

# Lighting healthcare facilities with the sky can promote healing

**R**eal daylight — the light from the sky — is the subjective reference point for all lighting. Exposure to the sky automatically brings with it three important elements — each linked to our well-being: daylight, sense of space and experience of nature. With civilization and especially modernization, the light that now illumines our interior day-to-day lives is very dif-

ferent from skylight and often has significant impact on our well-being.

Recently, it has been documented that when we are separated from regular exposure to natural skylight we suffer from psychological and physical problems that range from depression and seasonal affective disorder (SAD) to insufficient vitamin D production. Unfortunately, our current systems of lighting do little

to counteract daylight deprivation — much less the impact of insufficient exposure to the vastness of the sky's space and the loss of our most universal experience of nature.

Healthcare lighting has special design requirements that are concerned with patient experience, as well as the long-term health and performance of staff. In most healthcare facilities construction requirements and special needs created by modern medical technologies limit exposure to the light of the sky — true daylight. In such cases it is appropriate to explore alternative solutions.

Artificial lighting is typically described in terms of three factors: intensity measured by lux, color temperature indicated by Kelvin (K) and the ability of a light source to illuminate all colors uniformly indicated by the color rendering index (CRI). Lux values can range from 200 or less for ambient light to well over 1000 for task lighting. Color temperature commonly ranges from the 3300K of a warm white incandescent light to 4000K for cool white fluorescent — with daylight fluorescent ranging from 6000K to 6500K. A high CRI relative

to the type of light source mimics the experience of viewing color under daylight.

The delivery of artificial daylight can be accomplished through specialized fluorescent lamps (up to 6500K) and their highly efficient electronic ballasts. Recent developments have added RF-free LED technology (up to 6000K) to the daylight category.

## Sky ceilings

To step beyond the delivery of artificial daylight (6500K) in standard fixtures to a richer and more natural version of "sky lighting," healthcare designers are exploring the use of sky ceilings. When properly implemented, sky ceilings are illusions that take the observer well beyond the viewing of a beautiful picture to an authentic experience of the sky and the nature it represents.

Sky ceilings are based on an understanding of our habits of perception. A magician creates a highly believable (though completely unreal) reality through skilled manipulation of our perceptual habits; he cuts the lady in half, there is no doubt about it. Similarly, the designer of a sky ceiling



*Sky ceilings can be of value in clinic or hospital rooms that already incorporate a window offering some natural light.*

must understand our visual habits in order to create an architectural element that leads us beyond the mere idea of sky to an authentic experience of nature. A successful illusory sky will trigger the psychological and physiological response that an observer would automatically have when lying on the ground looking up into a beautiful sky. We all know the experience and we all know the result — deep relaxation, freedom, and inner peace.

While the use and experience of artificial daylight (6500K) is essential to a successful illusion of the sky, there are other equally important elements. These elements comprise the total information that is delivered to the observer. For the most part the lighting system acts as carrier of this information. Realistic rendering of space and an accurate display of the deep principals and patterns of nature are examples of this information. Because of a lifetime of exposure the eye and mind are highly tuned and alert to the flood of data that is present in a real sky. Consequently, if there is a violation or distortion of even subtle elements in a sky ceiling, then the illusion will break down.

For example, because sky color is directly correlated with altitude, temperature, humidity, barometric pressure, and pollution the color seen by the observer will

convey considerable information. Specifically, a violet-blue sky is characteristic of a high-pressure front (or high-altitude) and elicits a different experiential response than the softer high-humidity yellowish-blue of a low-pressure front. We simply feel better in the high-pressure, low humidity conditions and experience has taught us to associate that good feeling with the corresponding hue range of violet-blue. Likewise, a sky that contains too much cyan (blue-green) will simply read as unnatural and false.

Clouds also provide access to significant information for the mind and eye. Clouds have no intrinsic color, so their apparent colors are imparted by the atmospheric qualities previously discussed as well as the angle of the sun, the time of day, and the complexities of internal shadowing. Their physical structures and patterns of formation are also

built according to complex interactions governed by the basic laws of fluid dynamics and thermodynamics.

