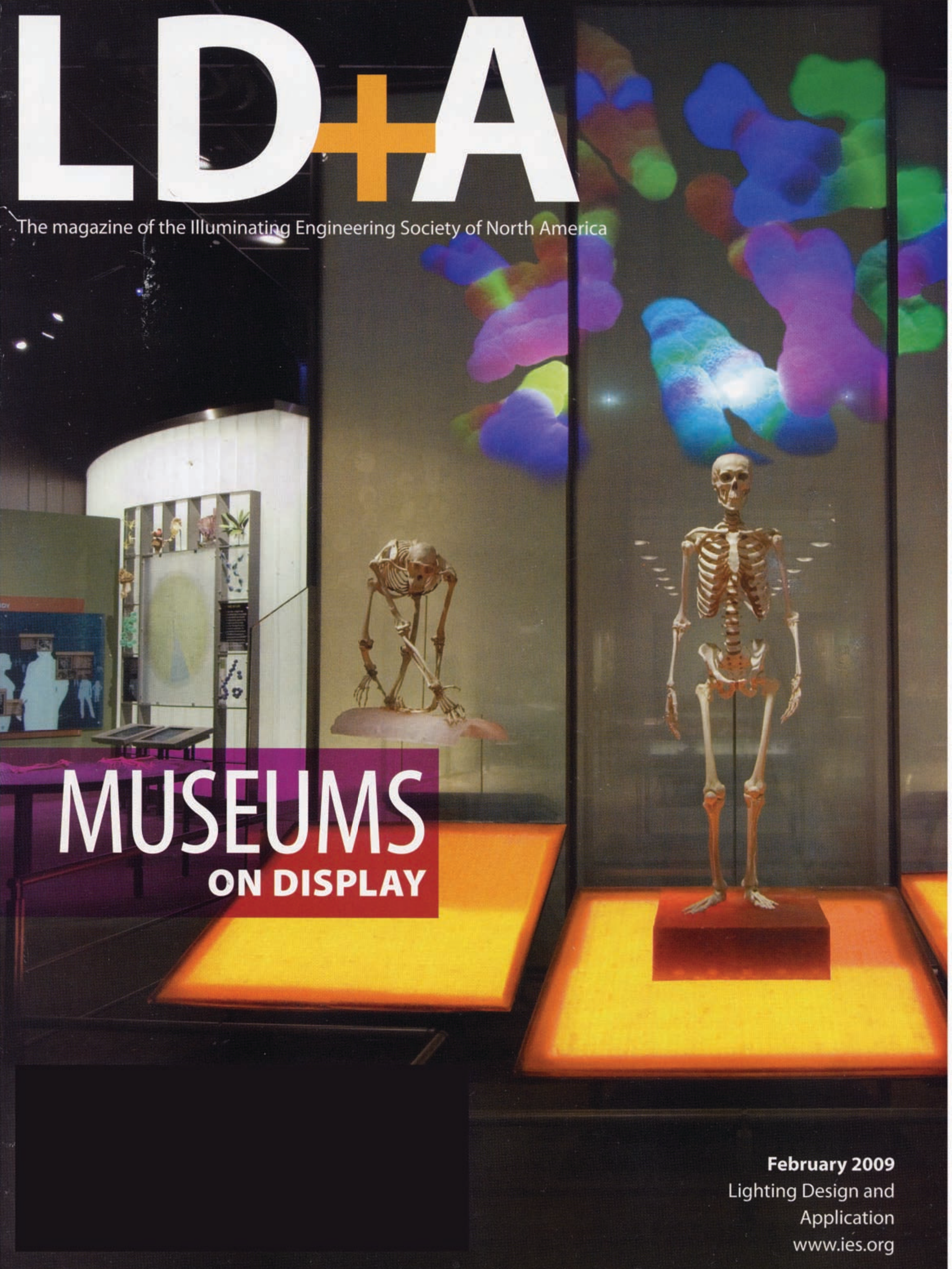

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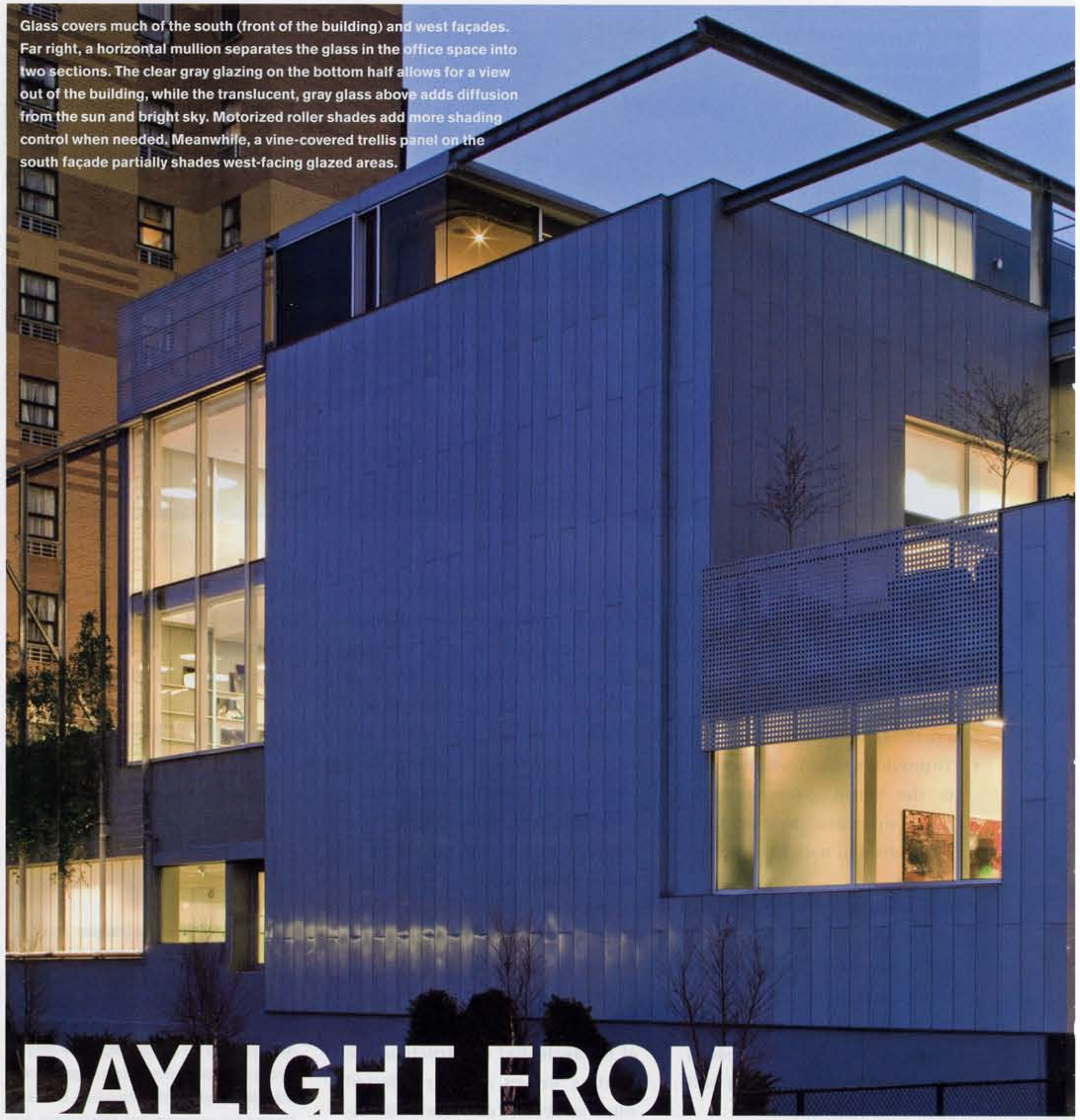
MUSEUM/EXHIBIT LIGHTING

departments

ON THE COVER:
The Spitzer Hall of Human Origins at the American Museum of Natural History (p.42). Photo courtesy of AMNH/ D. Finnin

features



Glass covers much of the south (front of the building) and west façades. Far right, a horizontal mullion separates the glass in the office space into two sections. The clear gray glazing on the bottom half allows for a view out of the building, while the translucent, gray glass above adds diffusion from the sun and bright sky. Motorized roller shades add more shading control when needed. Meanwhile, a vine-covered trellis panel on the south façade partially shades west-facing glazed areas.

