

# **Light in Design – An Application Guide**

**IES CP-2-10**



## **LIGHT IN DESIGN**

This publication is based on the book "Light in Design," authored by William F. (Bill) Blitzer, a talented lighting designer and former President of Lightolier, a major US lighting company founded by his grandfather in 1904. After a lifetime of leadership in lighting Bill founded Lightshop Asia-Pacific in 2003, which sponsored and supported the development of "Light in Design." IES appreciates the generous donation from Bill and Lightshop of the use of the material in this consumer publication.

# Light as a Creative Medium

Light is a creative medium...the most powerful of all. Most of what we know of our world comes to us through our eyes, and we have learned that the way we see things depends on how they are lighted.

## Light in Design-Bringing the Vision to Life

This application guide shows how lighting makes a difference- a practical and creative guide to the process of designing with light. It concentrates on three essential choices:

1. What to light
2. How to light it
3. What to light it with

We will look at each of these three decisions and the factors affecting them.

- “what to light” and “how to light it” choices for typical lighting situations such as dining, bedroom, and living areas.
- “what to light it with” choice, offering considerations for appropriate light sources, light fixtures and control options designed to meet the criteria set by your “what to light” and “how to light it” decisions.

## What to Light

Deciding what to light can often best be approached as a “layered composition” in which the nature of objects and surfaces being lighted play an important role.

These layers are:

- Task lighting
- Accent lighting
- Ambient or “space” lighting

What we actually see is almost always the reflection of light from a surface, not light itself. Hence we must consider the surface characteristics:

- *Is it light or dark?* Dark objects absorb more light, reflect less;
- *Is it polished or mirror-like?* Polished surfaces will reflect images;
- *Is it finely or coarsely textured?* Textured surfaces will diffuse the light striking them;
- *Is the color one we would like to enhance or one we would prefer to subdue?* The color of the object is determined by the color qualities of the source.



As a first step in planning your lighting, analyze each space in terms of:

- *Function*: What activities will occur in the space?
- *Tasks*: What seeing tasks are to be done in the space?
- *Objects*: Which ones do you most want people to see?
- *Architectural features*: Which ones are to be emphasized?
- *Location of furniture*: Where will people sit?
- *Mood*: What atmosphere is desired? Should it be variable?
- *Style*: What must the lighting “go with”?

Next, try to set priorities.

What is most important? Try to give the room a point of focus, something that will draw the eye. In the dining room or living room this might be a table setting, a painting, a flower arrangement, a fireplace wall.

There may be more than one priority, of course—for example “task” areas like a sideboard, a table or desk or kitchen counter.

These priority objects and areas will deserve accent lighting or task lighting, as described later.

Then try to consider the space as a whole:

- Lighting the walls can make the room seem more spacious.
- Local pools of soft-edge light around furniture can create a mood of intimacy.
- Glitter and a sparkle from cut crystal or polished metal convey an air of festivity.
- Highlighting the ceiling with indirect lighting will make the room seem a bit more formal, as well as more spacious.
- Highlighting a rug on the floor with downlighting is likely to make it cozier; but downlighting directed onto a glossy surface such as a glass top table or marble floor is likely to cause disturbing reflections.

We will say more about these aspects of designing with light later.

## How to light it

Once you have analyzed the space and decided what to light, you can decide how to best light it, using three basic lighting techniques

*Ambient lighting*—general, overall illumination that:

- Enables one to move about easily and safely
- Defines the space

- Makes the room seem larger
- Makes the space more comfortable by balancing the brightness of surfaces and objects in the field of view.

General lighting that brightens objects and surfaces in the lower part of the room creates a feeling of warmth and intimacy, whereas indirect lighting, directed to the upper walls and ceiling, gives the space a cooler, quieter, more spacious look.

#### *Accent lighting—light to view what's special*

Accent lighting directs extra light and thus extra attention to selected objects and surfaces. Accent lighting draws the eye, provides dramatic interest, and adds excitement. It says, "Look here!"

#### *Task Lighting—light to work by*

Task lighting illuminates areas where work is performed: reading, paper work, food preparation, laundry, games and hobbies. Paper work and reading generally require plentiful, well-diffused light coming from over the shoulder or from the side. For kitchen and hobby tasks, a concentrated light from above usually works best.

#### **Where to place the lighting**

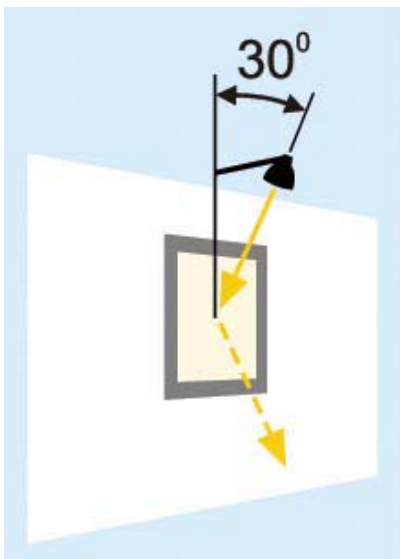
A key element in how to light is where to place the lighting. This is especially important in avoiding glare and veiling reflections. It is also a determining factor in whether a surface texture is to be emphasized or minimized.



