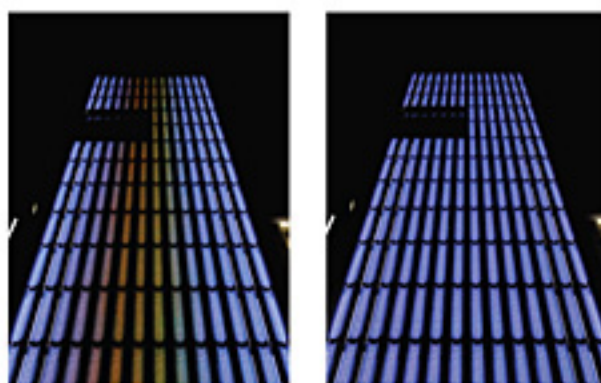


left: Detail of the "HelioTrace" adaptive curtain wall plan created by ABI in conjunction with SOM and the Permasteelisa Group as part of a presentation to the Center for Architecture.

above, right: An aerial view of the mock building in Manhattan looking south. It represents what the shading technology would look like deployed at 10:30 a.m., June 21. The system is designed to react to sunlight to reduce heat and glare.

below, right: Solid-state lighting also play an important role in adaptive architecture.



by Megan Mazzocco, associate editor

#### RESEARCH AND DEVELOPMENT

## Functional Beauty

Millions of dollars have been spent on an ingenious expanding toy called the Hoberman sphere. You may have seen it, or owned one of the plastic varieties, as it was recently enshrined as part of the MOMA New York permanent collection, which speaks to its iconic place in modern design. An offshoot of Hoberman, a company that specializes in transformative environments, the experts at Adaptive Building Initiative (ABI) have

*Like trees, these adaptive facades are programmed to respond in real time to the slightest fluctuation in the environment.*

been creating a systematic approach to product design and problem solving throughout their history as toy, product and architectural systems developers.

Working in an integrated partnership with Hoberman Assocs., the company shares resources based on project demand. ABI uses the same modular design concept, architectural know-how and 3-D modeling software to develop solutions called dynamic building facades that provide shade and respond to levels of sunlight. The company's designs imitate what plants do in nature, but with a mechanical system. They can be invaluable to building owners and operators when it comes to saving money on energy bills.

The same results could be achieved with the foliage of a deciduous tree, but old growth trees are not easy to come by on location where some of these exotic structures reside. For instance, the Pola (cosmetics) building in Tokyo, Japan, features custom mechanical large-scale polycarbonate facade panels

that act as shutters with a functional element of shading; the Aldorf Central Market in Abu Dhabi, UAE, is a modern reinterpretation of a souq. It features a roof grid system that opens and closes according to the daily path of the sun for shading and ventilation purposes.

Both projects are found in highly dense urban areas. "That's where the real environmental efficiency can be gained," says Craig Holland, VP of operations for ABI. "In urban environments, where energy consumption of buildings is really at peak point around the world—that, and it would very hard to find a series of trees over 50 stories tall." Like trees, the mechanical systems are in tune to the slightest fluctuations in the environment.

The dynamic systems are used as an element of art, as well. "Any time you put something kinetic, there's wonder and magic, and the theatrical," says Holland. For example, the Pola building facade panels glow with a luminescence and act as performance art in the evening, giving the building a unique identity and branding the space and neighborhoods surrounding them.

Another artful technique to provide adaptive shading and light control is in the form of ABI's original invention, adaptive fritting. It builds on the idea of standard fritting with a mechanical twist. Thin perforated steel mesh, stacked in layers in acrylic or glass sheets, create distinct patterns throughout the day. "Fritting design patterns are pretty much infinite; they act in layers to form patterns in negative space," explains Holland. "These systems are meant to be functional shading as well as art."

ABI took advantage of this technology for a building at the State University of New York at Stony Brook. The New York Center for Geometry and Physics' south-facing glass facade is a floor-to-ceiling interactive art piece and

functional piece of shading. It also reflects what's going on in the building, as ABI used a perforated method of five layers of stacked mesh with hexagonal, circular, square and triangular perforations. As a servomotor aligns and diverges the panels, different patterns emerge. At noon, the wall appears completely opaque. Curious? It opens to the public in November 2010.

There is a certain beauty in the functioning of these systems, just as dappled light patterns formed by layers of leaves make the most beautiful projections of light and shadow. "I think the functional system delivered can be beautifully integrated and beautiful in its own right," says Holland. An example of this is at the City of Justice in Madrid, Spain a 20,000-sq.-ft. atrium space where Foster + Partners wanted to conjure the idea of walking into dappled sunlight in the interior lobby. They also wanted offices looking out onto the atrium to experience the same effect. Using a custom algorithm combining historic solar gain data with real-time light-level sensing, ABI programmed the atrium's shading units to achieve that effect at both the ground level and vertically throughout the atrium. In accelerated animations, the dynamic servomotor controlled shading structures appear to be an automated version of a delicate origami design for a pergola.

People in urban areas all over the world will soon find themselves interacting with adaptive building facades, making them more conscientious of the interaction between the built and natural environments. "It affects the way users feel about their built environments," says Holland. "It gives the occupant the impression that the building is interacting with them, and it humanizes it." Visit [www.adaptivebuildings.com](http://www.adaptivebuildings.com) or Circle 522