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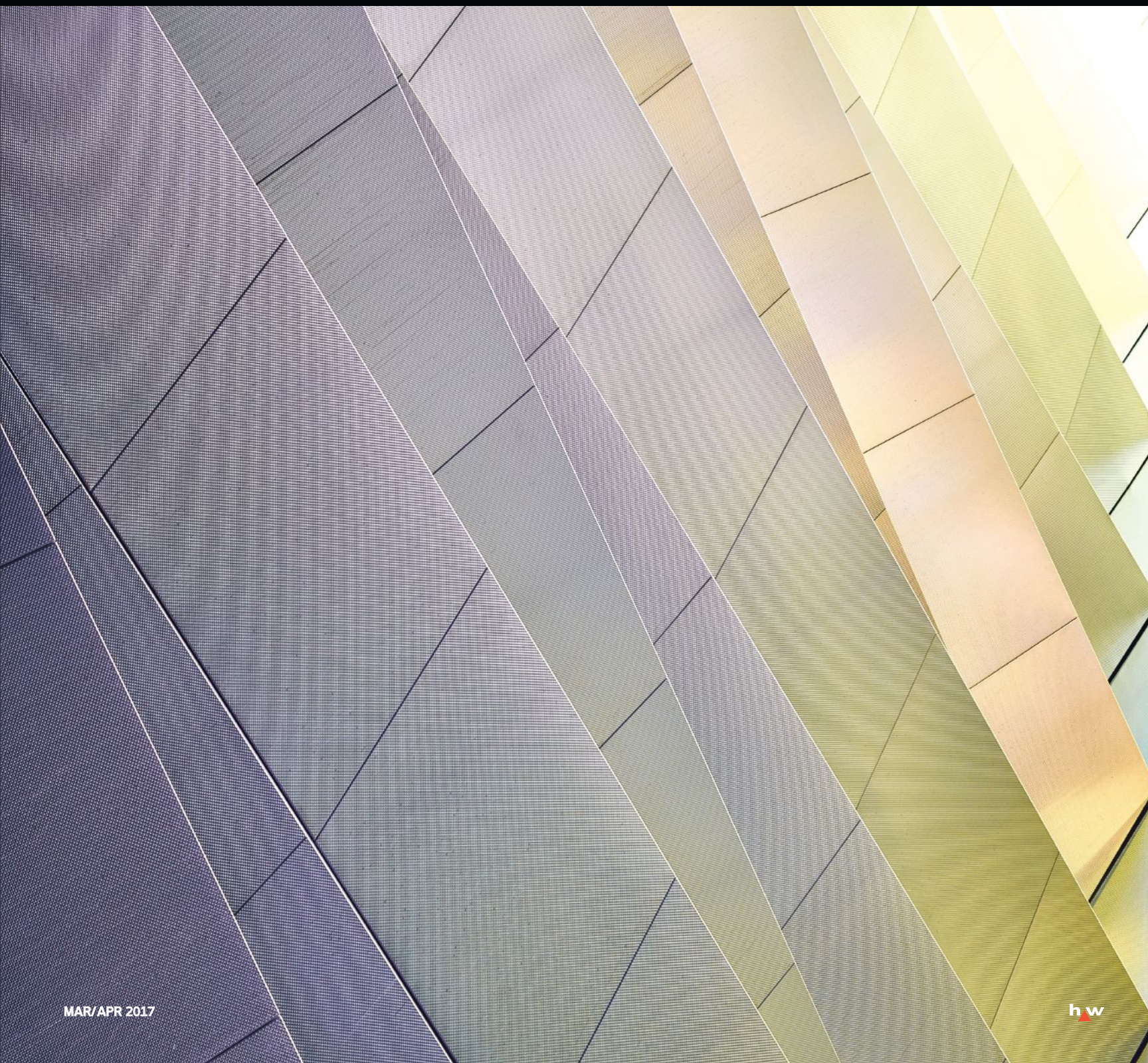
INSIDE: LIGHT FESTIVALS • NEW MATERIALS AND TECHNOLOGIES • JAMES CARPENTER ON THE INTERSECTION OF ART AND LIGHT • HILLMAN HALL • DOMINGO GONZALEZ



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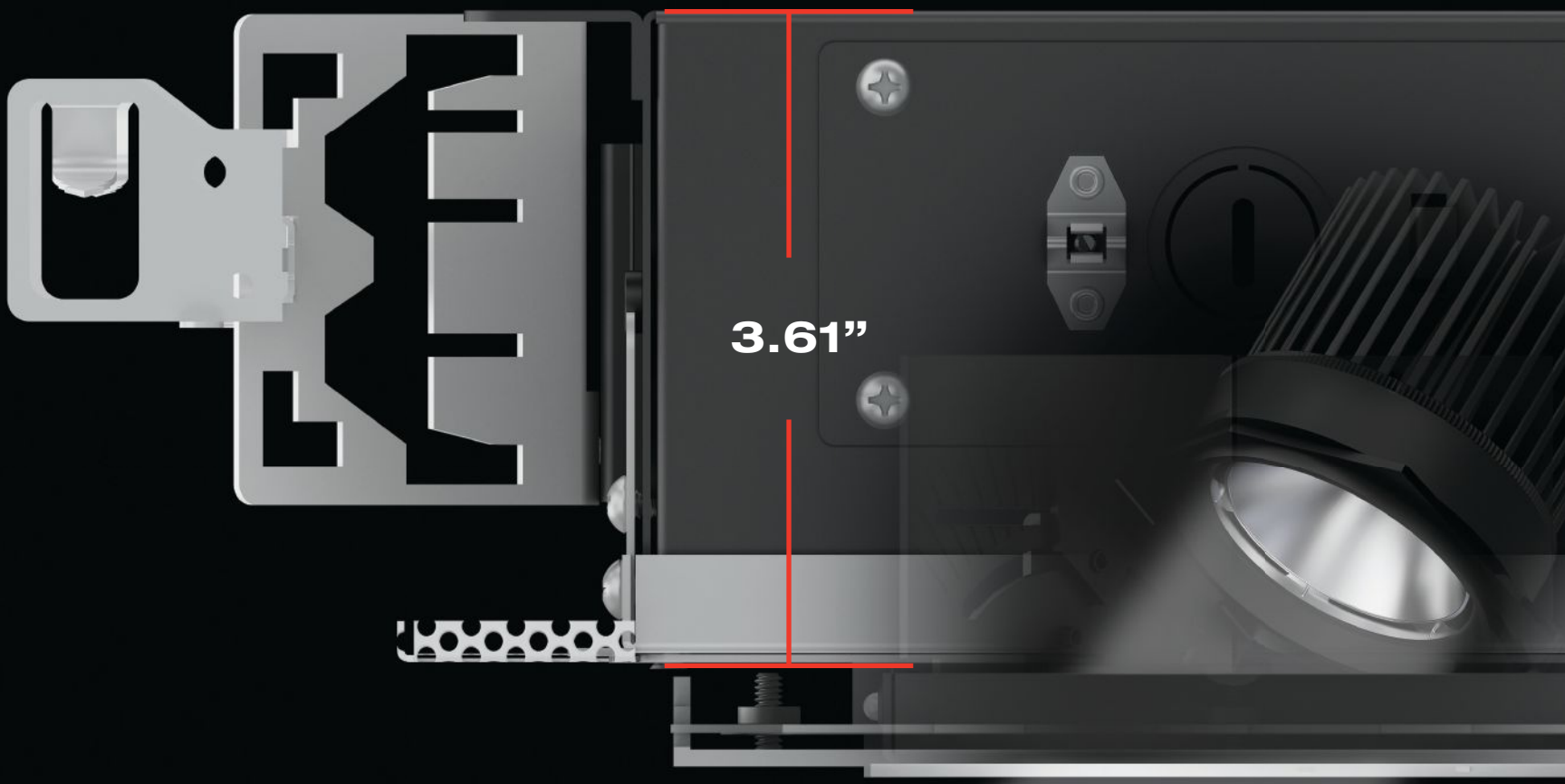

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ARCHITECTURAL LIGHTING

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A·L ARCHITECTURAL LIGHTING (Vol. 31, No. 2 USPS 000-846, ISSN 0894-0436) is published six times per year (Jan/Feb, March/April, May/June, July/August, Sept/Oct, Nov/Dec) by Hanley Wood, 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. Canada Post Registration #40612608/G.S.T. Number: R-120931738. Canadian return address: IMEX, P.O. Box 25542, London, ON N6C 6B2.

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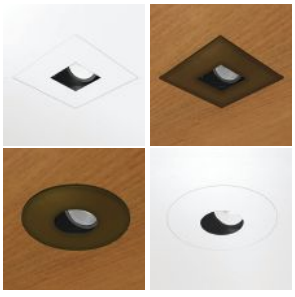

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FEATURES

A view of the forum at Hillman Hall, and its contemporary-styled wood ceiling.

DEPARTMENTS

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As always, check out our website for expanded article coverage, videos, and news. Also, subscribe to our email newsletter, AL Notes, and find a link to ARCHITECTURAL LIGHTING's digital edition.

On the Cover: Folded Light by Carpenter Lowings. Photo: Timothy Soar

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STAYING RELEVANT

Stephen Voss

The year has gotten off to a busy start. No sooner had we wrapped the Jan/Feb issue of ARCHITECTURAL LIGHTING than we began work on not one, but two future issues: the Annual Innovation Issue that you are reading now and the forthcoming Annual Product Issue that will be released at Lightfair. Producing two issues simultaneously, I've been struck by a significant contradiction. On the one hand, there has been rapid and monumental change in the lighting industry over the past several years; on the other hand, the lighting industry has not fundamentally changed that much. This dichotomy between continuity and transformation certainly keeps things interesting and it serves several purposes. It's a good way to think about how we adapt when presented with new ideas, technologies, and processes. It's also a good way to frame the thesis of this issue.

One of ARCHITECTURAL LIGHTING's priorities has always been to represent the range of work occurring across the lighting community. We meet that challenge, I believe, by presenting as many voices as we can—some who are new to lighting, some who are just establishing themselves, and others who have maintained their relevance across the decades. Finding a balance between the past, the present, and the future—and how to reconcile progress with tradition—is the eternal quest of humanity. On the following pages, you'll find a snapshot of the design community today and those working with light as their medium.

In a world that places great importance on the newest invention, there is something to be said for longevity and consistency in the face of change. One such example can be seen in our cover story about James Carpenter. For more than 40 years, Carpenter has found a way to bring together his interests in art, sculpture, architecture, and engineering. There is a continuity to his work, as he realizes his ideas about the interaction of glass and light in each successive project. Juggling the demands of four separate practices and the interdisciplinary nature of the work is no easy feat. And yet, Carpenter never ceases to push boundaries and harness the primal qualities of light.

Next, looking to the emerging generation of lighting designers, check out our feature on Gabe Guilliams—who leads the lighting design group at BuroHappold—and his scheme for Hillman Hall at Washington University in St. Louis. The complexity of the design for the building's forum space and its intricate wood ceiling is representative of the level of detail that is required of lighting designers today.

The complexity in executing a lighting design is also seen at Cadillac House in New York, the subject of our In Focus article. Here, the team at Brian Orter Lighting Design used a variety of sources—old and new—to reflect the automaker's history and transformation as a brand in its quest to appeal to a new audience.

For our Products article, Blaine Brownell looks at the way light is being incorporated into new materials and techniques by innovators who are not traditional members of the lighting community.

Our Technology article asks designers about the existing and forthcoming technologies that are impacting their day-to-day practices.

And finally, in our One-on-One interview, we speak with lighting designer Domingo Gonzalez, who reminds us about the importance of history as a guide for our work.

I also want to take this opportunity to share some exciting news with you. In February, AL received word that it is a finalist in four major categories for the Neal Awards, business-to-business journalism's highest form of recognition. The categories are: Best Media Brand, Best Website, Best Single Issue (30th Anniversary Issue), and Best Commentary/Blog. At press time, we don't know if we won, but we'll let you know online.

While I have the luxury of being the public face of this publication, there is an entire team working behind the scenes, and it wouldn't be possible to bring you AL without their hard work and talent. After all, collaboration is one of the hallmarks of innovation. •

Elizabeth Donoff
Editor-in-Chief
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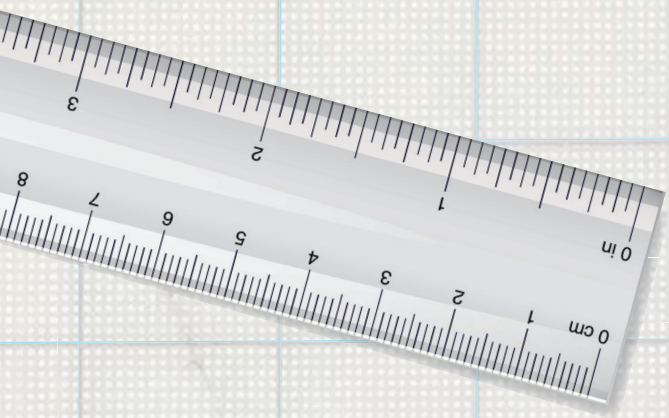