Yes



No

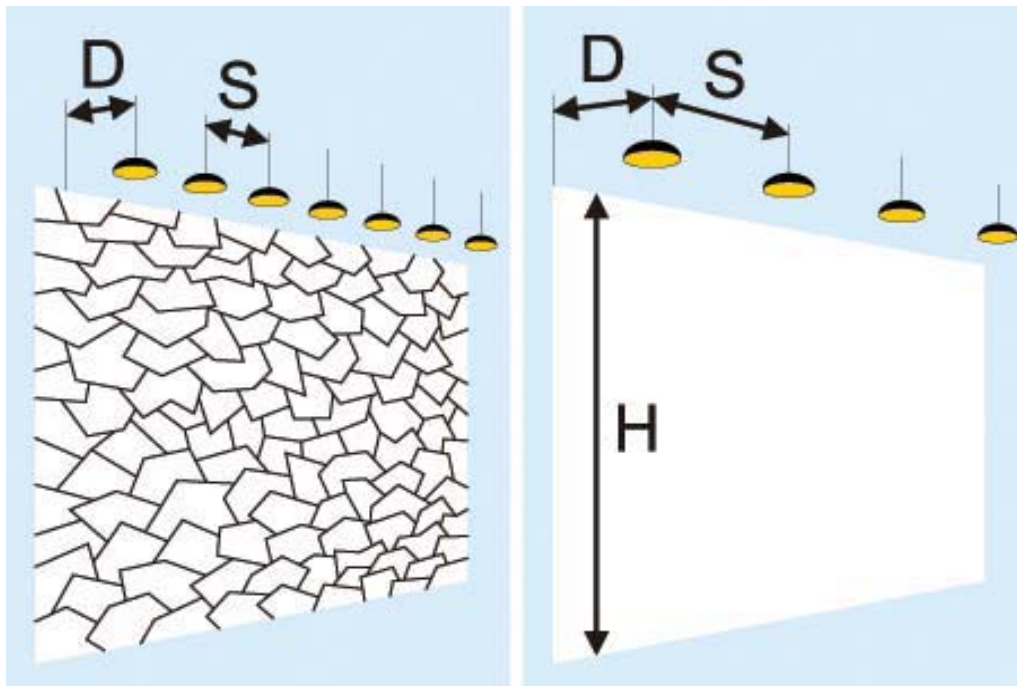


Yes



No

It can, in the case of lighting close to the wall (“grazing” rather than “washing”—see diagram below) reveal defects in the workmanship.



Grazing

Wall Washing

## What to light it with

Having decided what to light and how to light it, you’re ready to decide what to light it with. The selection of light sources, lighting fixtures, and controls for each aspect of the project is best done in that order.

### Choose the light source

To make a decision consider:

- The light distribution desired
- The color rendering
- The color appearance
- Maintenance costs

Obtaining the desired light distribution depends on the choice of both the light source and the lighting fixture, because the lighting fixture should not only support the source, but redirect its output into the desired zones and shield it so that it does not become a source of glare.

Depending on whether the purpose is ambient, accent or task lighting, the required light distribution may range from broad and widely diffused to narrow and focused. As a general rule, fluorescent light sources are the most suitable for broad distributions; low voltage incandescent and LEDs are the most suitable for narrow distribution.

### How much light is required?

The amount of light required for good vision depends on:

- The age of the people using the lighting
- The reflectance of the task

Older people require more light, (at age 65 we need twice as much light to see as well as we did at age 20) and are much more sensitive to glare, so lighting must not only be plentiful, but well shielded.

The table below shows recommended levels of illumination. In each case a range is indicated—the low value being for young people under 25, the middle value for 25-65 year olds, and the high value being for older persons over 65.

#### Recommended illuminance targets in footcandles

Area or activity	Under 25	25-65	Over 65
Passageways	2	4	8
Conversation	2.5	5	10
Grooming	15	30	60
Reading/Study	25	50	100
Kitchen Counter	37.5	75	150
Hobbies	50	100	200

### Choose the Fixtures

#### *How much energy is consumed?*

In today's world, with increased concern about energy consumption, some choices may be limited by codes and standards about the wattage that can be applied in particular lighting applications. We need to consider

- The efficiency of the fixture
- The effectiveness of the fixture
- The distance between the fixture and the task
- The use of occupancy-sensing, dimming or multi-level controls

### Choose the Controls

Wall switches, dimmers and programmable systems can:

- Change the lighting scene to suit the activity ("Programmable")
- Change the lighting level automatically according to the time of day (Photocell)
- Change the lighting scene at your will to set a mood or create an atmosphere ("Manual")
- Turn off the lights automatically when no one is present, to save energy ("Occupancy-Sensing")

# APPLICATION IDEAS

## Dining Area

### What to light & how to light it



Photo Dining Room (Ron Tan Pic)

The lighting must enable the dining area to be beautiful and functional for a variety of uses. It should make people, the table setting, food and prized possessions look their best, as well as providing for other activities at the table or around the room.

#### Focal Point

The dining table lighting should enhance the color and texture of the food and the complexions and apparel of the diners. It should create a festive mood by highlighting the table setting. Suggested lighting level: 10-20-40 footcandles.



Yes

No



Recessed lighting over the table, if used, should be positioned within the perimeter of the table. Downlights should not be placed over the chairs as the beams from above will cast unpleasant shadows on people's faces and the heat can be uncomfortable.

### General Lighting

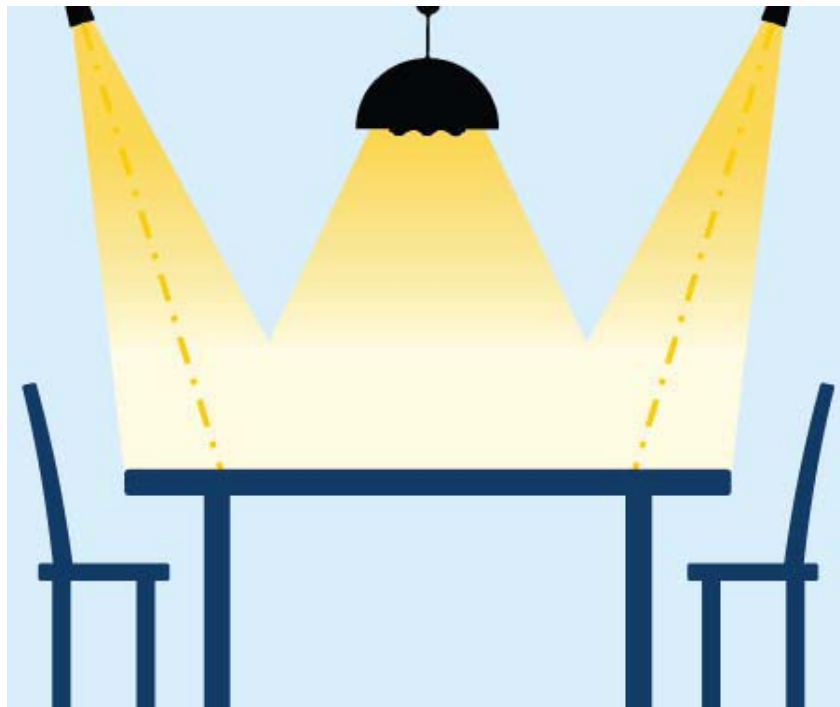
Should serve the need for flexible use of the space: buffet-dinner, cocktail party, clean-up, reading the newspaper. Suggested lighting level: 5-10-20 footcandles.



