

Directional Effects and Strategies


Quality of the Visual Environment

IESNA
Illuminating Engineering Society of North America

The IESNA is the recognized technical authority on illumination. For over ninety years its objective has been to communicate information on all aspects of good lighting practice to its members, to the lighting community, and to consumers through a variety of programs, publications, and services.

The strength of the IESNA is its diversified membership: engineers, architects, designers, educators, students, contractors, distributors, utility personnel, manufacturers, and scientists, all contributing to the mission of the Society: to advance knowledge and disseminate information for the improvement of the lighted environment to the benefit of society.

The Society publishes nearly 100 varied publications including recommended practices on a variety of applications, design guides, technical memoranda, and publications on energy management and lighting measurement. The Society, in addition, works cooperatively with related organizations on a variety of programs and in the production of jointly published documents and standards.



www.IESNA.org

Lighting Quality

Patterns of light and dark affect both our perceptions of the world and our emotional and physiological responses, and thus they are essential in gathering information about the physical world.

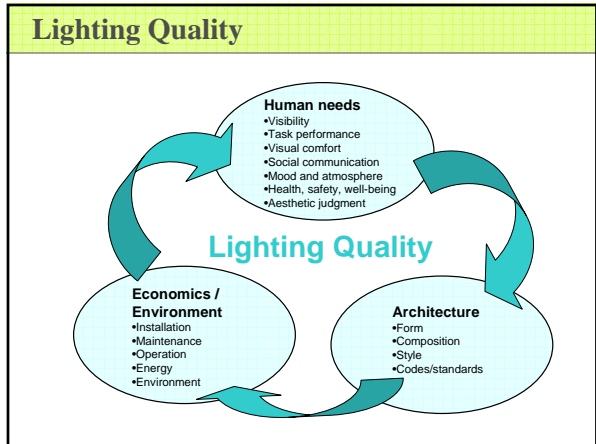
Good-quality lighting can support visual performance and interpersonal communication and improve our feelings of well-being.

Poor-quality lighting can be uncomfortable and confusing and can inhibit visual performance.

The overall purpose of lighting is to serve the needs of people.

The role of the lighting designer is to match and rank the needs of the people using the space with the economic and environmental considerations and the architectural objectives, and then to translate the results into a workable design and functional installation.






Directional Effects and Strategies


Lighting For Humans

Central to human needs is visibility, because it is the detection and organization of light patterns that allow a person to analyze and evaluate the environment.

Once objects and patterns are visible, one can use a pencil to write a note, learn to pronounce new words by following the facial expressions of a teacher, walk down a corridor without bumping into a vacuum cleaner on the floor, appreciate a painting, or feel relaxed in a dimly lighted restaurant.



visibility is central to a larger number of human needs



Lighting for Human Needs

Visibility

Visibility is the ability to extract information from the field of view, whether that information is the location of a curb or of a flower arrangement. It is a necessary condition for good-quality lighting.

Lighting installations exist to enable sight. The most powerful variables influencing the visibility of objects are:

- Contrast
- Background Luminance
- Time
- Size

Age modifies this relationship; for the older viewer, the task must be larger and brighter and its contrast higher in order to achieve visibility levels equivalent to those of younger viewers.



The rain in Spain stays mainly on the plane



The size of the object is ...

Lighting for Human Needs

Task Performance

Task performance is an essential human need. **The task is the user's activity**, whether measuring the size of a room, washing mud off hands, reading room numbers posted in a corridor to find a doctor's office, or seeing the details in the etchings displayed in a museum.

Lighting must enable users to perform the "work" they came to do.

Task performance and visual performance are not synonymous; in fact, several nonvisual factors contribute significantly to task performance. Training, motor skills, motivation, and many other human factors interact with visibility to affect the level of task performance.



Directional Effects and Strategies

Lighting for Human Needs

Mood and Atmosphere

Needs for mood and atmosphere encompass the emotional response to the luminous environment. Preference, satisfaction, relaxation, and stimulation are influenced by lighting. These mood states can indirectly influence other behaviors, such as task performance.

Lighting for Human Needs

Visual Comfort

Visual comfort is an essential human need that can affect task performance, health and safety, and mood and atmosphere.

Glare can cause discomfort and interfere with visibility. Direct glare occurs when the light travels directly from the source to the eye. This may include "disability glare," "discomfort glare," and "overhead glare".

Bad

Lighting for Human Needs

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Good

Directional Effects and Strategies

Lighting for Human Needs

Aesthetic Judgment

Aesthetic judgment needs differ from emotional responses. **Humans appear to need to make sense of what they see, so the information must be either immediately available in a scene or implied.**

Lighting can communicate meaning, reinforce rhythmic patterns in the architecture, and enhance color, thereby creating a hierarchy of social significance in the visual field.

