

Introduction to Lighting Design

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When horizontal surfaces are illuminated, people and activities become the dominant features in a space.

Light is fundamental in architecture. It affects the usefulness of a building and the enjoyment of a building interior. It also affects the way users feel about themselves and others. It shapes or misshapes the attraction a user feels for the surrounding activities and objects; the resulting attitude is a major factor in maintaining effective interest in an activity or task. For these reasons, the visual impressions induced by the lighting system are fundamental in planning and design, and they become a functional part of the activity.

The use of light is an inseparable part of the architectural conception. Many building projects require the help of special consultants to solve complex problems of lighting system design. Only the original designer, however, can visualize how things are to appear in the finished structure, that is, what will be emphasized and what will be subdued. To convey this concept to a consultant, it is essential to communicate ideas in a mutually understandable language.

Designing a complete and suitable luminous environment is more complicated than simply selecting lighting fixtures. To develop spatial patterns of light, shade, and color requires thinking about light in three dimensions. A mechanistic approach confuses a room's visual quality with the footcandles on the work plane. Preventing that confusion demands recognition of the psychological aspects of lighted space. Such recognition implies understanding of and sensitivity to techniques that create an environment where observers react with feelings of pleasantness and well-being through the use of silhouette, sparkle, focal emphasis, color tone, and other patterns of spatial light.

It is a mistake to concentrate on luminaires (lighting fixtures) as objects rather than on the surfaces being lighted: where the light lands is more important than the object that produces it. Luminaires should be the last components selected; early in the design process the designer should decide which surfaces and objects to light and which to leave in relative darkness. That is, first decide what you want to light, then work backward toward a solution.

The initial step in planning light for a space is to establish an appropriate emotional environment for the activity that will take place there. Lighting can affect impressions of spaciousness, relaxation, privacy, intimacy, and pleasantness; it can produce a festive, carnival-like atmosphere or a quiet place for contemplation; it can create cold, impersonal public spaces and warm, intimate, private ones. Light can have a strengthening or reinforcing effect in creating a suitable psychological setting, similar to that provided by background music.

After mood has been considered, the next question to be answered is, where do we need light? People and activities in a space become the dominant features and the architecture a secondary factor when horizontal surfaces -- the normal work plane for activities such as reading, typing, drafting, cooking, and sewing -- are illuminated. Increased consciousness of movement, people, and nearby detail creates a personality for the lighted space that encourages a gregarious attitude among its occupants.

When the lighting emphasis is shifted to the architecture, however, activity becomes visually subordinate to the architectural environment. People interpret the architectural environment through vertical and horizontal brightness relationships because these surfaces appear as major elements in their field of view. This shift reinforces a more introspective attitude, an intimate atmosphere with a feeling of privacy. Many times, horizontal illumination (downlighting) combined with vertical (wall washing) or overhead illumination (uplighting) is the most desirable solution. The important thing is to first decide what to light.

To specify a combination of surfaces to be lighted with those left in relative darkness, the designer must next think about the direction and distribution of light within the space. A luminaire with narrow, concentrated, downward light distribution deemphasizes ceilings and vertical surfaces, yielding an impression of comparatively low general brightness with high brightness accents. A downwardly directed luminaire that diffuses (spreads) the beam

pattern increases the incident light on walls and vertical surfaces, reducing the concentration of brightness within the space. A multidirectional lighting unit that delivers diffuse upward and downward light reduces shadows and contrast, creating a bright, generally uniform lighting condition.

Visual perception of space, of course, depends upon both incident light and surface finish. When designing a lighting system, then, it is important to recognize the influence of reflected light. Low reflectance and dark finishes absorb much of the light that strikes them, reflecting very little toward the eye. Because surface brightness is low, such finishes contribute to a general impression of a dark space. High reflectance and light-colored surfaces reflect a large proportion of the light that strikes them, which produces a brighter interior with a more general diffusion of light. It is essential that designers understand this fundamental relationship between lighting units (initial distribution) and building surfaces (reflected distribution).

The next step in the lighting design process is to determine how much light is required for the activity that will take place in a space. In general, the light needed for visibility and perception increases as the size of details decreases, as contrast between details and their backgrounds is reduced, and as task reflectance is reduced. Recommended lighting levels are Published in the IFS Lighting Handbook 1981 Application Volume. The IFS standards are intended as a guide to providing the amount of light needed for specific seeing tasks; that light, however, can be provided in many ways. Qualitative factors -- user attitude, well-being, and motivation -- are as important as the quantitative illumination requirements.

Color perception is yet another factor important to the appraisal and performance of a visual task. Color characteristics of light can significantly alter a person's appearance. Incandescent light sources, which are rich in the red region of the spectrum, complement and flatter the complexion, imparting a ruddy or rosy hue to the skin. Some fluorescent and high intensity discharge (HID) sources, which emphasize the yellow or blue range, produce a sallow or pale appearance.

Psychological experiments indicate that people are more accepting of "warm" colors of light (in the red region) at low brightness levels, while they accept "cooler" colors (in the blue region) at higher levels of illumination. This makes sense when one remembers that traditional sources of low level illumination for people were open fires, torches, candles, and oil and gas lanterns -- all sources rich in the red region of the spectrum. Traditional sources of high intensity illumination have been the sun and sky, both relatively "cool" colors of "white" light.

Choosing the light source follows easily once you decide on the color, quantity, and distribution of light for a space. At the counter of a gourmet food shop, for example, a diffuse distribution may be desired to provide a general brightness level and shadow-free illumination at the work surface, in a color that renders food appropriately. To do so, one might choose a line voltage incandescent lamp for several reasons: a low-voltage light source, with its compact filament, would produce too narrow a beam spread to achieve a great diffusion of light; a fluorescent lamp, because of its poor color-rendering qualities, would make many foods appear unappetizing.

Placement and position of light sources depend to a considerable degree on the direction and distribution of the light decided upon. The visual perception of surface textures and sculptural form is drastically altered by the lighting scheme's location and distribution characteristics. To reinforce the natural textures and sculptural relief of a stone wall, for example, it is possible to accentuate the relationship between highlight and shadow with a grazing light produced by concentrated sources mounted close to the surface. Conversely, a more diffuse lighting condition will reduce the visibility of surface flaws and create a visual impression more suitable for a gypsum board wall or an acoustical tile ceiling.

When you have reached this point in the design process, choosing a light fixture to meet your requirements will lose much of its mystery. The staggering array of lighting equipment available will narrow to a few choices: luminaires that use the source selected, produce the required light distribution, and provide enough brightness control to prevent glare in the normal field of view.

The lighting equipment should also be coordinated with the architecture. Surface- or pendant-mounted fixtures, in particular, become architectural elements as well as lighting units and are important to design harmony and the general impression of space. A proper relationship between lighting units and materials produces a coordinated architectural result.

In a well-integrated space, a casual observer should even be unaware of the lighting and the mechanics of light production. Observers should be conscious only of the overall architectural environment -- an environment that affects the way users feel about themselves and others and shapes the attraction they feel for surrounding activities and objects. In the end, it is not only the quality of light with which we are concerned, but also the quality of life.