Whatever the style of lighting, it should be proportioned to both the table and the room. The diameter or width should not be greater than the width of the table, less 12 inches, or people may hit it when rising from the table.

### Accent Task Lighting

Should bring featured objects or special areas (tasks) to light: a painting, flowers, the sideboard.  
Suggested lighting level: 5-10-20 footcandles.



If the over-the-table fixture has no central downlight, the table setting can be enhanced by accent lighting using recessed adjustable fixtures, spaced to avoid casting shadows. Reflections from glass-top tables, however, must be avoided.

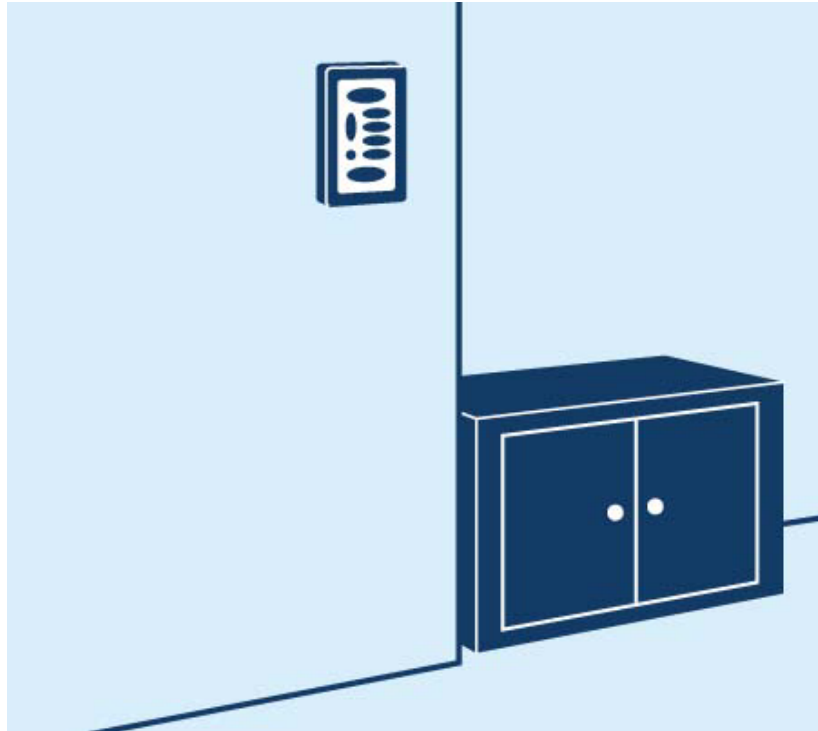


At the sideboard, carving and serving tasks should be provided with plentiful shadow-free lighting, from fixtures located on the underside of a wall-mounted cabinet or shelf.

## Controls

Lighting controls should be used to match the lighting to the activity: for instance, a dinner party, clean-up, reading the paper at breakfast.

Lighting controls are also necessary to save energy: for example, to turn the lights off when nobody is in the space.



A multi-scene control is particularly useful.

## Living Area

### What to light & how to light it



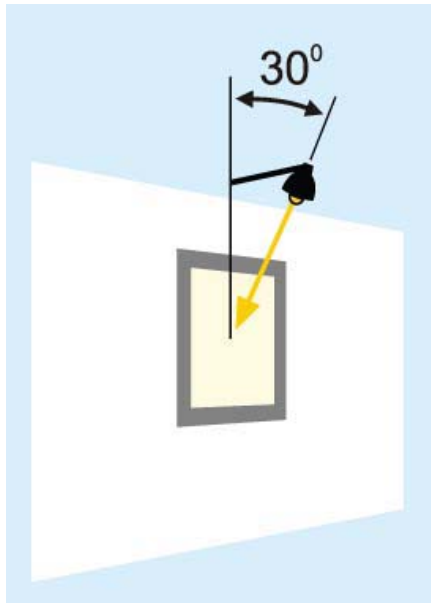
Most living areas today serve many different functions. Whatever the activity, the room should be comfortable and beautiful, and the lighting should be flexible enough to provide for a range of tasks, situations and desired aesthetic effects. Many people prefer to view paintings and other art objects without being distracted by the lighting equipment that illuminates them.

#### Focal Point

Create interest by highlighting one or two items or areas of interest—a painting, a textured wall, art objects or a prized piece of furniture. Suggested lighting level: 5-10-20 footcandles.

#### General Lighting

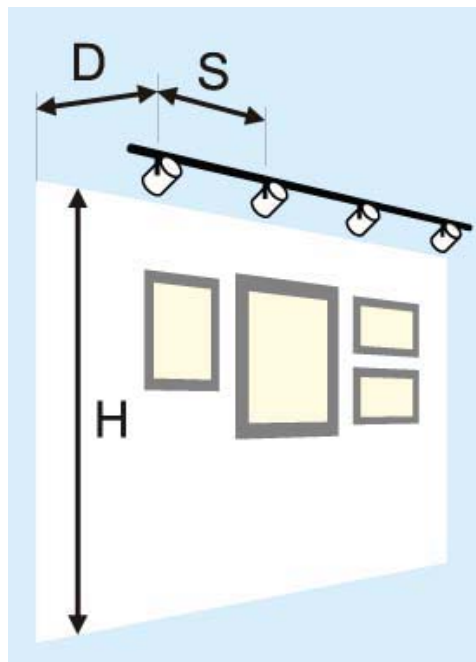
Provides for ease of moving about in the room and to bring the various sections of the room together. It is often supplied by reflections of light directed to the walls and furnishings. Suggested lighting level: 4-8-16 footcandles..



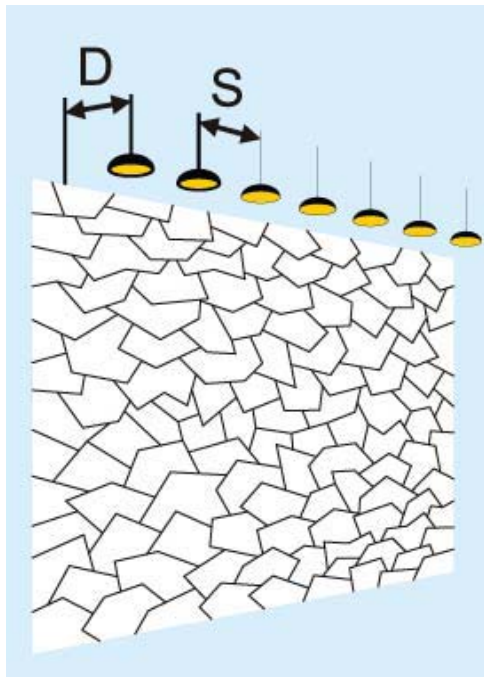
When lighting a small to medium size picture, have the lighting reach the picture at an angle of about 30° from the vertical.

