage lamps?

LEDS IN MUSEUM SETTINGS

Solid-state lighting can no longer really be considered a new or emerging technology. LEDs have been in use for architectural lighting applications for more than a decade, and LEDs and fixtures that use them continue to be plagued with excessive claims about their life span, efficiency, and output. Although there are now standards that describe how LEDs and LED products should be measured, such as LM-79 and LM-80, these standards do not inform designers about the reliability of the products. They only provide a basis under which they should be tested and how claims and specifications should be made.

So how are changes in the technology of light sources affecting conservation requirements and how artworks should be lit? What do designers need to consider when assessing LEDs for museum lighting applications?

The first thing to remember is that LEDs are not a like-for-like swap with low-voltage tungsten halogen, no matter what product literature might indicate. There are many replacement LED lamps on the market, but they are not ready for museum applications. The U.S. Department of Energy has been doing excellent work through its CALiPER testing program to evaluate products, and offers designers guidance for luminaire selections.

Ultimately, it is not possible to achieve the same performance as low-voltage tungsten halogen lamps by using LEDs when they are packed into the space of an MR16 reflector lamp. Compromises are required in thermal performance that lead to lower light output, lower efficiency, and shorter life.

COLOR RENDERING IS THE DIFFERENCE

Generally, the more light-sensitive the exhibit, the lower the light level a designer can use. In fact, it must be remembered that the 50-lux level was set on the basis of it being the lowest level at which the majority of people can perceive full color under incandescent light with a color rendering index of near 100.

Most lighting designers will have experienced exhibits lit to this level with fluorescent lamps, and will have noted the flat rendition and difficulty in differentiating color. Also, it is not uncommon to see this in the gloom of overly dimmed incandescent lamps. But it is possible to achieve bright and colorful displays with properly selected and installed low-voltage tungsten halogen at low-light levels.

Unfortunately, LEDs have more in common with the fluorescent lamp spectrum than the incandescent. White-light LEDs are usually made from combining a blue LED and a yellow phosphor. This produces peak outputs in blue and yellow with distinct fall-off in cyan and red output. The latter is of most concern from a lighting perspective. The lack of red, particularly compared to the red-rich incandescent lamp, results in poor rendering of warm tones, including skin tones. On the other hand, the peak in blue causes concerns for damage to light-sensitive objects. Designers and conservators are well aware that ultraviolet (UV) light is damaging and it is routinely filtered out before it comes into contact with an artwork.

Light is also more destructive the further it moves toward blue in the color spectrum. This concern has become the subject of a discussion led by Dale Kronkright, head of conservation at the Georgia O'Keeffe Museum in Santa Fe, N.M., (see sidebar at left). It is also the subject of an interesting paper "Color Degradation of Textiles with Natural Dyes and of Blue Scale Standards Exposed to White LED Lamps: Evaluation of White LED Lamps for Effectiveness as Museum Lighting" (Mie ISHII et al, *Journal of Light & Visual Environment* Vol. 32, No. 4, 2008). If we adopt LED technology, we could reduce the quality of light in a way that challenges some of the working norms in lighting museum objects.

The next question is, "Will LEDs ever provide a satisfactory color rendering?" The answer is a qualified "Yes." There are already products

The Getty Conservation Institute has teamed up with the Georgia O'Keeffe Museum for its first demonstration project, a new light filter for gallery luminaires. This filter was developed as a result of accelerated light-exposure experiments in side-by-side exposure booths—one outfitted with UV-filtered MR16 lamps, and one with thin-film filters developed at the University of Texas El Paso. Many colorants faded at slower rates under the filters.

• **Jim Druzik,** senior scientist at the GCI, discusses the institute's museum lighting research and the demonstration project set up at the Georgia O'Keeffe Museum. To see the video, go to getty.edu/conservation/publications/videos/museum_lighting.html.

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on the market that achieve the quality of color rendering close to that which lighting designers are accustomed, such as the Xicato's Artists Series. The only problem with modules like these is that their energy efficiency is not a great deal better than the best tungsten halogen lamps. Manufacturers promise efficiency improvements, but high-quality color rendering will come at a significant cost in energy usage.

This is not a new situation. We have had the option of high color-rendering fluorescent lamps for many years, but their energy efficiency is significantly below the efficiency of normal fluorescent lamps that have color rendering index in the 80s. These lamps typically produce 113 Lm/W for a color 85 lamp but only 75 Lm/W for a color 90 lamp. Realistically, fluorescent remains a more efficient light source than an LED but does not do the same job.

OPTICAL CONTROL

Another issue to consider with LEDs is optical control. At the moment, LED lightsources are configured in three different ways. First, there are individual LEDs used in groups to achieve the necessary light levels, with each LED having its own phosphors to create white and optics to control the beam and field angle. This system generally works well, but it is difficult to ensure good color consistency between different LEDs.

The second system is a group of LEDs behind a common phosphor. This allows for finer tuning of color, better color consistency, and better light-output consistency between devices. The downside of this arrangement is that you end up with a relatively large light source, typically 20mm (¾ inch) in diameter. This causes problems with optics that require a large-diameter reflector or lens to capture the light and focus it into the required beam angle, resulting in larger fixtures than what we are used to. It also results in a wide field angle that scatters light, which is a problem when you are trying to achieve a tightly focused exhibition.

Finally, the third system uses very small chips behind a single optic. This is the approach taken by Cree, and it produces a tight control of color. (I have not experimented with these, so I don't know how well the optics deliver a tight, controlled, uniform beam pattern.)

In my opinion, we do not yet have a good LED solution for museum lighting to replace the best low-voltage tungsten halogen lamps, and limitations in the technology may prevent us from getting there. Any lighting system that creates a discontinuous, nonlinear spectrum will always have issues with rendering color. Attempts to solve these problems erodes the raw efficiency of the LED. We might have to accept a loss of lighting quality in museums over the next decade in order to reduce our energy use by changing light-source technology to higher efficiency light sources.

Our other solution would be to reduce light exposure to objects, more comprehensive lighting control strategies, and limit the time objects are illuminated.

Museum lighting has always been about balancing incompatible requirements. New technologies and requirements are not making the designer's task any easier, and we have to educate our clients so that they understand the reason behind our decisions, and accept their share of responsibility for the presentation and conservation of our cultural heritage. •

Kevan Shaw, an independent lighting designer who has been working in museum lighting for 20 years, is director of sustainability of the Professional Lighting Designers' Association and chairman of the working group revisiting Lighting Guide 8, Museum and Gallery Lighting *for the Society of Light and Lighting in the U.K.*

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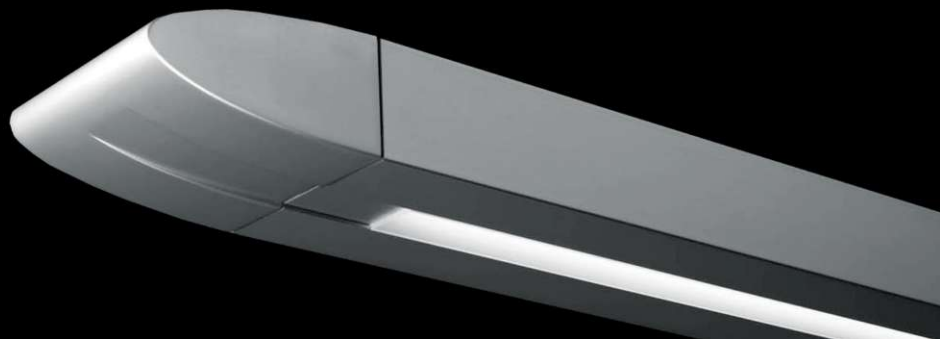
text by Elizabeth Donoff