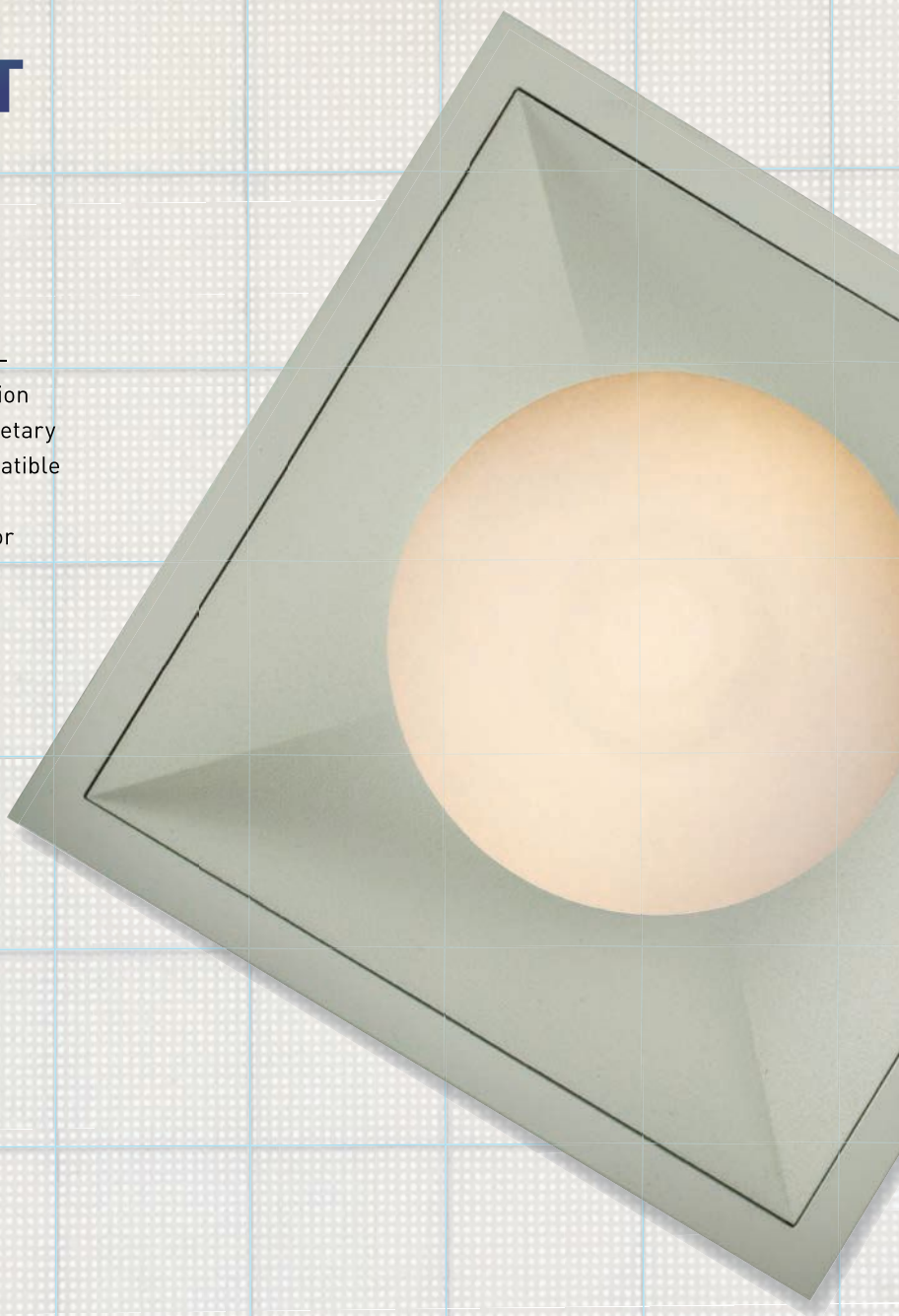

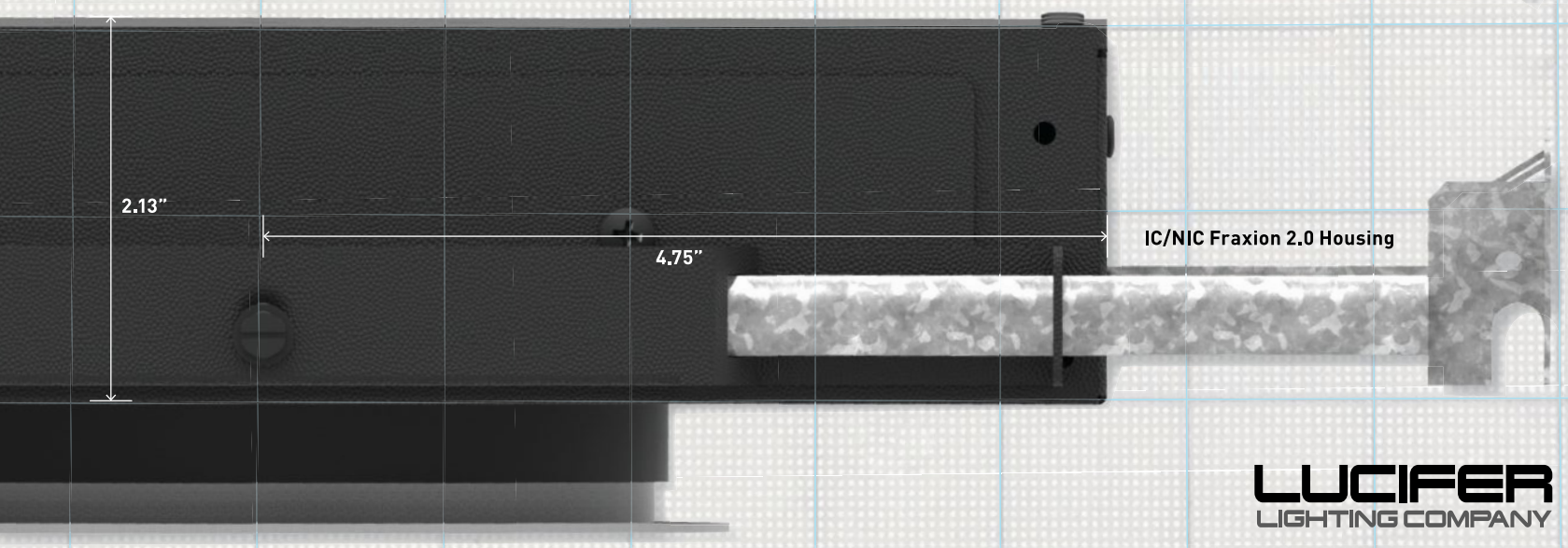

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Albert Vecerka/ESTO

RECLAIMED LIGHT

What to do with a leaky underground water cistern? The City of Houston was ready to demolish theirs and donate the land to the new Buffalo Bayou Park already underway directly above. But after one look, Lawrence W. Speck, principal of Washington, D.C.–based architecture firm Page, said "Don't destroy it." The space is now a venue for immersive art installations, relying on 2700K RGB LED rope lights, fitted into the handrails of the walkway that encircles the hypostyle hall, as the main illumination source. Two existing skylights and four new egress doors can be opened to let natural light filter in. "It was more about designing darkness than light," Speck says. "Part of what is so beautiful about the space is how mysterious it is—if you light it too much, it takes the magic away." —**Katie Gerfen** *bit.ly/BuffaloBayouPark* •

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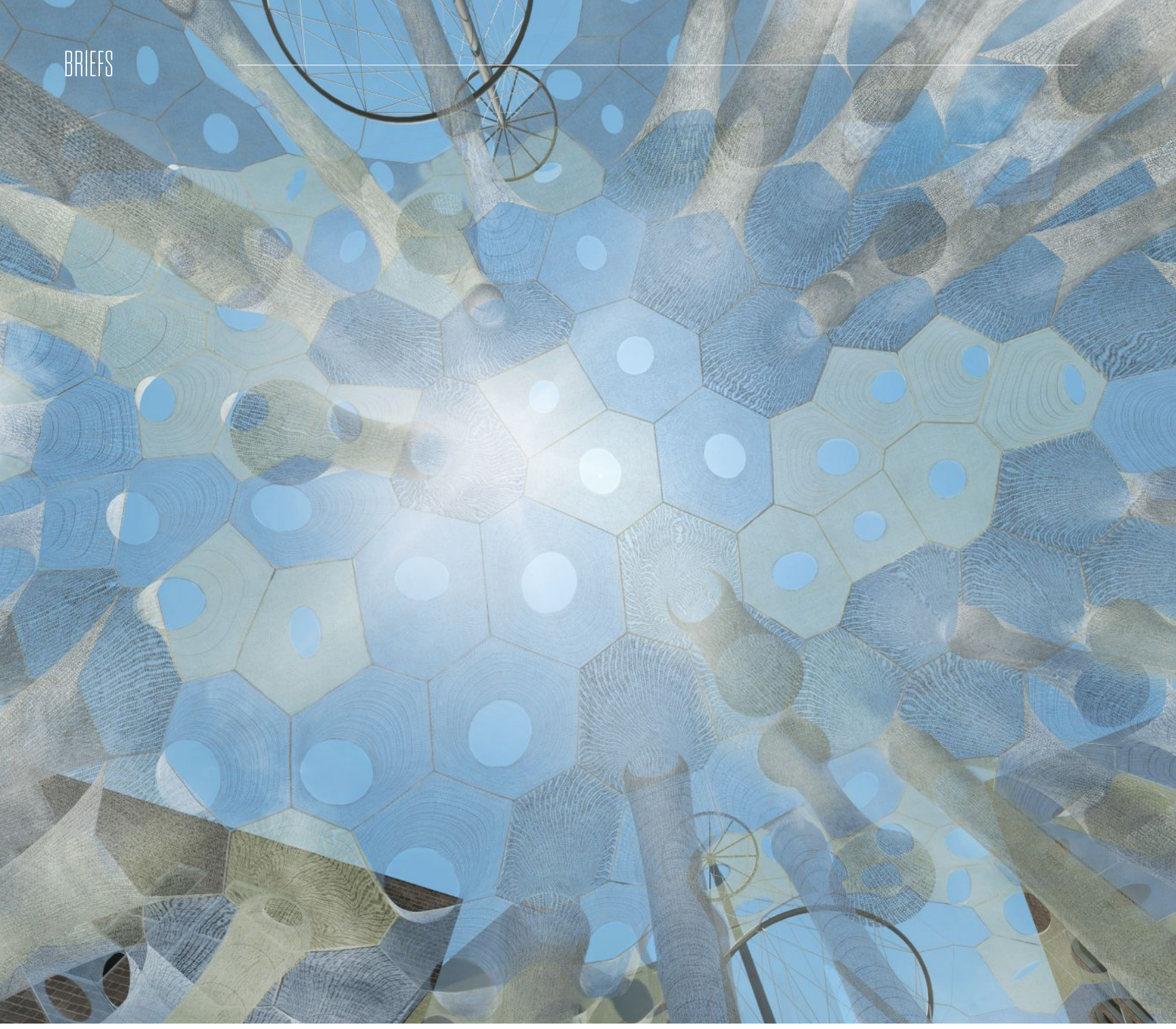

MoMA PS1, New York.
Courtesy Jenny Sabin Studio

SHELTERING LIGHT

"Lumen," an installation by Ithaca, N.Y.–based Jenny Sabin Studio, has been selected for the 2017 Young Architects Program, an annual commission to engage summertime visitors at MoMA PS1 in Long Island City, N.Y. Opening June 29, the installation will shade the museum's courtyard with what Sabin calls "knitted light," a synthetic fabric system she has been developing since 2012. "The project incorporates two types of responsive high-tech yarn," she says. "One is a photoluminescent yarn which absorbs light or UV and then slowly emits light over time, or essentially glows. The other responsive yarn is a solar active yarn that changes color immediately in the presence of the sun." MoMA PS1 will be the system's largest installation to date. —**Sara Johnson** *bit.ly/LumenYAP2017* •

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INFINITE LIGHT

Organized by the Hirshhorn Museum and Sculpture Garden in Washington, D.C., "Yayoi Kusama: Infinity Mirrors" features six of the Japanese artist's mirrored rooms along with other works, and will be on display until May 14. "Aftermath of Obliteration of Eternity" (2009, shown) uses strings of programmable LEDs embedded into acrylic lanterns, suspended from the ceiling. The LEDs switch on and off in a timed sequence to create a flickering effect. The mirrored walls create the illusion of infinite depth, a continuous theme in the artist's work. For this installation, Kusama was inspired by the lantern lighting ceremonies held in Japan to commemorate those killed by the detonation of the atomic bombs at Hiroshima and Nagasaki. —**Katharine Keane** *bit.ly/AL_Kusama* •


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SUSTAINABLE LIGHT

Exploring the intersection of architecture, landscape, and interiors has been at the core of Snøhetta's design mandate since its 1989 beginning. For Lampshade, an installation created for the i Light Marina Bay Festival in Singapore, which took place in March 2016, the project explored "the perception of light as a source independent from its energy source." Using locally grown bamboo for the dome-like structure, the 6-meter-square (387.5-square-foot) grid was covered with rechargeable solar lanterns. The structure provided shade during the day and a place of illuminated refuge at night. At the conclusion of the three-week festival, the lanterns and bamboo were donated to local communities in need of off-grid illumination strategies. —Elizabeth Donoff *bit.ly/AL_Lampshade* •

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"Lightwave: Baltimore's Beacon" was a feature installation at Light City 2016.

Lightwave: Baltimore's Beacon by Design Collective Inc., courtesy the Baltimore Office of Promotion & The Arts

ILLUMINATED ECONOMICS

Across the globe, cities are using light festivals to transform the urban experience and give their economies a boost.

text by Elizabeth Evitts Dickinson

A year ago this spring, my husband and I did something we never do. We walked Baltimore's Inner Harbor at night. The prevailing sentiment among most Baltimoreans is that the Inner Harbor is the place for tourists and conventioneers. But this evening was different. As my husband and I approached the water, we saw enormous crowds lining the 1.5-mile promenade. Sidewalks normally deserted after dusk were jammed, and on an expanse of concrete next to one of downtown's busiest multilane roads hundreds of people appeared to be dancing. We soon realized the source: an interactive display of circular lights on the ground, called "The Pool." The installation, by Brooklyn, N.Y.–based artist Jen Lewin, was composed of customized polyethylene shells housing multicolored LED strips that reacted to movement. Kids and adults laughed and hopped, as music played and the discs shifted hue.

The reason for this unusual revelry was the inaugural Light City Baltimore, a free annual event that launched in March 2016 and included installations along (and in) the water, as well as live performances, neighborhood installations, and a multiday ticketed conference aimed at addressing cultural and social strategies for the postindustrial city. Just a year after Baltimorean's protested in the streets in the wake of Freddie

Jen Lewin's installation for Baltimore's Light City 2016 used customized polyethylene shells with LED strips that responded to a person's movement.