See the table below for suggested spacing from the wall. Lighting placed much closer may cause unwanted shadows cast by the frame.

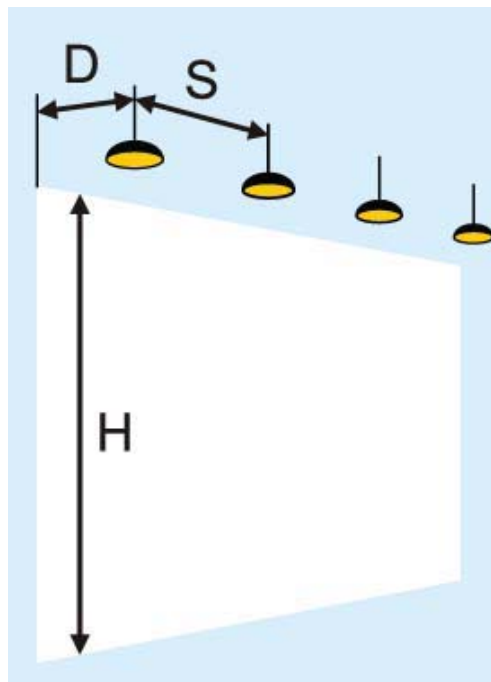
Ceiling Height (H)	Distance from Wall (D)
8 Feet	24 inches
10 Feet	36 inches
12 Feet	48 inches



A group of pictures is best lit by illuminating the surface as a whole rather than by lighting the pictures individually. Use the same spacing from the wall as for as single picture and, for even illumination, make the space between units not more than twice that from the wall.



The texture of a wall can be “raised” by placing the fixtures close to the surface, so that the lighting strikes it at a “grazing” angle. If there are unwanted irregularities in the wall surface these may be “hidden” or overcome by placing the lighting fixtures well away from the wall.



On the other hand, textures can be “flattened” and the wall surface made to appear smoothly and evenly illuminated by “washing” it with light from fixtures at greater distance from the wall. Wall washing makes spaces seem larger and is useful for achieving a comfortable level of balanced brightness.

#### Accent Task Lighting

Higher levels of illumination are needed for seeing small detail, e.g., sheet music, board games, the titles of books and recordings.

### Controls

Controls permit the lighting to be varied according to the occasion: quiet conversation, viewing television, a game of cards. A wall mounted multi-scene control can be programmed to produce the optimum lighting for each of these occasions. Controls should be provided to turn the lights off when nobody is present.

## Kitchen

### What to light & how to light it

Photo Lytetrin



The kitchen is fundamentally a work area for food preparation and clean-up, but it is often used for other activities: dining, homework, games, entertaining. It should be functional, comfortable and beautiful; therefore the lighting scheme should provide a combination of general, task, and accent lighting, controlled to suit the activity.

### Focal point

While the kitchen is fundamentally a work area for food preparation and cleanup, it should also be comfortable and beautiful, a point of pride for the owner.

The focal point is, most often, the cabinetry, and surrounding surfaces. The woods, tiles and metals of which these are made should be well lighted, enhancing their appearance and their functionality.

### General Lighting

Over-all lighting is needed to see into cabinets and drawers and for ease on moving about. It is best provided by fluorescent, which is the most efficient, producing the most light of good quality at the lowest cost.

Moreover, fluorescent fixtures simplify maintenance and can be readily integrated into the interior design. Their simple geometric shapes permits use in surface mounted installations, on ceilings, on the tops and bottoms of cabinets, on walls or recessed.



Indirect lighting from, fluorescent fixtures, mounted on top of cabinets, is widespread and comfortable.

Recessed downlighting, though not as efficient as fluorescent, has advantages in its flexibility, as the units can be arranged to provide illumination throughout the kitchen, even if the room has an irregular shape.

### Task Lighting

High levels of lighting should be provided at the counter, the sink and the stove. Attempting to provide this from a center-ceiling fixture will result in poor task visibility due to shadows caused by the person working, or the cabinets above.





At the sink, use a downlight with a concentrated beam from directly above.



Mounting the lighting fixtures on the underside of the cabinets, will produce optimum results, but the shielding should be provided by the fixtures for the comfort of persons seated nearby.

Task lighting is also usually required for reading at the kitchen table or dining counter. This can best be provided by a pendant fixture which can have the benefit of adding visual appeal.

Lighting controls allow one to set the lighting for the activity: food preparation, a late night snack, or breakfast. Suggested lighting level: 15-30-60 footcandles.



A key consideration shielding is that the lamp should not be visible in the seated position, meaning, as a rule, a shielding angle of 15° minimum.

#### Accent Lighting

Accent lighting of special objects such as cookware, a notice-board or a painting, contributes to making the kitchen the feature place it has become in many homes. Suggested lighting level: 5-10-20 footcandles.

## Bathroom

### What to light & how to light it



Today, most homes contain two or more bathrooms: the master bath, children's bath and the guest bath or powder room. While the master bath may be larger and even include space for exercise, the children's bath is simpler and more functional, and the guest bath something of a decorative statement, the lighting priority in each should be given to grooming at the mirror.

#### Focal Point

Lighting at the mirror serves for cleaning, make-up, shaving and dressing. It should be plentiful, evenly distributed over the face, hair and neck, and free of shadows.

Lighting from a fixture in the centre of the ceiling puts the face in shadow and, while useful for general lighting, cannot serve well for grooming.

Likewise, light from a small recessed downlight over the mirror, a "minimalist" solution, is usually unsatisfactory because of the strong shadows it produces under the eyebrows and chin.

An optimum solution is a pair of long, slim lighting fixtures, 24–36 inches in length, at the sides of the mirror, (24 inches) apart. Suggested lighting level: 15-30-60 footcandles.