Lighting can also hinder understanding by introducing patterns that conflict with the underlying scene. One research model that attempts to quantify aesthetic judgments uses four dimensions of appraisal:

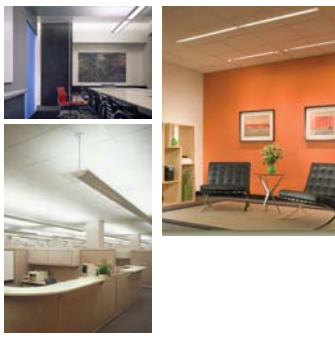
- Coherence
- Legibility
- Mystery
- Complexity



Lighting for Human Needs

Aesthetic Judgment

Another uses visual interest and visual lightness (room surface brightness). These studies conclude that preference for a scene increases when the lighting is nonuniform; however, high levels of one quality can reduce levels of another. For example, a scene that is complex may rank low in coherence.

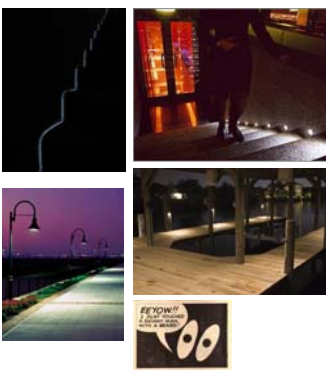


Lighting for Human Needs

Health, Safety, and Well-Being

Although they are needs of primary importance, health, safety, and well-being are often overlooked. As an example, flicker from some electric lighting can produce a stroboscopic effect with moving machinery, making the machine appear to move at a different rate. Electronic ballasts for fluorescent lamps reduce the perception of flicker, and it also appears that they reduce the incidence of headaches and eyestrain.

Safety is an important need, but emergency lighting is only one aspect of it. Lighting also affects the visibility of curbs, stair edges, train platforms, roadway intersections, and labels of critical chemicals and pharmaceuticals.



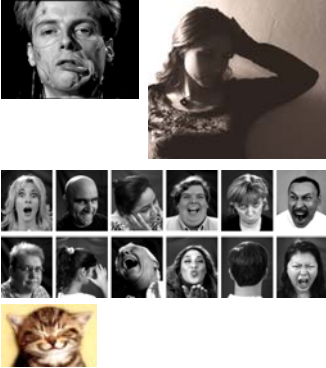
Directional Effects and Strategies

Lighting for Human Needs

Social Communication

Social communication needs include the creation of luminous conditions conducive to such communications in a setting, especially by facial appearance.

Much human communication occurs by nonverbal means, but these cues are missed if the lighting distracts from or masks the information. Facial recognition, for example, which is a critical element of security lighting, is influenced not only by the amount of light needed to detect a face, but also by the modeling of facial features created by the pattern of the light and shadow on the subject's face.



Light Patterns in Architecture



Light Patterns in Architecture



Directional Effects and Strategies

Light Patterns in Architecture



Luminance Patterns


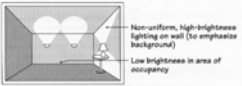
Specific luminous patterns have a consistent and definable effect on an occupants' subjective impression of a space.

Designers can use these patterns to create spaces which are appropriate for the intended use. Each pattern reveals its opposite as well: for example, to make a space seem more public, a designer can look at the criteria for making a space seem private and do the opposite.

- Spaciousness / Confinement
- Visual Clarity / Haziness
- Relaxation / Activation
- Private/ Public

Luminance Patterns

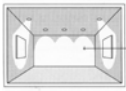
Privacy:
Privacy is light being in the shadows. Lighting patterns which are overall low, non-uniform, and darker zone of the occupant than in the surroundings will reinforce an impression of privacy. Vertical rather than horizontal surfaces should be lit.




Directional Effects and Strategies

Luminance Patterns

Relaxation:
Relaxation also implies non-uniform lighting, with non-uniform wall lighting contributing to this impression. Warm color sources contribute to a relaxing feeling. Aspects of the patterns for relaxation can be effectively combined with those for visual clarity to create effective and comfortable work environments




Non-uniform lighting on walls (warm color temperature light sources)





Luminance Patterns

Visual Clarity:
Visual clarity refers to the crispness and distinctness of the visual environment, rather than how well a task can be seen. Visual clarity is reinforced by shadows, by emphasis on horizontal surfaces such as the work plane and the ceiling, and by higher luminous in the center of the room.

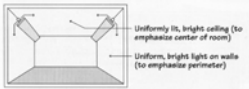


Uniform, bright light from ceiling (cool color temperature light sources)
High-brightness on horizontal plane (to emphasize work surfaces)
Workplane (usually table top height)





Luminance Patterns

Spaciousness:
Relatively bright ceilings and wall are particular importance to reinforce a sense of spaciousness. Uniform illumination also helps make the room feel spacious.