Naro, Peerless • Designed for commercial office, retail environments, and educational facilities, Naro is a linear, indirect luminaire that can be ceiling-suspended or wall-mounted, and spaced 14-feet-on-center. With a profile measuring 4 1/2 inches by 2 1/4 inches and available in 4- and 8-foot lengths, Naro delivers 90 to 92 percent energy efficiency. Available with use for one, two, or three T5 or T5HO lamps, the Naro can also be selected with a semispecular reflector for wide light distribution or with a white reflector for narrow beam optics. Luminaire configurations can be customized with X, T, and corner pattern connectors, as well as standard or sculpted die-cast aluminum end caps. *peerless-lighting.com* • Circle 125



Binic, Foscarini • The work of French designer Ionna Vautrin, the Binic table lamp (named after a lighthouse on the coast of Brittany, France) is inspired by the shape of ventilator tubes on ships. Made of the copolymer acrylonitrile-butadiene-styrene (ABS)—a thermoplastic material that is lightweight but can create rigid custom-molded plastic parts—with a polycarbonate diffusing lens, the fixture uses a single 12W compact fluorescent lamp and has a compact footprint, measuring only 5 3/8 inches by 8 inches. The color selections—rich tones of white, green, amaranth, orange, petrol, or gray—add a sophisticated touch to this whimsical fixture. *www.foscarini.com* • Circle 126

Pulse, Prudential Ltg • Suited for open office, conference room, retail, hospitality, and library applications, this sculptural indirect/direct pendant, which is suspended by adjustable aircraft cables, draws its inspiration from California's coastline. The luminaire measures 9 1/4 inches wide and 5 inches tall and is available in either 4- or 8-foot lengths. Additional fixtures can be installed in 4-foot increments. Opaque white graduated acrylic baffles shield the T5 or T5HO lamps that connect to programmed start electronic ballasts. Options include emergency battery, dimming, and the manufacturer's RightLight daylight harvesting photo sensor system. *prulite.com* • Circle 127

Mod TechZone, Litecontrol and Armstrong • Litecontrol has reengineered its Mod linear recessed lighting fixture to prequalify for fit and finish in Armstrong's TechZone Ceiling System. The TechZone System arranges lighting, air diffusers, and sprinkler heads in a linear "technical zone" to provide a less-cluttered ceiling plane. The Mod fixtures are available in either 6-inch-wide linear or 4-inch-wide linear versions, and both widths are available in 4- and 5-foot fixture lengths. A 6-inch-wide continuous version is available in longer lengths. All models coordinate with Armstrong's Optima and Ultima fine-textured ceiling panels and work with lay-in or tegular ceiling formats. The fixtures can be used with one or two linear fluorescent T5 or T5HO lamps. A diffuse lens and a white blade baffle help with light distribution and brightness control. *litecontrol.com* • Circle 128

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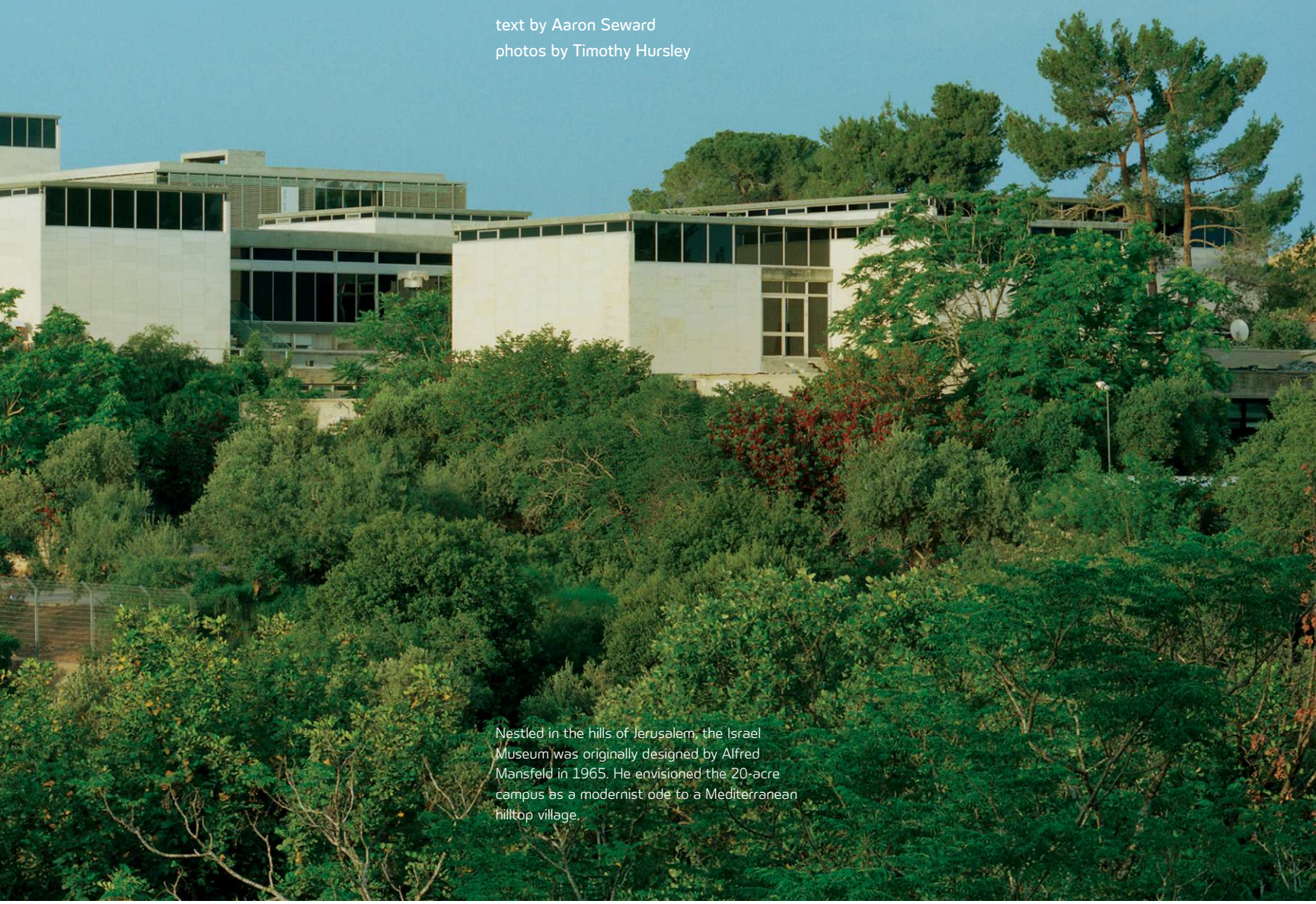
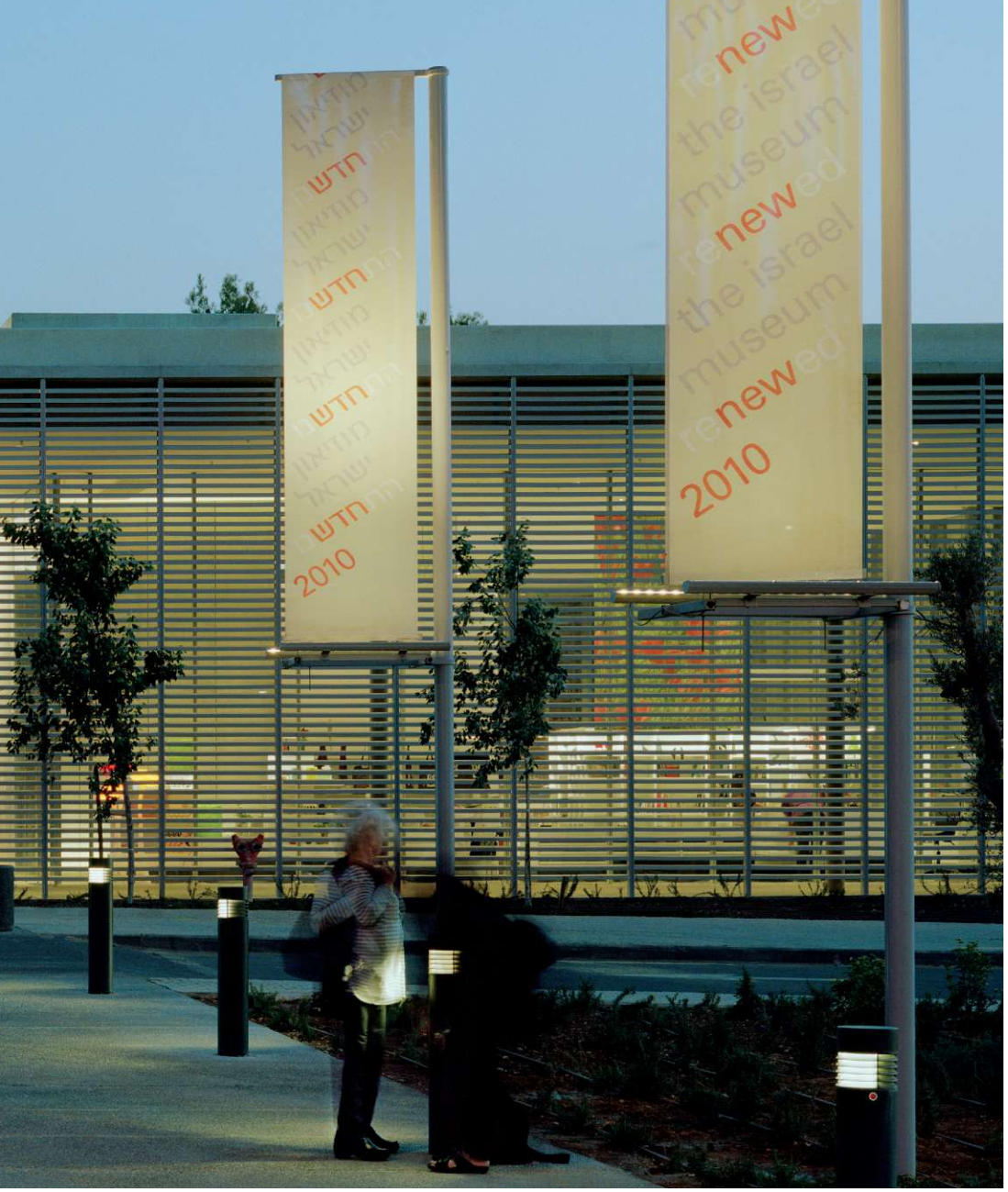
SUN-KISSED