Because of the underlying unity of nature's fundamental mechanics, it should be no surprise that clouds display the familiar patterns that we observe elsewhere in the world. A sky of rippling clouds is little different from the rippling patterns in a sandy river bottom, the eddy currents of blood in the aorta, the waves of peristalsis in the gut, or the centuries old erosion patterns of the Southwest. Accurately rendered cloud patterns displayed in a sky ceiling provide the observer with access to the same laws of nature that operate within our own bodies. As a result, considerable information is embedded and available in something as apparently simple as the form, pattern, and color of clouds.



*Sky ceilings offer designers an affordable means by which to bring the illusion of natural light into a windowless space.*

### **Making a successful illusion**

In the presentation of a dimensionally deep sky on a flat ceiling, there are several perceptual habits that must be considered to create a successful illusion. Proper perspective is one of the more important. When we look up into real clouds we see only the bottom of clouds that are directly above and see increasingly more of the sides of clouds as our view moves from zenith to horizon. Therefore, the straight up view appears very different from an oblique view. In fact, even when we look up into an empty blue sky, it is never a uniform blue of constant luminosity, but is always graded in hue and value from horizon to zenith. If we ignore these precise factors, then the picture that we place on the ceiling, no matter how pretty, will remain a mere idea or representation

## LIGHTING



*Sky ceilings utilize a combination daylight technologies, digital imaging technologies and a modular ceiling grid system to achieve a lighting illusion that can help patients relax.*

— not an experience of magic.

Basic considerations of perspective, three-dimen-

sional geometry and numerous other factors must be considered vis-à-vis the observer for the illu-

sion to work. Consider the following:

- One might be tempted to use a wide-angle lens in photographing the sky. However, the curvature and forced perspective that can be seen in converging trees and even clouds alerts the eye and mind to the fact that what is being observed is, in fact, a photograph – not sky.

- Blurring of motion is a convention of photography — not of our vision — and alerts mind and eye to the unreal photographic origin of the image.

- Use of a reflective surface alerts the eye and mind to the existence of the flat plane of the ceiling and hence conflicts with the

illusion of deep space. In spite of a beautiful image, it is difficult for the mind to accept a field of blue sky that is marred by the subtle, but telltale hot-spot stripes of old style indoor fluorescent backlighting. New advances in light-box design and 6500K technologies can eliminate this problem.

- A low CRI will subtly damage illusion by illuminating only a portion of the full spectrum while rendering other colors muddy.

- The size and placement of a sky ceiling, in addition to being a focal point for the observer, can also engage their peripheral vision to utilize the unique perceptual

attributes associated with that mode of vision.

□ The use of a grid (such as the extrusion that supports a true skylight or a ceiling grid system) might at first thought seem disruptive, but in fact, because of the visual habits developed by years of exposure to grids in windows and door, grids actually signal the eye and mind to read the space on either side as “beyond.” This significantly enhances the experience of space and contributes to the reality of the illusion.

The underlying principle is that mind and eye — operating independently of the intellect — are highly sensitive and linked to a vast

depository of information that is continually being updated and processed as a requirement for successful navigation in the sensory world.

#### Reasonable costs

From a purely practical point of view there is no reason why a successfully implemented sky ceiling cannot be affordable. Utilizing the powerful illusionist approach, executing with the newest daylight technologies, digital imaging technologies and modular ceiling grid systems, one can provide an authentic experience of nature for patients and staff alike. The cost for a luminous sky ceiling of 48

square feet (6'x 8') placed in the waiting room of a mid-size hospital emergency room amortized over three years is \$.04 per patient waiting hour — this does not include family and friends. Within a linear accelerator the cost is approximately \$.35 per patient procedure or \$.56 in an RF-free MRI. In a centralized staff lounge the cost is approximately \$.02 per staff visit. Comparing the reasonable cost to the benefits achieved in patient comfort and loyalty, as well as referrals and the improvements to staff well being and health, the utilization of this technology may well be an appropriate investment.

It is certainly worthwhile to explore new lighting technologies for the healthcare environment that do more than simply deliver lumens — regardless of their characteristics. Light is a carrier of information and when properly utilized, sky lighting can engage the awareness in an experience of the fundamental laws and forces of nature, thereby generating the psychological and physiological states of reduced anxiety and restfulness that support healing. ■■■

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