DAYLIGHT FROM ALL DIRECTIONS

PROJECT

Photos: Paul Warchol

A four-sided daylighting strategy controls natural light in a Manhattan arts building

Despite its urban setting near Times Square, the cliff-top site of the Affirmation Arts building resembles Malibu as much as Manhattan. This perch–overlooking a train gulley leading to the West Side rail yards–affords a classic panoramic view of the setting sun in the western sky, framed by the Javits Convention Center, over the Hudson River.

With that type of site, it follows that daylighting would become a critical design element at the five-story building–a former warehouse that was expanded to house galleries, offices and studios within 15,000 sq ft of space. Architect Peter Matthews (Matthews Moya Architects) and daylighting consultant Matthew Tanteri (Tanteri & Associates) collaborated on the daylighting aspects of the project.

The challenge, as described by Tanteri, was how to control the light on each façade of a building he describes as "aesthetically pleasing, but overexposed." Says Tanteri: "The architect's design had a high percentage of glazing on south- and west-facing walls, an almost completely glazed north building wall, a large north-facing skylight and several small skylights. The challenge was to bring a consistent quality and flow to the daylight throughout the building, tempering the high level of southwestern sun on this side of Manhattan where surrounding buildings are too low to block it."

The daylighting solution consisted of a variety of glazing, including solar gray glass, acid etched glass and 3-in. deep translucent glazing panels specified in conjunction with retractable solar-veil shades, blackout shades, a variety of projecting perforated metal panels, trelliswork, and steel and cable plant armatures mounted to the exterior of the building.

SKIN-LOADED BUILDING

The building takes the basic form of a block on a base. At the third level, double-height floor-to-ceiling glass and frame volumetric elements interrupt an opaque metal skin of naturally weathered zinc panels on the front (south) and back (north) exposures. The office "cube" gives depth to the street façade, as it is carved out of the main block creating an exposed corner condition that, like the building itself, is atypical for a mid-block site.

As with other "skin-loaded" buildings, direct heat gain during the day and heat loss at night through walls

A translucent glass clerestory wraps around the upper north wall and a section of the west wall.

and roof, are primary modes of energy transfer. Situated on the north side of the street, the building form is exposed to almost the entire solar window. Only during the winter, when the sun tracks low in the sky, does a row of low-rise former horse stables on the south side of the street block sunlight to the upper façade.

"Sunlight in Manhattan is not a fleeting phenomenon," says Tanteri. "The sun shines close to 60 percent of the year's daylighted hours. To consider its impact on a south- or west-building orientation you need to figure in the city's 30-deg offset (clockwise rotation) street grid. What you'll find is that the sun is just about centered between these two building facades during the building's peak cooling load, typically sometime around July 21, 3:00 pm."

FENESTRATION AND CONTROL

Several fenestration strategies are used to balance interior daylight levels throughout the building. The first was to provide an occupant-controlled means to balance the highly variable level of sunlight on the south and west sides of the building with the lower but more uniform levels of skylight on the north side. This was accomplished through the use of two types of manually operated roller shades. An oyster-colored "comfort shade" was used throughout the building to reduce interior shade brightness, yet provide a high interior reflectance for inter-reflected light. A PVC-coated fiberglass open basket weave was used for its opacity and non-directionality. A 3 percent openness factor provides good shading and insulating of direct sun exposure, but still allows some limited view. Blackout shades (black facing in and white facing out) with side channels were also added to the conference room and main studio with exterior light reflectance and interior room darkening capacity for projection purposes. These allow an additional level of control on the south and west side of the building.

The second strategy was to maintain a relative amount of daylight throughout the building using the "effective aperture" method, a product of window wall area and glazing transmittance. In the schematic design phase, each of the apertures in the architect's design was tuned in relation to room area, geometry and reflectance. This allowed setting a visible transmittance criterion for each of the glazing units and some minor changes to fenestration areas. Solar control was incorporated into the actual glazing unit with an exterior element sometimes added. U-values and solar heat gain coefficients were optimized in the selection of glazing so that mechanical engineers could calculate resultant heating and cooling loads to properly size the HVAC system.