#### Lighting for Other Activities

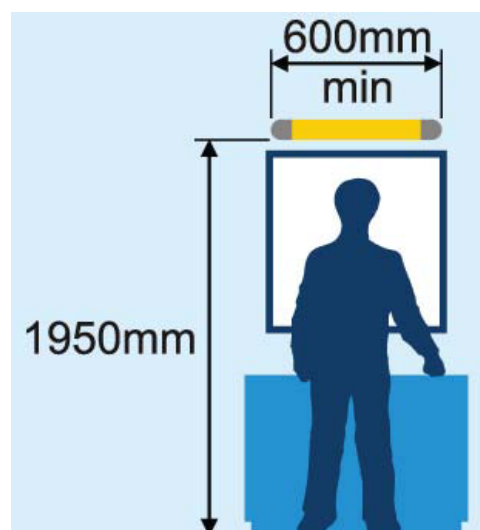
Other lighting needs in the bathroom that should be considered are the tub, where some people like to read; an enclosed toilet; the exercise area where general lighting from recessed or surface mounted fluorescent will serve to illuminate the space and closets.

#### Lighting for Use at Night

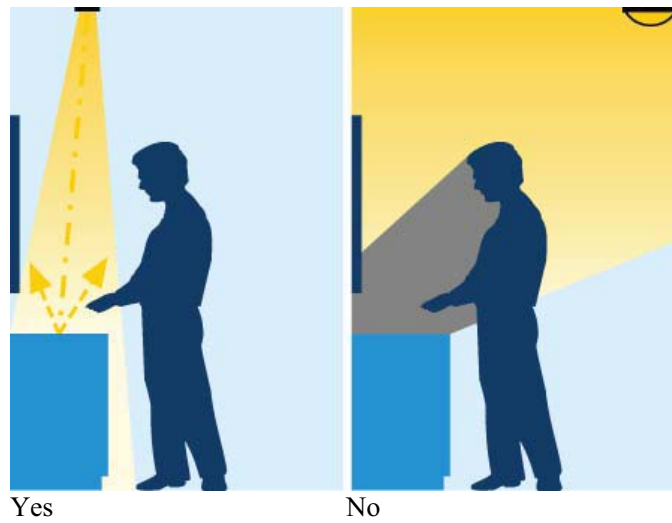
Some people need to use the bathroom at night, and for reasons of safety and comfort, low-level "night lighting" should be provided as an option, separately switched and dimmer controlled.

#### Controls

Lighting controls of two basic types should be considered: 1) An occupancy sensor to turn the lights off, when no one is there; 2) dimming, to permit people to adapt the lighting to their individual needs.



Elongated lighting at the side of the mirror works best. It should be at least 24 inches long. Lighting above the mirror should be at least 24 inches long to light both sides of the face and avoid shadows under the chin.



Recessed downlights have the benefit of being unobtrusive, but will produce shadows under the eyebrows, nose and chin unless placed close to the mirror, spaced well apart and above a light colored counter top which can reflect the downlight upwards to erase shadows.

## Home Office

### What to light & how to light it



Photo Track Bonser study

Working in an office usually involves two kinds of tasks that pose different lighting problems: computer tasks and paper tasks. The lighting of the wall surfaces in offices is of major importance because it gives greater visual comfort, makes space seem larger, compared to lighting that is located in the centre of the room which directs most of its light downwards.

### Focal Point

In a home office, the focal point can be photographs, diplomas, awards and other items of special interest expressing their nature and achievements of the user. These should be high-lighted by recessed or surface mounted lighting fixtures directing their light to the wall.

### General Lighting

Balanced lighting effects in the field of view will provide greater visual comfort and make the space seem larger. This can best be achieved by directing light to the walls, using, surface mounted recessed fluorescent lighting fixtures, mounted near the walls.



Attempting to provide this quality of illumination from a central point, on the ceiling, (because, very often that is where the electrical outlet has been placed) will likely result in a less comfortable working environment and the feeling that the lighting is inadequate.

### Task lighting

Work in a home office is likely to be of two kinds; paper task and computer tasks. For both kinds, the location of the light source relative to the worker and surface of the task is crucial for maximum visibility and productivity.

Since some paper tasks and most computer screens will reflect images of a light source placed in the “wrong” position, such “veiling reflections” should be avoided by a careful consideration of relative positions of the worker’s eyes, the task surface and the light source.



A combination of lighting fixtures, mounted in a fixed position, and portable lamps, readily moved, is usually the optimum solution. Suggested illuminance: on the task, 25-50 footcandles, and in the case of older eyes working with small detail, 100 footcandles.

### Controls

Lighting controls of two basic types are important: 1) Dimming Controls, which allow adjustment of the level of lighting to that required for a particular task; 2) Occupancy Sensing controls, which turn the lights off when no one is in the space.

## Entrance Areas

### What to light & how to light it



Photo ocular light lobby



The entrance foyer or lobby in apartment buildings are places where first impressions are gained and where important transitions take place, between public and private space, and between outdoor and indoor lighting levels, whether by day or night. The lighting of these areas is important not only because it gives a clue to the character of the interiors and of the inhabitants, but because it can assist in the comfortable adaptation from one level of lighting to very different one.

### Focal point

Artwork, furniture or other featured items which express the character and interests of the occupants should be high-lighted and be the brightest in the field of view.

### General Lighting

The style of lighting installation in the entry is a visual indication to those entering of the quality and image of the building—a clue to the style and ambience of the interior.

“Style” in this connection is, to varying degrees, a matter of fashion, a matter of cost, and of codes, such as the fire safety and the lighting load limits.

### Accent lighting

Key features such as furniture groupings, artwork, and elevator location should be emphasized.

### Controls

As most entry areas will be used for long hours, in both day time and night time, lighting controls are necessary for visual comfort, and for saving energy and lowering operating costs.

## Light Sources, Fixtures, and Controls

The following information indicates the many “What to light it with” options available to you. Here is a useful, practical guide to help you with your selection of light sources, fixtures and controls.

### Selecting the Right Light Source (Lamp)

#### What to light it with

With so many sources from which to choose, it is important to select the best ones for the application. The following criteria are offered to help with the choice.

#### Efficacy

Efficacy is a measure of efficiency, expressed in lumens per watt. This is most important for energy conservation. Review the information on light source packages and choose the source with the highest lumens for that particular wattage and type.