Additions to two of Israel's leading art museums open up to the vibrant daylight of the Mediterranean.

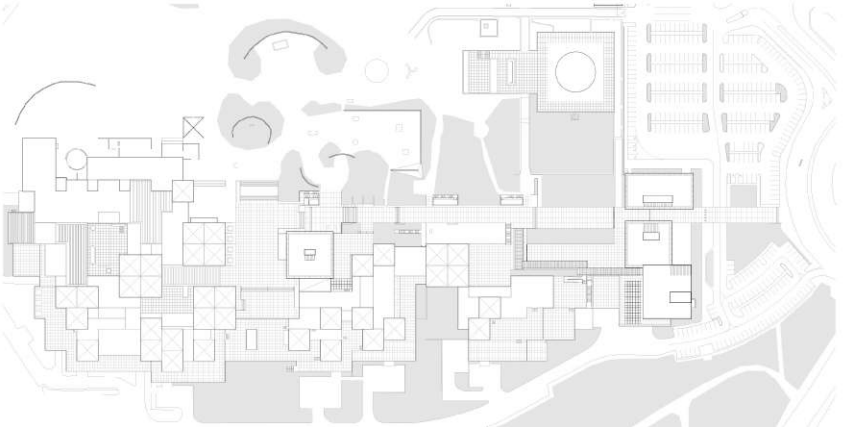
text by Aaron Seward
photos by Timothy Hursley



Nestled in the hills of Jerusalem, the Israel Museum was originally designed by Alfred Mansfeld in 1965. He envisioned the 20-acre campus as a modernist ode to a Mediterranean hilltop village.



Site Plan



N →

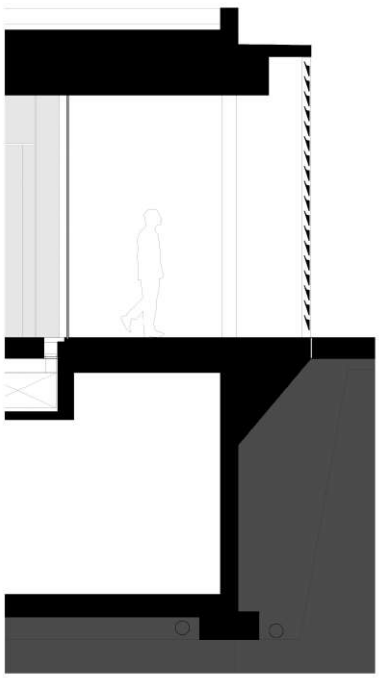
Modern architecture in Israel, of which there is a rich and abundant history, has always had to contend with an obstacle that the progenitors of the style, entrenched in northern European enclaves, probably never considered when dreaming up their effete glass boxes: at times, 4,000 footcandles of blazing Mediterranean sunlight. As a result, practitioners of this school of design, as they have had to in other places such as Palm Springs, Calif., have had to develop a different set of forms and strategies centered around managing the powerful presence of the sun.

This trend has become all the more imperative in view of our contemporary insistence—both fueled by quality of life and environmental concerns—on making the utmost use of available natural light. Two new additions to Israel's premier art institutions—the Israel Museum and the Tel Aviv Museum of Art—are prime examples of innovative architectural solutions that use daylight in this sun-drenched climate.