The third strategy called for maximizing the daylighted floor area by core-lighting the building to extend or overlap coverage with sidelighted areas. A large north-facing skylight was outfitted with a high transmission translucent glazing panel (Solera by Advanced Glazing) which provided diffused light to the first-floor exhibition area at the rear of the building. A similar glazing system was used for the large area of north-facing glazing at the rear of the building, for both its high diffusion and high insulation properties.

Some of the primary solar control strategies applied are as follows:

- On the third floor, the outer lites of south and west floor-to-ceiling glass walls of the office cube are sheathed in a 40 percent Tvis neutral gray "sun protection" glass and reduce radiant energy (heat) by 75 percent as defined by the solar heat gain coefficient (SHGC) with minimal color distortion. To limit the penetration of direct sunlight to the interior beyond the window wall, the inner lites of the cube are bisected at eye-level with a transparent glass below and a translucent acid-etched glass above. This keeps solar patterns close to the window wall and diffuses sunlight that would otherwise travel deep into the room. The use of gray glass on the outer lite keeps the heated lite away from the interior, reducing the effect of glare (visual comfort) and mean radiant temperature (thermal comfort) for someone seated near the window wall. Over the entire glazing area, a polyvinyl butyrate (PVB) lamination in combination with a low-E coating effectively blocks the sun and sky's ultraviolet spectrum to reduce fading of interior furnishings and artwork pigments. In addition, a vine-covered trellis panel is attached the south-facing parapet wall to partially shade west-facing glazed areas.

A massive glazed curtain wall in the studio section of the building.

• On the second floor south façade, the existing fenestration design using low-E glass (from Cardinal Glass) was maintained since it was still in good condition and complemented the exterior appearance of the gray glass. On the west facing glazing, acid-etched glazing in combination with a low-E glass is used to diffuse and attenuate direct sunlight. As with all fenestration, interior comfort shades reduce aperture brightness during periods of direct sunlight, as well as provide privacy.