#### Lamp life

Lamp life is measured in hours determined by the manufacturer based on testing to the point when half of the lamps in a test batch fail. Rated lamp life may range from 1000 hours for general lighting incandescent sources to 10,000–24,000 hours for fluorescent sources.

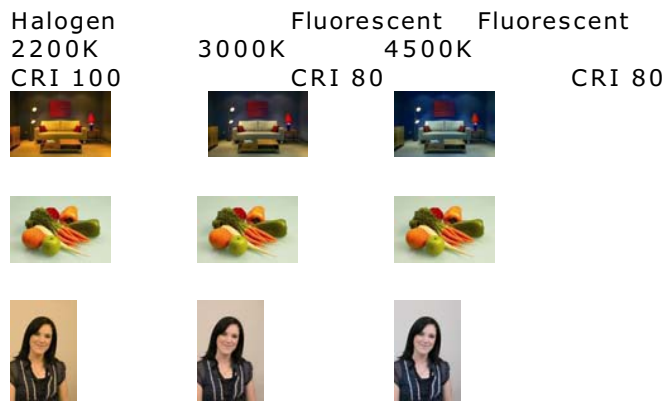
#### Color Temperature

Color temperature is a measure of the apparent color of the light source (color appearance). It is expressed in Kelvin; the lower the color temperature, the warmer the apparent color, and the higher the color temperature, the cooler the apparent color. For example, a 2800K source will be warmer than a 6000K source.

## Color Rendering

Color rendering indicates the degree to which a light source shows the “true” colors of the objects it illuminates. It is expressed in terms of a color-rendering index (CRI) on a scale of 0–100. The higher the CRI the “truer” people and objects look. On this scale, incandescent sources rate 100; fluorescent sources from the 70s to the 90s.

## Color rendering effects



Photos of color differences  
ECOV 2 198 3 shots (girl)  
ECOV0318-3-e 3 shots (couch)  
ECOV0357 3 shots (vegs)

## Incandescent

Incandescent lamps are the most familiar light source. They owe their popularity to their low cost, good color rendering, compact size, wide range of shapes and wattages and the fact that they are easily dimmed. Dimming causes incandescent lamps to run at lower temperatures, which results in longer lamp life, but also in a warmer color. Many of these source types, however, are being phased out because of energy conservation.

## Halogen

Halogen lamps are a type of incandescent lamp that is filled with a halogen gas, allowing the lamp to burn more intensely, with a whiter light, and a slightly higher efficacy than ordinary incandescent. Moreover, the “halogen cycle” re-deposits the evaporated tungsten filament, so that blackening is avoided and output is maintained throughout the life of the lamp.

## Low Voltage Halogen

Incandescent lamps designed to run at 12 volts are increasingly common. Low voltage halogen lamps have a smaller filament, permitting more precise beam control, smaller bulb size, smaller fixture size and whiter light.

Low voltage lamps require a transformer; this is normally part of the fixture, but sometimes it is remote, and because the life of low voltage lamps is dependant on the voltage with which they are operated, the transformer rating and the lamp wattage should be closely matched.

## Fluorescent Lamps

Today there is an increased interest in a “sustainable world” and the related issues of conservation of resources, efficient production and effective use of electricity, as well as the design and construction of green buildings.



In fluorescent lamps light is produced by means of an electrical discharge through a gas, contained in a “bulb” or “tube”, the inside of which is covered with a phosphor.

Fluorescent lamps are more efficient than incandescent sources, and use much less energy for the same light output: as much as 80% less. They also last 10–20 times as long as incandescent lamps.

Better color-rendering and new-electronic technology makes fluorescent a suitable source for applications in the home, and other “people-oriented” spaces.

Fluorescent lamps are essentially linear, and the light they produce is less readily controlled and is generally dispensed more evenly, resulting in more uniform illumination with fewer shadows.

#### Compact fluorescent

Compact fluorescent lamps can be more precisely controlled. They fit into smaller round and square fixtures, ceiling, wall and recessed types. These innovative products with integral electronic ballasts can replace screw base incandescent sources to achieve a savings of up to 80% in energy costs, 10 times the lamp life, and a choice of color appearance with excellent color rendition.

#### High Intensity Discharge Lamps (HID)

High Intensity discharge (HID) sources include metal halide and high pressure sodium. Their application in residences is confined primarily to outdoor applications. Ceramic Metal halide lamps produce a crisp white light with excellent stability and long life. The source can be small allowing the light to be controlled precisely. Therefore the use of Ceramic Metal Halide lamps is increasing rapidly in architecture applications such as a retail stores, and high ceiling spaces, where it is replacing incandescent.

#### Light Emitting Diodes (LEDs)

Light Emitting Diodes (LEDs), also known as solid-state lighting, constitute the most rapidly developing form of lighting.

Solid-state lighting represents the future of lighting. It offers the benefits of energy efficiency, long life, robustness, small size, color variability and directional distribution.

Solid-state lighting is now being used in many forms of lighting, interior and exterior, in combination with other elements in lighting “fixtures”, or lighting “systems”, or as “stand-alone units”.

Typical applications include:

- decorative lighting
- architectural detail lighting
- entertainment lighting
- outdoor lighting

#### Daylighting

Daylighting is distinguished as a light source by its unique, continuously varying color and distribution during the course of the day. Daylighting can contribute greatly to human satisfaction. It provides comfort, a distinctive ambience and a means of defining architectural spaces.

- Daylight is stimulating because of its variability due to time of day, season and weather.
- It can provide an outlook, a view through windows.
- It can provide an ambience, due to its color-rendering effects on interior surfaces.
- It can provide energy savings, supplementing interior levels of electric lighting.

Vertical shielding with curtains, blinds and exterior shading devices such as overhangs and plantings help to minimize glare and provide visual comfort.

When arranging furniture with respect to windows, it is important to consider the visual comfort of the occupants, e.g., the most comfortable position at a desk is with the window at the occupant’s side; and in

living rooms the seating must avoid placing occupants where they can only be seen in silhouette, against the brightness of a window.

Skylights provide general room illumination from the ceiling plane.

## Luminaires (Fixtures)

Obtaining the desired light distribution depends on the choice of both the lamp (light source) and the luminaire (lighting fixture).

The luminaire should not only support the lamp, but redirect its output into the desired areas and shield it so that it does not become a source of glare.