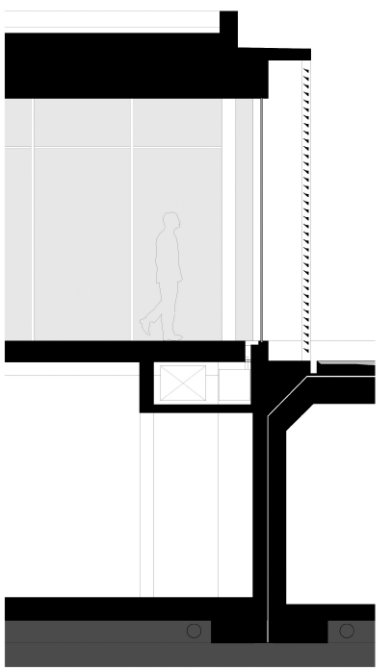
Constructed in 1965 on a hilltop in Jerusalem, the Israel Museum's original architect, Alfred Mansfeld—a student of Modernist architecture—envisioned the institution as a Mediterranean hilltop village cascading down the incline. He accomplished this by establishing an 11.2-meter-square (approximately 120.6-square-foot) modular grid which set the parameters of his buildings' plans: They either fill out a singular modular square, are combined to form a two-square rectangle, or form a large square of four. These orthogonal volumes step down the hillside and create a varied skyline that recalls the indigenous architecture of the region. Unable to go with a Miesian glass box due to the sun and the fact that this is an art museum, Mansfeld clad his buildings in Jerusalem stone, a white limestone local to the region. At the very top, there is a band of tinted clerestory

As part of the renewed campus plan, a series of new glass pavilions provide gallery entrances along with an entry and ticketing area, restaurant, and retail shop (top). At night, the museum's white Jerusalem stone façade lights up like a beacon (bottom).

Section Through Pavilion
East-West Louver Wall



Section Through Pavilion
North-South Louver Wall



windows. The idea was that these would appear black during the day, letting in a controlled amount of natural light and creating an interesting contrast with the white stone. At night, they would become glowing beacons to announce the museum's presence throughout the city. Visitors arrived at a parking lot at the bottom of the hill, then proceeded up a stately 100-yard promenade to the entrance in a sort of pilgrim's procession not unlike the route up the Acropolis to the Parthenon.

Over the intervening years, Mansfeld's scheme grew a bit threadbare and out of date. For some unknown reason, the clerestory windows were painted over and covered with drywall shortly after the museum's opening. Also, the climb to the entrance has proved to be too arduous for elderly visitors who were not keen about the lengthy trek up the mountain in the extreme heat of the summer or cold of winter. So an additional access road was installed, which essentially cut the campus in half, dividing the buildings from the landscaped gardens. And, as happens with all robust and ambitious institutions, the museum's collection, which encompasses everything from ancient artifacts to contemporary sculpture and painting, wound up outstripping the available exhibition space. It was time for a makeover.

"We decided to pull all the nonexhibition functions out of the main envelope and house them in new pavilion buildings, creating a new entry, new axial movement, and a new central circulating point," says James Snyder, director of the museum. To see this through, the institution hired two New York–based firms known for their deft understanding of light: James Carpenter Design Associates (JCDA) and lighting design firm Tillotson Design Associates. The brief was to create an architecture that would defer to the existing built environment while at the same time add a contemporary twist.

JCDA started by adhering to Mansfeld's 11.2-meter-square grid. But, where Mansfeld had felt the necessity to wall his buildings up with stone, Carpenter thought that there was a way, given today's technologies, that this could be achieved with glass cubes. "We wanted the new structures to be very open feeling and available to the landscape," he says. To do this while managing daylight, the firm developed two systems of white terra-cotta screens that function similarly to polarized sunglass lenses. For the east-west elevations, the screens feature louvers that are angled to block light from the rising and setting sun. At the same time the louvers have scoops on top to bounce light off of the bottom of the louver above, where it then radiates into the interior. Views do not pass through these screens. The north-south screens have a slimmer profile and the gap between them is larger to open the interiors to the landscape, but still diffuse incoming daylight. The louvers are placed from between 0.5 meters (1.6 feet) and about 3.5 meters (11.5 feet) away from the floor-to-ceiling glass walls, creating breezeways that keep things cool. The strategy was so successful that JCDA was able to specify monolithic laminated glass panels (a low-iron glass with no green tint that offers the purest transmission of light) and even to reduce the amount of cooling equipment necessary to keep the interiors comfortable.

The new pavilions sit at both the base of the hill, featuring such functions as a restaurant and café, ticketing, and the gift shop, as well as at the top of the hill, functioning as the new entrance and central circulation point. To connect the pavilions and get rid of the pesky old access road, the team removed the existing promenade, dug a trench that features no significant rise in grade, and covered it over with a reinterpreted promenade. The underground passage allows visitors to approach the museum's exhibition spaces along a more or less level course and in air-conditioned comfort. Carpenter also brought daylight into this space by way of sunken courtyards separated from the tunnel by diffused glass walls and a glass-bottomed watercourse that runs along one edge of the promenade, allowing the shadows of the rippling water above to fall across the polished black floor.

At night, in honor of Mansfeld's original intention, the lighting scheme is turned on its head and the buildings and promenade become lanterns. Lighting designer Suzan Tillotson and her team explored a number of options for the pavilions, but in the end went with a simple grid of 150W halogen downlights with a variety of beam spreads that bounce enough light off of the floor to create a luminous ceiling. Lighting the tunnel

James Carpenter Design Associates devised a screen system that shields the new glass pavilions from the sun, yet provides the interiors with natural light. For the east-west elevations (far left top), the screens feature white terra-cotta louvers that are angled to block light from the rising and setting sun. Scoops on top of the louvers bounce light off of the bottom of the louver above, where it then radiates into the interiors. The north-south screens (far left bottom), also white terra-cotta, have a slimmer profile and the gap between them is larger to open the interiors to the landscape, but still diffuse incoming light. A detail view of the louver system at one of the new entrance pavilions provides a silhouetted view of the Shrine of the Book in the background (left).

Details

Project: Israel Museum Addition, Jerusalem
Client: Israel Museum, Jerusalem
Architect (new circulation and amenities buildings): James Carpenter Design Associates, New York
Architect (renovation of existing museum buildings): Efrat-Kowalsky Architects, Tel Aviv
Project Architect: A. Lerman Architects, Tel Aviv
Lighting Designer: Tillotson Design Associates, New York
Project Cost: $100 million
Project Size: 624,000 square feet on a 20-acre campus: 84,000 square feet (new public entrance facilities, enclosed route of passage, gallery entrance pavilion, and new temporary exhibition galleries); 204,500 square feet (galleries)
Manufacturers: B-K Lighting, Bega, Concord, D-LED, Gaash Lighting, Hydrel, Lumiance, Lucifer Lighting, Osram Sylvania, Platek Light, Philips Lumileds, Unilamp

Project: Herta and Paul Amir Building, Tel Aviv Museum of Art, Tel Aviv
Client: Tel Aviv Museum of Art, Tel Aviv
Architect: Preston Scott Cohen, Cambridge, Mass.
Lighting Designer: Tillotson Design Associates, New York
Project Cost: $45 million
Project Size: 200,000 square feet
Manufacturers: Bega, Erco, Exterieur Vert, Gaash Lighting, Louis Poulsen, Lucifer Lighting, Osram Sylvania, Philips, Regent Lighting, Targetti Poulsen, We-ef, Xenon Architectural Lighting

James Carpenter: Environmental Refractions, *by Sandro Marpillero, Princeton Architectural Press, 2006*
This is the first monograph dedicated to James Carpenter who is known for his work with light and glass. Working across disciplines, his exploration of transparency, reflection, and refraction takes on an architectural and a sculptural form.