Gray's death in police custody, when the city had been shuttered with an imposed curfew and National Guard tanks, a diverse mix of city residents were now out en masse for a very different reason. Light installations—commissioned from established international designers as well as local artists and architects—ranged from the playful to the political, including one poignant large-scale projection that portrayed critical issues of police violence, education, recreation, and housing in Baltimore.

As we navigated the crowds and perused the installations, we kept bumping into people we knew, all of whom had the same reaction: "I can't remember the last time I hung out at the Harbor."

Part of the goal of Light City, which kicked off its second annual event this spring (March 31 to April 8), is to reclaim the Inner Harbor as a space for residents. "There's been this perception that the Harbor is only for tourists and you have to have a lot of money to enjoy it," says Kathy Hornig, festivals director at the Baltimore Office of Promotion & The Arts (BOPA), which spearheaded the event. "That's not true, and it's contrary to how [developer] James Rouse envisioned the harbor over 40 years ago. He wanted it to be the city's playground."

Of all the ways to invest in Baltimore, planners galvanized around the idea of a light festival because, as Hornig explains, "there is magic behind the power of light to transform a city and to let everyone reimagine a space that they are familiar with in their day-to-day lives—to see it, literally, in a new light."

THE GLOBAL RISE OF LIGHT FESTIVALS

Baltimore is not alone in using light to transform the urban experience. Around the globe, "a lot of places are thinking about light as a way to change the city," says Mark Burton-Page, general director of the Lyon, France–based Lighting Urban Community International (LUCI). Founded in 2002, LUCI is an international network of cities and lighting professionals who promote and use light as an urban and economic development tool. "A number of mayors around the world see that light is a cornerstone for many different policies," Burton-Page says.

LUCI advocates for those policies—from technological innovations that can sustainably light civic infrastructure to better understanding issues such as light pollution. LUCI also supports the planning, and tracks the rise, of light festivals. Of the 70 cities that are members of the LUCI network, 43 have established light festivals. "Many of those have been started in the past five years," Burton-Page says.

The reason for the uptick is due, in part, to the success of several established festivals in cities such as Amsterdam and Eindhoven, both of which are in the Netherlands, and what is perhaps the most influential light festival, Fête des Lumières (Festival of Lights), in Lyon. Each year, Lyon's multiday festival takes over the city and the waterfront with installations from international artists and designers, attracting upwards of a million people and garnering international press. They also host global forums. "You have artists, innovators, urban planners, mayors, gathered for these events and it's a good time to think about the city itself. Many festivals take the opportunity during the day to create conferences and additional exhibitions," Burton-Page says.

The Fête des Lumières has also evolved into a launch pad for young and experimental artists, and this is a model that is being exported to other cities: Lyon's event coordinators consult with cities such as Montreal, Shanghai, and Bogotá, Colombia.

But exporting a festival like Lyon's is not as simple as creating a flashy light show to attract tourists. The tradition of lighting the city dates back to Dec. 8, 1848, when the residents of Lyon spontaneously lit candles in their windows

The Pool by Jen Lewin, courtesy the Baltimore Office of Promotion & The Arts

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to celebrate civic pride after a particularly challenging time of political upheaval and natural disasters that included flooding. This grassroots gesture continued and by the 1980s, the city formalized an urban lighting plan to illuminate its historic buildings after dark. It is this connection to community that accounts, in part, for the festival's longevity. In the wake of the Nov. 13, 2015, terrorist attacks in Paris, the festival, after serious deliberation on the part of its organizers, canceled the event and instead called for a day of illuminated tribute, which resulted in an uptick in the sales of candles to light homes throughout the city. "Five times more candles were sold than ever before; a wonderful testament to the values of fraternity of the Festival of Light," says Gérard Collomb, who is both mayor of Lyon and the Rhone district's representative in the French Senate. "One of the most important things is that a light festival should be anchored into a local community," Burton-Page says. "That's why Lyon is so successful."

ECONOMICS AND INNOVATION

Another reason light festivals have become so attractive is because of their economic impact. A few years ago, LUCI commissioned a report to study the fiscal feasibility of light festivals in several cities and it found the return on investment (ROI) to be solid. "In some cities, you see an investment of $1 returning as much as $3.50," Burton-Page says.

In addition to these immediate gains, light festivals have the potential to burnish the reputation of a place. "One long-term impact is the image of the city," Burton-Page says. "One of the global challenges is that cities are in competition with each other to attract citizens—they want

A light projection show, "Evolutions," by artists Yann Nguema and Ez3kiel, used the façade of Lyon's Saint-Jean Cathedral as a backdrop, and was one of the highlights of the 2016 Fête des Lumières.

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more qualified workers, more universities and businesses. It's interesting to have this event where you welcome people together and see the great urban spaces in a new light."

But successful festivals are about more than mere entertainment—they foster innovation in lighting. Since 2011, the Amsterdam Light Festival, which runs from December through January and attracts around 800,000 people a year, has put out an international call for artists to bring their most experimental work to the city. Lennart Booij is the artistic director for the 2017 event and he helped develop this year's theme of

Visitors to the 2016 Amsterdam Light festival are intrigued by artist Victor Engbers' illuminated Greenhouse.

"Existentialism." Before the last festival was even over, Booij had received some 500 submissions from 85 countries. An international jury will select a group of finalists and these artists will develop their designs with the assistance of experts. This, Booij says, gets at the heart of the event.

"We are a makers' festival," Booij says. "We have an artist's meeting in April where we help people present their first ideas, and then we ask them to come back in September for the annual Makers Festival to show their prototypes. ... We want people to challenge the technical aspects of light. We think the installations need to be structural and of real quality, not only projections. We want to stretch the possibilities ... and we hope that people do something on the next level."

CIVIC PRIDE

In addition to being a catalyst for tourism and innovation, light festivals can promote social

Janus van den Eijnden

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"Garden of Light" designed by the French collective TILT, was on display during the Durham 2015 light festival.

cohesion in the places they are held. Helen Marriage is the director of London-based arts and event firm Artichoke who has, since 2009, run Lumiere, a biannual festival in Durham, in the north of England. This light festival, the United Kingdom's largest, is held in the tiny historic town with a population of just about 40,000. "Durham [is] a historic heritage place," Marriage says. "They've got an old castle and a cathedral, and people come on coach trips, and they walk the cobbled streets, and then they leave."

Outside of tourism, however, Durham's economy is flailing. The coal and steel industries have left a younger generation looking for work. "That economic deprivation is countered in a way by this brief moment of light in darkness," Marriage says. "What Lumiere has done is it's given the citizens the confidence that they can be known for things other than history, that they can be known for the vibrancy of a living city. There's a whole way you can offer back the city to people."

Lumiere curates each individual light installation to be site specific. Artists are brought in beforehand to tour the city and choose their project site. "We're working with the built architecture and the natural landscape to try and tell stories," Marriage says. "In that transformation of a physical building or a familiar structure, you can engender a range of emotion in people so they feel differently about the place."

Artichoke partners renowned artists with community members on projects that are created and designed by the citizens. "We like to showcase the work of international artists alongside, and with no distinction from, the artists in the community," Marriage says.

As Baltimore geared up for its second Light City, organizers increased their investment to include funding for more local artists, and expanded the festival into eight neighborhoods, with the aim of making this a citywide event. So far, the investment seems to be paying off. Last year's event generated $33.8 million in direct economic impact just from out-of-town spending. Of the estimated 400,000 people who attended in 2016, 70 percent were locals. The biggest sign of success for Hornig, though, was a post-event survey that showed a high number of repeat visits. "People loved it so much, they came back multiple nights," she says. That said, Hornig hopes Light City becomes more than just a celebration; she wants it to be a spotlight on local talent. "Our vision is for this festival to literally shine a light on the creative innovators who live and work in Baltimore every day of the year," Hornig says. •

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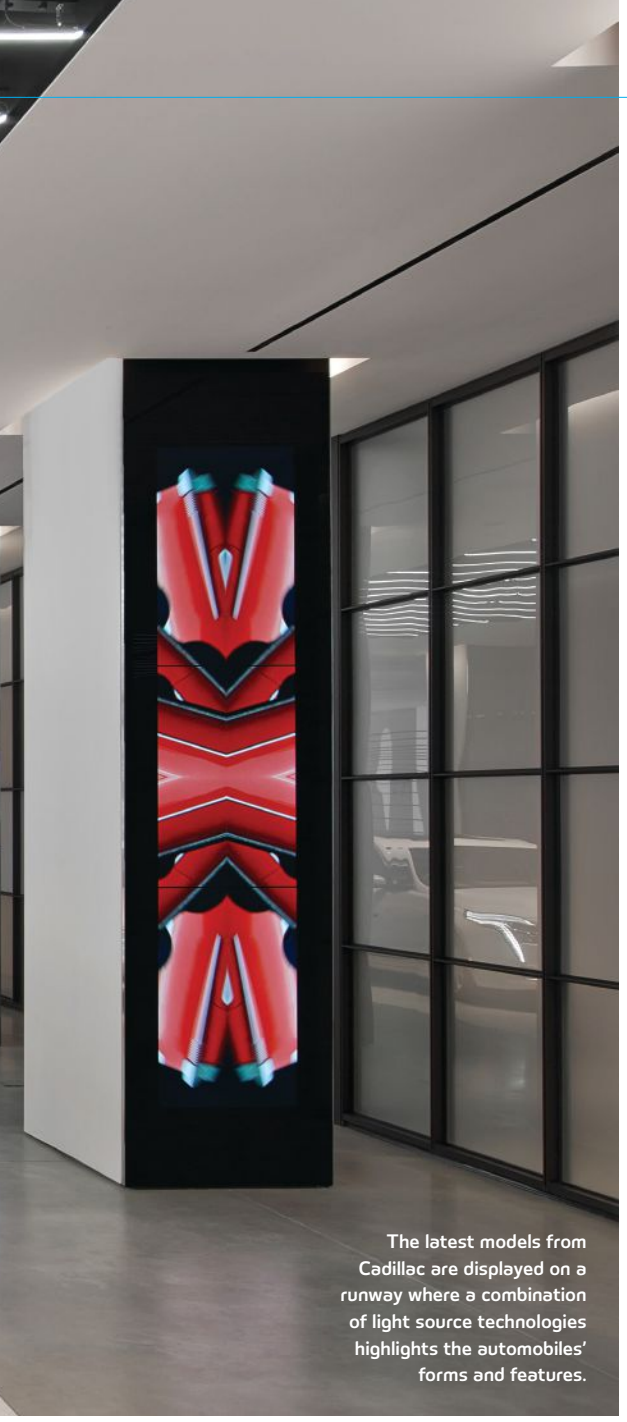
CADILLAC HOUSE

text by Belinda Lanks
photos by Eric Laignel, courtesy Gensler

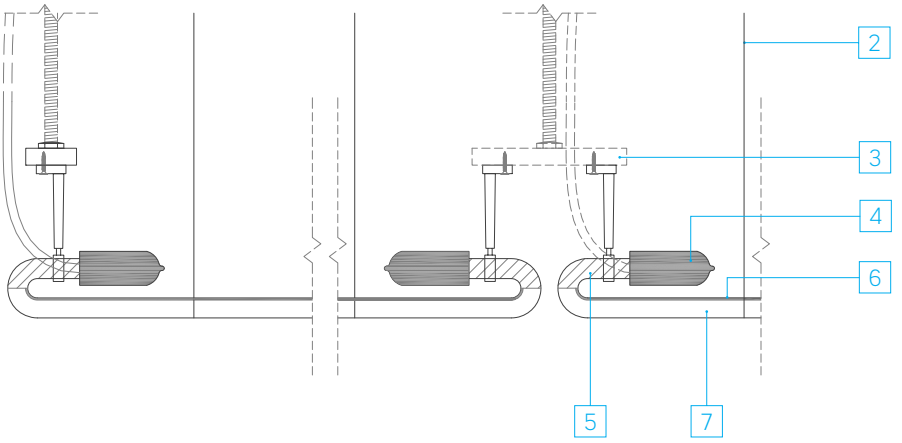
Last year, as part of an ongoing effort to attract young, affluent buyers, Cadillac drove its headquarters from Detroit to New York City's Hudson Square neighborhood. At the base of its new office building, the automaker opened a multipurpose "experience center." Named the Cadillac House and designed by Gensler, the 12,000-square-foot storefront contains an art gallery, a lounge, a communal meeting area, a coffee bar, and a novel twist on a car showroom: a runway. New Cadillacs are displayed on a terrazzo inlay embedded in the floor and which runs down the center of the space. Brian Orter Lighting Design (BOLD) chose to illuminate this feature with a combination of LED fixtures and strips of old-school neon—a nod to the automaker's midcentury-design heritage.

"Even though the space looks new and fresh," says BOLD principal Charlie Dumais, "we wanted to reference [Cadillac's] history, and we did that through [the] lighting design." Dumais and his team drew inspiration from pictures of the original Cadillac dealerships as well as the Eero Saarinen–designed GM Technical Center

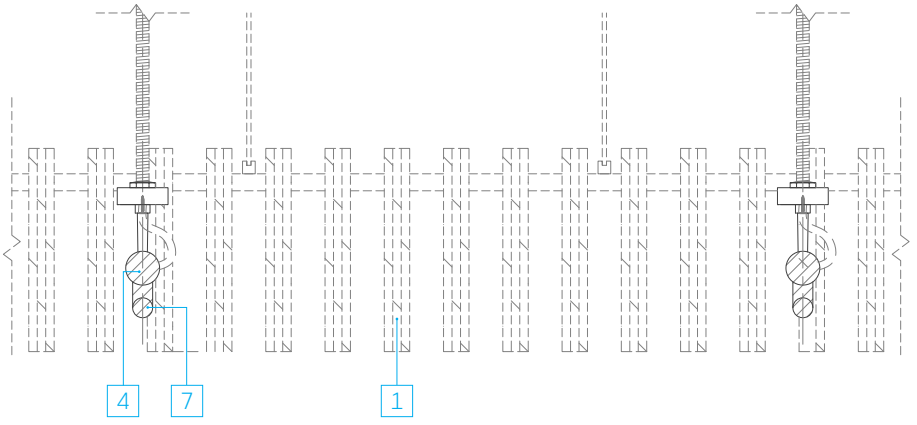


The latest models from Cadillac are displayed on a runway where a combination of light source technologies highlights the automobiles' forms and features.