The criteria to be considered are:

- Architecturally integrated
- Mounting – recessed, surface mounted, concealed/furniture mounted
- Style
- Energy consumption

### Architecturally integrated

Lighting that is integrated with the architecture can provide a variety of functions – accent, task, or ambient – and because it is visually unobtrusive it can be incorporated into almost any interior style. It can be integrated in various ways; by recessing into the ceiling, the walls or floor, or placed under cabinets or shelves, on top of cabinets or in coves.

### Decorative lighting

Decorative lighting should complement the interior design with elements of visual interest. When used repetitively it can provide a rhythm of light points that serve to define the space. Pendant luminaires that direct light both upwards and downwards are suited to large spaces with higher ceilings. Those that direct light downwards are most often used over tables and counters to focus attention and suggest intimacy. Chandeliers and other decorative pendants complement interior style.

Wall-mounted luminaires are often used in circulation areas such as hallways. They are also suitable for installation at a mirror where mounting on either side provides optimum lighting of the face.

Surface-mounted lighting on the ceiling is often used for broad light distribution in bathrooms and bedrooms.

Track lighting systems provide flexible and versatile solutions allowing the placement of light where it is needed for accent, task, or general lighting. Track can be mounted on the ceiling, near a wall or suspended on stems. Individual track fixtures are available as spots, floods, and wall washers for line or low voltage applications. Each unit can easily be added or removed as lighting needs change.

## Lighting Controls

Lighting controls are of two basic types: dimmers and switches.

### Dimmers

Dimmers, used individually or in combination, change the lighting to suit an activity, set a mood or create an atmosphere. They are sometimes referred to as aesthetic lighting controls.

Choose the dimmer:

- Use individual dimmers to dim one light or a group of lights together, as in a hallway.
- Use multi-scene dimmers to control all the lights in a room, creating different lighting compositions or “scenes” to suit various activities and moods.

### Switches

Switches turn the lights on and off and when combined with the motion detectors or occupancy sensors are often termed energy saving lighting controls.

Choose the switches:

- Use occupancy sensing controls to save energy by turning of the lights automatically when no one is present.
- Use whole-house systems to control all the lights in a group of rooms, from one or more locations, for reasons of convenience and safety, as in a home or office.

## Planning a multi-Scene Installation

### An example: Dining Area

Create one channel for each basic lighting effect: ambient, task, perimeter, accent, decorative. In addition, each visible light source should have its own channel, so you can separately balance the intensity of those sources which are brightest to the eye. Each channel takes a single dimmer, sized to the load.

Next, for each channel identify the lamp, ballast and /or transformers and total wattages. This will govern the type and size of each dimmer. Match each dimmer to the load being controlled, and size it according to the magnitude of the load.

Determine where you want the master control points for scene selection. These are the most important control points, more important than the individual dimmers.

Some small rooms need only one point; most spaces should have at least two for the convenience it adds; the masters are inexpensive, so this added convenience is not extravagant. A room with several entrances should have a master at each and a room with several sub-spaces should have a master at each.

From the master control points select one to be the primary location for the master and dimmers. The master and dimmers should be mounted near each other so that it is easy to compose the scenes. If you have more than one master location, it is best to put the master and dimmer in the least conspicuous one, using just the master for those locations that are in the main field of view.

When the lighting fixtures and lighting controls are in place, you are ready to create the lighting scenes by establishing for each scene (activity, mood or atmosphere) the pre-set level for each channel.

**Here is how one might establish the channel pre-sets:**

<b>Scene</b>	<b>Channel 1 General</b>	<b>Channel 2 Table</b>	<b>Channel 3 Sideboard</b>	<b>Channel 4 China Cabinet</b>	<b>Channel 5 Draperies</b>
Family Dinner	Med	Med	Low	Low	Low
Dinner Party	Low	High	Med	Med	Low
Cocktails	High	High	High	Med	High
Breakfast	High	Off	Med	Off	Off
Clean-up	High	Off	High	Med	Med

# Glossary

## Accent lighting

Directional lighting to emphasis a particular object or draw attention to a part of the field of view. (See directional lighting.)

## Adaptation

The process by which the retina of the eye becomes accustomed to more or less light than it was exposed to during an immediately preceding period. It results in a change in the sensitivity of the eye to light.

## Ambient light

General or base illumination within a space such as the general lighting within a retail area.

## Average rated life

An average rating in lamp operating hours when 50 per cent of the lamps initially installed in a lighting system have reached the end of life. At this juncture, typically, the remaining 50 per cent of the lamps will burn out at a progressively increasing frequency.

## Baffle

A single opaque or translucent element to shield a source from direct view at certain angles, or to absorb unwanted light.

## Ballast

An auxiliary device used with all discharge lamps (including fluorescent and HID) to obtain the necessary circuit conditions (voltage, current, and waveform) for starting and operating. Dimming ballasts are special ballasts which, when used together with a dimmer control, will vary the light output of a lamp. (See electronic ballast.)

## Color rendering

The effect of a light source on the color appearance of objects in comparison with their appearance under a reference light source.

## Color rendering index (CRI)

A numerical index assigned to a lamp source (lamp) which indicates its relative color rendering accuracy as compared to a reference light source. The CRI is only valid when comparing light source with like chromaticities.

## Color temperature

The absolute temperature at which a blackbody radiator must be operated to have a chromaticity equal to that of the light source.

## Diffuse lighting

Light that is not predominately incident from any particular direction.

## Diffuse source

A glowing broad surface light source, such as a fluorescent lamp, which provides soft wide multidirectional illuminations, but which is usually difficult to focus or pinpoint.

## Direct glare

Glare resulting from high luminance or insufficiently shielded light sources in the filed of view, or from reflecting area of high luminance. It is usually associated with bright areas such as luminaires, ceilings, and windows that are outside the visual task or region being viewed.

## Direct lighting

Lighting by luminaires distributing 90 to 100 percent of the emitted light in the general direction of the surface to be illuminated. Also includes reflector lamps that may be used without luminaires. The term usually refers to light emitted in a downward direction. (See accent lighting.)

#### Directional lighting

Illumination on the workplane or on an object predominantly from a single direction.

#### Disability glare

Glare resulting in reduced visual performance and visibility. It is often accompanied by discomfort.

#### Downlight

Luminaire with a lumen distribution directed downward onto a horizontal plane. Downlights usually incorporate a tight optical cut-off of 45 to 50 degrees.