Tel Aviv Museum of Art

Axonometric of the building

Courtesy Preston Scott Cohen

Natural light with electric lighting systems illuminate the Israel Museum's galleries and diverse collections in the archaeology wing (far left top), the upper entrance hall with pieces from the contemporary art collection (far left middle), and objects of Judaica in the Jewish Art and Life collection (far left bottom).

At the Tel Aviv Museum of Art, light plays a dynamic role as the defining spatial element in the museum's new addition and the building's central interior feature: the Lightfall (left top). The project's tight site conditions necessitated a creative architectural solution, the result of which is a complex architectural form (left bottom).

proved to be a greater challenge. "The floor in the underground passage is very dark," Tillotson explains. "We had to find a way to make it exciting." The designers embedded flush-mounted MR16 metal halide fixtures behind the diffused glass walls to graze them. Similar fixtures wash the vine-encrusted walls of the courtyards. The MR16s also cast light up through the glass-bottomed water feature, generating a strip of guiding light alongside the promenade.

Sitting high on a hill in its holy city, Carpenter's addition to the Israel Museum adheres respectfully to Mansfeld's precedent. The Tel Aviv Museum of Art's (TAMA) new addition, on the other hand, asserts a distinct identity among the bustling, cosmopolitan setting of Tel Aviv. The museum sits at the heart of the city's crowded cultural district. When it came time to add 200,000 square feet of new gallery space, the museum only had one place to grow: an idiosyncratic triangular site between its original building, a public park, and the Tel Aviv Performing Arts Center plaza. The problem was that there simply wasn't enough space on the lot to fit a structure of that size without exceeding the municipal height limits and overshadowing the older cultural buildings. Cambridge, Mass.–based architect Preston Scott Cohen, however, knew exactly how to solve this; his competition-winning design buries half of the project underground.

While this design direction remedied the issue of having enough space, it created a new concern: The subterranean parts of the structure threatened to become too disconnected and cavelike. "I wanted the building to create a seamless transition from the outside world to the artificial realm of art," Cohen explains. To accomplish this, he created a void in the middle of the building topped by a skylight, an 87-foot-tall atrium that Cohen calls the Lightfall. Piercing through all five floors of the museum, the Lightfall brings daylight to the lowest reaches of the museum. "You get an incredible glow below the building," Cohen says. "You know you have gone down into this subterranean condition, but the light there is uplifting. You also get a combination of warm natural light and cool artificial light that animates the white surfaces of the interior."

The Lightfall also presented a handy way of answering another of the project's dilemmas. The museum wanted traditional rectangular galleries, spaces that are difficult to accommodate in a triangular plan. To mediate the forms, Cohen established within the Lightfall subtly twisting geometric surfaces—hyperbolic parabolas—that connect the disparate angles between the galleries. These angles also help to refract daylight into the deepest recesses of the half-buried building.

The exterior of the addition, whose official name is the Herta and Paul Amir Building, has its own way of playing with light. Its poured-in-place concrete panels are faceted in a variety of angles that manipulate the blinding sunlight that strikes its surfaces. "The building is like a hovercraft," Cohen says. "It has lots of cantilevers that create interesting shaded porticoes and undercrofts. The upper part of the façade curves, catching the light and dissolving into the sky. It doesn't appear to have a definitive limit."

At night, Tillotson's electric lighting scheme picks up where the sun leaves off. While the galleries are soberly lit with 100W track-mounted halogen fixtures, the wild angles of the public spaces were given a more sensual treatment. "We decided to light the Lightfall and try to do things at night that daylight couldn't do," Tillotson says. The team outfitted the rim of the skylight with pipe-mounted theatrical metal halide spotlights that pour light through the twisting void to the bottom floor. "We have tons of layers of light," she says. At the bottom of the Lightfall, the designers placed an outline pattern of LEDs in the paving that describes the form of the skylight above. A similar "placemat" of LEDs in the sidewalk pavement marks the entrance of the museum outside. The team did not neglect the nighttime façade either. Pole-mounted 150W metal halide lamps illuminate the faceted surface, making it shine into the general illumination of the nighttime city.

Just as the trailblazers of Modernism developed one set of guidelines that were interpreted in hundreds of different ways for different conditions, the Israel Museum and TAMA show that there are even multiple ways to handle the singular condition of an abundance of natural light. One serene and contemplative, the other wildly imaginative, they both prove that with talented designers on the job such as Carpenter, Cohen, and Tillotson, a fresh perspective can always be found. •

RUTH AND CARL J. SHAPIRO FAMILY
COURTYARD

•EMERALD JEWEL

The new Art of the Americas wing at Boston's Museum of Fine Arts transforms the institution for the next century.

text by Elizabeth Donoff

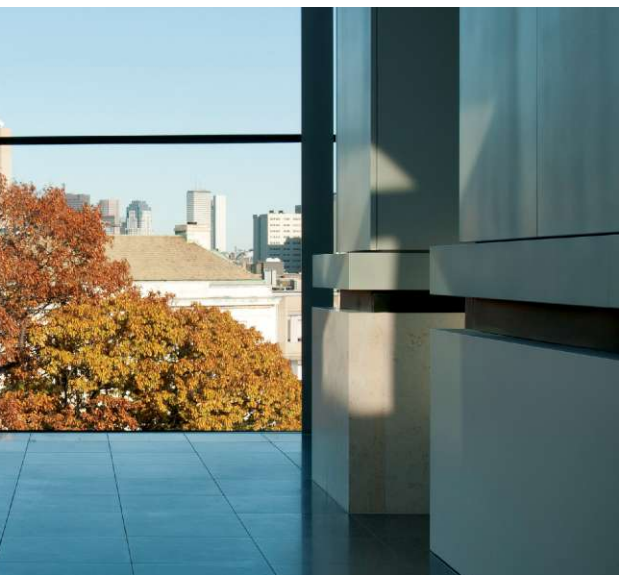
Details

Project: Art of the Americas Wing, Museum of Fine Arts, Boston
Client: Museum of Fine Arts, Boston
Design Architect: Foster + Partners, London
Executive Architect: CBT/Childs Bertman Tseckares, Boston
Lighting Designer: George Sexton Associates, Washington, D.C.
Project Cost: $345 million
Project Size: 121,307 square feet
Manufacturers: Edison Price Lighting, Erco, Litelab, Lithonia, Nulux, Zumtobel

The defining character of the Shapiro Family Courtyard, the gateway to the new Art of the Americas wing, is expansiveness, thanks to its skylight ceiling, glazed side walls, and 63-foot height.

"The MFA is more than just a great cultural institution—it is the catalyst for the rejuvenation of an entire neighborhood in Boston. Over time the museum had lost its connection to the Back Bay Fens and the beautiful landscape of Frederick Law Olmsted's 'Emerald Necklace.' In restoring Lowell's original master plan and in opening up and reasserting the grand Fenway entrance, we have rediscovered this link."

—Norman Foster



One hundred and three years after it first opened its doors on Huntington Avenue, the Museum of Fine Arts, Boston (MFA) is celebrating another milestone in its history—the opening of the Art of the Americas wing. More than a decade in the making, the new building is more than just an addition; it is the culmination of a complete reenvisioning of the museum in everything from its collections to its architectural footprint to its interaction with adjacent neighborhoods and the city at large.