NEON MOUNTING DETAIL (ELEVATION)



NEON MOUNTING DETAIL (SECTION)



in Detroit, the home of Cadillac's parent company, General Motors. In doing their research, BOLD discovered "a lot of very graphic and modern neon," Dumais says. "But what we wanted to do was introduce it in a clean, artistic kind of way." The solution: A custom ceiling installation of 3500K 13W neon strips arranged in 62 rows set 18 inches apart. (The repeating lines also echo the linear grille design of today's Cadillacs.) To supplement the neon glow, BOLD added 3000K 15W LED downlight track heads between the neon.

Legend

1 Architectural white painted wood-panel grilled ceiling system
2 Clear fishing wire safety cable
3 Rigid suspension mounting
4 Black insulator boots with feed to remote power supplies
5 Ends of neon to be finished/painted black
6 Top of neon to be finished/painted white
7 15mm-diameter 3500K neon tubes with remote, dimmable power supplies

Originally, the lighting designers wanted the 9-foot by 10-inch stretches of neon to be continuous tubes but, for budget reasons, had to separate each row into three parts arranged in two alternating patterns: long–short–long and short–long–short. Using different lengths of neon also helped to mask any imperfections between adjacent rows, since the rows don't have the same spacing. "The issue with having the runs all the same is that any misalignment of the fixtures would be visible to the naked eye," says BOLD studio leader Gary Wong. The designers applied black film to the ceiling-facing sides of the neon to prevent spill light from illuminating unattractive mechanical systems, and specified that the fixtures be dimmed to 30 percent output to extend their life span.

Many considerations factored into the color temperature choice for the neon. Its coolness blends with the light cast by the digitally programmed LED video screens mounted onto the structural columns flanking the runway. The color also approximates Cadillac's 3500K headlights. Behind the runway and separated by a wall is a communal meeting space, where 3000K 7W recessed slot fixtures continue the rhythm and length of the neon strips.

Along the sides of the runway, the color temperature grows warmer, starting with 3000K 4W ceiling coves, containing wall grazers with a 15-degree by 29-degree optic above the columns holding the LED screens. To the left of the columns, 2700K 10W pendants are suspended over the coffee bar. For the lounge, the architects designed a dark-bronze-finished chandelier, which BOLD, per Gensler's request, initially fitted with filament-style 2700K 4W lamps before swapping them for clear ones. Double-headed recessed 24W 3000K LED downlights help achieve an even level of illumination throughout the seating area.

Across from the lounge is a gallery space, where BOLD incorporated the same ceiling-suspended track heads as over the runway, as well as clusters of three 2700K 15W parabolic aluminized reflector lamps with a prismatic-glass lamp that hearkens to car headlights of the past.

But the strongest homage to the brand's history is the neon—an element that, Wong says, GM originally vetoed in favor of a stretched ceiling common in car dealerships. "They were concerned that the individual illuminated tubes would image on the super-shiny automotive paint finish," the designer recalls. BOLD persisted, and in the end, GM approved of the result. "The light actually accents the car's curvature," he says. "With a [stretched] ceiling, the cars would have looked very flat." •

Decorative pendants provide a design accent over the coffee bar.

DETAILS

Project: Cadillac House, New York • **Client:** General Motors/Cadillac • **Architect:** Gensler, New York • **Lighting Designer:** Brian Orter Lighting Design (BOLD), New York • **Engineers:** McLaren Engineering Group, New York • **M/E Engineers:** Fiskaa Engineering, New York • **A/V Consultant:** AV&C, New York • **Construction Manager:** Shawmut Design & Construction, New York • **Project Size:** 12,000 square feet • **Project and Lighting Costs:** Not Available • **Watts per Square Foot:** approx. 1.28 • **Code Compliance:** ASHRAE 90.1-2010

MANUFACTURERS

Aion LED: Bathroom covelight • **Aamsco:** Hybrid LED G25 retrofit lamps for custom pendant at lounge • **Cree:** LED PAR lamps for decorative fixtures at gallery • **EcoSense:** Surface-mounted 3000K LED grazing light strip at runway columns • **Flos:** IC tablelamp at lounge • **iGuzzini:** Track-mounted, high-output 15W 3000K LED accent light at runway and gallery • **Fluxwerk, a Lumenpulse Brand:** Recessed-mounted, high-efficiency, 7.5W-per-linear-foot, 3500K LED light slot at veranda and collaboration area • **Intense Lighting (Leviton):** Illuminated handrail at veranda • **Manhattan Neon:** Dimmable, 13W-per-linear-foot, 3500K custom neon configuration at runway • **Philips Color Kinetics and Philips Day-Brite:** Fixtures for back-of-house kitchen • **Resolute:** Decorative fixture in gallery • **Roll & Hill:** Decorative pendant at coffee bar • **USAI Lighting:** Recessed-mounted, trimless, dual-head adjustable LED accent light at lounges

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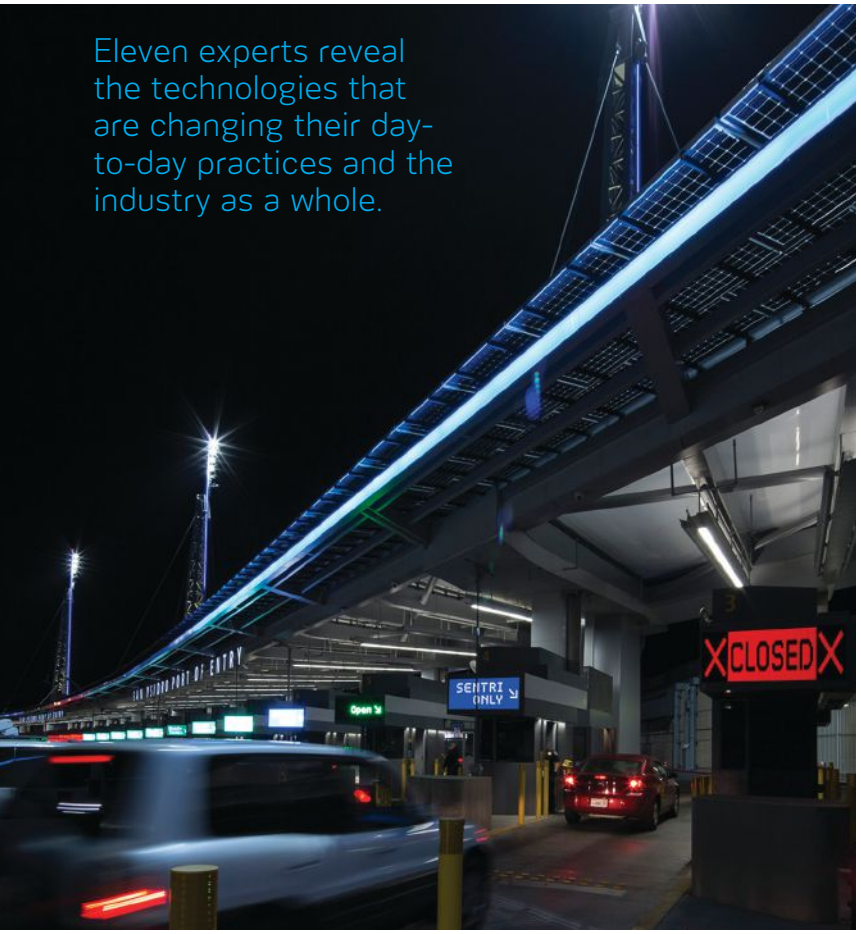
Eleven experts reveal the technologies that are changing their day-to-day practices and the industry as a whole.



Designed by Höweler + Yoon Architecture, the Double Horizon lighting installation at the San Ysidro Land Port of Entry, near San Diego, Calif., broadcasts real-time traffic data through a 520-foot-long linear array of LEDs.

by Mary Catherine O'Connor

Technology, both generally and lighting specific, has profoundly changed how designers illuminate the built environment. Digital advancements in particular have broadened design toolkits while boosting the role that lighting can play in energy performance, data communication, comfort, and even human physiology.

With endless innovation happening at the nexus of lighting technology, design, and data, identifying which tools hold the most promise for the profession can be a challenge. So, ARCHITECTURAL LIGHTING asked 11 architecture and lighting practitioners with a variety of backgrounds and lighting expertise to share what they consider to be the most valuable existing or emerging technologies in their own workflows and for the overall lighting industry. The breadth of products, research, and design strategies they named—which include virtual reality, sensor networking, and manufacturing tools—illustrate how lighting has become integrated with and influenced by advancements made outside the realm of architecture and design.

BIG DATA, NEW TOOLS

Andrea Wilkerson • Lighting Engineer, Pacific Northwest National Laboratory • Portland, Ore.

As computing power increases, so does the use of parametric modeling in generative design software. This big-data software enables users to calculate millions of design variables while incorporating the latest codes, standards, and research consensus. The approach, which can change the way we make and understand design decisions for spaces and buildings, is used for daylighting studies and ripe for further development and implementation by the larger lighting community. The software can be used in combination with virtual reality (VR), allowing a client to experience, say, the glare that comes with changing material surfaces from walnut walls to white marble. Plus, they will see how design choices can affect structural support, cost, energy consumption, construction time, and even maintenance.

Generative design will lead manufacturers to provide lighting system data in new formats, and software will automatically send detailed design specifications, such as sensor responsiveness, to the manufacturer. Product life-cycle tracking will begin at the point of manufacture and ensure products are installed, managed, and performing as specified.

Courtesy Höweler + Yoon Architecture, © Squared Design Lab

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“Our clients care about color temperature and color rendering—they want the numbers.”

—Jim Baney, partner, Schuler Shook

Jim Baney • Partner, Schuler Shook • Chicago

As lighting designers in the age of LEDs, we've had to become experts on color temperature and color rendering. We used to know, based on experience, that a given manufacturer's 2700K fluorescent lamp was a little warmer or cooler than another's. But now, we need tools to measure that difference, so our firm purchased an Asensetek Pro spectrometer. It was not inexpensive, but we wanted something accurate enough to evaluate LED sources that we are specifying for our projects.

We love the app-based controls, which let you manage the device with your smartphone via Bluetooth. It generates spectral distribution curves, measures flicker and correlated color temperature, and kicks out TM-30 fidelity and gamut indexes, as well as the color graphics. This allows us to compare light sources against each other or test the information we're getting from a given manufacturer. Our clients care about color temperature and color rendering—they want the numbers.

Mariana Figueiro and Mark Rea • Professors, Lighting Research Center, Rensselaer Polytechnic Institute • Troy, N.Y.

Some lighting professionals think of light and lighting simply in terms of horizontal footcandles, owing to how photometric instruments are calibrated based on the photopic luminous efficiency function, V(λ). But new metrics—circadian light (CL_A) and circadian stimulus (CS)—have been developed to represent the human circadian system's spectral and absolute sensitivities to light. The latest small spectroradiometers measure the complete spectral power distribution of light reaching the eyes and, together with on-board software, generate CL_A and CS values on the vertical plane (where the eyes are located). Armed with meaningful metrics for the human circadian system, future lighting professionals will provide people with healthier living environments.

Randy Fisher • Senior Associate and Lighting Designer, NBBJ • Seattle

We increasingly rely on VR tools and 3D printing to clarify design intent and reveal the real-world built environment to clients and contractors. Digital simulations require significant computing resources but can save the client time and resources on large-scale physical mock-ups. Our digital design team recently used VR simulations and 3D models to help a client understand the look and feel of a new lobby design, including its fixtures and lighting effects.

For another project, we 3D printed several small-scale variations of a custom decorative pendant. The models only took minutes to print and gave our team a better understanding of design constraints not revealed via computer-rendered models. We made modifications and then a fabricator mocked up the selected fixture at full scale.

Richard Mistrick • Associate Professor of Architectural Engineering and Graduate Program Officer, Pennsylvania State University • State College, Pa.

Future high-performance buildings will be designed with parametric modeling interfaces such as Grasshopper and Dynamo. Open-source and proprietary plug-ins for such interfaces link traditional modeling software, such as Revit, to energy, daylight, and computational fluid dynamics–based (CFD-based) tools. These tools can inform design decisions related to the building form, orientation, envelope, daylight apertures, and shading.

Some design firms have already embraced this approach, which involves co-simulation of daylight (Daysim and Radiance), HVAC loads (EnergyPlus and OpenStudio), and CFD. The user enters the variations in design parameters to study and the performance metrics to compute in a flexible model development environment. Simulation output helps

An in-house model shop outfitted with 3D printers allows NBBJ's staff to prototype and evaluate different design concepts.

NBBJ/Scot Walls

designers understand how a building interacts with its environment to enable high-quality, low-energy—or net-zero—building design.

ILLUMINATING COMMUNICATION

Florence Lam • Global Lighting Design Leader, Arup • London

LED technology ushers in more than energy efficiency and longevity—it is also enabling an "internet of light" ecosystem that supports new forms of distributed intelligence. In Arup's London exhibition space, we're using LED spotlights that double as Bluetooth beacons, broadcasting URLs to smartphones in order to report their current temperature or how long they've been powered on. These beacons, which use the Physical Web protocol, could give visitors a way to interact with the space through their smartphones, unlocking rich new data streams.

While this innovation is exciting, the paradigm shift will disrupt the lighting industry: Like how a smart watch is no longer just about telling time, smart or connected lighting can be disruptive if it is no longer just about illumination. Future generations of lighting designers will need to be as technically savvy as they are creative, and will need to track trends in urban development and sensory design—extending their design thinking well beyond art, architecture, and engineering.

Eric Höweler and Meejin Yoon • Principals, Höweler + Yoon Architecture • Boston

Artificial lighting evolved as a means of overcoming darkness and extending the length of the workday, but it has also been used for communication. Think of the lanterns Paul Revere used to warn of approaching British troops: "One if by land, two if by sea."