Uniformly lit, bright ceiling (to emphasize center of room)
Uniform, bright light on walls (to emphasize perimeter)



Directional Effects and Strategies

Basic Lighting Design




General or Ambient lighting
provides an area with overall illumination. Also known as ambient lighting, general lighting radiates a comfortable level of brightness, enabling one to see and walk about safely.

Task Lighting or Lighting at the Work plane
helps you perform specific tasks such as reading, sewing, cooking, homework, hobbies, games, or balancing your checkbook

Accent Light or Highlighting
adds drama to a room by creating visual interest. As part of a decorating scheme, it is used to spotlight paintings, houseplants, sculpture, and other prized possessions, or to highlight the texture of a wall, drapery or outdoor landscaping.

Basic Lighting Design



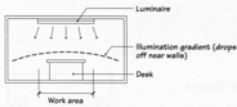
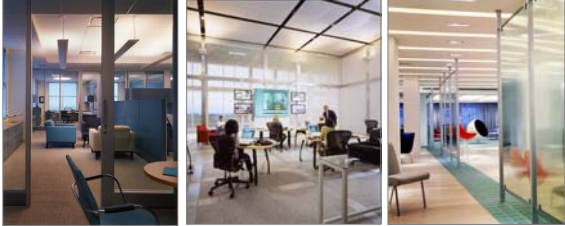
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Light Distribution Strategies


General or Ambient:
 General lighting provides uniform illumination over the entire area of a room, allowing flexibility in the placement of workstations. Localized general lighting also provides approximately uniform illumination, but luminaires are located in a pattern that responds to the specific arrangement of workstations.

Directional Effects and Strategies

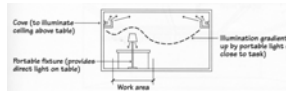

Light Distribution Strategies

Local Lighting
 Local Lighting provides high illumination on relative small areas. It can be too bright and uncomfortable unless surrounding surfaces are also illuminated, as shown. Local lighting used with general lighting is called supplementary lighting.

Light Distribution Strategies

Task-Ambient Lighting:
 Task ambient lighting provides high illumination on the task from light sources located close to the work areas, supplemented by ambient illumination, usually from indirect light sources (i.e. furniture-integrated fixtures which direct light toward the ceiling).

Light Distribution Strategies

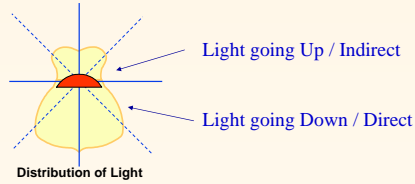
Highlighting
 Highlighting emphasizes areas of interest, such as table in restaurants or art work in galleries. Spill from the highlighted areas may provide sufficient ambient illumination.



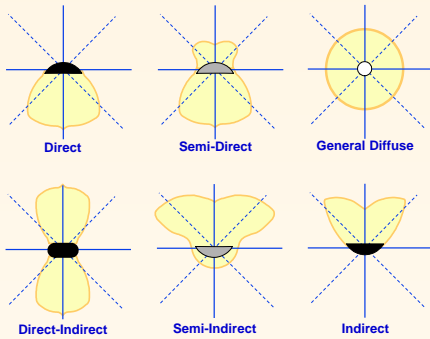

Directional Effects and Strategies

Direction of Light

- Goal of a luminaire is to put light where the user needs it
- Convenient way to classify luminaires is by the *direction* of light emitted from the luminaire
- Commission Internationale de l'Eclairage (CIE) sets up these classifications