#### Efficiency

See luminaire efficiency and luminous efficacy of a source of light.

#### Enhancing reflections

Reflections which enhance appearance described in terms of such as sparkling and glittering.

#### Feature lighting

Lighting that emphasizes or draws attention to an object that is higher (by ratios of 2:1 to 3:1) than general or base lighting. Feature lighting above a 3:1 ratio is usually considered accent lighting.

#### Fixture

(See luminaire)

#### Fluorescent lamp

A low pressure mercury electric discharge lamp, generally tubular in shape, in which a fluorescing coating (phosphor) transforms ultraviolet energy into visible light.

#### Focus

Directing or aiming light to a specific area or item within a space. Also, the act of physically directing or aiming an adjustable luminaire and/or the lamp within an adjustable luminaire.

#### Footcandle (fc)

A unit of illuminance: the illumination on the surface one foot square on which there is a uniformly distributed flux of one lumen ( $1 \text{ lm/ft}^2$  or 10.76 lux)

(See illuminance)

#### Flood

Lamp or luminaire with a focused optical system producing a controlled wide beam of light typically between 30 and 40 degrees.

#### General lighting

Lighting designed to provide a substantially uniform illuminance throughout an area, exclusive of any provision for special local requirements.

#### Glare

Any brightness or brightness relationship that annoys, distracts, or reduces visibility. See also direct glare, disability glare and reflected glare.

#### Halogen

A type of gas that, when used in the filament capsule of an incandescent lamp, permits the filament to burn "hotter". This results in improved lamp efficiency and performance. Incandescent lamps employing this technology are called halogen lamps.

#### High intensity discharge (HID) lamps

A general group of lamps consisting of mercury, metal halide, and high pressure sodium lamps.

### Illuminance, E

The density of the luminous flux incident on a surface; it is the luminous flux divided by the surface area when the latter is uniformly illuminated. The units of measurement are footcandle and lux.

### Incandescent filament lamp

A lamp in which light is produced by a filament heated to incandescence by an electric current.

### Indirect lighting

Lighting by luminaires distributing 90 to 100 per cent of the emitted light upward. Includes reflector lamps, which may be used without luminaires.

### Lamp

A generic term for a man-made source of light. By extension, the term is also used to denote sources that radiate in regions of the spectrum adjacent to the visible. Note: a light source consisting of a bare lamp with the addition of a shade, reflector, enclosing globe housing or other accessories is also sometimes called a "Lamp". In such cases, in order to distinguish between the total lighting assembly and the light source within it, the latter is often called a "bulb" or "tube". (See also luminaire.)

### Lens

A glass or plastic element used in luminaries to change the direction and control the distribution of light rays.

### Level of illumination

(See illuminance)

### Light source

(See lamp)

### Low voltage

6-volt to 24-volt power supplied to luminaires and/or lamps (12-volt power being the most common). A transformer is used either in individual luminaries or at a common distribution point to convert line voltage (120–277 volts) to the low voltage required by the luminaries and/or lamps.

### Luminaire

A complete lighting unit consisting of a lamp (or lamps) and ballasting (when applicable) together with the parts designed to distribute the light, to position and protect the lamps, and to connect the lamps to the power supply.

### Luminaire efficiency

The ratio of luminous flux (lumens) emitted by a luminaire to that emitted by a lamp or lamps used therein.

### Luminous efficacy of a source of light

The total luminous flux emitted divided by the total lamp power input. It is expressed in lumens per watt. Note: in the past the term luminous efficiency has been extensively used for this concept.

### Lux,

The international (SI) unit of illuminance: the illumination on a surface of one meter square on which there is a uniformly distributed flux of one lumen ( $1 \text{ lm/m}^2$ )

### Matte surface

A non-glossy dull surface as opposed to a shiny (specular) surface. Light reflected from a matte surface is diffuse.

### Modeling

The effect of using highly directional light to create form through shadows and highlights.

### Perimeter lighting

Illumination dedicated to vertical wall surfaces such as the perimeter walls of a retail sales area.

### Point source

Light source using a filament or arc tube, which produces a very small point of light that is easily focused and/or directed.

### Quality of lighting

Pertains to the distribution of illuminance in a visual environment. The term is used in a positive sense and implies that all luminances contribute favorably to visual performance, visual comfort, ease of seeing, safety and aesthetics for the specific visual tasks involved.

### Reflectance

The ratio of the light reflected by a surface to the light incident on it.

### Reflected glare

Glare resulting from specular reflections of high luminance in polished or glossy surfaces in the field of view.

### Reflector

A device used to redirect the light by the process of reflection.

### Shielding

A general term to include all devices used to block, diffuse, or redirect light rays, including baffles, louvers, shades, diffusers and lenses.

### Specular surface

A shiny, highly polished surface that reflects light at an angle equal to that of the incident light.

### Spot

Lamp or luminaire with a focused optical system producing a controlled narrow beam of light typically between 12 and 15 degrees.

### Transformer

A device that converts power line voltage to the higher or lower voltage required by specific lamp types. A step-up transformer creates the higher voltage needed for neon or cold cathode lamps. A step-down transformer creates the 6 to 24 volts needed for most low voltage lighting.

### Track lighting

A lighting equipment system consisting of an energized power channel (track) and snap-on luminaires (lamp holders). This system permits maximum lighting flexibility.

### Veiling reflections

Reflections which partially or totally obscure the details to be seen by reducing the contrast.

### Wall washer

An asymmetric distribution luminaire designed to direct a greater portion of its lumen package on a vertical surface such as a wall.

### Workplane

The plane at which work usually is done, and on which the illuminance is specified and measured. Unless otherwise indicated, this is assumed to be a horizontal plane 0.76 meters (30 inches) above the floor.

## Publications

RP-2

Recommended Practice for Lighting merchandise Areas (A Store Lighting Guide)

Published by the Illuminating Engineering Society of North America (IES), New York,

RP-30

Museum and Art Gallery Lighting: A Recommended Practice

Published by the Illuminating Engineering Society of North America (IES), New York,

RP-1

American National Standard practice for Office Lighting

Published by the Illuminating Engineering Society of North America (IESNA), New York,

RP-28 Lighting and the Visual Environment for Senior Living

Published by the Illuminating Engineering Society of North America (IESNA), New York,