Today, contemporary lighting technologies offer new possibilities in communicating through light patterns. Computer-controlled lighting allows architects to vary ambient natural light levels over the course of the day, tailor color temperature to user preferences, react to occupant behaviors and activities, index a building's energy consumption, and express an ambient mood.

Architecture is a broadcast medium. Recent developments in lighting technologies augment that communication, marking a shift from illumination to communication.

LIVING WITH LIGHT

Juan Pablo Lira • Principal Lighting Designer, Focus Lighting • New York

Clients want to see a return on their investment or a measurable change in their environment or product. Prior to implementing our new lighting design for the 7 For All Mankind store in SoHo, the client installed a RetailNext tracking system that, using a range of sensors, records how many shoppers walk by the store, how many walk inside, which product displays they view, and what they purchase. This "before" data allows us to determine if a lighting redesign on its own increases traffic and sales and, if so, by

After Focus Lighting completed a new lighting scheme for the 7 For All Mankind store in SoHo, New York, a sensor-based tracking system recorded a significant uptick in store traffic and retail sales.

Ryan Fischer

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"Beyond task illumination aspects, we need to better understand how much light exposure we need in order to fulfill our physiological needs."

—Marilyne Andersen, dean and professor, École Polytechnique Fédérale de Lausanne

exactly how much. In this case, the redesign was successful: Three months after changing the lighting, the number of shoppers who ventured inside increased by 197 percent, leading to a 20 percent increase in sales, and boosting the company's annual profit by $1 million.

Marilyne Andersen • Dean of the School of Architecture, Civil and Environmental Engineering and Professor of Sustainable Construction Technologies, École Polytechnique Fédérale de Lausanne • Lausanne, Switzerland

As we spend more time indoors in mostly static lighting environments, it is becoming increasingly urgent that we monitor the effects of daylight dynamics, from the spectral distribution of light to its temporal and compositional properties. These are key drivers of the nonvisual effects of light on physiology and health, as well as of our perceptual response to light.

Through modeling, we aim to find trade-offs to limit visual discomfort while ensuring sufficient light exposure, but we also need a way to measure such characteristics and develop tools to integrate them with conventional, 2D, threshold-driven metrics in a design process. Beyond task illumination aspects, we need to better understand how much light exposure we need in order to fulfill our physiological needs, whether regarding circadian entrainment or direct effects, such as alertness. We also need to embrace comfort criteria more holistically, including the emotional aspects of daylight beyond established performance indicators and its influence on behavior or preferences; that is, we need to bring spectral considerations and temporal dynamics into research and practice. •

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THE RE-EMERGENCE OF TANGIBLE LIGHT

Next-generation lighting products deliver a more tactile and personal illumination experience.

text by Blaine Brownell

Light is a multisensory phenomenon. Before electric illumination, light was palpable. Its material origins were evident: a wick in candle wax, oil in a lamp, or a log in the fireplace. With electricity, light assumed a more abstract and remote quality. After the mass production and distribution of incandescent and fluorescent fixtures, light could be deployed homogeneously. Point-sources transformed into fields, and spaces were lit with a regular distribution of lumens. Light switches furthered this detachment by enabling the remote control of light; no longer did a person require direct contact with the source.

But new technologies are making light tangible again, without the limitations of candlelight. Building occupants desire a greater level of control over their environments, and an enhanced appreciation for daylighting has brought about greater responsiveness in electric illumination. Designers are increasingly inspired by the affordability, mobility, smart functionality, and wireless capability of new technologies, not to mention alternative sources like phosphorescence. The trend to create a more direct and more personal lighting experience is reflected in products that are more integrated, interactive, immersive, and lifelike.

Light is no longer perceived as functionally discrete, meaning that a dedicated device must be used for illumination. Rather, light has expanded beyond fixtures and can be provided by furniture, walls, paving, or foliage. Interactivity need not be limited to a simple switch but can include sophisticated response mechanisms that react to a user's physical presence and touch. Immersion is a trend enhanced by new capabilities in spatial light tuning and volumetric projection that deliver a more corporeal illumination experience.

The following eight examples—which appear in my upcoming book *Transmaterial Next: A Catalog of Materials That Redefine Our Future* (Princeton Architectural Press, 2017)—illustrate the ways in which product designers and manufacturers seek to change how we experience light. •

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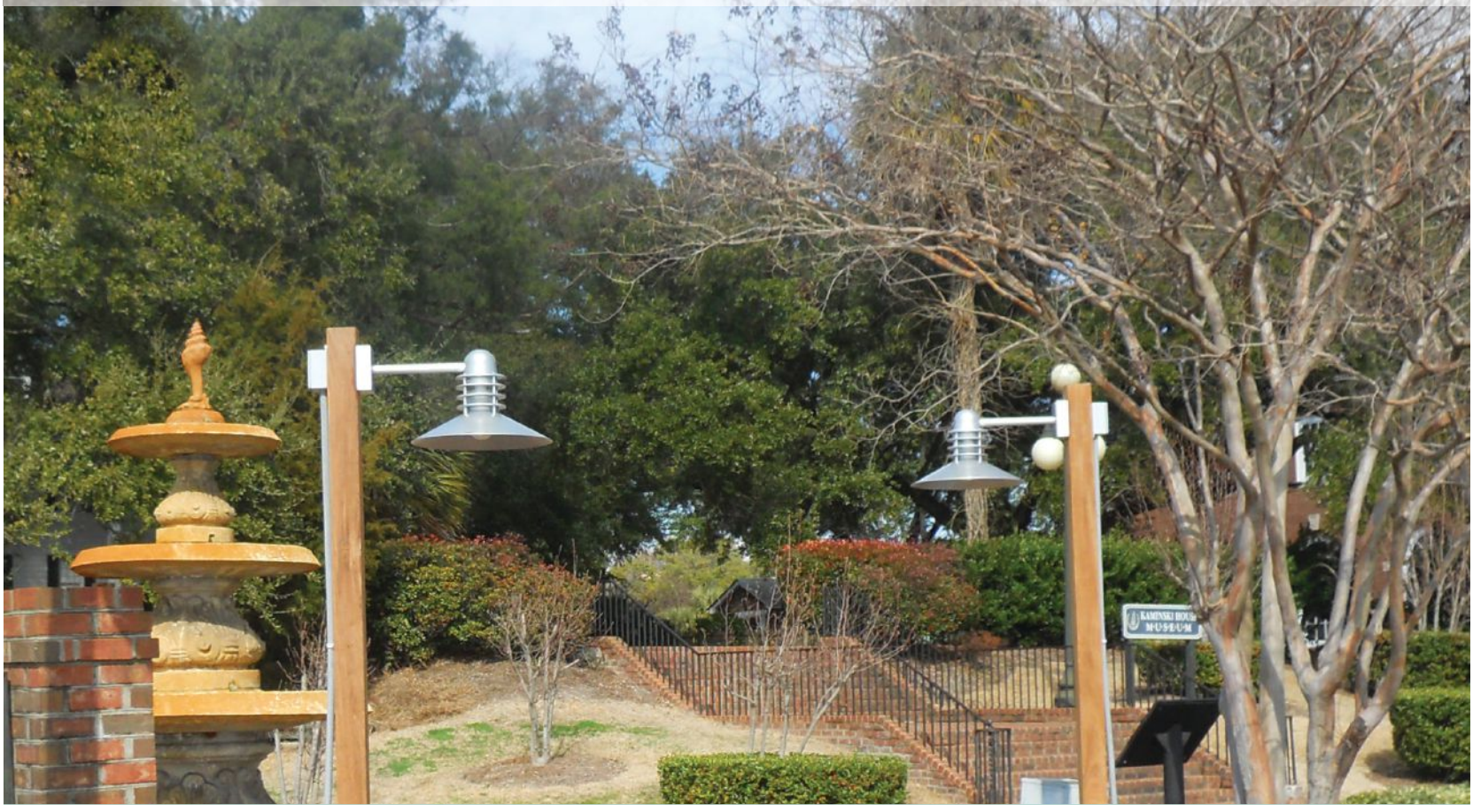

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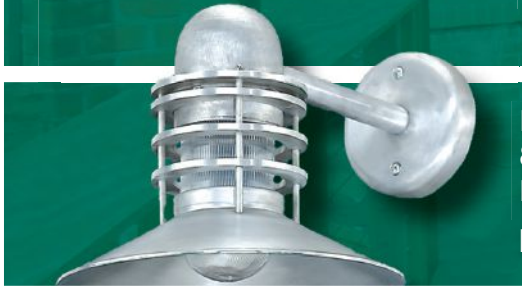

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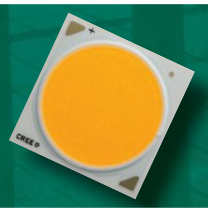

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INTEGRATED LIGHT

Common Desk • Despite the omnipresence of ambient lighting in work environments, tasklighting is critical in providing illumination focused on the work itself. What better way to do this than incorporate lighting into a desk? Pasadena, Calif.–based NONDesigns' Common Desk is a work surface that glows from within. Although its light does not flood the workplane itself, and therefore may not be adequate for tasks requiring high visibility, its connection to the desk's integral filing system provides unexpected practicality. The center of the desk is perforated with thin slots in which two sizes of acrylic divider panels may be placed. Linear strips of LEDs emit light through these channels from a central trough underneath. Not only do the panels' edges glow when placed in these slots, but papers, folders, and other filing materials are highlighted for easy recognition. Designers Scott Franklin and Miao Miao imagined Common Desk as a platform for workers who can't avoid a late night at the office. • *nondesigns.com*

INTEGRATED LIGHT

Van Gogh Path • Rotterdam, Netherlands–based Studio Roosegaarde has made headlines with its Smart Highway project, an ongoing research and development effort with Heijmans Infrastructure to create an interactive road surface. The objective is compelling: a highway that can provide important navigational information with self-illuminated lane lines, weather alerts, and other safety features that might one day make streetlights and road signage obsolete.

A decidedly simpler version of this can be seen in the firm's Van Gogh Path, a walking/biking surface composed of solar-powered photoluminescent aggregate. Thousands of glowing stones create swirling patterns in the path reminiscent of Vincent van Gogh's celebrated *Starry Night* painting. As a zero-energy solution for safe nocturnal circulation, Van Gogh Path cleverly bridges art and infrastructure, offering legible nighttime navigation that is also a source of delight. • *studioroosegaarde.net*

INTERACTIVE LIGHT

Lotus • Studio Roosegaarde also explores light-based installations that respond to user presence and interaction. The firm's Lotus is a smart surface composed of Mylar smart foils and aluminum arranged in a diagonal grid pattern. A clever combination of sensors and heat lamps enables the surface to open in the presence of people. As users approach the installation, the interior light sources increase the temperature of the foils, which in turn roll outwards and expose the space beyond. In addition to providing a diverting experience for its audiences, Lotus represents a compelling future for the architectural aperture: an automatically tunable surface made of dynamic materials that open and close without the need for additional mechanical systems or energy (aside from the heat lamps). Studio Roosegaarde has installed Lotus in two formats: a 13-foot-long curved wall and a 10-foot-diameter dome (shown). The modular system can be readily scaled to other dimensions and geometries. • *studioroosegaarde.net*

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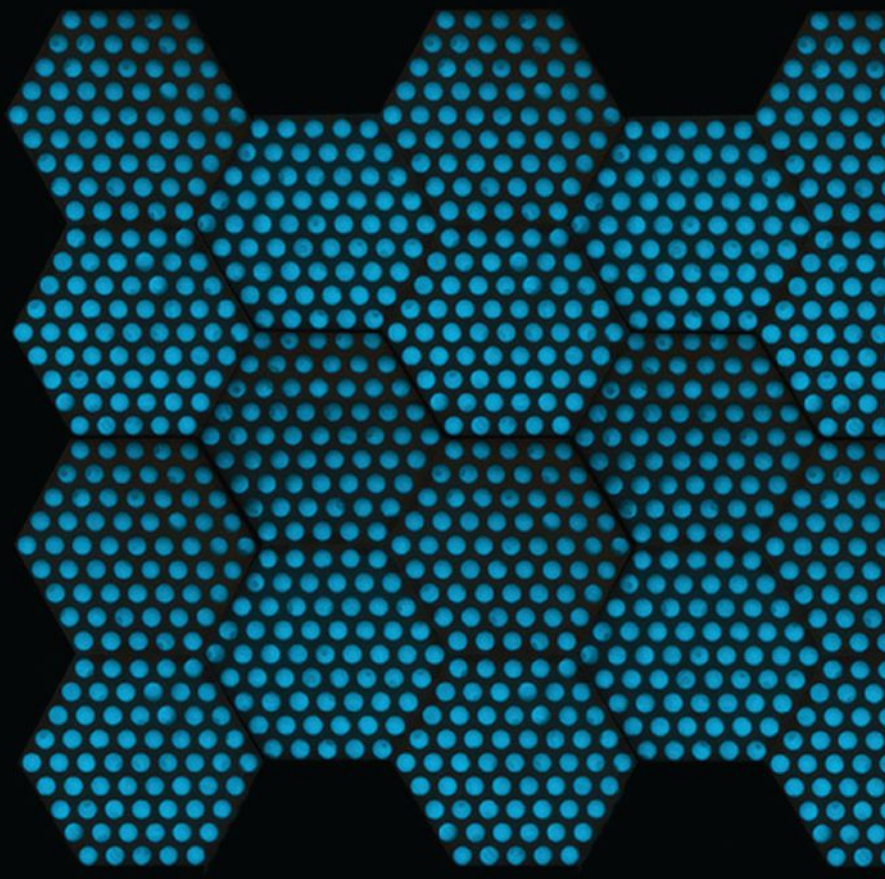
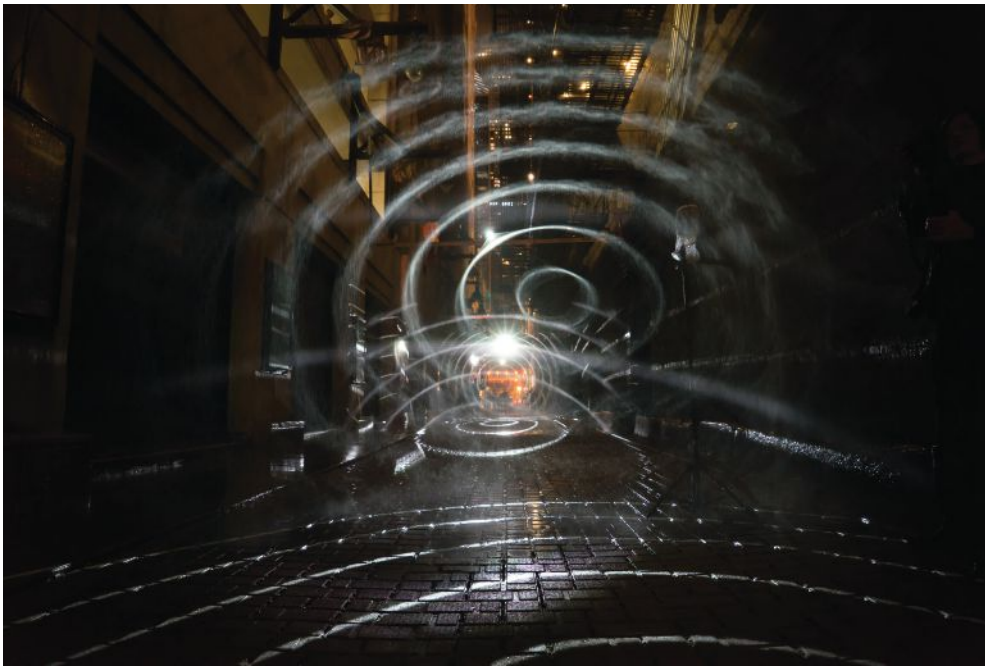
INTERACTIVE LIGHT