The MFA's building history is characterized by periods of expansion and periods of stagnation as the museum met the challenges imposed by two world wars and the Great Depression. When current director Malcolm Rogers arrived in 1994, the institution was facing a number of challenges, not the least of which was an operating budget deficit.

Rogers shook things up, reorganizing curatorial staff and staging exhibitions that dealt with more mainstream art topics. He had a plan, a larger vision of what the institution could be. In 2000, he embarked upon a fundraising campaign that would include resources for a building expansion that was rooted in a comprehensive strategic master plan developed by Foster + Partners in 1999.

Rogers' mission has paid off with the opening of the Art of the Americas wing in November. The 121,307-square-foot building is one of the most significant projects dedicated to American art in the past decade, thanks to the most successful fundraising campaign by any New England cultural institution. (The museum raised $504 million for new construction and renovations, endowment programs and positions, and annual operations.) The scope of work, which includes the new wing, evolved over time, and includes significant renovations to the museum's existing buildings.

The success of the project began with an extremely collaborative process among the museum leadership and staff and the various consultants. In determining how they should proceed, key museum officials joined the architectural team on visits to 29 museums in the U.S. and Europe to study different types of building and gallery layouts. "It was a shared learning experience," says architect Michael Jones, a partner at Foster + Partners who oversaw the project along with senior partner and head of design Spencer de Gray.

The result of this careful study is a T-shaped addition with two pavilion structures at each corner that carefully fit into the assemblage of older museum buildings like the missing piece of a puzzle. (Because of seismic code requirements, the new wing is actually a separate building.)

In their strategy for the new wing, Foster + Partners revisited the 1907 master plan laid out by architect Guy Lowell when the MFA moved from its original Copley Square home to its current 12-acre site between Huntington Avenue and the Fens. Lowell knew that limited funds would cause the museum to be built in stages. The first stage was his neoclassical pile along Huntington Avenue, completed in 1909. Lowell then extended the museum's north-south circulation axis to the Fens side of the site with the Evans Wing in 1915.

But Lowell's master plan also envisioned the museum growing to the east and the west. Over time, new building occurred, filling out the museum's site, including the 1928 Lowell-designed Decorative Arts Wing and a sculpture garden on the west side of the site, also completed in 1928. Architect I.M. Pei's 1981 West Wing shifted the focus of the museum away from its north-south spine, as the new entrance became the de facto front door.

The new wing on the eastern side of the museum campus now remedies this imbalance, further aided by the reopening of both the Huntington Street and Fens entrances, which had been closed over the previous decades as a cost-savings measure.

The Art of the Americas wing is all about the collection. Its ambitious purpose is to recount the art history of an entire hemisphere. Each of the 53 new galleries are organized by culture, period, region, style, theme, artist, and maker on four levels. And each level features a large center gallery surrounded by smaller galleries to either side and in the pavilion buildings.

The exhibits highlight the breadth of the museum's holdings and allow visitors to see the connection points between objects in the collection, such as John Singleton Copley's 1768 portrait of patriot and silversmith Paul Revere, which hangs alongside Revere's most significant work, the Sons of Liberty Bowl.

Lighting acts as the perfect complement to the gallery design by Foster + Partners. Lighting designer George Sexton has collaborated with Foster since the 1970s, and his scheme for the MFA responds to the mixed-media approach of the exhibits and the rich variety of interior finishes and colors.

A ceiling tracklighting system outfitted with halogen sources is the main lighting system in the galleries. Lighting in the display cases (there

The façade of the new Art of the Americas wing is a contemporary composition of granite and glass, accented on the interior by architectural screens created for the museum by artist Erwin Hauer (top). A museum visitor looks out at the Boston skyline from one of the perimeter walkways of the light-filled new wing (left).


PENNY AND JEFF VINIK GALLERY

The Art of the Americas Wing showcases a diverse collection of art and objects from North, South, and Central America. On the lower ground level, in the Ancient Central America Gallery, the museum's collection of Classic period Maya ceramics comes to life (left). On the second floor, the Penny and Jeff Vinik Gallery is home to a collection of 19th-century paintings hung salon-style from floor to ceiling; the middle of the room is dotted with sculptures (far left). The focal point of the Kristin and Roger Servison Gallery on the first floor is Thomas Sully's 1819 *The Passage of the Delaware* (left bottom).

are about seven different types throughout the new galleries) responds to what best serves the objects while offering a level of flexibility so that displays can be changed as needed.

Conservation requirements were a serious concern. "Boston has done a lot of research over the years in their conservation department on lighting, and they have pretty strict UV filtration requirements," Sexton explains.

This necessitated a very elaborate final focusing process. "Because we were contracted to physically adjust the exhibition for the opening, part of that task was to work directly with their conservation department to make sure the objects were lit within the standards they've created," says Brian McIntyre, Sexton's lead designer on the project. MFA conservator Dawn Kimbrel followed McIntyre, measuring and documenting the light levels on every artwork and object on display. She then entered that information into a database to track the exposure history of the object.

That same level of attention to light transmission occurs in the technical specifications for the glass curtainwall of the Shapiro Family Courtyard and a skylight that continues from the courtyard through to the third floor contemporary art galleries. Foster + Partners worked with German curtainwall specialists Seele for both the overhead and vertical glazing, each a complex matrix of glass panels with different coatings, interlayers, and laminations that responds to changing lighting conditions throughout the day. The skylight is made up of three layers: a top layer of glass with a UV filter, a middle layer of louvers that can be closed for blackout conditions, and a bottom layer of V-shaped ceiling louvers that provide the final layer of light filtration.

Light, space, and art all work harmoniously in this monumental project of elegance and ease. It is a testament to the clearly defined vision for the museum's future, led by director Malcolm Rogers, and the talented team of architects, lighting designers, curators, and conservators who steward this collection for future generations. •

AN EYE FOR ART

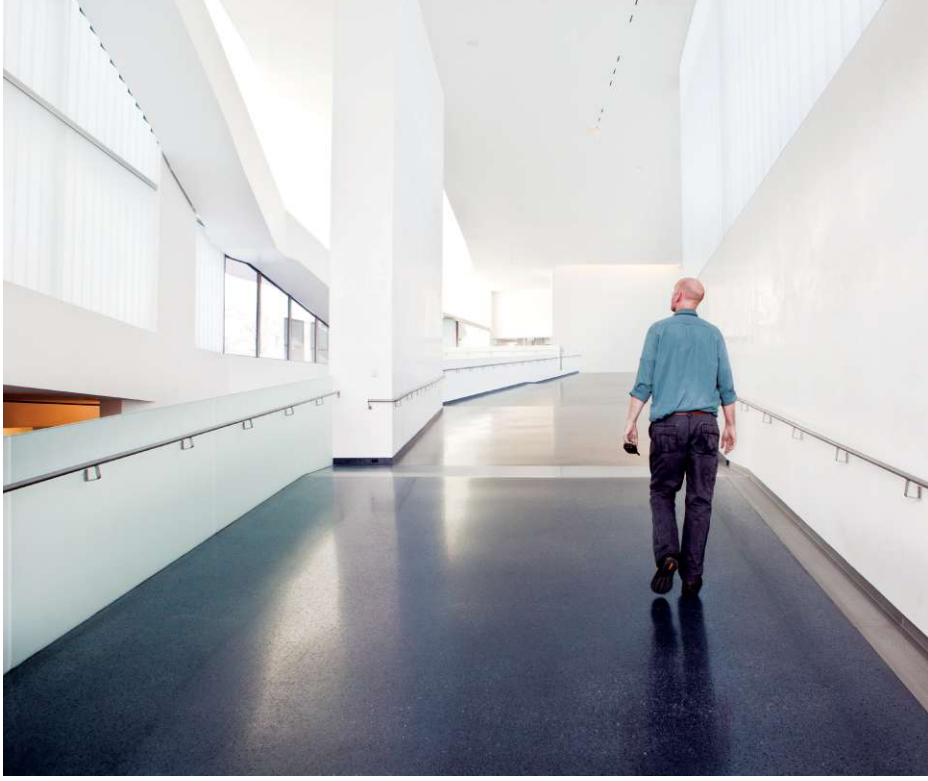
The Nelson-Atkins Museum of Art deploys its own lighting designer to make the most of its collections.

