

Implications

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Lighting: Its Effect on People and Spaces

How do you light a candy store? How do you light a funeral parlor? How does the lighting affect our impression of the space? What makes the lighting in a space enjoyable? Or perhaps not enjoyable? Why do you choose to spend time in a particular space? Or perhaps not to spend time there? The answers to these questions are what make lighting an exciting subject. Some of it is common sense, but it takes research and/or experience to provide the justification.

How is lighting design accomplished?

To implement a successful lighting solution—we must fully understand lighting design. A variety of designers may function as the lighting designer, i.e., the architect, electrical engineer, facility manager, interior designer, landscape architect, or urban planner. While the profession is relatively small, there is a chance it might be one of those rare breeds that call themselves “lighting designers.” Sometimes designers light the spaces with an understanding of lighting design excellence. Sometimes it takes a lighting designer to make the vision of excellence a reality.

Lighting design is an art and a science. This is true for many components

of our built environments. Designers are concerned about the aesthetics, the art of lighting. It also means utilizing an enormous body of technical knowledge, and updating due to new technology, the science of lighting. But most importantly, lighting is for people, so there must be an understanding of the visual quality users need for health, safety, and enjoyment. While the big three are the people, the aesthetics, and technical body of knowledge, we are dreaming if we do not factor in the economics and the environment.

The **Illuminating Engineering Society of North America (IESNA)** has the basic body of knowledge on lighting in the IESNA Handbook. It includes summaries of recommended practice based upon research and consensus of successful lighting for specific applications. It also includes a section that discusses lighting quality and visibility in our environments. The design issues discussed in this section include the following topics: appearance of space and luminaries, color appearance, daylighting integration and control, glare, light distribution, luminances of room surfaces, modeling of faces or objects, points of interest, shadows, source/task/eye geometry, desirable reflected highlights, surface characteristics, system control, solution



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flexibility, and level of illumination for specific tasks. Designers must consider many things, including the amount of illumination as one of the design criteria.

The process for lighting designers follows the same basic phases used by all designers, going through programming and schematic design, through design development, etc. In the schematic design phase of the process, many lighting designers think in layers:

—**visual task:** providing enough light to recognize a flaw in black silk or to be able to walk safely through a corridor

—**general lighting** or **ambient lighting:** to set a mood or impression and maybe the lighting that provides for safe circulation within the space

—**visual interest:** something that adds a touch of magic, or something to tickle the user's "joy button."

It is interesting to note that visual interest, the third layer, may be a priority in a restaurant; however, adequate lighting for menu reading, and for safe circulation through the space are also layers to include! So it may be the aesthetics that drive the design solution, or perhaps it will be the task. For instance, if the task is brain surgery lighting for function, visibility, and visual comfort for the medical staff must drive the design. All layers may be important, but priorities will determine which layers are critical.

Is that enough? Not really! We are lighting for people, and the psychological response may be equally important. How the lighting affects the behavior of people using the space is also of considerable concern for the designers of the space and their clients.

Lighting designers think about how behavior is affected by lighting. Here are a few interesting examples in terms of how lighting shapes behavior:

—Visibility of vertical and horizontal junctions aids orientation

- People follow the brightest path
- Brightness can focus attention
- Facing wall luminance is a preference
- Lighting can affect body position

Situational Examples

Here are some examples of issues that must be addressed when lighting a space to ensure that the psychological and behavioral issues of the users are met:

A. Lighting where **vertical meets horizontal** is important in terms of safe navigation through a space. Note in the room on the left (the white hallway) the junction of vertical and horizontal are the same in value and hue. This causes a visual problem, especially for the aging eye. The room on the right has the same problem; however, the loss of the visibility of vertical and horizontal is due to the specular (reflective) surfaces.



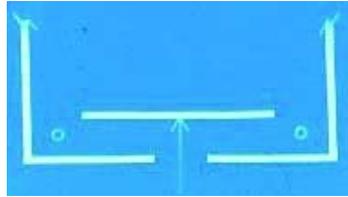
Courtesy: Hauserman



Courtesy: P. Yorks

B. People follow the **brightest path**. In a study by Taylor and Sucov (1974), people were asked to walk up to the wall shown in the floor plan (top of next page) and then read the directions found there. Directions asked them to proceed to the room in the back and complete the paper task on the table. In the study, the downlights illuminating the path to the

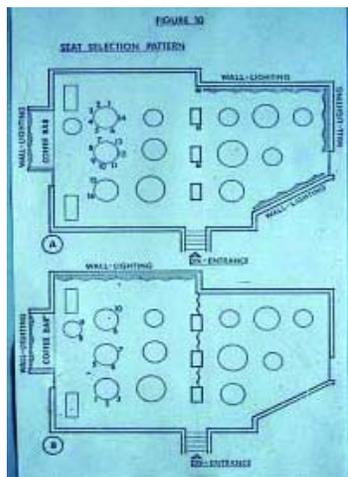
right and those illuminating the path to the left had an equal level of illumination, 69% of the people went to the right. Whereas when the path to the left had a higher level of illumination, 75% of the people went to the left. The study found that basically people are like moths—attracted to brightness.



