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Beyond the Bulbs: In Praise of Natural Light

By BRIAN LIBBY

Joel Loveland and G. Z. Brown are self-described evangelists of natural light.

As directors of the Better Bricks Daylighting Labs, nonprofit centers devoted to helping architects maximize natural light in their buildings, Mr. Loveland and Mr. Brown consistently preach the benefits of the sun's illumination.

"Daylighting is as old as architecture itself," said Mr. Brown, who is also a professor of architecture at the University of Oregon. "But with the invention of efficient electric light, it's something we've gotten away from."

Until recently, the rationale for using daylight was predicated largely on economics and altruism: greater reliance on natural light reduces energy consumption and costs. Now, a new generation of research is providing additional justification, including improved human performance.

Among the most significant are two studies conducted by Heschong Mahone Group of Sacramento, Calif. One involving 20,000 students in California, Colorado and Massachusetts in 1998 and 2002 found that standardized test scores among comparable students could be as much as 26 percent higher when they attended classes in buildings illuminated primarily by natural lighting, compared with those who relied mainly on artificial light.

Another Heschong Mahone study, conducted in 1995 at a Wal-Mart store in Lawrence, Kan., showed 40 percent higher sales at checkout counters underneath skylights.

At the Lighting Research Center, part of the Rensselaer Polytechnic Institute, environmentally conscious architecture and human biology are being analyzed together. The goal, said Dr. Mark Rea, the center's director, is to move beyond experiments that look at light's effect in existing settings to determine how and why natural light affects humans on a biological level. The center has drawn from previous studies of the relationship between seasonal depression and natural light, particularly those of Dr. Alfred Lewy of Oregon Health Sciences University, to determine that human performance is improved by natural light. A comprehensive research study is due to be released this summer.

Electric illumination replicates light levels the human body needs to see, but for the rest of the body "it's ineffective compared to something as simple as waking up and looking out the window at the blue sky," Dr. Rea said.

Artificial light exists primarily in the long wavelength, the red region. But the body's circadian system, governing waking and sleeping patterns, prefers light in the blue region of shorter waves, which suppress the natural hormone melatonin and stimulate the hormone serotonin. The combination leads to greater alertness.



Joel Loveland, top, helps architects maximize natural lighting. He was a consultant on the design of the Pierce County Environmental Services Building in Washington, above.

In a 1971 study of employees at a power company running day and night, the British researchers Robert Aldsworth and D. J. Bridgers showed that unvarying electric light led to low-level sensory deprivation, thereby reducing productivity. People need variability in their view, easily provided by a window, to give the eyes and mind a rest.

A psychological element is also involved. “People like to know what’s happening outside,” said Mr. Loveland, a professor of architecture at the University of Washington, even if it is just to get information about weather and the time of day.

A study at a Colorado software company, conducted by the Lighting Research Center, found that programmers in offices with natural light spent more time at their computers than those in windowless offices. For them, social interaction replaced the suppression of melatonin that occurs naturally with sunlight.

While the benefits of natural light may seem obvious, planners have sometimes been reluctant to provide it in their buildings. Many school classrooms, for example, have been designed without windows, in some cases to eliminate distractions and in others to cut costs.

And when natural lighting is provided in office buildings, the coveted window space is often designated for a handful of executives, while most employees are forced to rely on glaring, flickering, buzzing light tubes hanging from the ceiling.

In his lectures, Mr. Loveland often cites a New Yorker magazine cartoon in which an employer touring a series of cubicles with a colleague explains that “dim fluorescent lighting is meant to emphasize a general absence of hope.”

Still, architects seeking to bathe buildings in natural light can create as many problems as benefits. Simply adding windows is not necessarily the answer. “When we work on a project in the daylighting lab we often spend more time taking them out than putting them in,” Mr. Loveland said. If a window is added to a space, the designer must determine how to balance the room’s luminosity by spreading that light around.

Mr. Loveland calls architecture “a profession in denial” when it comes to evaluating how design will affect light levels. According to a study conducted by the power company PG&E of San Francisco, 90 percent of architects interviewed said they used daylight as a consistent design element. But fewer than 3 percent investigated the effects of different design decisions involving daylight.

To reverse that trend, Mr. Brown’s and Mr. Loveland’s laboratories in Portland and Seattle offer architects a variety of design tools. Some, like the heliodon, evaluate an existing design. Architectural models are placed on the heliodon, a rotating apparatus, to measure simulated light levels inside throughout the day and year.

But Mr. Brown stresses the importance of a series of formulas and calculations that help designers devise lighting solutions before their first blueprints are completed.

Some strategies are as simple as measuring the length and height of windows in relation to the depth of a space. Others rely on material suggestions like louvers and window coatings that allow indirect sunlight while minimizing windows’ unwanted heat gain and glare.

Even a small design change saving energy can have a huge effect on the bottom line, Mr. Brown said.

“We know people are healthier and more productive with daylight,” Mr. Loveland said. “Now it’s just a matter of putting it into practice.”