text by Steve Paul

photos by Ian Allen

"Some curators leave me to light the show on my own until a final walk-through, while others are more involved throughout the process. Most often, though, I would say it falls somewhere in between — a real collaboration."

— Balancing viewer comfort, object safety, and ideal illumination are all part of a day's work for lighting designer Clint Paugh.



It's a quiet Tuesday morning at the Nelson-Atkins Museum of Art in Kansas City, Mo. School children file into a room housing Egyptian funerary artifacts lighted from above by tiny fiber-optic dots—and Clint Paugh is perplexed. The museum's in-house lighting designer is bent over his laptop nearby, and he can't figure out why the software controlling the illuminators, the brains behind those lighted fibers, isn't working. The color seems to be off in one glass case, and he can't change it. An assistant emerges from a closet to report that he has tried adding and removing a small terminator on a cable. "It doesn't seem to be making any difference," Paugh says. "Let's just leave it off and I'll keep an eye on it the next couple of days."

This software anomaly presents Paugh his toughest challenge during the course of the day; it recurs as he makes his rounds of the museum's treasure-filled galleries. Museums typically employ outside consultants, so it's rare to find a full-time in-house specialist like Paugh dedicated to lighting issues such as this.

MR16 halogen lamps. Fluorescent tubes. Ganglions of fiber optics. These are Paugh's tools in making the artwork the main event of the museum experience. All light that shines on or near a piece is his responsibility. (Electrical engineers handle all other fixtures in open, artless areas and back-of-house spaces. As for outdoor sculptures, it is the museum's policy not to illuminate them.)

Paugh has begun this December day, as he does once or twice a week, walking through the museum, mostly looking up. A lanky six-foot-five, he circles room after room, head cocked and eyes alert for dark spots in tracklighting and dull spots on the walls. Nearly a dozen times he stops, clicks the Notes App on his iPhone, and leaves himself a reminder to return and install new lamps. In one gallery filled with impressionist paintings, Paugh finds a "dead" spotlight that's supposed to wash the wall between works by Cézanne and Pissarro. He explains how he might accessorize the halogen spotlights to achieve the desired effect—spread lenses to diffuse the light, hand-cut window screen to reduce it, or daylighting filters to tweak colors.

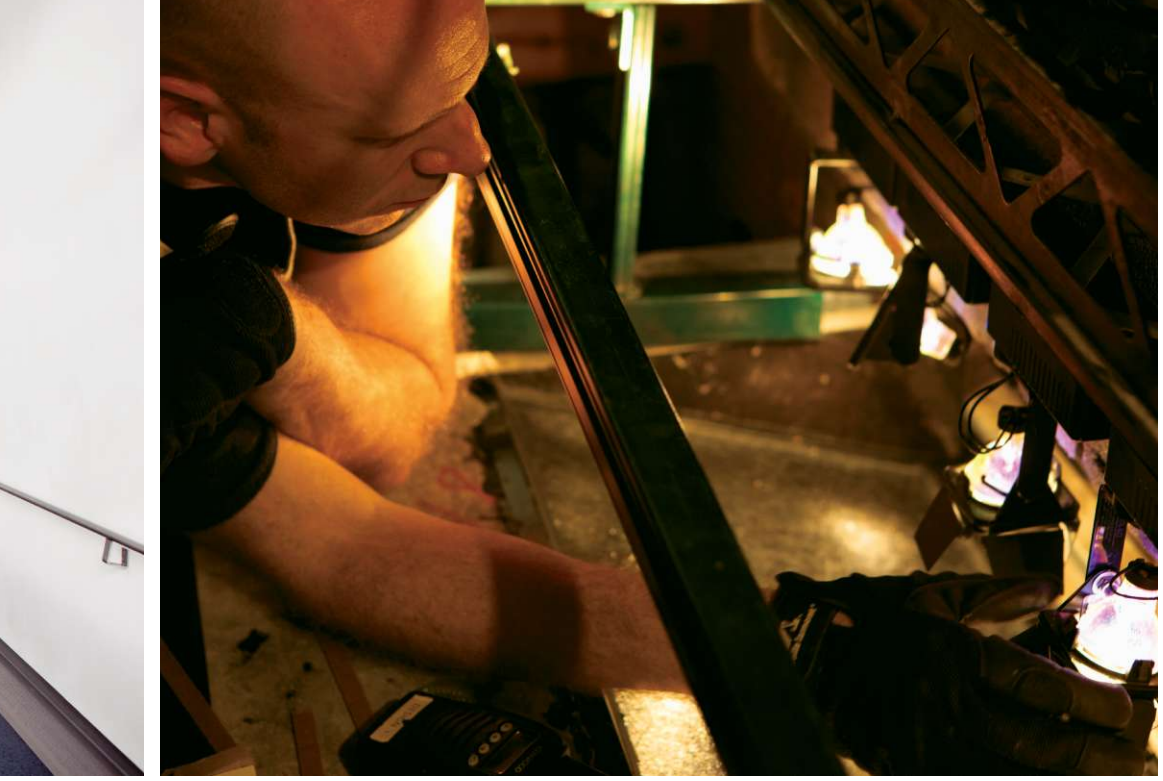
While planning for a forthcoming exhibit, "Monet's Water Lilies," opening April 9, Paugh found that adding daylight filters to three of the 12 spotlights aimed at the Museum's violet-tinged version helped the 14-foot canvas pop. Monet painted approximately 250 canvases depicting the water lily pond in the garden of his home at Giverny, France. The spring exhibit will reunite the Nelson-Atkin's painting with two companions from the art museums in St. Louis and Cleveland. "A little bit of that cooler color hitting the painting seemed to make a difference," Paugh says.

Paugh's interest in light began with photography. The Wichita, Kan., native, now 40, attended graduate school at the University of Illinois, where he worked odd jobs, including lighting and exhibit design, at the campus museum. After leaving Illinois in 1996, he taught photography at a community college in western Kansas.