Ball Wall • The Ball Wall is designed for user interaction but without the need for sensors or lamps. Created by designers Paul Bird, Conor Oberlander, and Kevin Remy as a transformable façade for the Rhode Island School of Design's entry into the 2014 Solar Decathlon Europe, the wall converts solar energy absorbed throughout the day into manipulable illumination at night. The wall is composed of a regularly spaced matrix of polypropylene spheres coated in photoluminescent paint. Suspended between perforated layers of acrylic, the spheres are held in place yet allowed to rotate freely. Once charged by sunlight, the spheres can be adjusted manually to create patterns of light and dark—like painting with physical pixels. Developed as a modular system of hexagonal tiles, it is an infinitely scalable surface that can conform to planar or curved geometries. Each day, the wall resets itself in anticipation of another evening of luminous graffiti. • *portfolios.risd.edu/gallery/12346047/Ball-Wall*



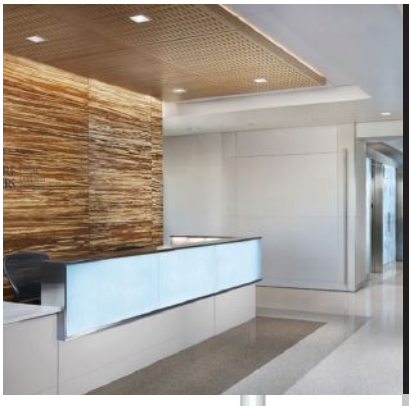


IMMERSIVE LIGHT

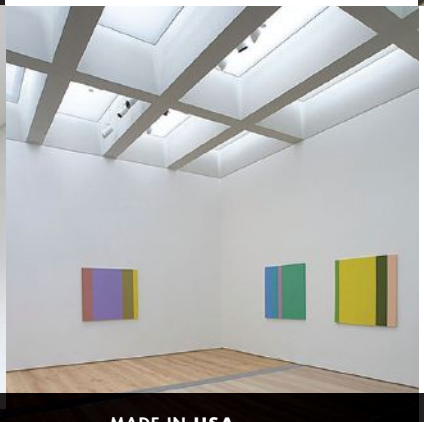
Flow • Chicago-based Luftwerk develops sophisticated installations that utilize water to carry light and information. Flow consists of custom-built aluminum tubing with welded brass spray nozzles that continuously emit fine mist. These planes of vapor serve as ephemeral yet constant projection surfaces that may be viewed from multiple angles. Because the mist curtains define particular volumes of space, the notion of a display is transformed into that of an occupiable room.

FLOW/Im Fluss (shown) was a specific installation Luftwerk designed in 2014 for the 20th anniversary of the Chicago and Hamburg sister-city relationship. Focusing on the topic of waterway health, data about the Chicago and Elbe Rivers was projected into the volumetric mist. The installation demonstrates how scientific research—which can typically seem dry or inaccessible—can be communicated within a highly interactive form of public art. • *luftwerk.net*

Above: Conor Oberlander; Left: Peter Tsai/Courtesy Luftwerk



EDISON PRICE LIGHTING



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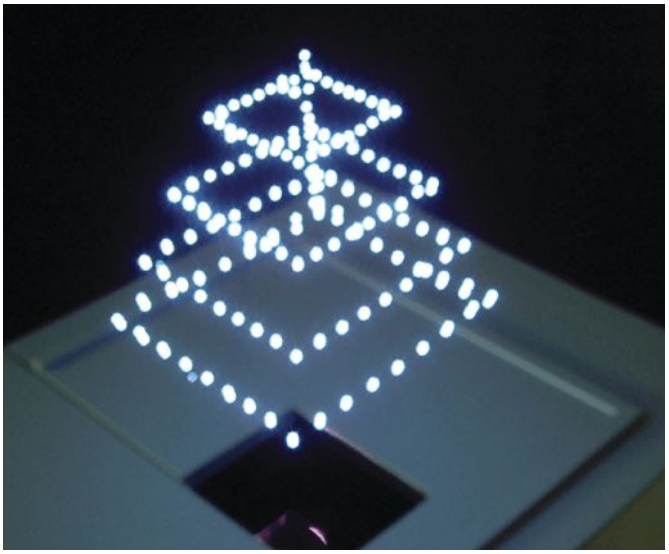


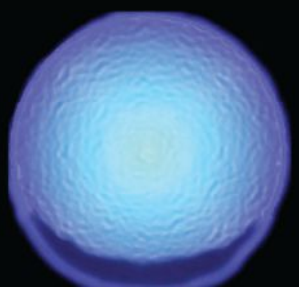
IMMERSIVE LIGHT

Aerial 3D • As digital projection technologies become more sophisticated, the lines between lighting and visual communications continue to blur. A case in point is the Aerial 3D system developed by Japanese company Burton. Aerial 3D enables real three-dimensional projection using points of illumination in space. The remarkable technique employs laser light combined with a plasma emission process to position bright dots at specific x, y, and z coordinates mid-air using the laser's spatial targeting system. The display constructs constellations of dot arrays to create three-dimensional shapes, which may be static or animated. Unlike other 3D projection technologies, Aerial 3D does not use optical tricks or require special 3D glasses for full effect; its projections can be appreciated with the naked eye. Although early in development, Aerial 3D presents intriguing possibilities for lighting design as well as information display—such as volumetric, animated exit lighting that could provide more helpful cues about safe egress pathways to building occupants in an emergency. • *burton-jp.com*

LIVING LIGHT

Starlight Avatar • The Starlight Avatar features genetically enhanced bioluminescence via a modified organism—an ornamental Nicotiana alata plant, more commonly known as flowering tobacco. Molecular biologist Alexander Krichevsky developed the specimen as an autoluminescent plant capable of emitting light continuously throughout its life span, possessing a luminous capacity similar to fireflies, glow worms, and other naturally occurring bioluminescent organisms. Krichevsky founded the company Bioglow in 2010 with the idea that such plants can be used as zero-energy light sources, and the Starlight Avatar is its first commercially available offering. While the plant does not emit a light bright enough to replace high-visibility light sources such as street lamps, but, with a proliferation of such organisms in a poorly lit area, one could imagine them providing useful—if subtle—nighttime navigation. • *gleaux.us*

Biobulb • Bioluminescence, the capability of organisms to emit light via chemical means, has inspired a new generation of research and development efforts aimed at harnessing this so-called "net-zero energy" form of illumination. Researchers at the Wisconsin Institutes for Discovery developed the Biobulb with this purpose in mind. Powered entirely by microbes, the lamp employs E. coli bacteria that have been genetically engineered to glow in the dark, in addition to other organisms necessary for sustaining the process, such as microalgae for harvesting sunlight and predatory protists for recycling nutrients and keeping the bacteria population under control. Theoretically, the Biobulb can emit light continuously. In reality, the lamp's intricate and delicate balance of organisms requires maintenance and occasional recharging to operate effectively. • *wid.wisc.edu*



Top left: Burton; Far left: Alexander Krichevsky; Left: Princeton Architectural Press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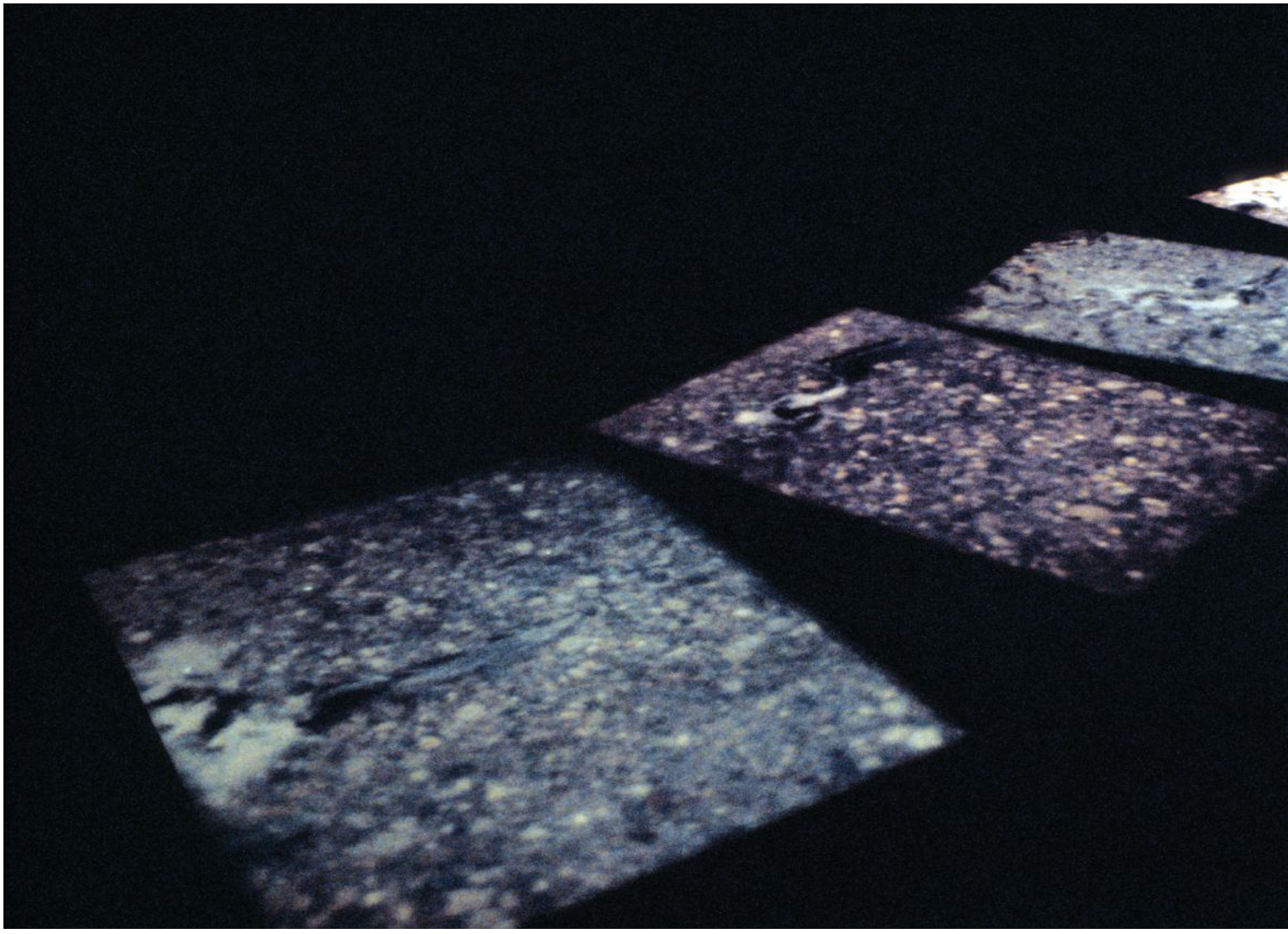
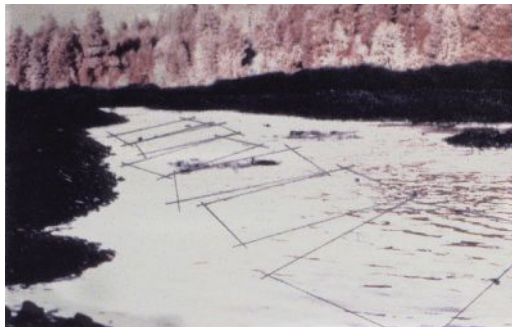
BENDING LIGHT

text by Aaron Seward
portrait by Robert Clark

Over a career that spans more than 40 years, James Carpenter has inhabited the junction of architecture, art, design, and engineering. Working with glass, steel, and the sun, his studio crafts environments that mitigate the boundary between inside and outside and bring attention to the phenomenological qualities of light.

"I think of light in an intellectual or philosophical way, it carries information from its history, which could be a millisecond, or could be a billion years. It's not just something illuminating a wall. It has an informational resource within it and what we're trying to do is understand how you can bring about a realization or a manifestation of that." —James Carpenter





"Migration," Super 8 film loop (1975)
The film documents the spawning of Pacific Northwest salmon and explores the phenomena of light and transparency through the spatial compression of the sky and its reflection on the water's surface (this image). One of Carpenter's early storyboard panel for the film (above).

James Carpenter, principal of New York–based James Carpenter Design Associates (JCDA), isn't a lighting designer in the traditional sense. His practice has carved out a specialty in developing technically adroit, architecturally integrated apparatuses that sculpt and transmit daylight—often paired with electric sources—which bring illumination far into the interior of a building or even underground. And Carpenter's 40-plus-year career has encompassed everything from material research and structural engineering to architectural design and sculpture.