C. Brightness can focus attention. When creating a focal point, increasing the brightness contrast between the object and the surround increases the impact.



D. People like to face walls that are illuminated. In Plan A and B (shown at right), people that had the first choice, selected seats that faced the illuminated walls. Similar studies show that people do not like to sit in brightness but like to see brightness. Both John Flynn and David Loe have conducted studies that conclude that people prefer spaces with wall luminance.



E. Lighting can cause people to alter body positions. Any one that has worked at a computer screen knows that reflected brightness on the screen will

cause you to alter your sitting position or sometimes the position of the screen. The same is true when you attempt to read materials that have a specular surface.

Criteria to Evaluate Lighting

Years ago, Dr. John Flynn developed criteria for evaluating the lighting of spaces. His work is considered seminal to this day. Flynn’s conceptual framework used the following cues to determine the users’ subjective response to the lighting of the space.

- uniform/non-uniform distribution of light
- bright/dim levels of illumination
- overhead/peripheral (or wall) lighting

Using a semantic differential scale (using opposite terms to determine the subjects’ attitudes or opinions along a continuum) and large numbers of subjects, he concluded that lighting could create a space that would make users say it was:

- “pleasant” versus “unpleasant”
- “public” versus “private”
- “spacious” versus “confined”
- “relaxed” versus “tense”
- “visually clear” versus “hazy”

Creating the Appropriate Impression

Obviously, there are other elements in the space that affect our subjective impressions, and as design professionals we make an even stronger statement by have the lighting express the same impression as the other elements. To create the following impressions, here is a summary of how to manipulate lighting conditions. (If you wish to create the opposite impression than those listed below, remember to do the opposite with the lighting.)

Pleasant: use wall lighting, instead of the majority of the lighting coming directly down from the ceiling. Use a non-uniform distribution of brightness in the space; how bright or dim is dependent upon the visu-

al tasks being performed within the space

Public: rely on higher levels of illumination with a more uniform distribution of light from overhead lighting sources, predominantly.

Spacious: provide overall high levels of illumination with even distribution of light on the walls and uniform lighting on all surfaces.

Relaxed: use non-uniform distribution, wall lighting, and lower light levels, typically.

Visually Clear: provide higher luminance on the activity/task planes, with peripheral luminance.

Another aspect that has been a standard in lighting design practice relates to expected activity levels and how lighting relates to expected costs. Consider the large discount stores or even department stores. There is a very “public” approach to lighting, and people expect to have economical prices and typically more crowded shopping patterns. Compare that to the small specialty shop where the lighting subjective impression is more “private” and there is an expectation that there will be lower light levels, a sales person to assist, fewer customers, and often higher product costs. The same expectations are true for the lighting of fast food restaurants compared to more expensive restaurants.



Thinking about the layers of light and how light affects the users of a space on both psychological

and behavioral level will present you with a mental lighting design concept when someone says—how do you light an expensive candy store, a funeral parlor or—? Lighting is a key factor in helping the space meet the intent of its owner and the needs of its users. Keep that in mind, and remember that often incorporating a lighting designer into the design team could be quite beneficial to the outcome of the design solution.

—Delores (Dee) A. Ginthner, Associate Professor, University of Minnesota

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Related Research Summaries

InformeDesign has many Research Summaries about lighting design and other related, pertinent topics. We believe that this knowledge will be valuable to you as you consider your next design solution and worth sharing with your clients and collaborators.

“Lighting, Worker Performance, and Comfort”
—*Lighting Research and Technology*

“Gender and Age Affect Response to Indoor Lighting”
—*Environment and Behavior*

“Lighting - the Role It Plays in a Museum”
—*Journal of Interior Design*

“Impact of Office Workers Having Environmental Control”—*Journal of Environmental Psychology*

“Color Judgment is Influenced by the Aging Eye”
—*Family and Consumer Sciences Research Journal*

“Color of Light Affects Psychological Processes”
—*Journal of Environmental Psychology*

“Institutionalized Older Adults are Affected by Lighting”—*Journal of Gerontology: Medical Sciences*

“Effects of Workplace Lighting Levels on Employees”
—*Applied Ergonomics*

“Office Lighting Affects Mood Differently in Men and Women”—*Environment and Behavior*

“Improve Reading with Luminance”
—*Journal of Illuminating Engineering Society*

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