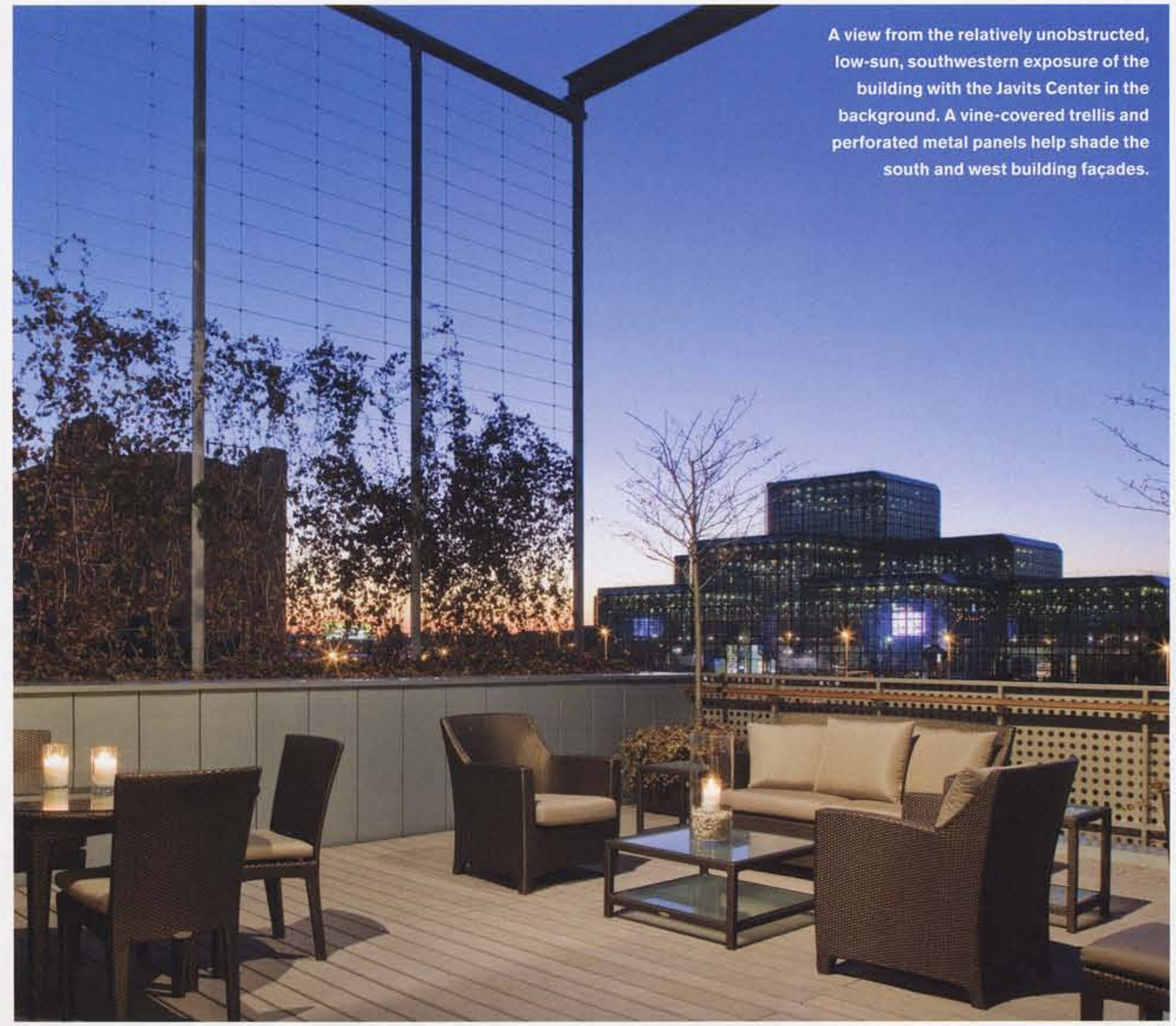
• On the rear façade, the glazing strategy leans more towards diffused north light, the optimal lighting condition for classic studio arts. In the first floor gallery, a series of floor-to-ceiling 18-in wide 3-ft deep translucent glazing units (TGUs) of approximately 60 percent Tvis run from the northwest corner partway along the north wall and wrap equally along the west wall. These create a clerestory light source that provides diffuse natural light, low sound transmission and a high degree of thermal insulation.

• Exterior shading devices in the form of projecting perforated metal panels, trelliswork, and steel and cable plant armatures is the final shading strategy. These provide shade on the south and west façades and roof decks while adding depth and interest to the base form.

FLOW OF LIGHT

In addition to incorporating specific daylighting techniques into the project, the design team was conscious of light's more general effect on the interiors. For example, high-reflectance material finishes and the placement of internal partitions foster an established flow of light. Several translucent elements, such as a 60-ft long light filter bookshelf, allow natural light to filter laterally, so that it may be borrowed by adjacent spaces. Another element, a glass staircase, allows light to flow vertically between the ground level and second floor.

In short, the artful use of light fits perfectly with the core mission of Affirmation Arts.



A view from the relatively unobstructed, low-sun, southwestern exposure of the building with the Javits Center in the background. A vine-covered trellis and perforated metal panels help shade the south and west building façades.

About the Designers: Matthew Tanteri, Member IES (1988), IALD Educator, SBSE, is principal of Tanteri & Associates, a consulting firm that specializes in daylighting and projects that combine light, architecture and art. Mr. Tanteri coordinates a studio and lecture series on daylighting and building system integration for the MFA Lighting Program of the School of Constructed Environments, Parsons The New School for Design and teaches Daylighting in Cooper Union's Continuing Education program. He also serves on the IES Daylighting Technical & Research Committee, The Richard Kelly Grant Board of Managers, and the LIGHTFAIR 2009 Conference Advisory Committee.

Peter Matthews, AIA, is a principal with Matthews Moya Architects in New York. An award-winning architect, Mr. Matthews has led the design effort for many building projects, including the Software Engineering Institute at Carnegie Mellon University. Throughout his career, he has worked at architectural offices in New York, Boston, San Francisco and Pittsburgh, as well as the LeFrak Organization. He is a Registered Architect in New York and Massachusetts