Although he eventually switched his artistic emphasis to sculpture, his eye for light served him well. He landed at the Nelson-Atkins in 1999, first spending a three-month, part-time gig in packing and storage, then was hired on full-time as a preparator and lighting technician. He was in the right place at the right time. In 1999, the museum began planning an expansion project, and the new addition—the Bloch Building, designed by architect Steven Holl—was all about light. (Opened in 2007, the new wing sports five glass-walled pavilions that bring natural light into underground spaces during the day and glow at night. See "Sculpting with Light," Sept/Oct 2007.)

Early on, Paugh had the chance to spend a week-long internship at the National Gallery of Art in Washington, D.C., and he attended a museum-lighting workshop at GE's Lighting & Electrical Institute at Nela Park in Cleveland. This provided a good foundation when, in 2001, he moved from his position with the preparation staff (art handlers and exhibit builders) to one of design.

Another training opportunity arose when he spent three weeks in 2004 interning with George Sexton Associates in Washington, D.C. Sexton, an independent lighting designer, had worked on gallery renovations for the Nelson-Atkins in the 1980s. Paugh learned about fixture specification and placement and picked up technical skills involving mathematical formulas and footcandle levels. But much of what he brings to the job today comes from his time working with, watching, and learning from lighting consultant Richard Renfro and his colleagues at Renfro Design Group, who were tasked with solving the lighting challenges of Holl's Bloch Building. "The whole process was



A typical workday for the Nelson-Atkins Museum of Art's in-house lighting designer Clint Paugh is never dull. Myriad lighting issues—including software programming, scouting for "spent" lamps, adjusting luminaire equipment, and focusing and relamping fixtures (above left to right)—occupies his time, as he stewards every light that interacts with a piece of art in the museum.

one big learning experience for me," Paugh says, and involved everything from angling tracks to using low-voltage fixtures.

Paugh is the sole lighting designer at the museum; a former lighting technician, Amber Mills, was not replaced when she moved to the exhibition design department, though Mills and others do help Paugh handle lighting duties. On his rounds this December day, Mills takes the 14 Bloch Building galleries as Paugh inspects most of the 64 individual galleries in the museum's original, 1933 Beaux Arts palace. After a couple of hours, lamps replaced and some focusing adjustments made, Paugh huddles with an electrical engineer about tweaking fixtures in a Bloch Building gallery.

Next stop is a small dark room where several staffers have gathered to look at backlighting mock-ups for the Monet exhibit. The show will include X-rays of the museum's *Water Lilies*. Paugh has set up three options for European curator Ian Kennedy and exhibit-design colleagues. One mock-up uses an electroluminescent panel, the others incorporate LEDs with either cool or warm filters. They settle on the brighter and warmer LED option.

Although LEDs are the solution for this installation, Paugh is cautious about them. "As for using LEDs on most artworks, so far they haven't got there yet," he says. "Mainly the color quality isn't that good yet and the beams aren't as tight or as neat as I would like to see them."

Lighting issues don't take a break. A few minutes later, Paugh finds himself standing on a ladder, opening a display case lid in the Native American galleries. It's another issue involving the software breakdown between Paugh's computer and the fiber-optic illuminators from that morning. Now, to lower the intensity of light in the case, Paugh has to bypass the system software and connect the illuminator directly to the laptop on his mobile cart.

The illuminator is like a single lamp with numerous tentacles—the fiber optics, that is—says Steven Mark Johnson, master electrician with the Kansas City Repertory Theatre, who volunteers to work with Paugh at the museum a few hours a week. Among the advantages of the CMY150 illuminators is the ability to mix colors when necessary, to control timing and fine-tune lighting effects with relative ease. In addition, Paugh notes, a single 150W device with numerous pinpoint fibers can replace 900W or more of conventional lamps.

After lunch, Paugh meets with Colin Mackenzie, senior curator of early Asian art, who is in the midst of gallery renovations in the Chinese collection. Mackenzie hopes to minimize the room light and keep the drama on the artifacts. "I wanted this gallery to have an air of mystery," he tells Paugh.

To Paugh, that means the usual period of give and take, balancing viewer comfort, object safety and ideal illumination. "Some curators leave me to light the show on my own until a final walk-through," Paugh says, "while others are more involved throughout the process. Most often, though, I would say it falls somewhere in between—a real collaboration." •

Steve Paul is a senior writer and arts editor at The Kansas City Star*, where he writes about culture, architecture, books, food, and other subjects.*

AD INDEX

George Sexton

interview by Elizabeth Donoff

"It seems like there is a major upheaval or paradigm shift every decade. The profession will change, and, through that change and growth, the profession will sustain itself. It will always be an evolving format."

Unlike the artworks he illuminates, George Sexton prefers not to be in the spotlight. Rather, he prefers to let his work speak for itself. Trained in architecture at Virginia Polytechnic Institute, he found himself—after graduation, amid a recession in the early 1970s—seeking employment beyond architecture firms and had the good fortune to find a position with lighting designer Claude Engle. Assigned to the east wing extension for the National Gallery of Art in Washington, D.C., which Engle was working on at the time, was what set Sexton on a course of museum work that has been the cornerstone of his professional lighting career.

Do you have a design or a lighting philosophy?
Design-wise it's about listening to the client. In terms of lighting, we are of the school that you shouldn't notice our work; it should be transparent.

What are the specific challenges of museum and exhibit lighting projects?
Conservation, flexibility, budget, and continuity. I think of museums as slow-moving, temporary exhibitions.

What are some museum lighting trends?
I think that museum lighting will always look for flexibility. I think that current lighting in museums is moving to respond to conservation and energy issues.

Are museums trying to incorporate greater amounts of daylight into their galleries?
Daylight is very important to the visitor's experience. Architects and lighting designers have a great comfort level in working with daylight. It is something that can be managed in a way that is consistent with museums, but when making that choice, there is a cost of controlling daylight that needs to be considered.

How are new technologies, such as LEDs, impacting museum lighting applications?
It's a technology that is evolving, and in terms of the expectations of museums—conservation, flexibility, control, color, and budget—LEDs aren't there yet. But at some point they will make the leap where they are used for their compactness and for their energy and maintenance characteristics.

What other technologies are impacting museum lighting?
There's a whole area of controls, particularly as they relate to conservation and energy issues. Interactive media as well. We need to be clever as designers and consider these other sources (i.e., the whole range of media generated light) as part of the lighting solution. •

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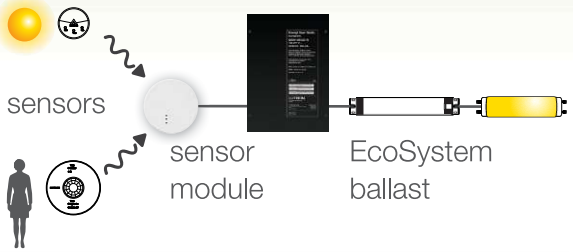

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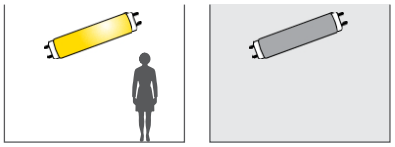

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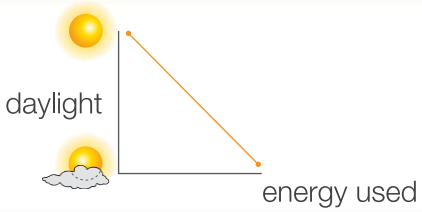

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