His background, interestingly enough, is firmly rooted in the art world. Born in Washington State and raised in New England, Carpenter enrolled at the Rhode Island School of Design (RISD) in 1968. There, he started studying architecture, but an interest in working directly with materials, combined with the excellent workshops at the industrial-design-focused RISD, led him to switch his focus to sculpture during his second year. He was particularly taken with glass, and studied under artist Dale Chihuly.

Another interest was film. Carpenter made a number of movies—using Super 8 film—that he projected on glass and other materials, and that were shown in galleries in New York and Europe during the 1970s. Between making films and working on glass sculptures, Carpenter became fascinated with light and how he could make people aware of its informational content and phenomenological characteristics.

You can see the early stages of his experiments in the 1975 movie "Migration," which documents salmon swimming up a 60-foot section of a shallow river off the Puget Sound in Washington. On a scaffold perched over the river, Carpenter set up six cameras, 90-degrees to the water and each rotated off axis in relation to one another, looking down into the rippling surface. Projected on a gallery floor at full-scale, the six frames present a fractured record of the river, so that the salmon swimming upstream from frame-to-frame go in and out of view, as they move from light to dark underwater. Each of the nine frames in each film is also copied and repeated three times, giving the movie a staccato quality and holding the image a moment longer for viewers to absorb the information. "You realize what you're looking at is not just the fish swimming upstream, or the gravel below. It's also the perfectly reflected image of the sky overhead," Carpenter says. "The water in that river has information on top, within it, and beyond it. I think of glass the same way. The material coalesces all those levels of information. Your eye tends to dismiss glass as a nonentity, but I'm thinking of it for its wealth of information."

FROM ART TO ARCHITECTURE

After college, Carpenter taught at the University of California, Berkeley for a brief period before moving back east to take a job at Corning with inventor Donald Stookey. Stookey, who established the field of glass ceramics, was, at the time, developing a process for making color photography using glass as a medium. In the late 1970s, architect Norman Foster heard of the technology and approached Corning about developing an architectural variation that he could incorporate into the design of his HSBC project in Hong Kong. The idea was to create an integrated louver system in the building's curtainwall, with the photosensitive emulsion that forms stripes in the glass that would change the angle of entering light and cut down on heat loading and glare. Corning put Carpenter in charge of the project, and while it proved

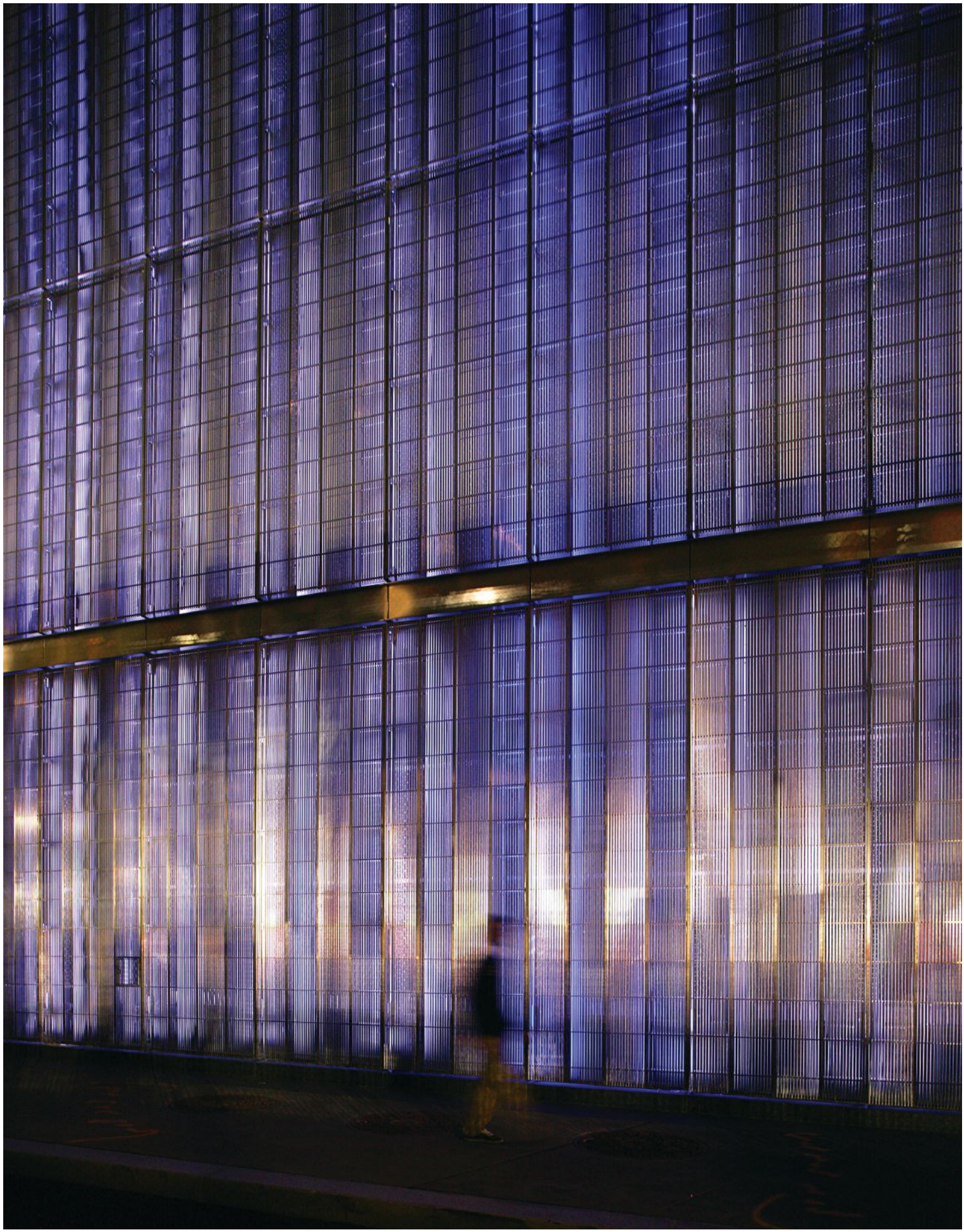
too expensive to be implemented, the louver project made him realize that he knew a lot about the technical nature of glass—and that there was an opportunity to work with the architectural community. So in 1979, he set up JCDA and the firm was soon getting calls from the likes of architects I.M. Pei and Edward Larrabee Barnes.

Over time, JCDA's role as a glass consultant evolved to the point that it was being asked to design specific parts of buildings. One such project is the Dichroic Light Field, an installation on the Handel & Associates–designed Millennium Tower on Columbus Avenue in New York City, completed in 1995. JCDA outfitted the building's block-long, blind masonry façade with a glass screen; from this screen projects a matrix of 2-foot-long dichroic glass fins. The reactive surface picks up available light, deepening the façade and activating it with an array of colors and atmospheric reflections—whether directly from the sun on a clear, blue day; diffusing from a gray, overcast sky; bouncing off the surrounding

7 World Trade Center, New York (2003–06, right)
The tower's 82-foot-high podium wall at its base is composed of a double-layer stainless steel screen and conceals Con Edison transformers. The screen's prismatic wires catch light during the day, and at night interact with LED lighting.

Dichroic Light Field, New York, (1994–95, below)
The dichroic glass fins projecting from the façade react with available light, creating an ever-changing pattern of color and shadow.

Left: © David Sundberg; Right: © Andreas Keller



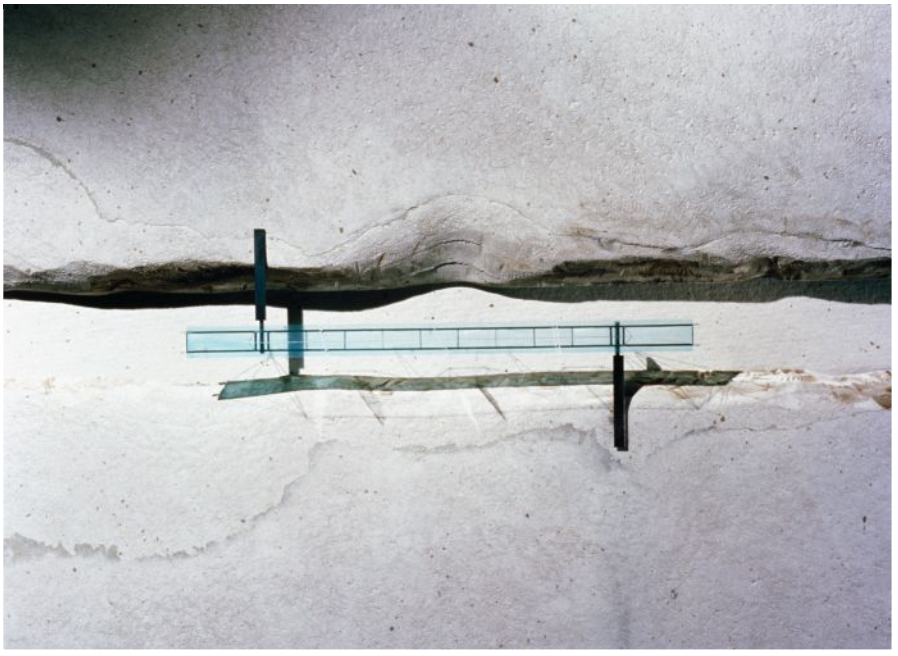
Left: Timothy Soar; Right: ©JCDA

"It's not just about light washing a surface, but interacting with elements and materials, providing a richer and more informative capability to elucidate the character of a place."

—James Carpenter

Folded Light, London (2013–16, left)
Designed by Carpenter's U.K. firm, Carpenter Lowings, this artwork was created for a 40-meter-tall atrium in a new office building. The folded panels capture the vertical angles of light across the 10-story space.

Luminous Glass Bridge, Marin County, Calif. (1987, below)
A proposal for a private client, the project is one of Carpenter's early explorations examining the use of glass as a structural material.



buildings; or coming from electric light at night. The appearance of the installation also changes as the viewer's perspective changes, so that everyone who looks at it sees something slightly different depending upon where they stand.

"A lot of our projects, like Dichroic Light Field and 7 World Trade Center, deal with volumetric qualities," Carpenter says. "It relates more to how you see things in nature. In a natural setting you're looking at billions of illuminated surfaces over a deep field of vision, and the eye is capable of comprehending that and assessing it. It's not just about light washing a surface, but interacting with elements and materials, providing a richer and more informative capability to elucidate the character of a place."

MANY DISCIPLINES, MANY COMPANIES

In addition to JCDA, Carpenter is a partner in three other companies: Carpenter Norris Consulting, in New York, which designs daylighting systems; Architecture Operations, also in New York, a licensed architecture practice that works on smaller building projects; and London-headquartered Carpenter Lowings, which takes on European projects and is run by former JCDA employee Luke Lowings.

Carpenter Lowings recently completed Folded Light, an installation that embodies the blend of architecture, art, design, and engineering that characterizes Carpenter's career-long fascinations. Running the full height of a narrow, 40-meter-tall (430.5-foot-tall) atrium in a 10-story office building in London, the work is composed of 47 folded, triangular stainless steel panels asymmetrically divided by a blade of dichroic glass. As in JCDA's Sky Reflector-Net at the Fulton Transit Center in lower Manhattan, daylight activates the rippled surface by entering at the top of the atrium, connecting the space to what is happening in the sky. Meanwhile, the dichroic glass casts differing complementary colors on either side of the space. Cool-white electric lighting shines down on the installation from above, while a range of sources, emitting different colors, uplight the work, and sidelight emanates from each of the building's floors. All supplement the natural light and accentuate the rich hues produced in the surfaces of the stainless steel panels.

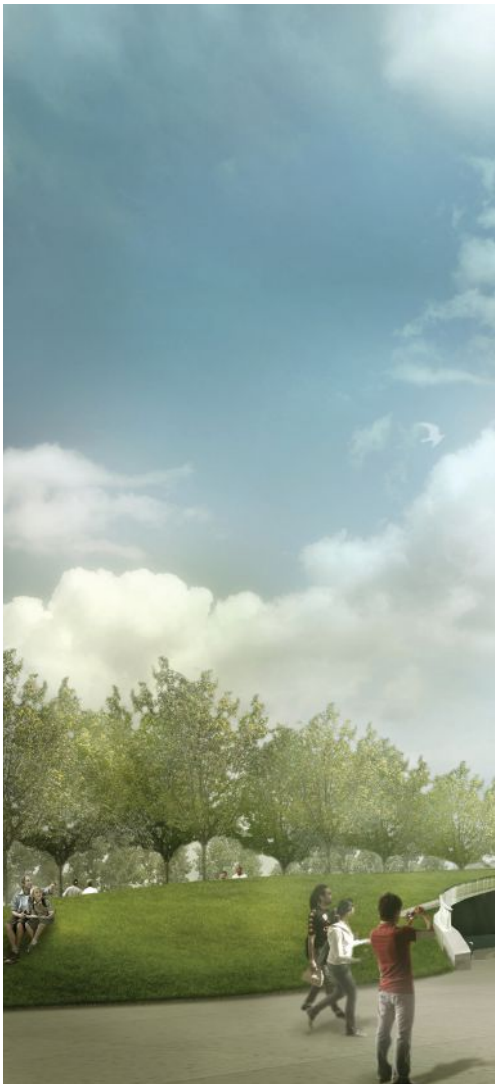
ILLUMINATING PHENOMENA

JCDA is currently working with architects Cooper Robertson and Partners and landscape architecture firm Michael Van Valkenburgh Associates on a renovation of the Museum of Westward Expansion at the Jefferson National Expansion Memorial in St. Louis. The project includes a new western entrance and 45,000-square-foot addition to the museum, which is buried under the plaza at the feet of Eero Saarinen's Gateway Arch. For this, JCDA is designing optical aluminum surfaces that diffuse and reflect the natural light conditions on the plaza deep into the interior, blending the experience of the exterior and subterranean environments.