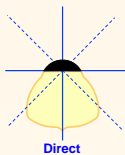


Distribution Types



Distribution: Direct

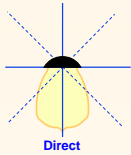
100% of the light directed down




Directional Effects and Strategies

Distribution: Direct

100% of the light directed down

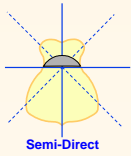


Direct




Distribution: Semi-Direct

Smaller portion direct up
-
Most of the light directed down

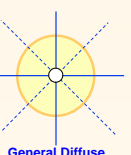


Semi-Direct




Distribution: General Diffuse

Light directed evenly around



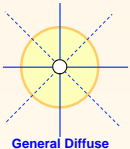
General Diffuse




Directional Effects and Strategies

Distribution: General Diffuse

Light directed evenly around

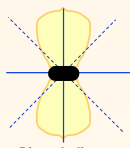


General Diffuse




Distribution: Direct - Indirect

50% of the light directed up
-
50% of the light directed down

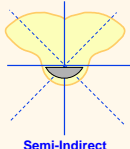


Direct-Indirect




Distribution: Semi-Indirect

Most of the light direct up
-
Small portion of the light directed down



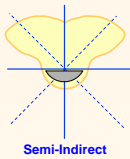
Semi-Indirect




Directional Effects and Strategies

Distribution: Semi-Indirect

Most of the light direct up
-
Small portion of the light directed down

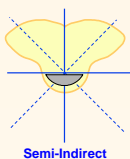


Semi-Indirect




Distribution: Semi-Indirect

Most of the light direct up
-
Small portion of the light directed down

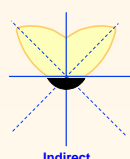


Semi-Indirect




Distribution: Indirect

100% of the light directed up




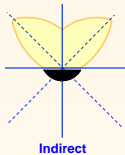
Indirect



Directional Effects and Strategies

Distribution: Indirect

100% of the light directed up



Indirect

General or Ambient: Standard Lighting


What's wrong with this picture?

- Specular surfaces
- Glare effect
- Dark colored finishes
- No light on ceiling
- Straggles



Avoid staggered layouts and locating fixtures too close to walk.

Better



better yet


Directional Effects and Strategies

Better



better yet


General or Ambient: Direct versus Indirect



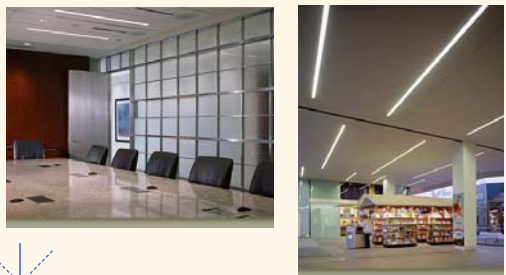
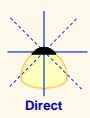
In the last decade, during which personal computers have proliferated in the office, researchers have paid increased attention to lighting. Several studies have investigated the relationship of modern office lighting to the visual health, satisfaction and productivity of office workers.

- The American Society of Interior Designers found that 68% of employees complain about the light in their offices.
- A Silicon Valley study pointed out that 79% of VDT users want better lighting.
- A 1989 Louis Harris survey, the Steelcase Office Environment index, revealed that workers think of eyestrain as the number one health hazard in the office—ahead of radiation, asbestos

This degree of dissatisfaction is difficult to ignore. It confirms the need to identify the best methods of lighting the computerized office.

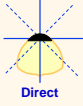
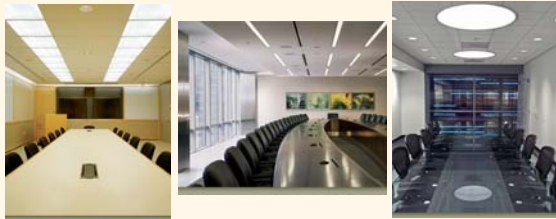


General or Ambient: Recessed

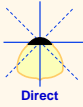
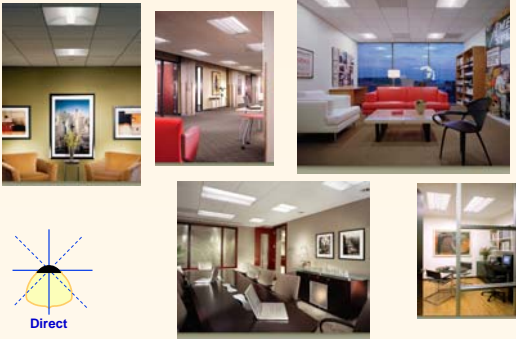



Directional Effects and Strategies

General or Ambient: Recessed



General or Ambient: Recessed

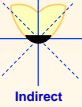


General or Ambient: Recessed




Directional Effects and Strategies




General or Ambient: Pendant





Indirect




Direct



General or Ambient: Pendant

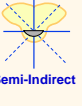


Semi-Indirect



Semi-Direct

General or Ambient: Pendant



Semi-Indirect

Directional Effects and Strategies

Accent: Asymmetrical Distribution

Asymmetrical Direct Asymmetrical Indirect

Accent: Asymmetrical Distribution at Wall

Asymmetrical Direct

Accent: Asymmetrical Distribution at Wall

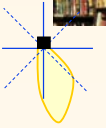

Pendant

Asymmetrical Direct

Directional Effects and Strategies

Accent: Asymmetrical Distribution at Wall

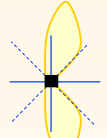

Recessed



Asymmetrical Direct

Accent: Asymmetrical Distribution at Wall

Surface



Asymmetrical Indirect / Direct

Highlight or Accent:



Directional Effects and Strategies

Highlight or Accent



Combinations



Combinations



Directional Effects and Strategies

Combinations



Combinations



Problems with combinations