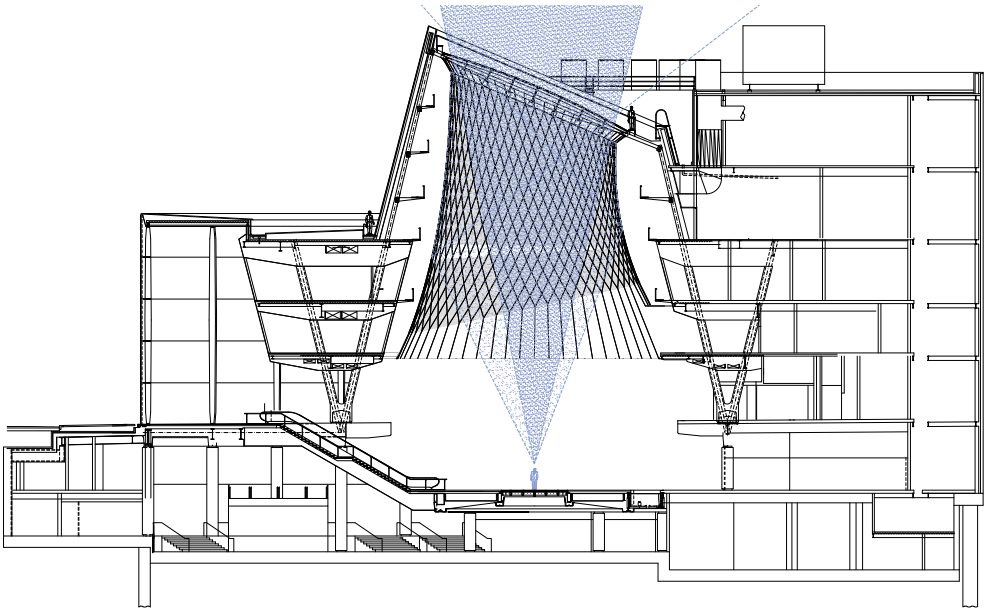
Though not a lighting designer per se, Carpenter has worked with light throughout his professional life. His innovative approach to materials and how they can be developed and used to further our understanding and appreciation of light phenomena serves as a guide and as an inspiration for those working with light. As in a James Turrell Sky Space or Robert Irwin light work, Carpenter's projects ask us to slow down and experience something we take for granted, namely the behavior of a star's life-giving photons as they interact and illuminate the world around us. •

Sky Reflector-Net at Fulton Transit Center, New York, (2004–14, right)
Commissioned for the MTA Arts for Transit and Urban Design, JCDA's competition-winning "lightweight tensile structure" brings daylight through the transit hub's atrium and all the way down to the station's subway platforms below.

Museum of Westward Expansion, St. Louis, (2010–present, below)
Scheduled to open in 2017, this rendering shows the new entry plaza. The form "suggests the cast shadow of the Arch on the landscape."



Right and Top: ©JCDA



THE WOODEN LANTERN

For Hillmon Hall's intricate ceiling design, the lighting gets hyper-detailed.


EXIT

Above: Gabe Guilliams

The mock-up allowed the lighting designer and the client to see how the lighting would work with the intricate wood-slat ceiling design (left). During the day, the forum is a light-filled space that welcomes the entire WashU campus (far left).

text by Timothy Schuler
photos by Colins Lozada/Moore Ruble Yudell

On a Tuesday in November 2014, Gabe Guilliams, a lighting designer with BuroHappold, found himself in a dark warehouse in Marshfield, Mo. The building's halogen lamps were turned off, and the only illumination came from a 38-foot-long wood ceiling section suspended from the steel rafters. Below a white ceiling panel ran a series of large ducts and a grid of curved wood members, all of it glowing from integrated LEDs.

The assembly was a portion of a ceiling being designed for Hillman Hall, the new home of the George Warren Brown School of Social Work at Washington University in St. Louis. The building overlooks a pedestrian thoroughfare and is sited diagonally across from Brookings Hall, the university's main administrative building on the main (Danforth) campus, and is designed by Santa Monica, Calif.'s Moore Ruble Yudell Architects & Planners with local firm Mackey Mitchell Architects in the university's Collegiate Gothic–style vernacular. Its centerpiece is a round, glass-enclosed event space known as the Maxine Clark and Bob Fox Forum that includes a small stage, a balcony, and a café, as well as seating for informal gatherings.

Extending from the building's curved glass façade, the forum was designed to act like a porch light that says "Guests welcome." But as the design progressed and the necessary electrical and mechanical systems were added, the architects saw the need for a decorative dropped ceiling that would obscure the unsightly infrastructure. The result was an ornate ceiling made of densely spaced, radial wood slats, which curve and taper as they approach a center oculus. It was an elegant solution but, from a lighting perspective, it created a novel set of illumination challenges. Guilliams and his team initially planned to uplight the ceiling, but they were constrained by the presence of a balcony, which wraps the inner perimeter of the space. Instead, they illuminated the ceiling from above, choosing to run linear LED arrays inside channels routed into the top of the wood slats.

"The wood [members taper] as they move toward the center," Guilliams says. "At the perimeter, there's much more obstruction, so you see more of the wood glowing. Toward the middle, you see more of the ceiling behind the wood." That meant that the ductwork, the speakers, and everything else that the architects were trying to hide were suddenly visible.

Guilliams' solution was to design a circular aluminum pendant that would be suspended from the dropped ceiling. The uplight would illuminate the face of the wood structure and screen the elements behind it. Because the use of the LEDs in this custom application was untested, Guilliams wanted a trial run to understand how it would perform photometrically.

Fortunately, a full-scale mock-up was already being constructed by the project's millworker at its facility in Marshfield, south of St. Louis. The architects had wanted to study the various densities of the wood elements and their finishes, and after talking with Guilliams, the university agreed to cover the costs of a mock-up of the lighting design as well.

So in November 2014, Guilliams traveled to Missouri to see the mock-up in person. Suspended by a series of metal chains, the 300-square-foot wedge—just one-thirtieth of the total ceiling—could be raised and lowered, allowing Guilliams and the client to see what it would look like.

The initial design did not look great, Guilliams recalls. The pendant was too large, spreading the light too far from the center of the ceiling. Instead, Guilliams wanted the oculus to feel as if it were radiating light. He also saw that they needed to dim the linear LEDs that ran immediately below

The forum's wood ceiling extends over the balcony area and houses downlights and wallwashers for the art display wall.

the ductwork and speakers. They had increased the density of the luminaires in these areas to provide uniform illumination, but the increased lumens now created the opposite effect. To create a completely consistent wash of light, the LEDs would have to be dimmed according to their location. Guilliams would eventually need 17 different lighting layers just for the forum's ceiling, with eight more layers for the rest of the space.

On site, however, the lighting scheme faced a final challenge. As much as the wood ceiling was intended as a focal point, Guilliams also wanted to maintain a visual connection with the historic Goldfarb and Brown halls (the school's previous home) at night. Lighting glass façades is one of the most complex lighting assignments, and yet windows "give people context," Guilliams says. "During the day, you look out of the window and you see the neighborhood, or the campus, or the city that you're in. But at night, you lose that connectivity." Guilliams spent "two nights solid" adjusting the dimming to limit reflectiveness, so that the neighboring buildings—newly floodlit as a part of the Hillman Hall project—remained visible.

In the 18 months since it has opened, Hillman Hall has succeeded in attracting the WashU community. The school had wanted its new home to be a welcoming public space, and during the fall 2015 semester, 80 percent of people who visited the forum's café were not affiliated with the School of Social Work. For Guilliams, the statistic is validation that the lighting design team's instincts were right, and that the extreme level of detail involved was worth it. •

DETAILS

Project: Hillman Hall, George Warren Brown School of Social Work, Washington University in St. Louis • **Client:** Washington University in St. Louis • **Architects:** Moore Ruble Yudell Architects & Planners, Santa Monica, Calif., and Mackey Mitchell Architects, St. Louis • **Lighting Designer:** BuroHappold, New York • **Structural Engineers:** KPFF, St. Louis • **M/E Engineers:** BuroHappold, New York • **Project Size:** 105,000 square feet • **Project Costs:** $42 million • **Lighting Costs:** Not Available • **Watts per Square Foot:** 0.6 • **Code Compliance:** ASHRAE 90.1-2007

MANUFACTURERS

Architectural Lighting Works: 30W 3000K LED customized surface-mounted double-gimbal fixture recessed in wood-slat ceiling of pedestrian street to either side of the forum • **Feelux:** Low-voltage, linear, surface-mounted, 4W-per-foot, 3000K LED fixture recessed in routed channels in top of wood ceiling in forum • **Lighting Services Inc:** 12W 3000K LED pendant wallwash fixtures for art accent wall along back of balcony overlooking forum • **1212 Studio:** Custom 19-foot-diameter aluminum 500W 3000K pendant suspended below wood ceiling in forum • **V2:** 36W 3000K LED pendant downlight in wood ceiling in forum

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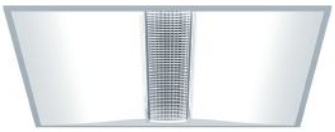

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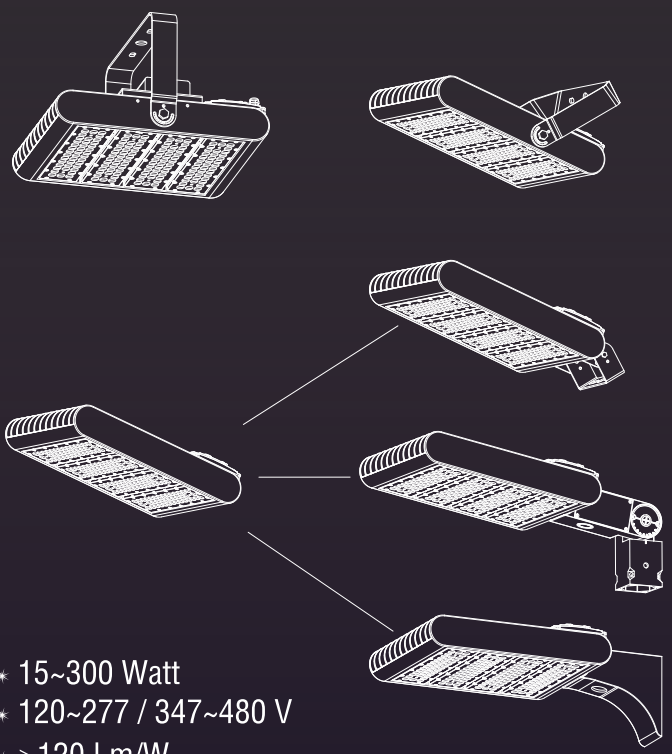

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DOMINGO GONZALEZ

"There is always more than just one solution. That means a designer must be willing to explore, examine, and see the project as a journey."

Like so many lighting designers, Domingo Gonzalez didn't set out to be one. After graduating from the architecture program at City College in New York City in 1978, he took a summer drafting job with Evans & Hillmann. There, he assisted the interiors group, and, when that group spun off, was asked to stay on and do lighting. From there his own practice, Domingo Gonzalez Associates, emerged in 1985, one in which there are few boundaries between architecture and lighting. As Gonzalez says, "I've always seen myself as a design professional first, one who happens to be a design professional involved with lighting."

What areas of design influence you?
I'm a fan of design in all its forms. Architecture is at the top of the list along with product design, and cooking. I see tremendous parallels between designing and cooking.

What text has influenced your thinking?
There are several, but Robert Venturi's *Complexity and Contradiction* (1966) is one of the most important architectural dissertations of the 20th century. One of its many lessons is that a better understanding of history helps to inform and enrich our work.

How do you describe what a lighting designer does?
It comes down to being a problem solver. The rest is understanding the rules, tactics, and techniques to deliver the desired solution.

Does that translate into a design or lighting philosophy?
I have a soft spot for comic books. The makeup of my ideal project is like *The League of Extraordinary Gentlemen:* There's the architecture hero, the engineering hero, the landscape hero, the lighting hero, etc. ... and all the heroes join forces on this great mission called "The Project."

How has the evolution of lighting technology impacted your work?
The evolution of lighting design as a profession has always been inextricably linked to the evolution of lighting technology. It goes back to the analogy between lighting and cooking. A good chef will create a terrific meal with any ingredients under almost any circumstances. Any good designer or good lighting professional should be able to do the same. •

interview by Elizabeth Donoff
photo by Laura Barisonzi

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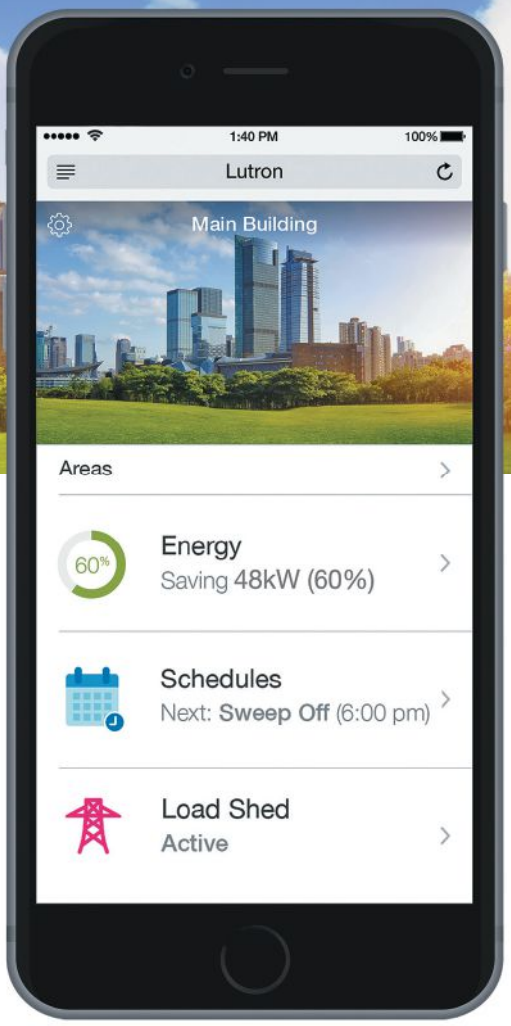

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